OneAdvisor 800 Radio Analysis User's Guide

R021

OneAdvisor 800 Radio Analysis Module User's Guide

Notice

Every effort was made to ensure that the information in this manual was accurate at the time of printing. However, information is subject to change without notice, and VIAVI reserves the right to provide an addendum to this manual with information not available at the time that this manual was created.

Copyright/Trademarks

© Copyright 2026 Viavi Solutions Inc. All rights reserved. No part of this guide may be reproduced or transmitted, electronically or otherwise, without written permission of the publisher. VIAVI Solutions and the VIAVI logo are trademarks of VIAVI Solutions Inc. ("VIAVI").

The Bluetooth® word mark and logos are registered trademarks owned by Bluetooth SIG, Inc. and any use of such marks by VIAVI is under license.

All other trademarks and registered trademarks are the property of their respective owners.

Copyright release

Reproduction and distribution of this guide is authorized for US Government purposes only.

Terms and conditions

Specifications, terms, and conditions are subject to change without notice. The provision of hardware, services, and/or software are subject to VIAVI's standard terms and conditions, available at www.viavisolutions.com/en/terms-and-conditions.

Open Source Disclaimer - IMPORTANT READ CAREFULLY

The ONA-800 includes third party software licensed under the terms of separate open source software licenses. By using this software you agree to comply with the terms and conditions of the applicable open source software licenses. Software originated by VIAVI is not subject to third party licenses. Terms of the VIAVI Software License different from applicable third party licenses are offered by VIAVI alone.

About this User Guide

This prefix explains how to use this *User Guide*.

- “Purpose and scope” on page vi
- “Assumptions” on page vi
- “Terminology” on page vi
- “Related Information” on page vii
- “Conventions” on page vii
- “Safety and compliance information” on page ix
- “Technical assistance” on page ix

Purpose and scope

This manual is intended to help you use the capabilities of the OneAdvisor 800 Radio Analysis Module/SPA06MA, RA44MA-O, RA32MA-O, RA18MA-O, and RA09MA-O and is used in conjunction with the *ONA-800 Getting Started Guide*.

These manuals includes task-based instructions that describe how to configure, use, and troubleshoot the test capabilities available on your instrument, assuming it is configured and optioned to support the capabilities.

Assumptions

This manual is intended for novice, intermediate, and experienced users who want to use their instrument effectively and efficiently. We are assuming that you have basic computer experience and are familiar with basic telecommunication concepts, terminology, and safety.

Terminology

The following items are used throughout this manual and appear on the user interface when performing testing. Some terms are also used to label the ports (connectors) on instrument connector panels.

- **5G —** Fifth Generation
- **CPRI** — Common Public Radio Interface
- **FDD —** Frequency Division Duplex
- **LTE —** Long Term Evolution
- **LTE Line —** Termination Equipment
- **O-DU —** O-RAN Distributed Unit
- **O-RU —** O-RAN Radio Unit
- **RA44MA-O —** Radio Analysis module 44 GHz
- **RA32MA-O —** Radio Analysis module 32 GHz
- **RA09MA-O —** Radio Analysis module 9 GHz
- **RF —** Radio Frequency
- **RFoCPRI —** Radio Frequency over Common Public Radio Interface
- **RTSA —** Real Time Spectrum Analyzer
- **SPA06MA —** Spectrum Analysis module without RFoCPRI
- **SPA06MA-O —** Spectrum Analysis module with RFoCPRI
- **OneAdvisor 800 Radio Analysis Module —** Spectrum Analysis module with RFoCPRI
- **TDD —** Time Division Duplex

Related Information

This manual is application-oriented and contains information about using these instruments to test service carried on each of the listed networks. It includes an overview of testing features, instructions for using the instruments to generate and transmit traffic over a circuit, and detailed test result descriptions. This manual also provides contact information for VIAVI's Technical Assistance Center (TAC).

Conventions

This manual uses conventions and symbols, as described in the following tables.

Table 1 Text formatting and other typographical conventions

Item(s)	Example(s)
Buttons, keys, or switches that you press or flip on a physical device.	Press the **On** button. – Press the **Enter** key. – Flip the **Power** switch to the on position.
Buttons, links, menus, menu options, tabs, or fields on a PC-based or Web-based user interface that you click, select, or type information into.	Click **Start** – Click **File > Properties**. – Click the **Properties** tab. – Type the name of the probe in the **Probe Name** field.
Directory names, file names, and code and output messages that appear in a command line interface or in some graphical user interfaces (GUIs).	`$NANGT_DATA_DIR/results` (directory) – `test_products/users/defaultUser.xml` (file name) – `All results okay.` (output message)
Text you must type exactly as shown into a command line interface, text file, or a GUI text field.	– Restart the applications on the server using the following command: **`$BASEDIR/startup/npiu_init restart`** Type: **`a:\set.exe`** in the dialog box.
References to guides, books, and other publications appear in *this typeface*.	Refer to *Newton's Telecom Dictionary.*
Command line option separators.	`platform [a|b|e]`
Optional arguments (text variables in code).	`login [platform name]`
Required arguments (text variables in code).	`<password>`

Table 2 Symbol conventions

	This symbol indicates a note that includes important supplemental information or tips related to the main text.
	This symbol represents a general hazard. It may be associated with either a DANGER, WARNING, CAUTION, or ALERT message. See Table 3 for more information.
	This symbol represents an alert. It indicates that there is an action that must be performed in order to protect equipment and data or to avoid software damage and service interruption.
	This symbol represents hazardous voltages. It may be associated with either a DANGER, WARNING, CAUTION, or ALERT message. See Table 3 for more information.
	This symbol represents a risk of explosion. It may be associated with either a DANGER, WARNING, CAUTION or ALERT message. See Table 3 for more information.
	This symbol represents a risk of a hot surface. It may be associated with either a DANGER, WARNING, CAUTION, or ALERT message. See Table 3 for more information.
	This symbol represents a risk associated with fiber optic lasers. It may be associated with either a DANGER, WARNING, CAUTION or ALERT message. See Table 3 for more information.
	This symbol, located on the equipment, battery, or the packaging indicates that the equipment or battery must not be disposed of in a land-fill site or as municipal waste, and should be disposed of according to your national regulations.

Table 3 Safety definitions

Term	Definition
DANGER	Indicates a potentially hazardous situation that, if not avoided, *will* result in death or serious injury. It may be associated with either a general hazard, high voltage, or other symbol. See Table 2 for more information.
WARNING	Indicates a potentially hazardous situation that, if not avoided, *could* result in death or serious injury. It may be associated with either a general hazard, high voltage, or other symbol. See Table 2 for more information.

Table 3 Safety definitions (Continued)

Term	Definition
CAUTION	Indicates a potentially hazardous situation that, if not avoided, could result in minor or moderate injury and/or damage to equipment. It may be associated with either a general hazard, high voltage, or risk of explosion symbol. See Table 2 for more information. When applied to software actions, indicates a situation that, if not avoided, could result in loss of data or a disruption of software operation.
ALERT	Indicates that there is an action that must be performed in order to protect equipment and data or to avoid software damage and service interruption.

Safety and compliance information

Safety and compliance information for the instrument are provided in printed form and ship with your instrument.

Technical assistance

If you require technical assistance, call 1-844-GO-VIAVI. For the latest TAC information, go to http://www.viavisolutions.com/en/services-and-support/support/technical-assistance.

Table of Contents

About this User Guide v

Purpose and scope . . . vi
Assumptions . . . vi
Terminology . . . vi
Related Information . . . vii
Conventions . . . vii
Safety and compliance information . . . ix
Technical assistance . . . ix

Chapter 1 Overview 1

Radio Analysis module overview . . . 2
Exploring the module . . . 2
Module installation . . . 6

Chapter 2 Using GNSS and Clock Source 9

Setting up the GNSS . . . 9
Specifying GNSS settings . . . 9
Sky Plot . . . 10
Signal strength . . . 11
Using the Clock Source . . . 12

Chapter 3 Using OneCheck 13

Introduction . . . 14
Selecting mode and measure . . . 14
Creating OneCheck . . . 14
Loading a OneCheck file . . . 19

Chapter 4 Using Spectrum Analyzer 23

Introduction . . . 24
Selecting mode and measure . . . 25
Configuring spectrum measurements . . . 25
Setting frequency . . . 26

Setting channel 28
Setting amplitude 29
Setting BW/AVG 32
Selecting sweep 33
Setting reference clock and frequency reference 35
Setting trace 36
Setting limit 39
Using marker 41
Managing files 43
Glancing at menus and icons 47
Conducting spectrum measurements 50
RF analysis 50
Sweep Tuned Spectrum 50
Channel Power 51
Occupied bandwidth 53
Spectrum emission mask (SEM) 54
Adjacent channel power (ACP) 56
Multi adjacent channel power 58
Spurious emissions 60
Total harmonic distortion (THD) 61
Field strength 62
AM/FM audio and modulation analysis 63
Internal power meter 65
Gated sweep 66
Route map 68
Online route map 71
Online route map 71

Chapter 5 Using Real-Time Spectrum Analyzer 77

Introduction 78
Selecting mode and measure 78
Interference analysis 79
Persistent spectrum 79
Persistent spectrogram 83
Persistent RSSI 86
Persistent interference finder 88
Persistent radar chart 95
Real-time spectrum replayer 102
Online interference analysis 103
Online persistent interference finder 103
Online persistent radar chart 110

Chapter 6 Using RFoCPRI Interference Analyzer 119

Introduction 120
Selecting mode and measure 120
Connecting cables 121
Selecting port 122

Configuring Auto CPRI 122
Setting measure setup 127
Configuring Rx parameters 129
Setting frequency 132
Setting reference level 133
Setting scale per division 133
Setting external offset 133
Enabling auto leveling 134
Setting RBW 135
Setting average 136
Setting sweep mode 136
Setting limit 137
Setting trace 137
Selecting network technology 139
Conducting spectrum measurement 139
Layer 2 CPRI testing 142
Layer 2 CPRI BULK and Channelized BER testing 142
Conducting spectrogram 143
Using spectrum replayer 144
Setting display 145
Conducting optics test 146

Chapter 7 Using TDD Auto Gated Spectrum Analyzer 149

Introduction 150
Selecting mode and measure 150
Auto configuring parameters 151
Interference analysis 158
Spectrum 158
Spectrogram 161
Persistent spectrum 164
Persistent spectrogram 167
RSSI 170
Interference finder 173
Radar chart 180
Spectrum replayer 186
Online interference analysis 187
Online interference finder 187
Online radar chart 195
RF Viewer analysis 201
Directional antenna 201

Chapter 8 Using Interference Analyzer 207

Introduction 208
Selecting mode and measure 208
Interference analysis 209
Spectrum 209
Spectrogram 211

RSSI . . . 213
Interference finder . . . 214
Radar chart . . . 220
Spectrum Replayer . . . 225
PIM detection . . . 226
Online interference analysis . . . 229
Online interference finder . . . 229
Online radar chart . . . 236
RF Viewer analysis . . . 241
RF Viewer . . . 241

Chapter 9 Using EMF Analyzer 245

Introduction . . . 246
Connecting antenna . . . 246
Selecting mode and measure . . . 248
RF analysis . . . 248
Spectrum . . . 249
Scanner . . . 259
5G NR analysis . . . 268
5G NR beam analysis . . . 268
5G NR traffic analysis . . . 278
LTE analysis . . . 290
LTE FDD analysis . . . 290
LTE TDD analysis . . . 298
Real-time analysis . . . 306
Spectrum . . . 306
Scanner . . . 315

Chapter 10 Using 5G NR Signal Analyzer 325

Introduction . . . 326
Selecting mode and measure . . . 327
RF analysis . . . 327
Trigger spectrum . . . 327
Channel power . . . 331
Occupied bandwidth . . . 335
Spectrum emission mask . . . 339
ACLR . . . 343
Multi-ACLR . . . 347
Spurious emissions . . . 349
OTA analysis . . . 351
Beam analyzer . . . 351
Carrier scanner . . . 355
Route map . . . 361
Beam availability Index . . . 370
Freq/Time/Power variation . . . 374
Multipath profile . . . 378
Signal analysis . . . 381

Constellation . . . 382
Allocation mapper . . . 386
Power vs Time (Slot) . . . 390
Power vs Time (Frame) . . . 394
Cell phase synchronization . . . 397
Sync Analysis . . . 397
Sync route map . . . 401
Online route map . . . 408
Online OTA route map . . . 408
Online sync route map . . . 415
PDSCH analysis . . . 421
PDSCH constellation . . . 422
EVM vs subcarrier . . . 429

Chapter 11 Using 5G TM Signal Analyzer 437

Introduction . . . 438
Selecting mode and measure . . . 438
Conducting conformance test . . . 438
BS output power . . . 438
Occupied bandwidth . . . 441
ACLR . . . 443
Multi-ACLR . . . 445
Operating band unwanted emission . . . 447
Transmitter spurious emissions . . . 450
Transmit on/off power . . . 452
Modulation quality . . . 455
MIMO time alignment error . . . 458
CA time alignment error . . . 461

Chapter 12 Using RAN Analyzer 465

Introduction . . . 466
Selecting mode and measure . . . 466
5G NR signal analysis . . . 467
Beam analyzer . . . 467
Freq/Time/Power variation . . . 471
Allocation mapper . . . 475
Route map . . . 479
Real-time spectrum analysis . . . 488
RtSA persistent spectrum . . . 488
RtSA persistent spectrogram . . . 491
Real-time spectrum replayer . . . 494
TDD auto gated spectrum analysis . . . 495
Auto configuring parameters . . . 495
TAGS spectrum . . . 502
TAGS spectrogram . . . 504
TAGS persistent spectrum . . . 507
TAGS persistent spectrogram . . . 510

TAGS spectrum replayer . . . 514
RF Viewer analysis . . . 515
Directional antenna . . . 515
Cell phase synchronization . . . 519
Sync Analysis . . . 519
Sync route map . . . 523
Online route map . . . 530
Online OTA route map . . . 530
Online sync route map . . . 537

Chapter 13 Using Blind Scanner 545

Introduction . . . 546
Selecting mode and measure . . . 546
Configuring blind scan . . . 546
Performing blind scan . . . 549
Performing blind scan (FR2) . . . 552

Chapter 14 Using Multi-RAT Signal Analyzer 555

Introduction . . . 556
Selecting mode and measure . . . 556
Conducting OTA analysis . . . 556
Multi-RAT analyzer . . . 556
Multi-RAT scanner . . . 564
Multi-RAT route map . . . 571
Online route map . . . 582
Online Multi-RAT route map . . . 582

Chapter 15 Using 5G DSS Signal Analyzer 593

Introduction . . . 594
Selecting mode and measure . . . 594
RF analysis . . . 595
Spectrum . . . 595
Channel power . . . 596
Occupied bandwidth . . . 598
Spectrum emission mask . . . 599
ACLR . . . 600
Multi-ACLR . . . 601
Spurious emissions . . . 603
OTA analysis . . . 604
OTA channel scanner . . . 604
OTA ID Scanner . . . 608
OTA multipath profile . . . 611
OTA Control Channel . . . 614
OTA Route Map . . . 618
Freq/Time/Power Variation . . . 625
Power vs Time (Frame) . . . 629
Power vs Time (Slot) . . . 631

Signal analysis . . . 632
Constellation . . . 633
Channel mapper . . . 636
Control channel . . . 638
Subframe . . . 643
Frame . . . 649
Time alignment error . . . 653
Online route map . . . 655
Online OTA route map . . . 656

Chapter 16 Using LTE/LTE-A FDD Analyzer 663

Introduction . . . 664
Selecting mode and measure . . . 665
RF analysis . . . 665
Spectrum . . . 665
Channel power . . . 666
Occupied bandwidth . . . 668
Spectrum emission mask . . . 669
ACLR . . . 670
Multi-ACLR . . . 671
Spurious emissions . . . 673
OTA analysis . . . 674
OTA channel scanner . . . 674
OTA ID scanner . . . 678
OTA multipath profile . . . 680
OTA control channel . . . 682
OTA datagram . . . 684
OTA route map . . . 686
Freq/Time/Power variation . . . 692
Signal analysis . . . 696
Constellation . . . 696
Data channel . . . 698
Control channel . . . 701
Subframe . . . 704
Time alignment error . . . 707
Data allocation map . . . 709
Carrier aggregation . . . 711
Power vs Time (Frame) . . . 713
Online route map . . . 715
Online OTA route map . . . 715
. . . 720

Chapter 17 Using LTE/LTE-A TDD Analyzer 721

Introduction . . . 722
Selecting mode and measure . . . 723
RF analysis . . . 723
Spectrum . . . 723

Channel power 725
Occupied bandwidth 727
Spectrum emission mask 728
ACLR 730
Multi-ACLR 731
Spurious emissions 732
OTA analysis 734
OTA channel scanner 734
OTA ID Scanner 738
OTA multipath profile 740
OTA control channel 741
OTA datagram 744
OTA route map 745
Freq/Time/Power variation 751
Signal analysis 755
Constellation 755
Data channel 758
Control channel 761
Subframe 764
Time alignment error 768
Data allocation map 769
Carrier aggregation 771
Power vs Time (Frame) 773
Power vs Time (Slot) 775
Online route map 777
Online OTA route map 777
. 783

Chapter 18 Using GSM Signal Analyzer 785

Introduction 786
Connecting cables 786
Direct connection 786
Indirect connection 787
OTA (over the air) connection 787
Selecting mode and measure 788
RF analysis 788
Spectrum 788
Channel Power 789
Occupied bandwidth 790
Spectrum emission mask 792
Output RF spectrum 793
Spurious emissions 794
OTA analysis 796
Channel Scanner 796
Frequency scanner 797
Custom scanner 798
Multipath profile 799
Modulation analyzer 800

Signal analysis . . . 802
Constellation . . . 802
Power vs Time (Slot) . . . 805
Power vs Time (Frame) . . . 806

Chapter 19 Channel Scanner 809

Introduction . . . 810
Selecting mode and measure . . . 810
Channel scanner . . . 810
Frequency scanner . . . 811
Custom scanner . . . 812
Route map . . . 813
Online route map . . . 817
Online route map . . . 817

Chapter 20 Using O-RAN 823

Introduction . . . 824
Selecting mode and measure . . . 824
Optical BERT . . . 824

Chapter 21 Optics Testing and Parameters 827

Optics Self-Test . . . 828
Running the Optics Self-Test . . . 828
Generating Reports . . . 829
I^2C Peek/Poke . . . 829

Chapter 22 Ethernet Testing 831

About Ethernet testing . . . 832
Features and capabilities . . . 832
Understanding the graphical user interface . . . 832
Adjusting the frequency of transmitted optical signals . . . 833
Enabling automatic traffic transmission . . . 834
Prerequisites for traffic transmission . . . 834
Issues to consider . . . 834
Enabling the feature . . . 834
Layer 2 testing . . . 835
Specifying interface settings . . . 835
Specifying Ethernet frame settings . . . 835
Specifying Ethernet Filter settings . . . 839
Specifying traffic load settings . . . 845
Transmitting and analyzing layer 2 traffic . . . 849
LBM (Y.1731) . . . 850
Layer 3 testing . . . 850
Specifying L3 interface settings . . . 850
Specifying the data mode and link initialization settings . . . 850
Specifying transmitted IPv4 packet settings . . . 851

Specifying IPv4 filter settings . . . 852
Specifying transmitted IPv6 packet settings . . . 853
Specifying IPv6 filter settings . . . 855
IPv6 Ping testing . . . 856
Transmitting and analyzing IP traffic . . . 858
Capturing packets for analysis . . . 859
What is captured? . . . 859
How is the capture buffer filled? . . . 860
Why use frame slicing? . . . 860
Understanding the Capture toolbar . . . 860
Specifying filter settings . . . 861
Capturing packets . . . 862
Saving or exporting captured packets . . . 864
Analyzing the packets using Wireshark® . . . 866
Loopback testing . . . 867
Inserting errors . . . 867
Inserting alarms . . . 868
Measuring round trip delay or packet jitter . . . 868
Measuring Peak IFG . . . 869
Capturing packets for analysis . . . 870
What is captured? . . . 871
How is the capture buffer filled? . . . 871
Why use frame slicing? . . . 872
Understanding the Capture toolbar . . . 872
Specifying filter settings . . . 872
Capturing packets . . . 873
Capturing packets based on a trigger . . . 874
Saving or exporting captured packets . . . 875
Analyzing the packets using Wireshark® . . . 877

Chapter 23 PTP/IEEE 1588v2 Testing 879

About IEEE 1588 PTP testing . . . 880
Features and capabilities . . . 880
PTP/1588 test applications . . . 880
Optional time sources . . . 881
Connecting a TEM Module . . . 881
Analyzing PTP traffic . . . 881

Chapter 24 Automated Testing Using Workflows 887

Launching an automated test . . . 888
Automated Test Availability . . . 889
Automated RFC 2544 tests . . . 889
Features and capabilities . . . 890
About loopbacks . . . 891
QuickCheck . . . 891
Throughput test . . . 892
Latency (RTD) test . . . 894

Packet Jitter test . . . 895
Frame Loss test . . . 896
Back to Back Frames test (Burst test) . . . 896
Optimizing the test time . . . 897
Importing and exporting RFC config files . . . 897
Initiating the Enhanced RFC2544 Test . . . 898
Configuring the Enhanced RFC 2544 tests . . . 898
Setting Connection parameters . . . 899
Test selection . . . 902
Running Enhanced RFC 2544 tests . . . 904
About the Y.1564 SAMComplete test . . . 907
Initiating the SAMComplete test . . . 908
Configuring SAMComplete test settings . . . 909
Choosing SAMComplete tests . . . 914
Running SAMComplete tests . . . 914
5G NR Discovery . . . 916
Automated VLAN tests . . . 917
Saving automated test report data . . . 918

Appendix A Physical specifications 921

1

Overview

This chapter provides a description of the OneAdvisor 800 Radio Analysis modules. Topics covered in this chapter include:

- “Radio Analysis module overview” on page 2
- “Exploring the module” on page 2
- “Module installation” on page 6

Radio Analysis module overview

The Radio Analysis module is comprised of the following components:

- SPA06MA: Supported bandwidth from 9 kHz to 6 GHz without optic hardware
- SPA06MA-O: Supported bandwidth from 9 kHz to 6 GHz with optic hardware
- RA09MA-O: Supported bandwidth from 9 kHz to 9 GHz with optic hardware
- RA18MA-O: Supported bandwidth from 9 kHz to 18.5 GHz with optic hardware
- RA32MA-O: Supported bandwidth from 9 kHz to 32 GHz with optic hardware
- RA44MA-O: Supported bandwidth from 9 kHz to 44 GHz with optic hardware

Exploring the module

The following figures and tables describe the Radio Analysis module.

Figure 1 SPA06MA-O



Table 1 Port description for SPA06MA-O

No	Port name	Description
1	RF Input port	Used as input signal port for spectrum analysis, signal analysis, and RF power measurement.
2	Ext. Ref	SMA type female connector to receive 10 MHz, 13 MHz, or 15 MHz reference clock signals from an external frequency source.
3	Trigger Out	SMA connector to send 1 PPS clock or 10 ms synchronization signals from an internal timing reference. Digital CMOS Input DC Coupled
4	Trigger In	SMA connector to receive 1PPS clock or 10 ms synchronization signals. Digital CMOS Input DC Coupled

Table 1 Port description for SPA06MA-O

No	Port name	Description
5	GNSS Antenna	SMA connector for GNSS antenna.
6, 7	SFP+/SFP28	You can use these ports to connect SFP modules to test CPRI protocols, detect an error or alarm, perform interference analysis, and transmit test pattern over fiber link.
8	QSFP+/QSFP28	You can use these ports to connect QSFP modules to test CPRI protocols, detect an error or alarm, perform interference analysis, and transmit test pattern over fiber link.

Figure 2 RA09MA-O and RA18MA-O

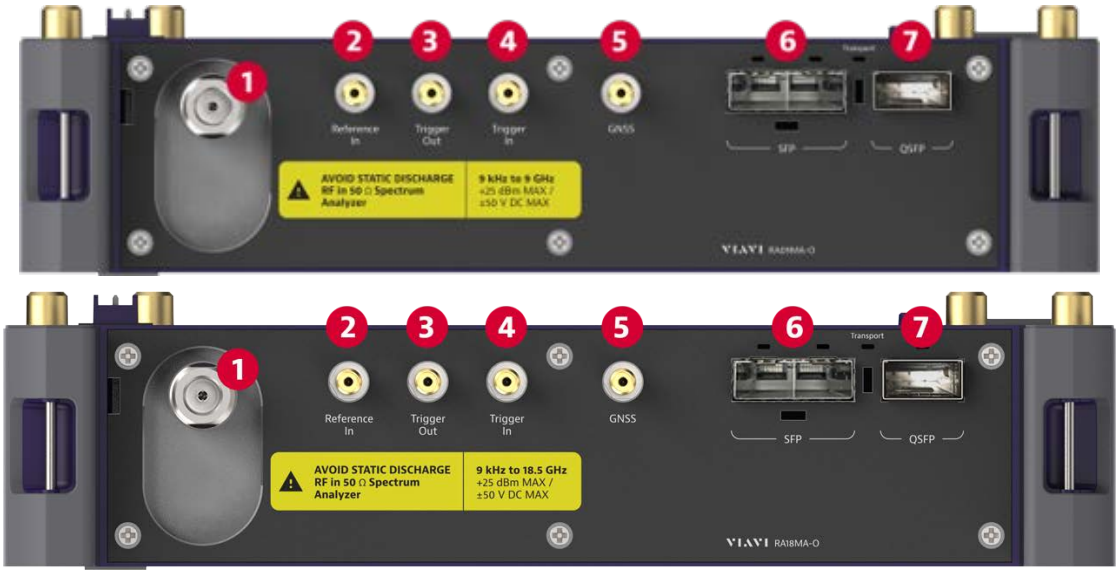


Table 2 Port descriptions for RA09MA-O and RA18MA-O

No	Port name	Description
1	RF Input port	Used as input signal port for spectrum analysis, signal analysis, and RF power measurement.
2	Ref. In port	You can use this SMA type female connector to receive 10 MHz, 13 MHz, or 15 MHz reference clock signals from an external frequency source. Input is AC-coupled 50-Ohm terminated. Input signal requirements: AC or DC coupled signal, Frequency 10 MHz, 13 MHz or 15 MHz, Maximum Amplitude 500 mV peak to peak, Minimum Amplitude 50 mV peak to peak.
3	Trigger Out	SMA connector to send 1 PPS clock or 10 ms synchronization signals from an internal timing reference. Digital CMOS Input DC Coupled
4	Trigger In	SMA connector to receive 1PPS clock or 10 ms synchronization signals. Digital CMOS Input DC Coupled
5	GNSS Antenna	SMA connector for GNSS antenna.
6	SFP+/SFP28	You can use these ports to connect SFP modules to test CPRI protocols, detect an error or alarm, perform interference analysis, and transmit test pattern over fiber link.
7	QSFP+/QSFP28	You can use these ports to connect QSFP modules to test CPRI protocols, detect an error or alarm, perform interference analysis, and transmit test pattern over fiber link.

Figure 3 RA32MA-O and RA44MA-O

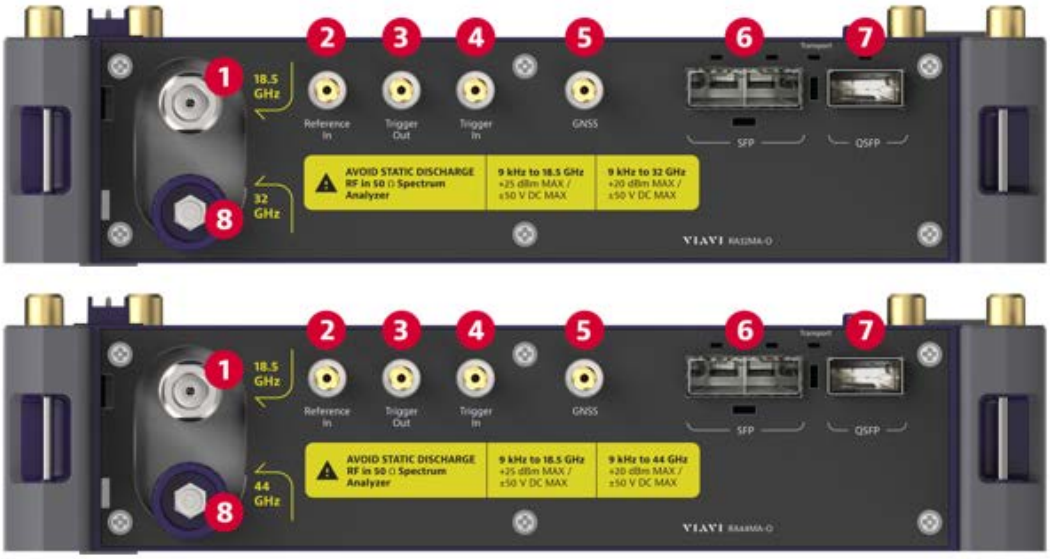


Table 3 Port descriptions for RA32MA-O and RA44MA-O

No	Port name	Description
1	RF Input port	Used as input signal port for spectrum analysis, signal analysis, and RF power measurement.
2	Ref. In port	You can use this SMA type female connector to receive 10 MHz, 13 MHz, or 15 MHz reference clock signals from an external frequency source. Input is AC-coupled 50-Ohm terminated. Input signal requirements: AC or DC coupled signal, Frequency 10 MHz, 13 MHz or 15 MHz, Maximum Amplitude 500 mV peak to peak, Minimum Amplitude 50 mV peak to peak.
3	Trigger Out	SMA connector to send 1 PPS clock or 10 ms synchronization signals from an internal timing reference. Digital CMOS Input DC Coupled
4	Trigger In	SMA connector to receive 1PPS clock or 10 ms synchronization signals. Digital CMOS Input DC Coupled
5	GNSS Antenna	SMA connector for GNSS antenna.
6	SFP+/SFP28	You can use these ports to connect SFP modules to test CPRI protocols, detect an error or alarm, perform interference analysis, and transmit test pattern over fiber link.
7	QSFP+/QSFP28	You can use these ports to connect QSFP modules to test CPRI protocols, detect an error or alarm, perform interference analysis, and transmit test pattern over fiber link.
8	RF Input port	Used as input signal port for spectrum analysis, signal analysis, and RF power measurement.

Module installation

The following procedure describes how to install the module to the base.

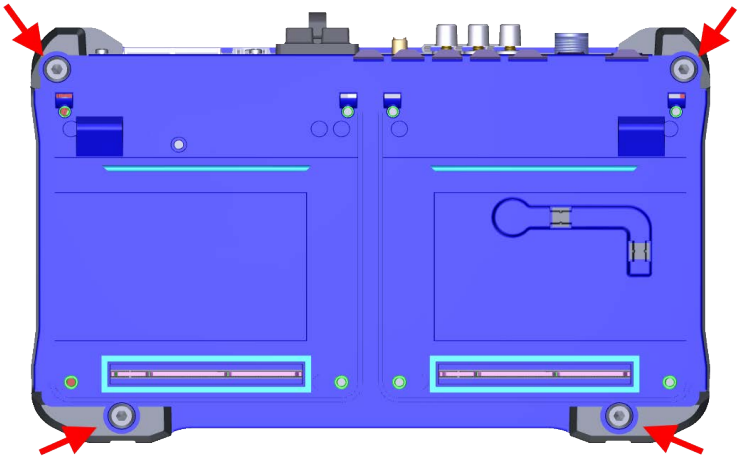
To connect the module to the ONA-800

1. Verify that the power is OFF on your ONA-800 and the power adapter is unplugged.
2. Remove the back termination cover or CAA/OTDR modules.

3 Remove the screen from the ONA-800 base:

a Set the unit so you have access to the back. Using the hex key located in the groove on the back of the ONA-800, loosen the four fasteners, as shown in Figure 4.

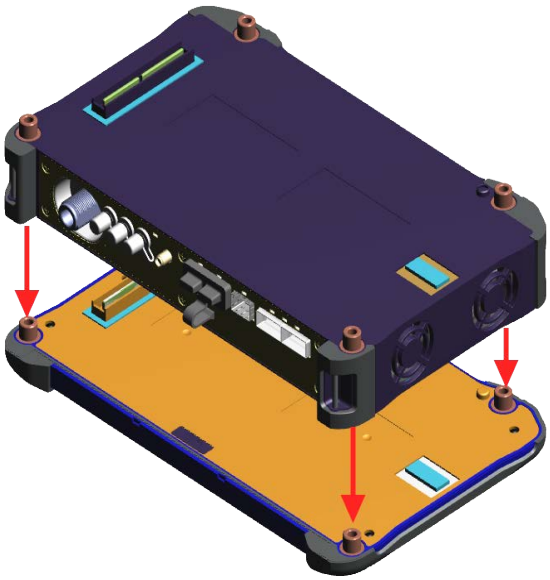
Figure 4 Fastener locations



b Lift the ONA-800 base off of the screen.

4 Set the module onto the screen, ensuring the mating connectors between the two pieces are aligned, as shown in Figure 5.

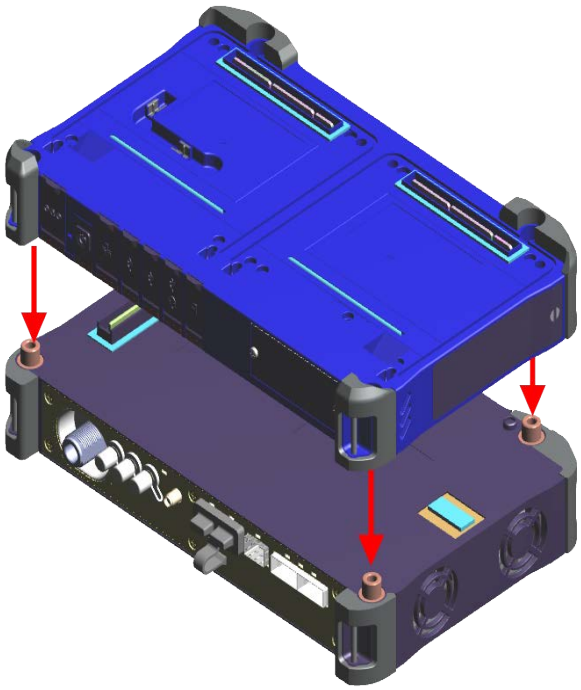
Figure 5 Module to screen alignment



5 Insert the hex key in the brass fittings on the rear of the module and tighten the internal captive fasteners to secure the module to the display.

6 Set the ONA-800 base to the module, ensuring the mating connectors are aligned, as shown in Figure 6.

Figure 6 Base to module alignment



7 Set the unit so you have access to the back. Using the hex key, tighten the fasteners.

8 Replace the back termination cover or CAA/OTDR modules.

2

Using GNSS and Clock Source

This chapter provides a description of the OneAdvisor 800 Radio Analysis modules. Topics covered in this chapter include:

- “Setting up the GNSS” on page 9
- “Using the Clock Source” on page 12

Setting up the GNSS

NOTE
GNSS is an option that must be available on the unit before this procedure can be performed. Contact your VIAVI sales representative for more information.

If your device is licensed to do so, you can configure the GNSS setting by tapping the GNSS icon on the System screen. You are required to configure GNSS settings of you need the GNSS location or need to use it as a frequency and clock source.

To turn on GNSS

- Select the **System** icon, then select **GNSS**.

Specifying GNSS settings

You can configure the GPS settings depending on what is needed, however turning GNSS and Antenna Power on should make it work in most cases.

To specify GNSS settings

1 In GNSS, turn on **Antenna Power** if required. The antenna power setting enables the external antenna power, depending on what you have plugged into the instrument. If you have an externally powered antenna, you do not need to turn on the antenna power.

2 Select the required **Fix Type**:
   - **2D Mode**: A 2D (two dimensional) position fix that includes only horizontal coordinates. This mode requires a minimum of three visible satellites.
   - **3D Mode**: A 3D (three dimensional) position fix that includes horizontal coordinates. This mode requires a minimum of four visible satellites.
   - **Any**: Calculates a 3D position if possible, but reverts to 2D position if necessary.

3 Turn the **GNSS** value to On if using GNSS.

4 Select the **GNSS System** supported in the region where you intend to conduct testing. If using a Satellite Based Augmentation System (SBAS) to augment the GNSS system, select the option that provides SBAS (indicated with **+SBAS**).

5 Select the desired **Survey Mode** from the following choices:
   - **Dynamic**: Continuously calculates positioning for continuous location information
   - **Auto**: Calculates positioning until accurate location information is determined and switches to fixed position using accurate location information, and switches to determine timing accuracy

6 In **Elevation Limit (deg)**, specify the elevation limit in degrees. This value represents the lowest point on the horizon on which the receiver will try to locate and obtain information from GNSS satellites. The default elevation is set to 10 degrees. Using satellites near the horizon may degrade performance.

7 In **Minimum C/No (dBHz)**, specify the minimum Carrier to Noise Ratio (C/ No) for the satellite signals that will be used by the module's GNSS receiver. The C/No is an indication of signal strength ranging from 0 to 50 dBHz. The default value is 9 dBHz. Using satellites with a weak C/No may degrade performance.

8 Specify the **Antenna Time Bias** value. The default Antenna Time Bias value is 28 (the optimal value for the VIAVI qualified antenna). If you are using a different antenna, determine the optimal bias value by referring to the vendor specifications for the antenna (and, if applicable, splitter or amplifier), then specify the bias value in nanoseconds. This value represents the bias that is used to compensate for the delay introduced by your antenna, the antenna's cable, and if applicable, an inline splitter or amplifier where absolute accuracy of PPS is important.

Sky Plot

The Sky Plot illustrates the satellites that were identified using the GNSS receiver attached to the instrument. The ID is provided for each satellite, and colors are used to indicate the satellite's status (No Signal, Signal, Ready, or Used). Figure 7 shows the Sky Plot.

Figure 7 Sky Plot

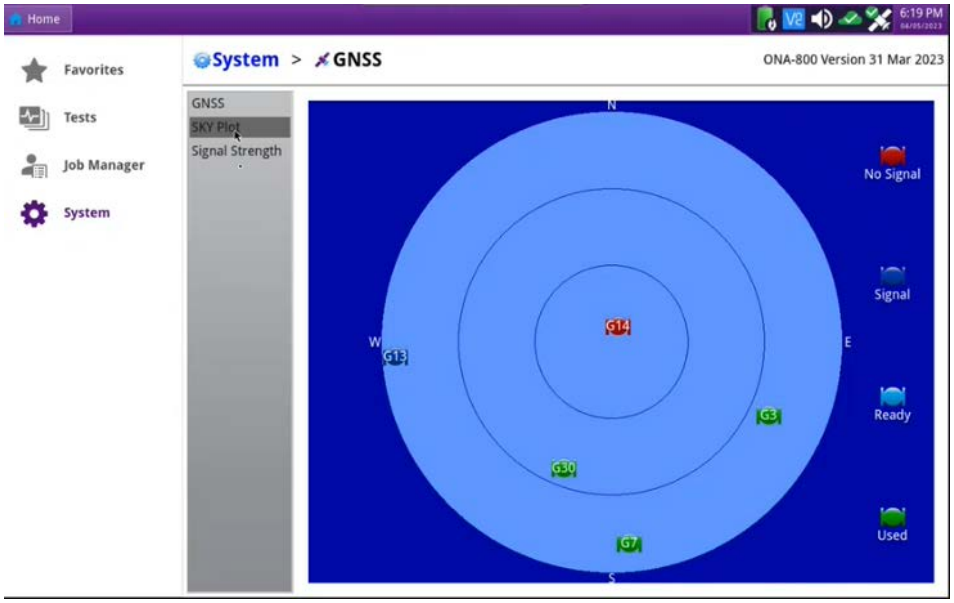


Table 4 describes each color used to communicate the satellite status.

Table 4 Satellite status

Color	Status	Indicates
Red	No Signal	A signal from the satellite is not available, but the satellite's presence is known based on information provided in the Almanac (and broadcast by other satellites within the constellation).
Dark Blue	Signal	The signal from the satellite has been acquired and the GNSS receiver is receiving data.
Light Blue	Ready	The GNSS receiver is receiving position information from the satellite, but the information is unusable because the satellite is: – below the Elevation Limit (specified as a GNSS configuration setting) – less than the Minimum C/No (specified as a GNSS configuration setting) – offline
Green	Used	The signal from the satellite is being used to provide GNSS timing.

Signal strength

The signal strength for each received channel for used satellites is illustrated in the signal strength category, and represents the Carrier to Noise Ratio (C/No or CNO) on

a scale of 0-50, with 50 representing the optimal signal strength. Each bar is color coded to communicate the satellite's status per descriptions provided in Table 4.

Using the Clock Source

The Clock Source is used as a reference frequency and timing source for the OneAdvisor 800 application. You can configure the clock source to be used.

1. Navigate to the measurement you want to test.
2. Tap **Menu** on the side bar.
3. Select **Frequency Reference**.
4. Select the desired option from the three available choices.
   - **Internal**: Uses a 10 MHz internal clock.
   - **External**: Uses external 10 MHz, 13 MHz, or 15 MHz clock, automatically detected and set by the instrument.
   - **GNSS**: Uses a built-in GNSS receiver as a frequency and timing source via a 1 PPS signal.

Locking	Locked	Unlocked
		

3

Using OneCheck

This chapter describes how to use OneCheck. Topics covered in this chapter include:

- “Introduction” on page 14
- “Selecting mode and measure” on page 14
- “Creating OneCheck” on page 14

Introduction

OneCheck is a part of TPA (Test Process Automation) solution, providing optimized functionality that automates the work process done by technicians who take care of installations, customization, and maintenance of a cellular network. Due to increasing complexity of network, work process trainings are more needed. In this regard, the scenario-based OneCheck helps customers conduct their jobs easier and faster with pre-defined procedures and settings and it can also diversify work scenarios based on different conditions.

OneCheck is structured with Selector and Measure. The Selector suggests required settings only and the Measure consists of subcategories related to the settings. Once you have finished all the required measurements, you can check the measurement results by creating a report.

OneCheck Supports the following measurement:

- OneCheck

Selecting mode and measure

The following procedure describes how to start measurement.

To select mode and measure

1 Tap **OneCheck** on the **MODE** panel.

2 Tap the measurement mode from the following choice:
   – **OneCheck > OneCheck**

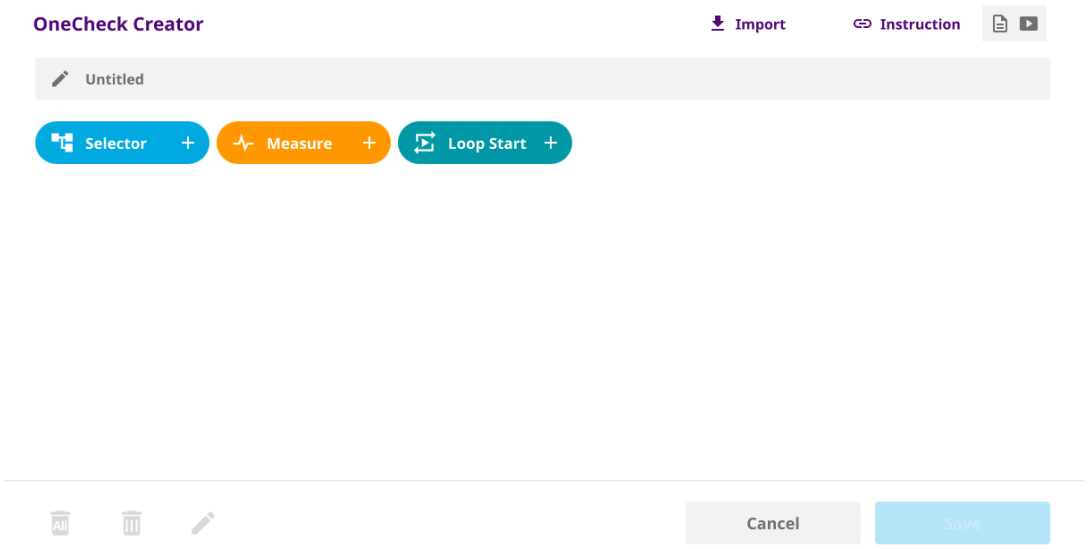
Creating OneCheck

The following procedure describes how to create OneCheck scenario.

To create OneCheck

1 Tap the **OneCheck Creator** () button on the Information pane.
The **OneCheck Creator** page appears, as shown in Figure 8.

Figure 8 OneCheck Creator page



2 If there is a OneCheck file saved in the internal storage, perform the following steps:

a Tap the **Import** icon.

b Tap the required OneCheck file in the Import window.

c *Optional.* Tap the **Instruction file name** button to load the file if you have to refer to it.

- Tap the **Document** button to import the document and select the file in the file list.

  Only a pdf document can be uploaded and the duplicated document cannot be uploaded

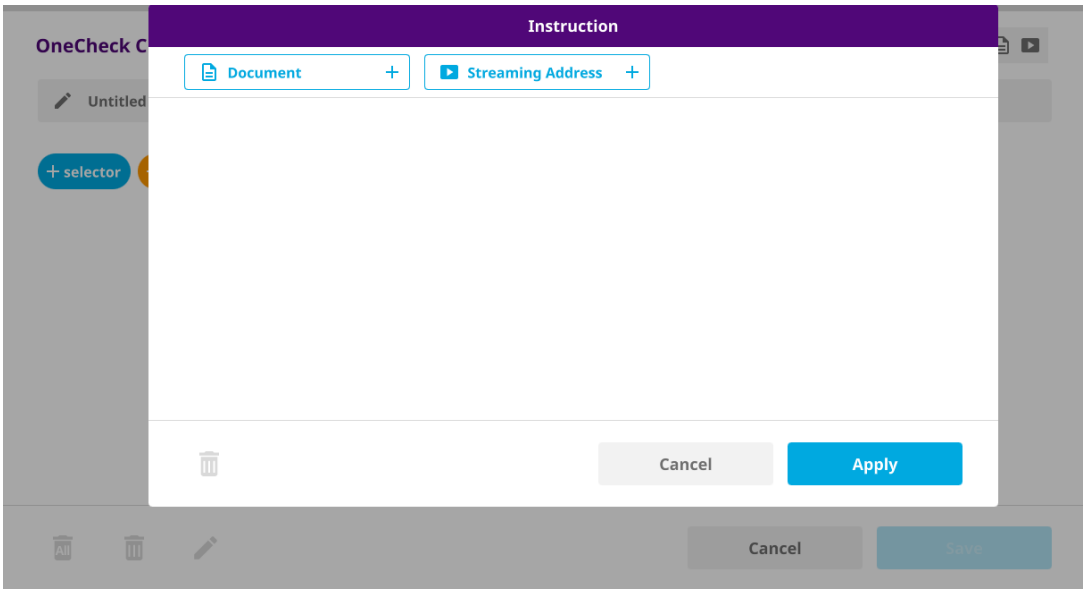
- Tap the **Streaming Address** button to play the video file and input the **Title** and **YouTube URL**.

  Only YouTube URL is available and played.

NOTE

You can also tap the Quick Operation icon for the Instruction next to the Instruction button.

Figure 9 OneCheck Instruction window



3 If there is no OneCheck file saved in the internal storage, perform the following steps:

a Tap the **Title** bar and input the required title using the on-screen keyboard.

b Tap **Selector** to create the required setting.

- Input Title (required), Sub-title, and Note. You can also import images as required for options that you have created.
- Add options by tapping the + button.
- Select the option by tapping the Next/Back arrow button.
- Tap the **Apply** button to apply the changes.

c Tap **Measure** to load the required setup files for the measurement.

- Tap **Load Setup** pane.
- Tap the **Setup file name here** () button.
- Import the required setup file saved in the internal storage.
- Tap the **Import** button to import the selected setup file.
- Tap the **Timer** checkbox. Once the timer ends, the file is saved automatically.



NOTE

If no timer is set and the user moves to the EMF Analyzer, testing starts automatically without tapping the Testing button.

- Tap the **Apply** button to apply the changes.

d Tap **LoopStart** to begin your measurement till **LoopEnd**.

- Follow the procedure, **b** and **c** as required.

e Returning to the OneCheck Creator page, tap **Measure** to set the required parameters/items for the measurement.

- Tap **Setting**.
- Select the required **Mode and Measure**.
- Tap the **Next** button.
- Select the menus to be set.
- Tap the () icon at the left bottom to keep the menus as set. See Figure 12 to check the menus you want to keep for the next measurement.
- Tap the **Next** button.
- Input the required values in the User Setting Item List window.
- Tap the **Configuration** () icon to edit the setting menus.
- Tap the **Chart View** () icon to go to the measurement screen.
- Once you have set all the required menus, tap the **Done** button.

4 Returning to the OneCheck Creator page, tap the **Save** button to save all the changes.

The Export window will appear then you need to input the OneCheck file name and tap the **Export** button to export in the internal storage for the future usage.

NOTE

You can delete all OneCheck files created, selected OneCheck files, or edit Selector using the icons at the bottom left.

Figure 10 Selector configuring window

Figure 10 Selector configuring window

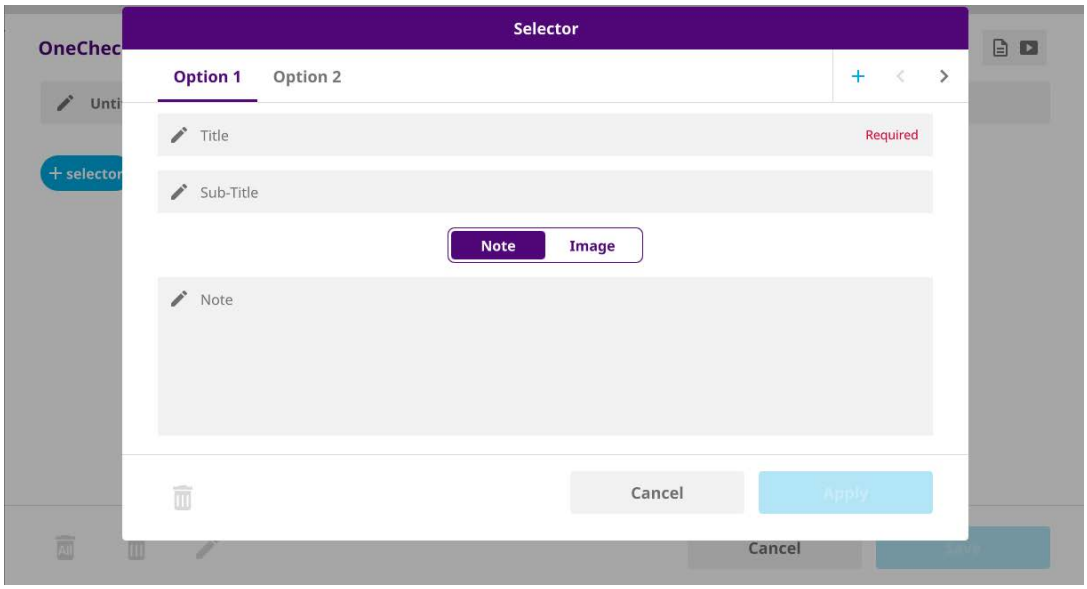


Figure 11 Measurement configuring window

Figure 11 Measurement configuring window

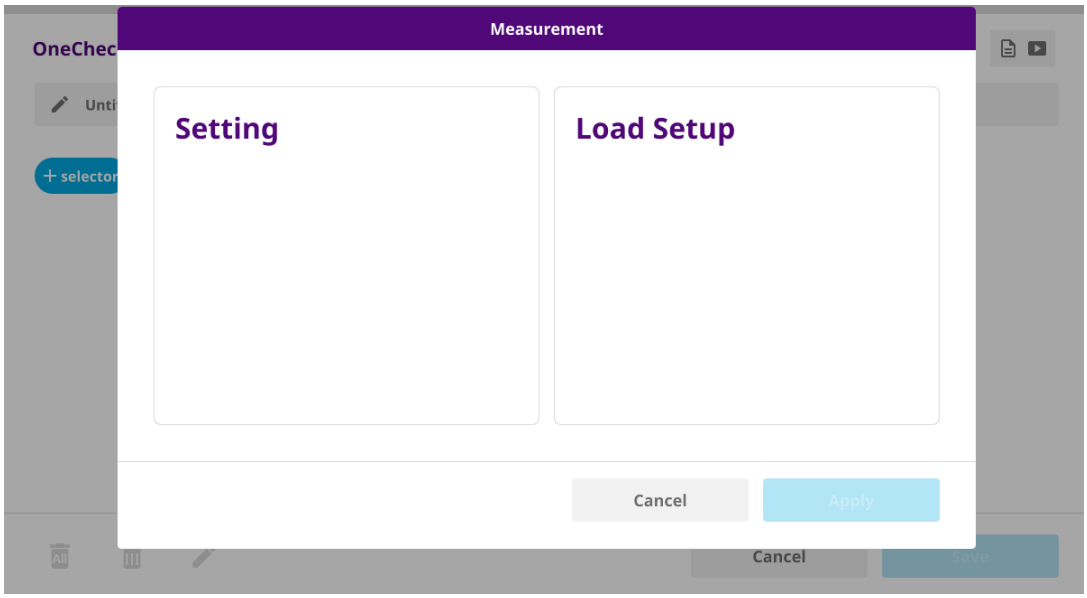
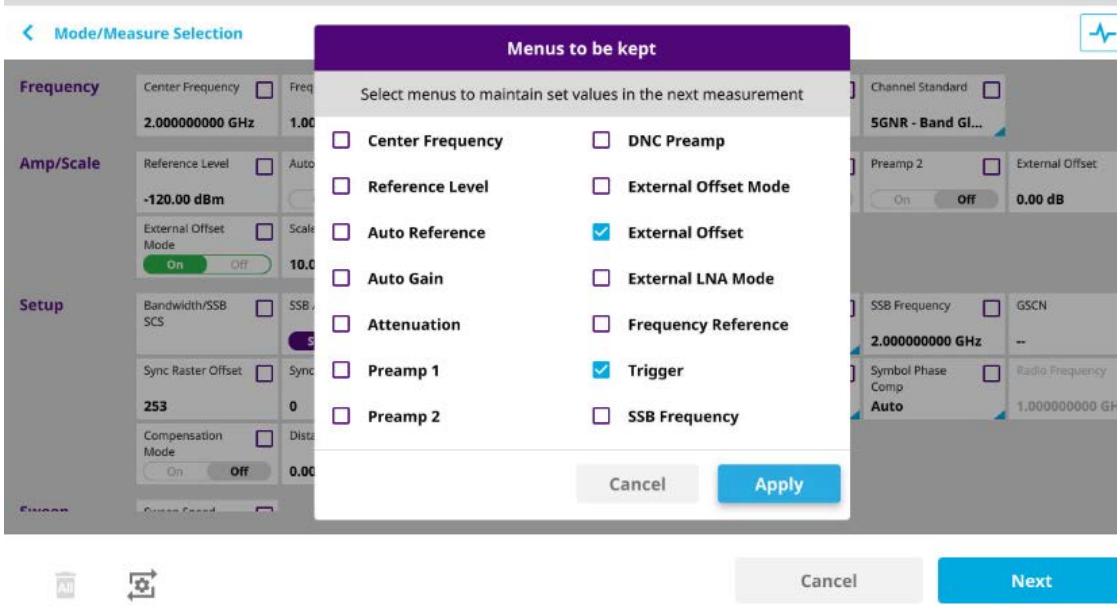


Figure 12 Menus to be kept

Figure 12 Menus to be kept



Loading a OneCheck file

If there is an already created OneCheck file in the internal storage in the left pane, you can simply load the file and operate it.

To load a OneCheck file

1. Select the required OneCheck file (.wfa) in the left pane.
2. Tap the **Load** button at the bottom right.
3. It goes to the first scenario step that was pre-defined.
   a. Tap the ( ) icon on the top left to check the saved scenario.
   b. Tap the **Instruction** button to view the instruction file saved.
   c. Tap to switch the ( ) icon on the top right to view the list with a window or a list.
   d. Tap the ( ) icon to configure settings as required. The setup parameters are shown based on the measurements you have pre-defined in the scenario.
4. Tap the **Next** (Next) button at the bottom right until it disappears.
5. If the loaded OneCheck file with a timer set, the measurement screen appears with the timer on top left and goes to the next step automatically.

   As soon as the timer ends, the current screen will be saved automatically.

6 If the loaded OneCheck file is without a timer set, you will need to go to the next step by tapping the **Next** (Next)icon on top of the current measurement screen.

7 Once you reach a final step in the OneCheck file loaded, a Report window appears.

8 Input the **File Name** field using the on-screen keyboard.

You can also import file using the internal file folder icon and input other fields as required.

9 Check or uncheck **View report after creation** or **Save inserted screen as file**.

10 Tap the **Create Report** button to create a pdf report file.

Figure 13 and Figure 14 show measurement screens with or without a timer

Figure 13 Measurement screen with timer

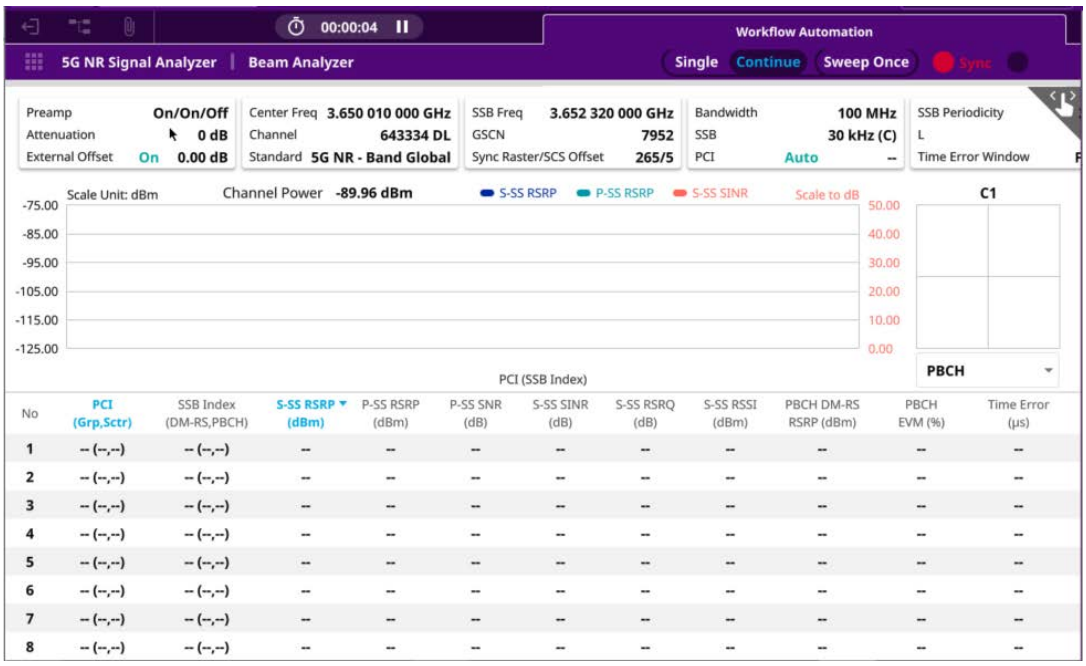
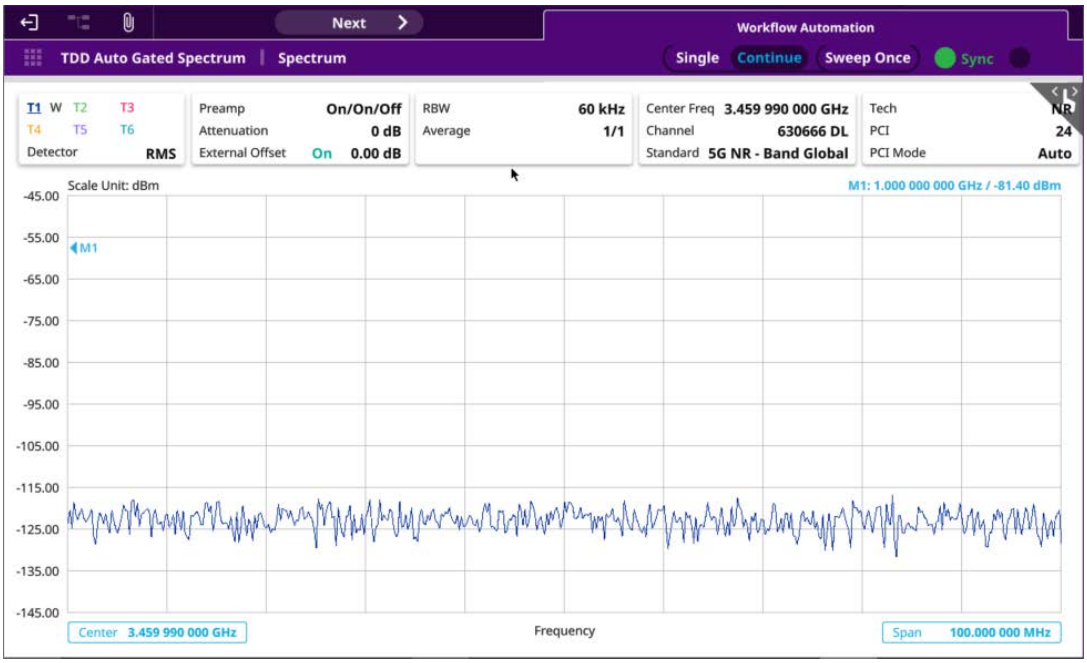


Figure 14 Measurement screen without timer



4

Using Spectrum Analyzer

This chapter describes how to use the Spectrum Analyzer. Topics covered in this chapter include:

- “Introduction” on page 24
- “Selecting mode and measure” on page 25
- “Configuring spectrum measurements” on page 25
- “RF analysis” on page 50
- “Gated sweep” on page 66
- “Route map” on page 68
- “Online route map” on page 71

Introduction

The advantage of using the Spectrum Analyzer is that it is easy to verify the presence of unwanted signals such as spurious and harmonics, which are normally very hard to identify in time domain analysis.

Performance assurance in wireless communication systems includes the observation of the out-of-band signal characteristics in order to identify the presence of harmonic signals. Harmonic signals of a carrier may interfere with other signals far out of the transmission band, or harmonic signals from other transmitters may interfere with in band signals affecting the spectral integrity.

In these days when a wide variety of wireless communication services are provided in frequency bands assigned very closely to each other, it is critical to ensure that each communication service is carried out within their assigned frequency band minimizing interference with adjacent frequency bands. The Adjacent Channel Power Ratio (ACPR) characteristic of a power amplifier or other RF components is an important factor in evaluating the system performance.

Spectrum analyzer has measure categories as the following:

- RF Analysis
  - Sweep Tuned Spectrum
  - Channel Power
  - Occupied Bandwidth
  - Spectrum Emission Mask (SEM)
  - Adjacent Channel Power
  - Multi Adjacent Channel Power
  - Spurious Emissions
  - Total Harmonic Distortion
  - Field Strength
  - AM/FM Audio and Modulation Analysis
  - Internal Power Meter
- Gated Sweep
  - Gated Sweep
- Route Map
  - Route Map
- Online Route Map
  - Online Route Map



NOTE

If you have an AntennaAdvisor Handle attached to your module, the Trigger button functions as Quick Save.

Selecting mode and measure

The following procedure describes how to start measurement.

To start measurement

1 Tap **Spectrum Analyzer** on the **MODE** panel.

2 Tap any measurement mode from the following choices:

- **RF Analysis > Sweep Tuned Spectrum, Channel Power, Occupied Bandwidth, Spectrum Emission Mask, Adjacent Channel Power, Multi-Adjacent Channel Power, Spurious Emissions, Total Harmonic Distortion, Field Strength, AM/FM Audio and Modulation Analysis,** or **Internal Power Meter**
- **Gated Sweep > Gated Sweep**
- **Route Map > Route Map**
- **Online Route Map > Online Route Map**



NOTE

If you have a CAA module with CAA-RFS license (enabled), the RF Source menu will be activated. Go to **Setup** > **RF Source** > **CAA RF Power**. And tap to switch **CAA RF Power** to **On**. Then you can tap to switch **RF Source** to **On** and set **Frequency**/**Power Level** as required. Note that if you have a CAA module with catalog number (CAA06MB with Bias Voltage option), you can tap to switch **Bias Voltage** to **On** and set the required **Bias Voltage**.

With this Bias Voltage, you can enhance the sensitivity while performing interference analysis on feeder of old BTS (Base Transceiver Station) without RRH.

Configuring spectrum measurements

The Quick Access and Display tab contains all necessary functions to configure the horizontal axis, vertical axis, and to configure and trigger the sweep for spectrum measurements. The Quick Access and Display tab also allows you to set traces, markers, Reference Lines, and limit lines. The contents of the menu vary by the currently selected measurement.

The horizontal axis contains frequency information in spectrum mode. You can specify the frequency in terms of the center frequency or by defining a start and stop frequency for a particular span. The settings related to the vertical axis can be accessed using the Amp/Scale menu.

Setting frequency

You need to set the frequency range to be measured with either the center frequency/span or the start/stop frequencies. You can also set the frequency with the channel

number and span. The center frequency or start and stop frequency values appear below the graticule on the display.

If you are aware of the frequency of the signal you are going to measure, the best option is to match the center frequency to the signal's frequency. If you are investigating signals that are within a particular frequency range, it is best to enter a start and stop frequency to define the span.

Frequency and span

Table 5 describes each key function.

Table 5 Key Frequency Functions.

Parameter	Description
Center Frequency	Sets the horizontal center of the display to a specific frequency using the on-screen keyboard. The left and right sides of the graticule correspond to the start and stop frequencies using the on-screen keyboard. **Access: Menu> Frequency> Center Frequency**
Start Frequency	Sets the frequency starting at the left side of the graticule. *This menu may not be shown in specific measurement mode.* **Access: Menu> Frequency> Start Frequency**
Stop Frequency	Sets the frequency starting at the right side of the graticule. The right sides of the graticule correspond to the stop frequency using the on-screen keyboard.*This menu may not be shown in specific measurement mode.* **Access: Menu > Frequency > Stop Frequency**
Frequency Step	Sets the step size for the frequency setting. The step size function is useful for finding harmonics and sidebands beyond the current frequency span of the instrument using the on-screen keyboard. **Access: Menu > Frequency > Stop Frequency**
Frequency Offset	Allows you to set a frequency offset value that is added to the frequency readout of the marker, to account for frequency conversions external to the instrument using the on-screen keyboard. Offset entries are added to all frequency readouts including marker, start frequency, and stop frequency. Offsets are not added to the span or frequency count readouts. Setting and offset does not affect the trace display. *This menu may not be shown in specific measurement mode.* **Access: Menu > Frequency > Frequency Offset**

Table 5 Key Frequency Functions.

Parameter	Description
Span Frequency	Sets frequency range symmetrically about the center frequency using the on-screen keyboard. The span frequency readout describes the total displayed frequency range. To determine span frequency per horizontal graticule division, divide the frequency span by 10. *This menu may not be shown in specific measurement mode.* **Access: Menu > Frequency > Span Frequency**
Full Span	Sets the span to full span, showing the full frequency range of the instrument. *This menu may not be shown in specific measurement mode.* **Access: Menu > Frequency > Full Span**
Zero Span	Sets the frequency span to zero. In this mode, the current center frequency is displayed in the time domain. It is only available in the spectrum mode. *This menu may not be shown in specific measurement mode.* If you have selected Zero Span, select **Trigger> Free, External, GNSS,** or **Video**. **Access: Menu > Frequency > Last Span**
Last Span	Sets the span to the previous span setting. *This menu may not be shown in specific measurement mode.* **Access: Menu > Frequency > Last Span**
Center Frequency List	Sets the Technology,Center Frequency, Channel Number, Bandwidth as required using the **Add (+)** button from the Center Frequency List table. *This menu may not be shown in specific measurement mode.* **Access: Menu > Frequency > Center Frequency List**

NOTE

If you want to edit the added center frequency list, tap the one of the list items (highlighted in purple) then tap the **Configuration** icon at the bottom of the table. You can select the required parameters. You can also tap the **Toothed Wheel** icon to load the applied parameters based on the center frequency input values. This applies commonly to the following measurement mode:

- **Commonly supported:** Spectrum Analyzer, Real-time Spectrum Analyzer, TDD Auto Gated Spectrum Analyzer, 5G NR Signal Analyzer, RAN Analyzer, LTE FDD/TDD Analyzer, and DSS Signal Analyzer
- **Multi-select supported:** Carrier Scanner in 5G NR Signal Analyzer, Carrier Aggregation, and OTA Channel Scanner in LTE FDD/TDD Analyzer, Multi-RAT Signal Analyzer, OTA Channel Scanner in DSS Signal Analyzer
- **Not supported:** Interference Analyzer, Channel Scanner, 5G TM Signal Analyzer, RFoCPR Interference Analyzer, 5G TM Signal Analyzer, and EMF Analyzer

You can multi-select the center frequency list and apply them to your measurement only if there are more than 2 carriers to be set. For more details, you can find it in each measurement mode.

Setting channel

Almost all transmission systems divide their assigned frequency ranges into channels. Each channel corresponds to a specific frequency. To operate such systems, you can use a channel standard table instead of setting frequencies manually. You can set the frequency with either frequency or channel number.

Channel number, channel step, and channel standard

Table 6 describes each function.

Table 6 Channel functions

Parameter	Definition
Channel Number	Sets the channel number using the on-screen keyboard. You can set the center frequency as channel number instead of setting frequency. In order to set the accurate frequency, you need to set the channel standard and link first. **Access: Menu > Channel > Channel Number**
Channel Step	Sets the channel step using the on-screen keyboard. **Access: Menu > Channel > Channel Step**
Link	You can toggle between **Uplink** and **Downlink**. *This menu may not be shown in specific measurement mode.* **Access: Menu > Channel > Link Uplink/Downlink**

Table 6 Channel functions

Parameter	Definition
Channel Standard	Shows a list of technology, Band Class, Channel Range, and Frequency Range (MHz). Tap to set the channel standard. **Access: Menu > Channel > Channel Standard**
Channel List	Sets the Technology, Center Frequency, Channel Number, Bandwidth as required using the **Add (+)** button from the Center Frequency List table. *This menu may not be shown in specific measurement mode.*



NOTE

The menu Channel List functions the same as Center Frequency List. If you want to edit the added center frequency list, tap the one of the list items (highlighted in purple) then tap the Configuration icon at the bottom of the table. You can select the required parameters. This applies commonly to the following measurement mode:

- **Commonly supported:** Spectrum Analyzer, Real-time Spectrum Analyzer, TDD Auto Gated Spectrum Analyzer, 5G NR Signal Analyzer, RAN Analyzer, LTE FDD/TDD Analyzer, and DSS Signal Analyzer

Setting amplitude

You can set the reference level and attenuation automatically or manually to optimize the display of the traces measured.

Table 7 describes each function.

Table 7 Amplitude functions

Parameter	Definition
Auto Reference Level	Tap to automatically set the reference. Each time you tap this, the Y-axis scale is to be optimized with some margin. **Access: Menu > Amp/Scale > Auto Reference Level** Note that this menu is not available in 5G NR Traffic Analysis in EMF Analyzer, Channel Mapper, Constellation, Control Channel, and Frame in DSS Signal Analyzer, and Control Channel in LTE Signal Analyzer. Instead, Auto Scale menu remains.
Reference Level	Sets the horizontal bar that can be placed at any graticule. Enter a value using the on-screen keyboard. **Access: Menu > Amp/Scale > Reference Level**

Table 7 Amplitude functions

Parameter	Definition
Auto Reference On/Off	Tap to turn the Auto Reference to on or off. If you change Scale Division, Attenuation, Preamp, External Offset, or External Offset Mode when the Auto Reference is set to On, Auto Reference Level is automatically adjusted. **Access: Menu > Amp/Scale > Auto Reference On/Off** Note that this menu is not available in 5G NR Traffic Analysis in EMF Analyzer, Channel Mapper, Constellation, Control Channel, and Fram in DSS Signal Analyzer, and Control Channel in LTE Signal Analyzer.
Auto Gain On/Off	Tap to turn the Auto Gain to on or off. If it sets to on, it applies amplitude automatically based on the input power. **Access: Menu > Amp/Scale > Auto Gain On/Off** Note that this menu is not available in RF Analysis of 5G NR Signal Analyzer.
Attenuation	Tap to set the attenuation value using the on-screen keyboard. **Access: Menu > Amp/Scale > Attenuation**
Preamp 1 On/Off	Allows you to turn the internal pre-amplifier on to correct and compensate for the gain of the preamp so that amplitude readings show the value at the input connector. It is the first Preamp for the FR1 Band and operated when the input level is -50 dBm or below. **Access: Menu > Amp/Scale > Preamp On/Off**
Preamp 2 On/Off	Allows you to turn the external pre-amplifier on to correct and compensate for the gain of the preamp so that amplitude readings show the value at the input connector. It is the second Preamp for the FR1 Band and operated when the input level is -70 dBm or below. **Access: Menu > Amp/Scale > Preamp 2 On/Off**
External Offset	Tap to manually set the external offset value from -120 to 120 using the on-screen keyboard. When you compensate for the external loss, input the positive values. when you compensate for the external gain, input the negative values. **Access: Menu > Amp/Scale > External Offset**
External Offset Mode On/Off	Tap to turn the external offset mode on or off. **Access: Menu > Amp/Scale > External Offset On/Off**

Table 7 Amplitude functions

Parameter	Definition
Scale Division	Allows you to use the Scale/Div feature available for the total harmonic distortion screen. It represents the value of one division on the horizontal scale. The default setting is 10 dB per division and the maximum value can be set up to 20 dB. Set the value using the on-screen keyboard. **Access: Menu > Amp/Scale > Scale Division**
Scale Unit	Tap to change the scale unit of the display scale: dBm, dBV, dBmV, dBµV, V, or W. **Access: Menu > Amp/Scale > Scale Unit** Note that the scale unit options vary based on the measurement mode.
External LNA Mode On/Off	Tap to turn the external LNA (low-noise amplifier) mode to on or off. When on, it will compensate the low-level signal. If it is on and the center frequency is between 26 GHz and 30 GHz, the external offset is automatically changed to -15 dB, and the center frequency is between 37 GHz and 40 GHz, the external offset is automatically changed to -20 dB. **Access**: **Menu** > **Amp/Scale** > **External LNA Mode On/Off**

Table 7 Amplitude functions

Parameter	Definition
Linearity High/ Normal	Allows you to switch Linearity to High to measure high input signal without attenuation. It is mainly recommended to measure TOI and 2nd harmonic distortion performance. The recommended input level is as below: 9 kHz to 18.5 GHz: ≤ -20 dBm 18.5 to 44 GHz: ≤ -25 dBm Note that the attenuation range to be set for 9 kHz to 18.5 GHz is 0 to 55 dB and for 18.5 to 44 GHz is 0 to 50 dB, and Preamp setting is not available. Allows you to switch Linearity to Normal to measure spectrum analysis with no noise floor. The recommended input level is as below: 9 kHz to 18.5 GHz: ≤ -30 dBm 18.5 to 44 GHz: ≤ -35 dBm Note that the attenuation range to be set for 9 kHz to 18.5 GHz is 0 to 55 dB and for 18.5 to 44 GHz is 0 to 50 dB, and Preamp setting is available. **Access: Menu > Amp/Scale > Linearity High/Normal** Note that Linearity High/Normal setting is not available in OTA Analysis of the instrument. If you set Linearity to High, the instrument automatically applies this setting in the case of mode change.
Auto Scale	Tap to automatically set the attenuation. Each time you tap this, both of the Y-axis scale and input attenuation level change to be optimized with some margin. Access: Menu > Amp/Scale > Auto Scale

Setting BW/AVG

You can manually set the Resolution Bandwidth (RBW), Video Bandwidth (VBW), and the proportional VBW based on the designated RBW. Selecting Auto changes the value to correspond to your frequency span setting for RBW and VBW/AVG settings for VBW.

Table 8 describes the key functions.

Table 8 BW/AVG functions

Parameter	Description
RBW	Tap RBW to set it manually. Tap a value between 1 Hz to 3 MHz. The RBW setting automatically changes to Manual. **Access: Menu > BW/AVG > RBW**
RBW Mode Manual/Auto	Toggle the RBW Mode to Manual or Auto. When you select Auto, it will be automatically set to an approximate value for Span/100. **Access: Menu > BW/AVG > RBW (Manual/Auto)**
VBW	Tap VBW to set it manually. Tap a value between 1 Hz to 3 MHz. The VBW setting automatically changes to Manual. **Access: Menu > BW/AVG > VBW**
VBW Mode Manual/Auto	Toggle the RBW Mode to Manual or Auto. **Access: Menu > BW/AVG > VBW (Manual/Auto)**
VBW/RBW	Sets the proportional VBW based on the designated RBW. Select the ratio: 1, 0.3, 0.1, 0.03, 0.01, 0.001, or 0.003. Toggle the VBW and RBW to Auto. **Access: Menu > BW/AVG > VBW/RBW**
Average	Sets the number of measurements to be averaged for the trace presentation. **Access: Menu > BW/AVG > Average**

Table 9 provides a VBW/RBW ratio example.

Table 9 VBW/RBW ratio example

RBW	Ratio (VBW/RBW)	VBW
30 kHz	1:1	30 kHz
	1:0.3	10 kHz
	1:0.1	3 kHz
	1:0.03	1 kHz
	1:0.01	300 kHz
	1:0.003	100 Hz

Selecting sweep

You can set the length of time that the instrument takes to tune across the displayed frequency span or, in zero span, the time that the instrument takes to sweep the full screen. Reducing the sweep time increases the sweep rate. The default setting for the sweep mode are **Continue** and **Normal** to sweep continuously at a normal speed for

most on-going measurements. If you want to hold the measurement or get a single sweep, you can change the sweep mode.

Table 10 describes each key function.

Table 10 Sweep functions

Parameter	Definition
Sweep Time	Shows the sweep time when the sweep time is set to **Auto**. If the sweep time is set to **Manual**, you can manually input the sweep time using the on-screen keyboard. **Access: Menu > Sweep > Sweep Time**
Sweep Time Mode Manual/Auto	Select the sweep time mode to **Manual** to set it manually or to **Auto** to set it automatically. **Access: Menu > Sweep > Sweep Time Manual/Auto**
Sweep Mode Single/Continue	Tap to switch the sweep mode to **Single** or **Continue**. **Access: Menu > Sweep > Sweep Mode Single/ Continue**
Sweep Once	Tap to get a new measurement in **Single** mode. If **Continue** is set in **Sweep Mode**, the sweep mode will be changed to **Single** after tapping it. **Access: Menu > Sweep > Sweep Once**
Sweep Speed	Tap the sweep speed to **Fast** to speed up sweeping. You can set the parameter to **Fast** when the **RBW** range is from 1 kHz to 3 MHz. **Access: Menu > Sweep > Sweep Mode Fast/Normal**
Zero Span Time	Enabled when you select **Zero Span**. Adjusts **Sweep Time** to allow enough time for a cycle. **Access: Menu > Sweep > Zero Span Time**
Period Time	Enabled when you select **Zero Span**. Tap to set Period Time using the on-screen keyboard. **Access: Menu > Sweep > Period Time**
Period Type Manual/Standard	Enabled when you select **Zero Span**. Tap to switch Period Type to Manual or Standard. **Access: Menu > Sweep > Period Type Manual/ Standard**
Standard Signal	Enabled when you select **Zero Span**. Tap to select **Standard Signal** from: **GSM**, **WCDMA**, **LTE**, **EV-DO**, **TD-SCDMA**, or **WiMAX**. **Access: Menu > Sweep > Standard Signal**

Setting reference clock and frequency reference

If you have to perform measurements according to certain signal conditions, you can use a trigger. A trigger and a frequency reference respond to certain events. When a trigger and a frequency reference source other than Free, the Spectrum Analyzer starts to sweep only when the selected trigger and frequency reference source conditions are met. The trigger can be generated either externally or internally.

GNSS trigger can be generated via a GNSS receiver and once it's enabled, the GNSS trigger options appear in the menu. The available measurements are as below:

- **RAN Analyzer**: Beam Analyzer, Freq/Time/Power Variation
- **5G NR Signal Analyzer**: Beam Analyzer, Carrier Scanner, Route Map, Freq/Time/Power Variation, Constellation, Sync Analysis, Sync Route Map, Online Sync Route Map, Online OTA Route Map
- **5G DSS Signal Analyzer**: Constellation, Frame, OTA Control Channel, Subframe, Freq/Time/Power Variation
- **LTE Analyzer**: Constellation, OTA Control Channel, OTA Channel Scanner, OTA ID Scanner, Subframe, Freq/Time/Power Variation
- **5G TM Signal Analyzer**: MIMO Time Alignment Error, CA Time Alignment Error
- **Multi-RAT Signal Analyzer**: Multi-RAT Analyzer, Multi-RAT Scanner, Multi-RAT Route Map, Online Multi-RAT Route Map

Table 11 describes each function.

Table 11 Trigger functions

Parameter	Description
Free	Select **Free** to start a new sweep immediately after the current sweep ends. This is the default state of the Spectrum Analyzer module. **Access: Menu > Reference Clock > Trigger > Free**
Internal (Trigger)	Select **Internal** to start a sweep using the internal reference clock and creating a trigger. **Access: Menu > Reference Clock> Trigger > Internal**
External (Trigger)	Select **External** to start a sweep based on the external input trigger. **Access: Menu > Reference Clock > Trigger > External**
GNSS (Trigger)	If you use a GNSS receiver while performing measurements on a base station, you can synchronize the sweep via the GNSS receiver. Note that if the GNSS is enabled for the measurements with Time Error, GNSS Trigger menu appears and you can select UTC, UTC+2000, UTC+3000, or UTC+5000 as required. The default will be set to GNSS when GNSS status is set to LOCKED in System > GNSS. **Access: Menu > Reference Clock > Trigger > GNSS**

Table 11 Trigger functions

Parameter	Description
TEM2 (Trigger)	If your TEM2 module is connected, you can select this option. Make sure to tap the **Position Fixed** button to receive the accurate position information. If it is not updated it affects your measurement due to an offset occuring. **Access: Menu > Reference Clock > Trigger >TEM2**
Video (Trigger)	A sweep starts when the video voltage exceeds a particular level. The video trigger is only available in the time domain (when it is Zero Span = 0). **Access: Menu > Reference Clock > Trigger >Video**
Internal (Frequency Reference)	Uses a 10 MHz internal clock. **Access: Menu > Reference Clock> Frequency Reference > Internal**
External (Frequency Reference)	Uses external 10 MHz, 13 MHz, or 15 MHz clock automatically set by the instrument. **Access: Menu > Reference Clock > Frequency Reference > External**
GNSS (Frequency Reference)	Uses a built-in GNSS as a frequency and timing source. **Access: Menu > Reference Clock > Frequency Reference > GNSS**
TEM2 (Frequency Reference)	Uses TEM2 pps as a frequency and timing source. Note that TEM2 setting is available only when it is connected. **Access: Menu > Reference Clock> Frequency Reference > TEM2**
Auto Select (Frequency Reference)	TEM2 and GNSS are primarily set and then set to External Clock automatically. **Access: Menu > Reference Clock > Frequency Reference > Auto Select**



NOTE

Make sure to connect TEM2 to EXPC-B next to the DC Input jack to receive the clock resource properly.

Setting trace

The Spectrum Analyzer module provides display of up to 6 traces. Each trace consists of a series of points where amplitude data is stored. The module updates the information for any active trace with each sweep.

Table 12 describes trace the functions.

Table 12 Trace functions

Parameter	Definition
Select Trace	Tap to select trace from the following options: Trace 1, Trace 2, Trace 3 **Access: Menu > Trace > Select Trace**
Trace View On/Off	Select the **Trace View** to **On** or **Off**. Once you have selected On, you can see the selected trace with its dedicated color on the chart. When Off, the Trace Legend is indicated on the Quick Access and display tab for Trace. **Access: Menu > Trace > Trace View On/Off**
Trace Type	Tap to select the Trace Type from the following options: Clear Write, Capture, Max, Min, or Load. For details, see “Table 12 describes trace the functions.” on page 37. **Access: Menu > Trace > Trace Type**
Trace Hold Time	Tap to set the Trace hold Time using the on-screen keyboard. **Access: Menu > Trace > Trace Hold Time**
Select Trace Info	Tap to select the trace information from the following options: **None**, **Trace 1**, **Trace 2**, **Trace 3**, **Trace 4**, **Trace 5**, or **Trace 6**. **Access: Menu > Trace > Select Trace Info**
Detectors	Tap to select the detection mode from the following options: **Normal**, **Peak**, **RMS**, **Negative Peak**, or **Sample**. See “Table 12 describes trace the functions.” on page 37 for more information. **Access: Menu > Trace > Detectors**
Trace Clear All	Tap to remove all the traces and initialize the trace settings. **Access: Menu > Trace > Trace Clear All**
T1-T2 → T5	If Trace 1 and Trace 2 are active, this menu is activated.
T2-T1 → T5	If Trace 1 and Trace 2 are active, this menu is activated.
Number of Trace	Tap to select the number of trace points options from **501**, **1001**, **1501**, **2001**, **3001**, **5001**, or **10001**.
Threshold RMS	Tap to switch **Threshold RMS** to **On** or **Off**. Note that this is only available in SA. **Access: Menu > Trace > Threshold RMS**
Threshold Auto	Tap to switch **Threshold Auto** to **On** or **Off**. Note that this does not affect the value for Threshold RMS level. Note that this is only available in SA. **Access: Menu > Trace > Threshold Auto**
Threshold RMS level	Tap to set Threshold RMS level only if Threshold RMS/ Threshold Auto are disabled.

Table 12 Trace functions

Parameter	Definition
Set Write/Min/Max	Tap to set Trace 1 to Clear Write, Trace 2 to min, and Trace 3 to Max automatically in SA, IA and RFoCPRI Interference Analyzer. Note that Trace 1 for Spectrogram measurement in IA and RFoCPRI Interference Analyzer is only available and automatically set to Clear Write.

NOTE:

Threshold RMS feature is to measure Channel Power for TDD signal more accurately and it creates a trace that averages trace points over a specific level.

Trace type

The following **Trace Types** are available:

- **Clear Write**: Clears current data and display with new measurements. Once selected, the Trace Legend, W is indicated on the Quick Access and display tab for Trace.
- **Capture**: Captures the selected trace and compares traces. Once selected, the Trace Legend C is indicated on the Quick Access and display tab for Trace.
- **Max Hold**: Displays the input signal's maximum response only (unlimited or for a certain amount of time). Once selected, the Trace legend M is indicated on the Quick Access and display tab for Trace.
- **Min Hold**: Display the input signal's minimum response only (unlimited or for a certain amount of time). Once selected, the Trace legend m is indicated on the Quick Access and display tab for Trace.
- **Load**: Loads a saved trace. Once selected, the Trace Legend L is indicated on the Quick Access and display tab for Trace.

NOTE:

For the Max Hold and Min Hold, your instrument compares newly acquired data with the active trace and displays larger maximum values or smaller minimum values on the screen.

Trace detection

The following Trace detections are available:

- **Normal**: Displays random noise better than the peak without missing signals.
- **Peak**: Displays the highest value in each data point.
- **RMS**: Displays root mean squared average power across the spectrum.
- **Negative Peak**: Displays lowest value in each data point.
- **Sample:** Displays the center value in each data point.

Trace math

The trace math shows the difference of Trace 1 and Trace 2 measurement results, If Trace 1 and Trace 2 are active, the menu, T1 - T2 → T5 or T2 - T1 → T6 become available and you can perform trace math. When performing the trace math, the scale is automatically set and the display of scale for the trace math is on the right side of the screen, as shown in Figure 15.

Figure 15 Trace 1 and Trace 2 measurement results



Setting limit

A limit value can be set to alert you that the measured value exceeds the value that is specified. If the span is selected as Zero Span, the line is not displayed.

Table 13 describes each function.

Table 13 Limit functions

Parameter	Description
Reference Line	Tap to set values for the reference line using the on-screen keyboard. **Access: Menu > Limit > Reference Line**
Reference Line Mode On/Off	Tap to set the **Reference Line Mode** to **On** or **Off** to display or dismiss the reference line. The inactive vertical move bar on the left edge with straight line appears across the screen to be used as a visual reference only. To adjust the Reference Line, tap and drag the move bar up or down. The vertical move bar then becomes activated. If there is no touch operation for 2 seconds, the move bar becomes inactive again. The Reference Line does not indicate Pass/Fail. **Access: Menu > Limit > Reference Line Mode On/Off**

Table 13 Limit functions

Parameter	Description
Multi Segment Line	Tap Multi Segment Line for Pass/Fail indication. **Access: Menu > Limit > Multi Segment Line**

To configure Multi Segment Line

1. Tap **Menu > Limit**
2. Tap **Multi Segment Line**.
3. Tap to switch the selected side to **Upper** or **Lower**.
4. Tap the **# of Line** to set the number of segments for the selected side for upper or lower up to 50 segments using the on-screen keyboard.
5. Tap the **Autoset** soft key to automatically set the limit for each segment and display the line.
6. Tap **Offset Up/Down** or **Offset Left/Right** to move the limit line using the on-screen keyboard.

   Table 14 describes the parameters displayed for the multi segment line.

Table 14 Multi Segment Line parameters

Parameter	Description
Autoset	Tap to autoset the limit for each segment and Reference Line. **Access: Menu > Limit > Multi Segment Line > Autoset**
Select Side	Tap to set the Select Side to Lower or Upper to select the one to be displayed. **Access: Menu > Limit > Multi Segment Line > Select Side Lower/Upper**
Limit	Tap to select the Limit to On or Off, Once the Autoset is selected, the Limit changes to On. **Access: Menu > Limit > Multi Segment Line > Limit On/Off**
# of Line	Tap to set the **# of Line** up to 50 segments for the upper or lower limit line using the on-screen keyboard. **Access: Menu > Limit > Multi Segment Line > # of Line**
Offset Up/Down (dB)	Tap to set the **Offset Up/Down** to move the limit line up or down when the **Reference Line Mode** is set to **On** using the on-screen keyboard. **Access: Menu > Limit > Multi Segment Line > Offset Up/ Down**
Offset Left/Right	Tap to set the **Offset Left/Right parameter** left or right when the **Reference Line Mode** is set to **On** using the on-screen keyboard. **Access: Menu > Limit > Multi Segment Line > Offset Left/ Right**

Table 14 Multi Segment Line parameters

Parameter	Description
Edge Limit Table	Tap to edit the **Limit Table**. The **Limit Table** appears on the bottom of the chart screen. **Access: Menu > Limit > Multi Segment Line > Edit Limit Table**

Editing limit table

1. Tap to switch the select side to **Upper** or **Lower**.
2. Tap **Select Display Plot** to select the segment that you want to edit.
3. Tap the switch to switch the selected segment line to **On** or **Off**.
   To remove the selected segment line, select **Off**.
4. Tap **Add Point** to add a new segment line
5. Tap **Delete Point** to delete the selected point.
6. Tap **Frequency** or **Amplitude** to change the position and input the value using the on-screen keyboard.



NOTE

If the **Upper** and **Lower** are set to **Off** in the **Select** side menu, **Edit Limit Table** mode is not available.

Using marker

Marker is used to get the information about a specific trace. Six markers can be set on the display, and each marker can be used independently The X and Y coordinates of the trace are displayed when the marker is placed on any position of the trace. The position displaying the marker's X and Y coordinates may be slightly different for each measurement mode and refer to the description of each measurement. There are three different marker types available: Normal, Delta, and Delta Pair. Marker position can be set manually by entering numeric values (frequency) or using the purple move bar when one of the marker types is selected.

Table 15 describes the functions.

Table 15 Marker functions

Parameter	Definition
Frequency Count On/Off	Used when a highly accurate reading of the frequency is needed for the active marker on the signal, then measurement of the signal peak with 1 Hz resolution in background. Select to switch the **Frequency Count** between **On** and **Off** to enable or disable the frequency count for the selected marker. **Access: Menu > Marker > Frequency Count On/Off**
Noise Marker On/Off	Used to measure a noise adjacent to a signal by an average in several data points to calculate the readout for the Noise marker as if making a measurement using a 1 Hz bandwidth. Select to switch the **Noise Marker** between **On** and **Off** to enable or disable the **Noise Marker** function for the selected active marker. **Access: Menu > Marker > Noise Marker On/Off**

NOTE

Frequency Count and Noise Marker functions are only used in the Spectrum Analyzer mode.

Using marker table

The following describes the marker table.

- **Select Marker**: Selects an active marker whose position can be changed by tapping and switching marker from M1 to M6. Each marker has a different color. The assigned number of the active marker is displayed in the Marker Table box, and the active marker number is displayed next to the active marker on the trace. When tapping the Active Marker Off (M) icon, the selected marker disappears.
- **Normal**: Provides the reading of a marker position on the trace, along with the marker number between one and six.
- **Delta**: This Delta marker type is associated with a Normal marker. A Normal marker must be set before a Delta marker is set. When the Delta marker is set, the position set by the Delta marker becomes the reference position of the Normal marker, and the marker's X and Y values display the difference compared with the Delta marker.
- **Delta Pair**: This marker type is associated with a Normal marker. A Normal Marker must be set before a Delta pair marker is set. When the Delta Pair marker is set, the position set by the Delta Pair marker becomes the reference position of the Normal marker, and the marker's X and Y values display the difference compared with the Delta Pair marker. The reference position will be varied in accordance with trace change.

- **Marker All Off**: Turns all markers on the screen off. When the Marker View is selected for those markers the instrument displays those markers at the previous position. If a measurement mode is changed, the current settings are not restored.
- **Start**: Sets the frequency of the active marker to the start frequency of the spectrum analyzer.
- **Center**: Sets the frequency of the active marker to the center frequency of the spectrum analyzer.
- **Stop**: Sets the frequency of the active marker to the stop frequency of the spectrum analyzer.
- **Peak Search**: Moves the active marker to the highest peak of the trace. You can also tap the hot key icon to use this function.
- **Min Search**: Moves the active marker to the lowest peak of the trace.
- **Next Peak**: Moves the active marker to the second highest peak of the trace.
- **Left Peak**: Moves the active marker to the highest peak to the left of its current position.
- **Right Peak**: Moves the active marker to the highest peak to the right of its current position.
- **Always Peak**: When Always Peak is set to On, the instrument moves the active marker automatically to the highest peak of the trace every time the trace is refreshed.

To move a marker to a selected trace

1 Tap **Menu > Trace**

2 Tap Select **Trace**, and select the trace from **Trace 1** to **Trace 6**.

3 Tap **Trace View** and select **On**.

The selected marker moves to the selected trace.



NOTE

If the marker is beyond the frequency range, the purple horizontal move bar appears on the left and right edge of the chart screen. You can move the marker by moving the bar right and left.

Managing files

The instrument lets you save and load screen, result, setup, logging data, or Fail events depending on your selected measurement modes and options. You can also save the limit when saving the File Type as Setup.

Using save

You can save your current screen, result, and setup into the internal memory or your external USB memory drive, **USB A** or **USB B** or **SD card**. Make sure to insert a USB memory drive to USB A or B port and insert the SD card to MicroSD port to enable the

option. After insertion, you'll have access to the external storage, where you can find a sub-directory corresponding to the instrument you're using. When you are using the Save feature, Hold is automatically enabled.

1 Tap **Menu** > **File** > **Save** or tap the **Save** ( ) icon on the side bar.

2 Tap the **File Name** input field.

3 Enter the file name you want using the on-screen keyboard.

4 To know what and how to save, see the following options:

a Select **Screen (.png)** to save the current screen with a file type, .png.

b Select **Report (.pdf)** to save the measurement result in a report format with comments and captured screen images with a file type, .pdf.

If you select Screen or Report in the save options, you can automatically save setup information with screenshots.



NOTE

When you are operating multi-tabs and trying to save the File Type as Report (.pdf), a pop-up asking you to save the active tab only or to save all visited tabs will appear.

c Select **Result (.json)**to save the measurement result with a file type, .json and .gomv (Route Map).

d Select **Result (.gomv)** to save the measurement result with a file type, .gomv (Route Map).

e Select **Result (.csv)** to save the number of points displayed on the screen with a file type,.csv.



NOTE

The file type, Result (.csv) is inactivated (greyed-out) based on the selected measurement mode. The option, Logging (.csv) and IQ Capture (.bin) are available based on the selected mode.

f Select **Setup (.stav)** to save the setup and test configuration with a file type, .stav.

g Select **Logging (.csv)** to save all measurement results with a file type, .csv.

h Select **IQ Capture (.bin)** to save the raw data with a file type, .bin. (LTE/LTE-A FDD Analyzer, LTE/LTE-A TDD Analyzer, and 5G NR Signal Analyzer).

5 *Optional.* Tap to switch the **Color Inversions** to **On** to invert the image color (only available to save as Screen (.png) or Report (.pdf).

Creating a report

1 Tap the **Report Setup** box.

2 Insert the company image using () the icon.

3 Enter the company name in the **Customer Name Here** field.

4 Enter the name of the person who performed testing in the **Your Name Here** field.

5 Enter your company or site address in the **Site Location/Site Information** field.

6 Enter your test purpose in the **Test Purpose** field.

7 Enter a summary of your test results in the **Result** field.

8 Tap the **Image Add** (+) button to add up to six screenshots and tap the **Apply** button.

Using event save

Depending on the measurement mode, you can let the instrument automatically save measurement screen or result that falls outside the defined limit settings or the Fail indicator is on. You can also set to save the first event and hold the measurement or to save all the events continuously.

1 Tap the **Event Save** tab.

2 Tap the **File Name** input field and enter the file name using the on-screen keyboard.

3 Tap to select the **File Type** from the options displayed on the screen.

4 Specify the **Save To** directory where you want saved files to be stored.

5 Tap to switch the **Save On Event** to **On** or **Off**.

If the Save On Event is On, it is saved with the selected file type in accordances with limit(s) fail.

6 Tap to switch the **Save Then Stop** to **On** to save the first event that fails outside the defined limit(s) and to hold the measurement automatically.

To resume the measurement until the next event occurs, tap the **Hold** icon on the side bar. Otherwise, leave this feature off to save the fail event every time a new event occurs.

7 Tap to switch the **Color Inversions** to **On** to invert the image color when the **File-Type** is **Screen**.

8 Tap to switch the **Save Event Type** to **Pass** or **Fail**.

9 Tap the **Apply** button to get ready for event saves the file. Then the **Event Save** ( ) indicator appears up on the screen.

10 Tap the **X** button in the Event Save indicator to turn the event save off.

Using quick save

You can save your configured settings by using this Quick Save feature.

1 Tap the **Quick Save** tab.

2 Tap the **File Name** input field and enter the file name using the on-screen keyboard.

3 Tap to select the **File Type** from the following options: **Result**, **Report**, and **Screen**.

If the file type is not selected, it is saved as a Screen type.

4 Tap the **Apply** button to apply the settings.

Using Load

You can load your saved screen, result, and setup from the internal memory or your external USB memory drive, USB A or USB B or SD card. Make sure to insert a USB memory drive to USB A or B port and insert the SD card to MicroSD port to enable the option. After insertion, you'll have access to the external storage, where you can find a sub-directory corresponding to the instrument you're using.

1 Tap **Menu** > **File** > **Load** or tap the **Load** ( ) icon on the side bar.

2 Select the file to be loaded from the internal memory or from your USB drive.

Information of your selected file appears in the File Information pane.

3 Check the file information on the right pane.

Tap the **Load** button to load the file.

NOTE

You cannot load setup files in the following cases:

- If the platform where the setup file was saved and the platform to be loaded are different. For example, you cannot load the setup saved in ONA-800 on the CA5000.
- If the RF HW module where the setup file was saved and the equipment to be loaded are different. For example, you cannot load the setup saved in ONA-800 6G(v1) on ONA-800 44G(v2).
- If there is no license for the mode in the setup file. For example, you cannot save in LTE mode on equipment with the LTE license and load on equipment without the license.

Using favorite

Managing a setup file

You can manage a setup file you have saved in the favorite group using the Favorite Item menu.

1 Tap **Menu** > **File** > **Favorite** or tap the **Favorite** ( ) icon on the side bar.

2 Tap the Group icon from Group A to Group R to get focus (highlighted in purple).

3 Tap the Group icon again to open.

4 Tap the **Add** icon.

The File Info window appears and you can select the setup files you want to load.

5 Tap the **Apply** button to load the selected file.

6 Tap the **Delete** icon to delete the selected file.

7 Tap the **Rename** icon to rename the selected file.

8 Tap the **Apply** button to load the saved file.

Managing a favorite group file

You can manage a favorite group file using the Favorite Group menu.

1 Tap **Menu** > **File** > **Favorite** or tap the **Favorite** (★) icon on the side bar.

2 Tap the **Group** icon from Group A to Group R to get focus (highlighted in purple).

3 Tap the **Rename** icon to change the Group name.

4 Input the Group name using the on-screen keyboard and tap the **Enter** key.

5 To load a favorite DB file, tap the **Import** icon.

The File Info window appears and you can select the Favorite DB files you want to load.

6 To save all favorites in a new DB files, tap the **Export** icon.

7 Tap the **File Name** field and change the file name using the on-screen keyboard.

8 Tap the **Apply** button to save the file.



NOTE

The instrument manages only one Favorite DB file as a system info. Therefore, once a Favorite DB is exported as a file, it will not be synched with any change on Favorite DB.

Glancing at menus and icons

There are menus and icons that you need to get familiar with to operate the instrument efficiently.

Table 16 Menus on the side bar

Icons	Name	Description
	Menu	Tap to view all menus for the selected measurement and mode. Note that the Menus vary based on the selected measurement and mode.
	Setup	Tap to view measure setup menus for the selected measurement and mode. Note that the measure setup menus vary based on the selected measurement and mode.
	Full menu	Tap to view full menus for the selected measurement and mode in one screen. You can set all the parameters needed for a test at once.
	More	Tap to view more hot keys available.
	Help	Tap to view the instrument Help.

Table 17 Hot keys and icons on the side bar

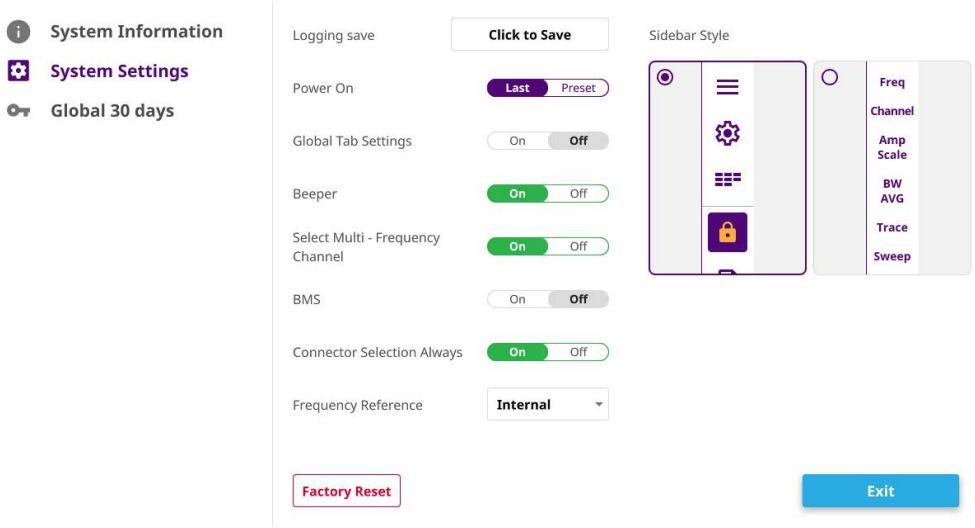
Item	Name	Description
	Hold	Tap to hold spectrum measurement.
	Save	Tap to save the current measurement from one of the five file types: **Result**, **Result as CSV**, **Setup**, **Report**, or **Screen**.
	Load	Tap to load the saved measurement result file.
	Auto scale	Tap to set the scale automatically.
	Marker table	Tap to view the active marker with its information.
	Marker setting	Tap to select the marker from 1 to 6 to set the marker position.
	Peak search	Tap to set the active marker to peak. When makers are all off, M1 will be the active marker.

Item	Name	Description
	Screen capture	Tap to quick save the current screen.
PRE	Preset	Tap to reset the instrument to the factory default. It can be shown when you tap the more (⋯) icon on the side bar.
	System setting	Tap to view the system information, system settings, and global 30 days license.
	Favorite	Tap to view pages identified as Favorites and the most recent pages visited.
	Connector selection	Tap to select a connector between 9 kHz to 18.5 GHz and 9 kHz to 44 GHz. You must select a correct connector based on the connected input RF port on the top panel of your instrument.

NOTE

In the System Setting screen, there is Global 30 days options available. You can simply tap the Active button to activate the option you want, and you can only use it for 30 days once activated.

Figure 16 System Settings Screen



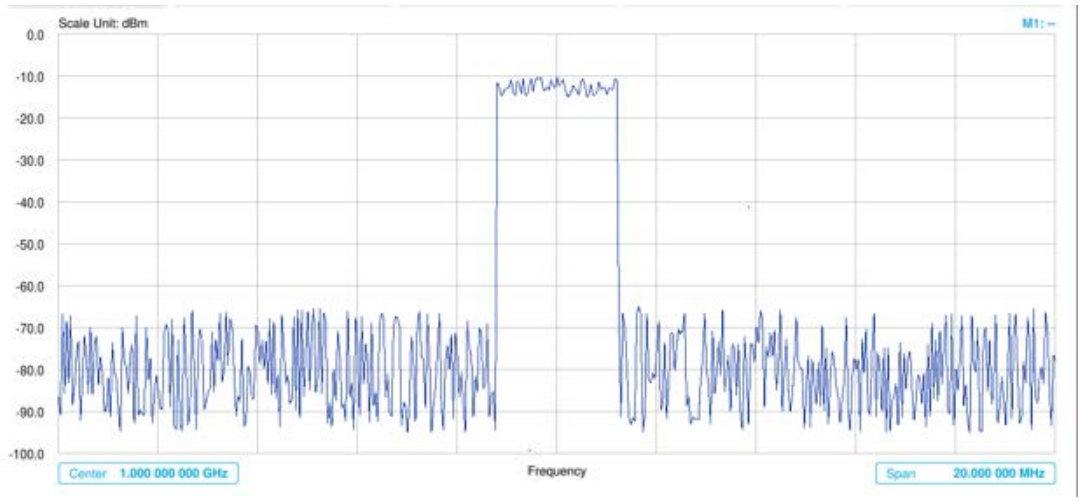
NOTE

You can change the sidebar style from icons to menu names and vice versa, as you wish. When Global Setting mode is On, the following items will be applied even when switching tabs: Auto Reference, Used N-Type Port, External LNA Mode, Center Frequency, Attenuation, Attenuation Mode, Preamp 1 / Preamp 2 / DNC Preamp, Linearity, Frequency Reference, External Offset, and Auto Gain.

Conducting spectrum measurements

If you have configured test patterns as described in “Configuring spectrum measurements” on page 25, your measurement is displayed on the screen, as shown in Figure 17 on page 50. You can change **Center Frequency** and **Span** by tapping the icons below the result chart screen.

Figure 17 Sweep tuned spectrum measurement with spectrum analyzer.



NOTE

If the sweep mode is set to Normal and RBW is 300 Hz or below, the Sweep Type changes to FFT. If the Sweep Mode is set to Fast and RBW is 30 kHz or below, the Sweep Type changes to FFT.

RF analysis

The following sections describe how to conduct RF measurements.

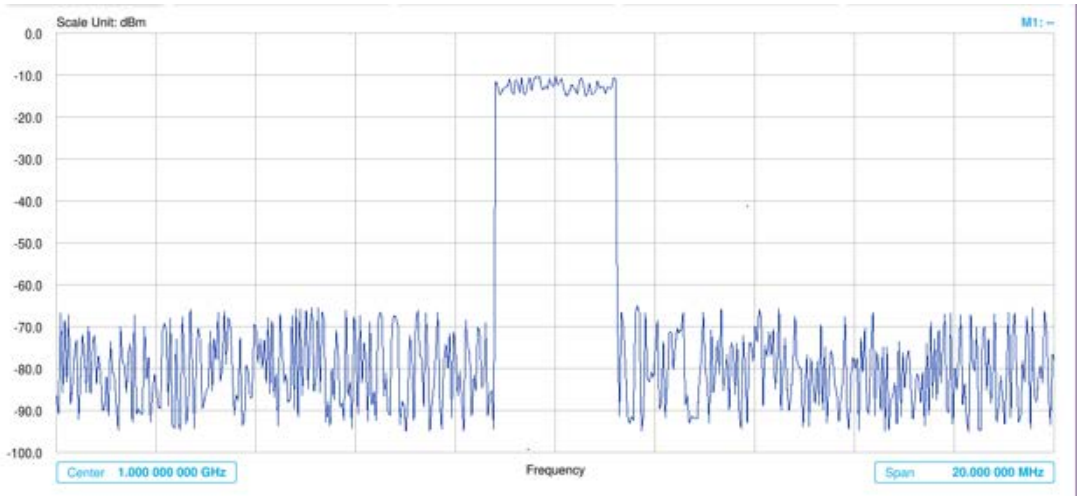


You can quickly access the Auto Gain feature by tapping the Auto Gain icon in the top right corner of the measurement screen. If you tap the Auto Gain icon, the following icon appears. + indicates the attenuation increases by 5 each time. - indicates the attenuation decreases by 5 each time. The third one is auto scale and it automatically adjusts scales.You can tap X to exit the Auto Gain feature.

Sweep Tuned Spectrum

If you have configured test patterns as described in “Configuring spectrum measurements” on page 25, your measurement is displayed on the screen, as shown in Figure 17 on page 50. You can change **Center Frequency** and **Span** by tapping the icons below the result chart screen.

Figure 18 Sweep tuned spectrum measurement with spectrum analyzer.



NOTE

If the sweep mode is set to Normal and RBW is 300 Hz or below, the Sweep Type changes to FFT. If the Sweep Mode is set to Fast and RBW is 30 kHz or below, the Sweep Type changes to FFT.

Channel Power

The Channel Power measurement is a common test used in the wireless industry to measure the total transmitted power of a radio within a defined frequency channel. It acquires a number of points representing the input signal in the time domain, transforms this information into the frequency domain using Fast Fourier Transform (FFT), and then calculates the channel power. The effective resolution bandwidth of the frequency domain trace is proportional to the number of points acquired for the FFT.

The channel power measurement identifies the total RF power, power spectral density, and Peak to Average Ratio (PAR) of the signal within the channel bandwidth.

Setting measure setup

After configuring the spectrum measurement as described in “Configuring spectrum measurements” on page 25, you can set the measure setup to continue your measurement. The measurement settings can be saved and recalled as a file by selecting **File Type** as Setup, and load the file onto the instrument using the Save/Load icons on the side bar.

To set measure setup

1 Tap the **Setup** ( ) icon on the side bar.

2 Tap **Integrated BW** and input the value using the on-screen keyboard.

You can also tap the rectangle with the value under the chart screen and input the value using the on-screen keyboard.

3 Tap Span 50.000 000 MHz to set the frequency range over which the instrument will sweep using the on-screen keyboard.

4 Tap **Menu > Sweep > Gated Sweep** to set the Gated Sweep On or Off.

5 Tap **Menu > BW/AVG > Average** to set the number of measurements to be averaged using the on-screen keyboard. The input value range is from 1 to 100.



NOTE

Ensure the Detector is configured as RMS when you perform the channel power measurement.

To set the Setting limit

1 Tap **Menu > Limit**.

2 Tap to switch the **Test Limits** to **On** or **Off** to enable or disable Pass/Fail indication.

The result table color for Pass is green, and the result table color for Fail is red.

3 Tap **High Limit** to set the upper threshold using the on-screen keyboard.

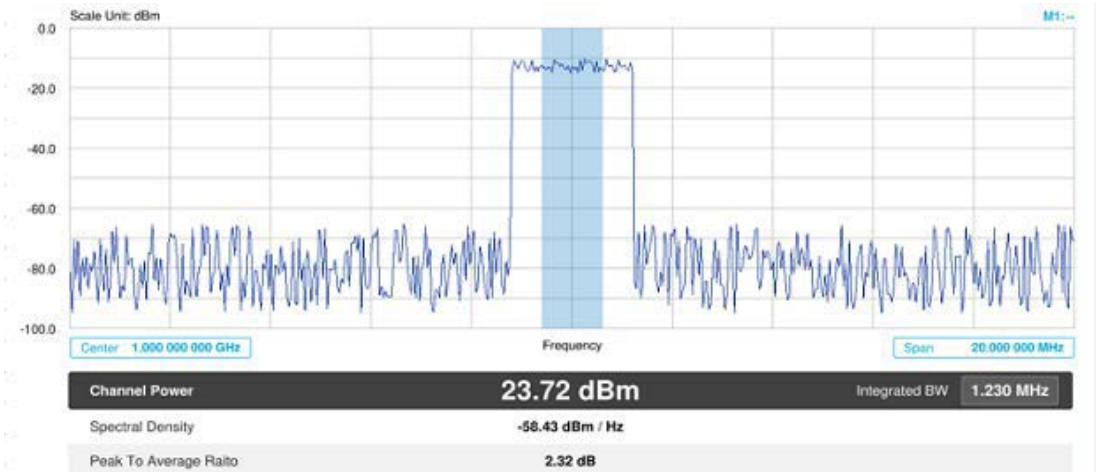
4 Tap **Low Limit** to set the lower threshold using the on-screen keyboard.

5 *Optional*: Tap the **Save** icon on the side bar and select the save option from the choices available for your measurement mode.

Channel power measurement

Channel Power Measurement result shows channel power and spectrum density in a user specified channel bandwidth. The peak to average ratio (PAR) is shown at the bottom of the screen as well. The shaded area on the display indicates the channel bandwidth. Figure 19 shows an example of Channel Power Measurement.

Figure 19 Channel power measurement



NOTE

If the Trace View is set to Off, the Channel Power, Spectral Density, and Peak to Average Ratio is shown with value and "*" at the end of the value.

Occupied bandwidth

Occupied Bandwidth measures the percentage of the transmitted power within a specified bandwidth. The percentage is typically 99%.

After configuring spectrum measurement in "Configuring spectrum measurements" on page 25, you can set the measure setup to continue your measurement. The measurement settings can be saved and recalled as a file by selecting the File Type as Setup, and load the file onto the instrument using the Save/Load icons on the side bar.

To set measure setup

1. Tap the **Setup** ( ) icon on the side bar.
2. Tap **Occupied BW% Power** and input the value using the on-screen keyboard.

   You can also tap the rectangle with value located under the chart screen and input the value using the on-screen keyboard.
3. Tap **x dB** to input a value using the on-screen keyboard.

   The input value range is from -50 to 0 dB.
4. Tap Span to set the frequency range over which the instrument will sweep using the on-screen keyboard.
5. Tap Menu > BW/AVG > Average to set the number of measurements to be averaged using the on-screen keyboard.
6. The input value range is from 1 to 100.
7. Tap Menu > Sweep > Gated Sweep to set the Gated Sweep On or Off.

To set Limit

1 Tap **Menu > Limit**.

2 Tap to switch the **Test Limits** to **On** or **Off** to enable or disable Pass/Fail indication.

The result table color for Pass is green, and the result table color for Fail is red.

3 Tap **High Limit** to set the upper threshold using the on-screen keyboard.

4 *Optional*: Tap the **Save** icon on the side bar and select the save option from the choices available for your measurement mode.

Spectrum emission mask (SEM)

The Spectrum Emission Mask (SEM) measurement identifies and determines the power level of out-of-band spurious emission outside the necessary channel bandwidth and modulated signal. It measures the power ratio between in-band and adjacent channels. The instrument indicates either Pass or Fail based on the specified limit of the signal.

Setting measure setup

After configuring spectrum measurement as described in “Configuring spectrum measurements” on page 25, you can set the measure setup to continue your measurement. The measurement settings can be saved and recalled as a file by selecting File Type as Setup and load the file onto the instrument using the Save/Load icons on the sidebar.

To set measure setup

1 Tap the Setup ( ) icon on the side bar.

2 Tap Main Channel BW to set the main channel bandwidth and input the value using the on-screen keyboard.

You can also tap the rectangle with value under the chart screen and input the value using the on-screen keyboard

3 Tap Configuration to configure an offset, up to five. The SEM offset configuration table appears, as shown in Figure 20.

Figure 20 SEM offset configuration table



a Select **Offset** from 1 to 5 and switch each to **On** to display or **Off** to hide the active offset.

b Select **Offset Frequency** to start the frequency of SEM using the on-screen keyboard.

c Select Measurement Bandwidth to set the bandwidth for the selected offset using the on-screen keyboard.

d Switch the Reference to Relative or Absolute, depending on how you are using the reference.

e Select Start Limit to set the start point of the mask.

f Select Stop Limit to set the stop point of the mask.

4 Tap **Menu > Sweep > Gated Sweep** to set the **Gated Sweep On** or **Off**.

To set the limit

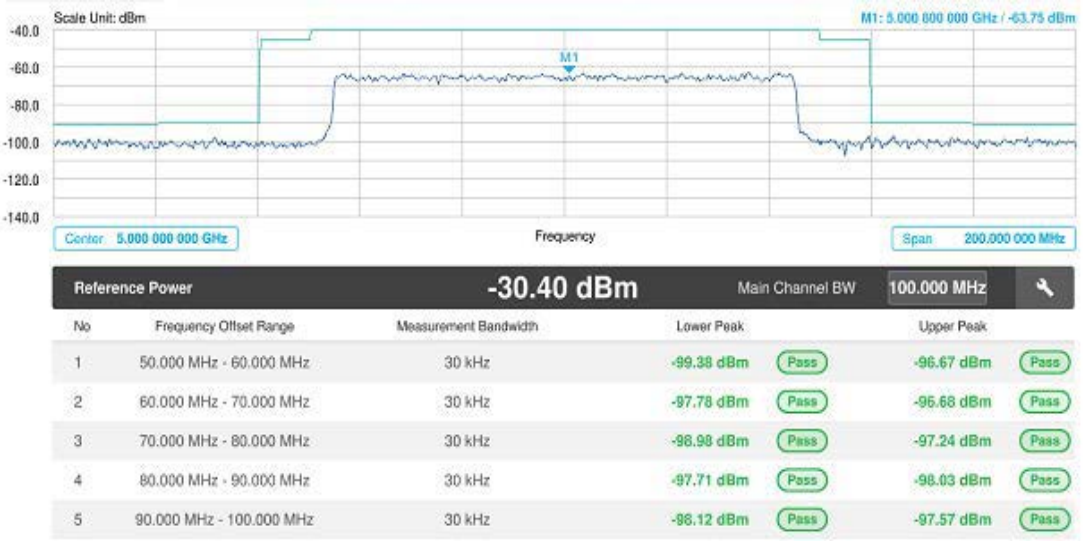
1 Tap **Menu > Limit**.

2 Tap to switch the **Test Limits** to **On** or **Off** to enable or disable Pass/Fail indication.

The result table color is green for Pass, and red for Fail.

3 *Optional*: Tap the Save hot key on the side bar and select the save option from the choices available for your measurement mode.

Figure 21 Spectrum emission mask measurement with spectrum analyzer



If Lower Peak or Upper Peak indicates Fail, the mask line becomes red.

NOTE

If the Trace View is set to Off, the Reference Power, Lower Peak, and Upper Peak is not shown. If the Trace View is set to On and the Trace Type is selected other that Clear Write, the Reference Power, Lower Peak, and Upper Peak is shown with value and “*” at the end of the value.

Adjacent channel power (ACP)

The Adjacent Channel Power (ACP) is the power contained in a specified frequency channel bandwidth relative to the total carrier power. it may also be expressed as a ratio of power spectral densities between the carrier and the specified offset frequency band.

The ACP measures the power of a carrier channel and the power in its adjacent (offset) channels. The measurement results allow you to determine whether the carrier power is set correctly and whether the transmitter filter is working properly. You can measure the channel power in from one to five adjacent (offset) channels on the lower frequency band.

Setting measure setup

After configuring spectrum measurement in “Configuring spectrum measurements” on page 25, you can set the measure setup to continue your measurement. the measurement settings can be saved and recalled as a file by selecting File Type as Setup and load the file onto the instrument using the Save/Load icons on the side bar.

To set measure setup

1. Tap the **Setup** ( ) icon on the side bar.
2. Tap **Main Channel BW** to set the main channel bandwidth and input the value using the on-screen keyboard.

   You can also tap the rectangle with value under the chart screen and input the value using the on-screen keyboard.
3. Tap Configuration to configure an offset, up to five. The table appears as shown in Figure 22.

Figure 22 ACP offset configuration table



a Select **Offset** from 1 to 5 and switch each to **On** to display or **Off** to hide the offset.

b Select **Offset Frequency** to set the center frequency of the offset using the on-screen keyboard.

c Select **Integration BW** to set the channel power bandwidth for the selected offset using the on-screen keyboard.

d Select **Lower** to set the threshold for the power difference between the main channel bandwidth and the selected offset bandwidth on the left using the on-screen keyboard.

e Select **Upper** to set the threshold for the power difference between the main channel bandwidth and the selected offset bandwidth on the right using the on-screen keyboard.

4 Tap **Menu > Sweep > Gated Sweep** to set the Gated Sweep **On** or **Off**.

5 Tap **Menu > Trace > Threshold RMS** to switch **On** or **Off**. The Threshold RMS function detects RMS above a certain level of power and make sample detecting for the power below that level. When switched **On**, Average is automatically set to 100. When switched **Off**, Average is automatically set to 1. Threshold can also be adjusted by the menu under **Trace**, **Threshold Auto**, and **Threshold RMS Level**.

An offset represents a difference in center frequencies of the carrier channel and its adjacent channel to be measured. The frequency range for each offset is specified with an Offset Frequency and Integration BW. Each offset that is created has a Lower and Upper set of frequencies.

NOTE

Make sure the Detector is selected to RMS when you perform the adjacent channel power measurement.

To set the limit

1 Tap **Menu > Limit**.

2 Tap to switch the Test Limits to On or Off to enable or disable Pass/Fail indication.

The result table color is green for Pass, and red for Fail.

3 *Optional*: Tap the Save hot key on the side bar and select the Save option from the choices available.

Figure 23 Adjacent channel power measurement with Spectrum Analyzer



Multi adjacent channel power

The Multi-ACP measurement is used to do multi-channel ACP testing. It helps you to measure ACP in multichannel transmitting base station environment.

Setting measure setup

After configuring spectrum measurement in “Configuring spectrum measurements” on page 25, you can set the measure setup to continue your measurement. The measurement settings can be saved and recalled as a file by selecting File Type as Setup and load the file onto the instrument using the Save/Load icons on the side bar.

To set measure setup

1 Tap the **Setup** ( ) icon on the sidebar.

2 Tap **Main Channel BW** to set the main channel bandwidth and input the value using the on-screen keyboard.

You can also tap the rectangle with value under the chart screen and input the value using the on-screen keyboard.

3 Configure the channel settings:

a Tap **Lowest Channel Number** and input the value using the on-screen keyboard.

b Tap **Highest Channel Number** and input the value using the on-screen keyboard.

4 Configure the **Frequency** settings:

a Tap **Lowest Frequency** and input the value using the on-screen keyboard.

You can also tap the rectangle with value under the chart screen and input the value using the on-screen keyboard.

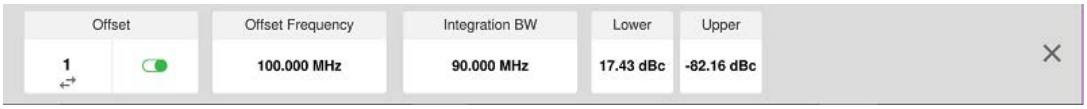
b Tap **Highest Frequency** and input the value using the on-screen keyboard.

You can also tap the rectangle with value under the chard screen and input the value using the on-screen keyboard.

5 Tap **Configuration** to configure up to five offsets. The configuration table appears, as shown in Figure 24.

You can also tap the **Configuration** icon under the chart screen.

Figure 24 Multi-ACP offset configuration table



a Select **Offset** from 1 to 5 and switch each to On to display or Off to hide the active offset.

b Select **Offset** Frequency to set the offset frequency using the on-screen keyboard.

c Select **Upper** to set the threshold for the power difference between the main channel bandwidth and the selected offset bandwidth on the right using the on-screen keyboard.

6 Tap **Span** to set the frequency range over which the instrument will sweep using the on-screen keyboard.

7 Tap **Menu > Sweep > Gated Sweep** to set the Gated Sweep On or Off.

NOTE

Make sure that RMS is selected when you perform the multi-adjacent channel power measurement.

To set limit

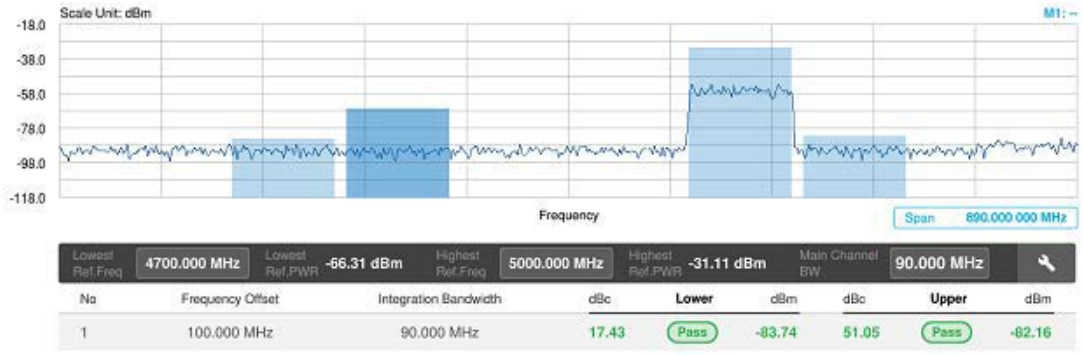
1 Tap **Menu > Limit**.

2 Tap to switch the **Test Limits** to **On** or **Off** to enable or disable **Pass/Fail** indication.

The result table color is green for Pass and red for Fail.

3 *Optional*: Tap the **Save** icon on the side bar and select the save option from the choices available for your measurement mode.

Figure 25 Multi-adjacent channel power measurement with spectrum analyzer.



Spurious emissions

The Spurious Emissions measurement identifies or determines the power level of in-band or out-of-band spurious emissions within the necessary channel bandwidth and modulated signal. The instrument indicates either Pass or Fail based on the specified limit of the signal.

Setting measure setup

After configuring spectrum measurement in "Configuring spectrum measurements" on page 25, you can set the measure setup to continue your measurement. The frequency setting is not used in Spurious Emissions mode. The measurement settings can be saved and recalled as a file by selecting File Type as Setup and load the file onto the instrument using the Save/Load icons on the side bar.

To set measure setup

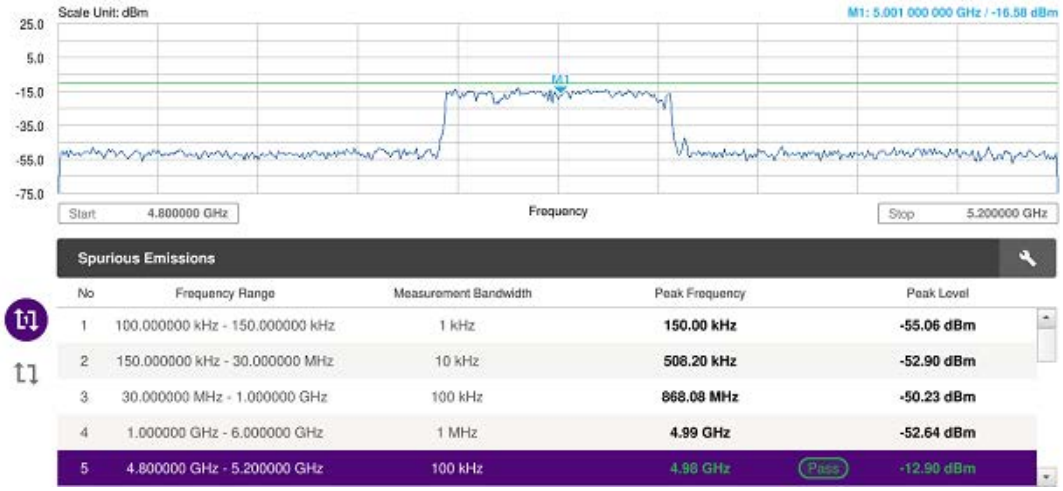
1. Tap the **Setup** ( ) icon on the side bar.
2. Tap to switch the **Measure Type** to **Full** or **Examine**.
3. Tap **Configuration** to set up the range table and parameters.
   - **a** Select **Range** from 1 to 20 and switch each to **On** to display the selected range in the result table, or **Off** to hide it from the table.
   - **b** Select **Start Frequency** to specify the start frequency for the selected range using the on-screen keyboard.
   - **c** Select **Stop Frequency** to specify the stop frequency for the selected range using the on-screen keyboard.
   - **d** Select **Start Limit** and **Stop Limit** to specify the upper limit for Pass/Fail indication using the on-screen keyboard. You can set the threshold line by setting the start/stop limit.
   - **e** Select **Attenuation** and specify a value as a multiple of five using the on-screen keyboard.
   - **f** Select **RBW** to specify an RBW value using the on-screen keyboard.
   - **g** Select **VBW** to specify a VBW value using the on-screen keyboard.
4. Tap **Menu > BW/AVG > Average** to set the number of measurements to be averaged using the on-screen keyboard. The input value range is 1 to 100.

To set limit

1. Tap **Menu > Limit**.
2. Tap to switch the **Test Limits** to **On** or **Off** to enable or disable Pass/Fail indication.
3. *Optional*: Tap the **Save** icon on the side bar and select the save option from the choices available for your measurement mode.

Figure 26 shows a spurious emissions measurement with the spectrum analyzer.

Figure 26 Spurious emissions measurement with spectrum analyzer



NOTE

If you select the first icon next to the Range table above, it only shows the selected range. If you select the second icon next to the Range table, it keeps moving from the first selected range to the final selected range.

Total harmonic distortion (THD)

You can measure the Total Harmonic Distortion (THD) using the spectrum analyzer. THD is defined as the ratio of RMS voltage of the harmonics to that of the fundamental component. This is accomplished by using a spectrum analyzer to obtain the level of each harmonic with peak detector.

To set measure setup

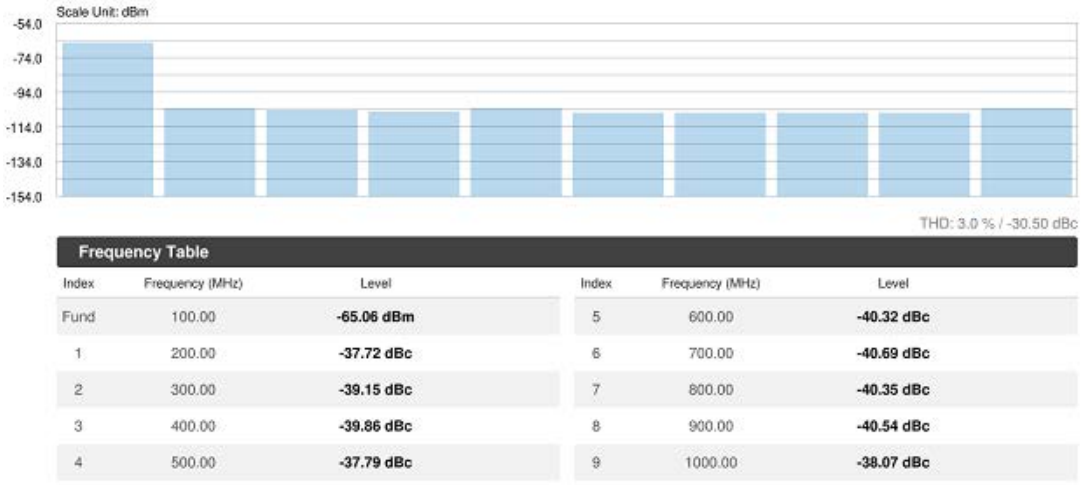
You need to set the fundamental frequency to measure the total harmonic distortion. Once you set up, it will automatically collect the harmonic outputs up to the tenth harmonics from the spectrum analyzer and calculate the corresponding THD value (%) and the distortion attenuation (dB).

1 Tap the **Setup** ( ) icon on the side bar.

2 Tap **Fundamental Frequency** and input the value using the on-screen keyboard. The total harmonic distortion screen changes accordingly.

3 Tap **Menu > Amp/Scale** to set the related parameters such as **Reference Level**, **Attenuation**, **Preamp**, **External Offset**, and **Scale Division**. See “Setting amplitude” on page 29 for more information.

Figure 27 Total harmonic distortion measurement with spectrum analyzer



Frequency Table

Index	Frequency (MHz)	Level	Index	Frequency (MHz)	Level
Fund	100.00	**-65.06 dBm**	5	600.00	**-40.32 dBc**
1	200.00	**-37.72 dBc**	6	700.00	**-40.69 dBc**
2	300.00	**-39.15 dBc**	7	800.00	**-40.35 dBc**
3	400.00	**-39.86 dBc**	8	900.00	**-40.54 dBc**
4	500.00	**-37.79 dBc**	9	1000.00	**-38.07 dBc**

Field strength

The Field Strength Meter measures the field strength over the frequency range of a connected antenna, which is known with its specific bandwidth and gain characteristics. A standard or user-defined antenna can be selected from the antenna list in the instrument. After configuring spectrum measurement in “Configuring spectrum measurements” on page 25, you can set the measure setup to continue your measurement.

To set measure setup

1. Connect an antenna to be used with your instrument.
2. Tap the **Setup** (⚙) icon on the side bar.
3. Tap **Antenna List** to select antennas to be used for field strength measurement from the list stored in the instrument.

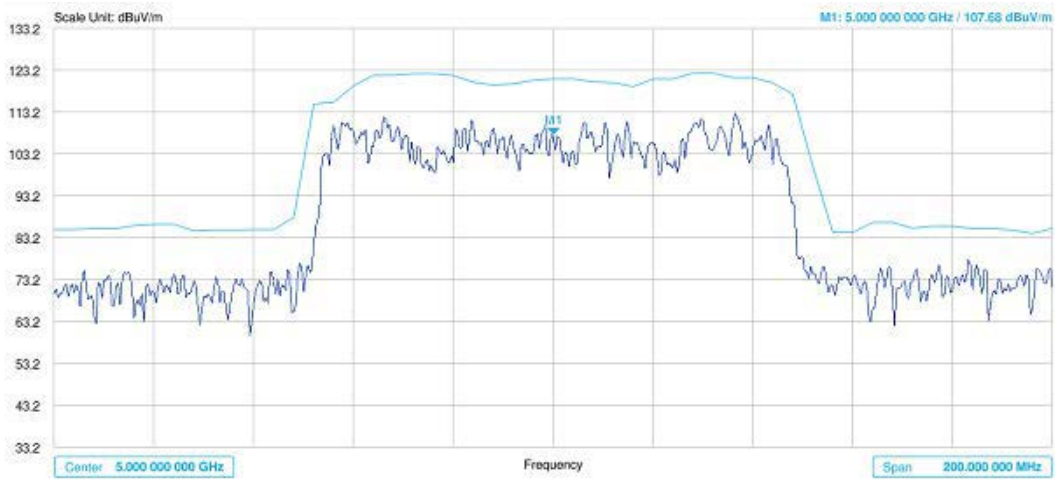
   The antenna list window appears.
4. Tap the **Apply** button to apply the selection.
5. Tap **Antenna Start Frequency** to edit the start frequency of the connected antenna using the on-screen keyboard.
6. Tap **Antenna Stop Frequency** to edit the stop frequency of the connected antenna using the on-screen keyboard.
7. Tap **Gain** to input the gain information of the antenna using the on-screen keyboard.

To set the limit

You can show or hide the Reference Line on the screen that is used as a visual reference only. You can also use the multiple segment limit line to set up different limits

for different frequency ranges for Pass/Fail indication. See “Setting limit” on page 39 for more information.

Figure 28 Field strength measurement with spectrum analyzer



AM/FM audio and modulation analysis

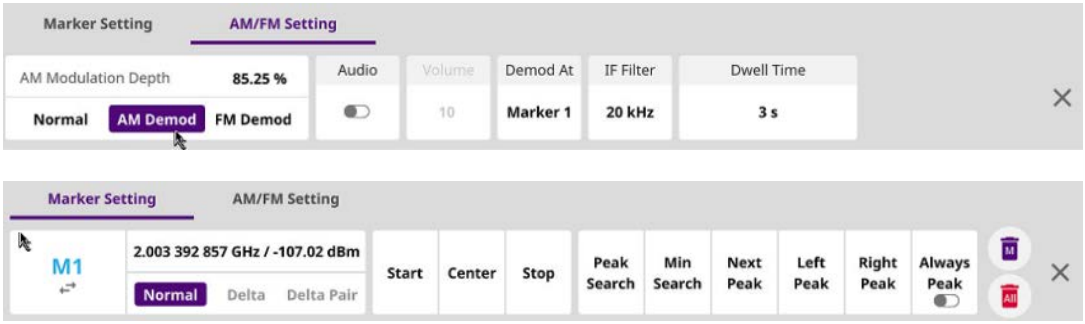
The AM/FM Audio Demodulator operates using the power received from radio waves and it serves as an alternative to identify interfering signals easily. The instrument sounds demodulated signals that can be heard through the built-in speaker or plugged-in headphones. You can hear the sound and identify interfering signals easily.

To set measurement setup

Before starting the Route Map measurement, you need to set Spectrum measurements displayed on the quick access and display tab. See “Configuring spectrum measurements” on page 25 for more information.

1. Tap the **Setup** (⚙) icon on the side bar.
2. Tap **Audio Status** and select the options from **Normal**, **AM Demod**, or **FM Demod**:
   - Normal: When demodulation is not being measured
   - AM Demod: When AM Modulation Depth is being measured
   - FM Demod: When Frequency Deviation is being measured
3. Tap to switch the **Audio Demod** to **On** or **Off** to turn the audio on or off.

4 Tap **Demod At** to select the marker number for the frequency to be demodulated.
   – Set the marker(s) first as the AM/FM demodulator uses the marker position to demodulate. See “Using marker” on page 41 for more information.
   – Tap the **Marker** icon on the side bar then the **Marker Setting**/**AM/FM Setting** table appears.



5 Tap **IF Filter** and select the options.
   – When AM Demod is selected: 20 kHz
   – When FM Demod is selected: 180 kHz, 25 kHz, 12.5 kHz, or 6.25 kHz

6 Tap **Dwell Time** and set the demodulation interval between 1 and 20 using the on-screen keyboard.

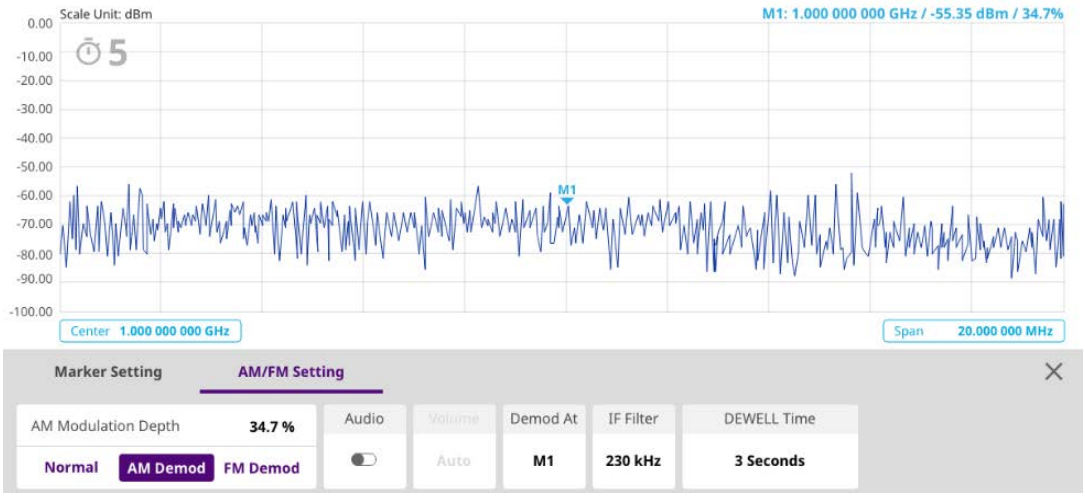
7 Tap **Volume** to set the speaker volume using the on-screen keyboard.

To set the limit

1 Tap **Menu** > **Limit**.

2 See “Setting limit” on page 39 for more information.

Figure 29 AM/FM audio and modulation analysis with spectrum analyzer



NOTE

A 5-second countdown appears in the upper-left corner of the screen to indicate the required preparation time when switching between Audio and FM/AM Demod.

Internal power meter

The internal power measurement of the RA module collects powers from the raw data of spectrum analyzer in the optimal span and integrates the powers up to the specified user span, which results in an accurate power measurement, independent of the span setting. Before starting the Internal RF Power Meter, you need to set Spectrum measurements displayed on the top menu.

To set measurement setup

Before starting the Route Map measurement, you need to set Spectrum measurements displayed on the quick access and display tab. See “Configuring spectrum measurements” on page 25 for more information.

1. Tap the **Setup** ( ) icon on the side bar.
2. Tap **Resolution** and select the resolution option from the following choices:
   - 0: Displays the reading with no decimal place.
   - 1: Displays the reading with one decimal place.
   - 2: Displays the reading with no decimal place.
3. Tap RBW to set the resolution bandwidth and select from the 8 options available.
4. Tap **Accuracy Mode** and select the accuracy mode option: **Low**, **Middle**, or **High**.
   - Select High when the measurement accuracy is high comparing to speed
   - Select Low when the measurement accuracy is low comparing to speed.
5. Tap **Average** to specify the number of measurements to be averaged from 1 to 100 using the on-screen keyboard.
6. Tap **Menu** > **Amp/Scale** > **Reference Type** to set **Relative**, then the **Set Reference** shows up on chart.
7. Tap to switch the **Limit** to **On** or **Off** to enable or disable the Pass/Fail Indication on bottom of result screen.
   - **a** Tap the value box next to **High** to set a threshold value using the on-screen keyboard.
   - **b** Tap the value box next to **Low** to set a threshold value using the on-screen keyboard.

Figure 30 shows an example of the Internal Power Meter.

Figure 30 Internal Power Meter with spectrum analyzer



Gated sweep

To get appropriate gated sweep, you have to set the gate delay and gate length in a way that the measurement is active during the interesting part of the signal. You can also modify the sweep time in order to match the horizontal axis to the length of the signal and thus set the gate delay and gate length parameters more accurately.

The gate delay parameter means the time between the trigger event and the beginning of the actual measurement. The gate length means the duration of the measurement before it is interrupted, and the next gate signal is expected to resume the measurement.

Measurement settings can be saved and recalled as a file by selecting Setup as the File Type and load the file onto the instrument using the Save/Load icons on the side bar.

Figure 31 shows the Gated Sweep Setup screen.

Figure 31 Gated Sweep Setup screen

To set Gated Sweep



1 If you want to set Gated Sweep automatically, tap **Auto Set**.

Be aware that it changes to single gate.

2 If you want to set Gated Sweep manually, do the following steps:

a Tap Gate Delay/Gate Delay 2 on the setup table and input a value using the on-screen keyboard.

When the gate delay changes, the gate length line also changes accordingly with the same interval.

b Tap to Switch **Dual Gate** to **On** or **Off**. This will let you set the gated window to one (Off) or two (On).

c Tap **Gate Length** on the setup table and input a value using the on-screen keyboard. The gate length cannot be moved on the left side of the gate delay.

d Tap **Zero Span Time** on the setup table and input a value using the on-screen keyboard.

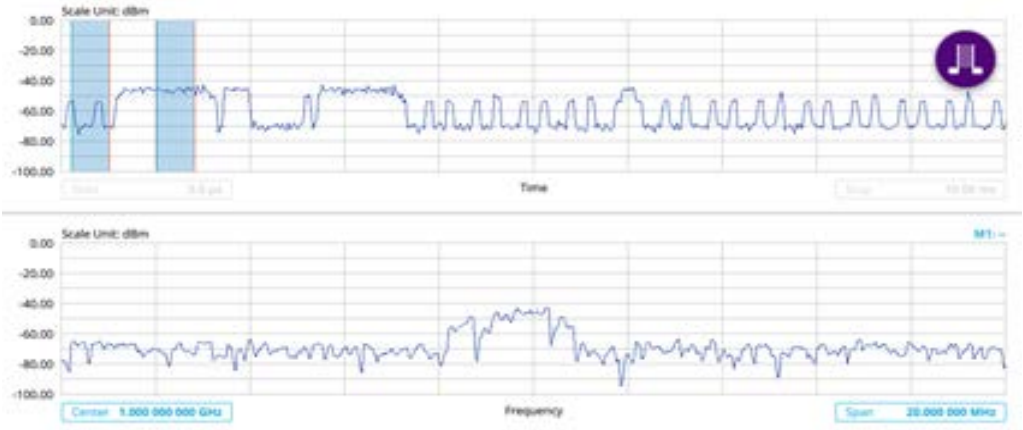
e Tap **StdSignal** to select a **Standard Signal** from the pop-up list.

f Tap **Period** and switch it to **Standard** or **Manual** and input a value using the on-screen keyboard.

g Tap the **X** button on the setup table. **Gate Sweep** becomes On.

The setup table disappears and the edit mode icon appears on the right edge of the chart screen, as shown in Figure 32.

Figure 32 Gated Sweep with spectrum analyzer



3 When the judged **Triggering** is not valid, for example a **Delay** set larger than **Trigger Period**, the “Trigger Not Detected” message appears on the screen.

Route map

The module provides a Route Map function that allows you to collect data points in an indoor or outdoor environment and track the received signals and coverage of RF transmitters by plotting data real time directly on top of a loaded floor plan or a map.

Figure 33 shows an example of the Route Map.

Figure 33 Route Map with spectrum analyzer



Loading a map

To use any features related to maps, you need to download and install the maps on the instrument. The VIAVI JDMapCreator will help you download maps. Make sure the JDMapCreator application on your computer is connected to the instrument via LAN. You can send a map file with a single layer to the instrument directly by using the Send to EQP menu in JDMapCreator. For more information on how to use the JDMapCreator, see the *JDMapCreator 2.0 User Guide*.

To load a map

1 Plug in your USB flash drive that has a map with a file type of .mcfv created in JDMapCreator.

2 Tap the **Load** icon on the side bar.

3 Navigate to the map file that you want to open.

The **File Information** pane displays the file properties, including its name, size, type, and date modified.

4 Tap the **Load** button on the screen.

5 Once you have loaded the map, you can also control the map using the following icons on the map.

Table 18 Map icons

Icon	Description
	Tap to go to your current location on the map. Once tapped, a purple icon appears on the map, indicating your current location.
	Tap to switch to the full screen map view.
	Tap to zoom in on the map.
	Tap to zoom out on the map.
	Tap and select the area that you want to expand.

To set measurement setup

Before starting the Route Map measurement, you need to set Spectrum measurements displayed on the quick access and display tab. See “Configuring spectrum measurements” on page 25 for more information.

1 If required, connect a GNSS receiver to your instrument for outdoor mapping. Indoor mapping does not necessarily need a GNSS antenna.

2 Tap the **Setup** ( ) icon on the side bar.

3 Tap to switch the Plot Point to **GNSS**, **Position**, or **Time**.

   a To collect data/plot points automatically as you move around in a vehicle or outside, select **GNSS**, then tap to switch the **Screen Mode** between **Map** and **Full**. With the **Map** setting, you can view only the collected points that can be seen within the boundary of the loaded map. With the **Full** setting, you can view all the collected points of the route without the loaded map.

   b To collect data/plot points manually in an indoor layout without a GNSS antenna, select **Position**.

   c To collect data/plot points based on time, select **Time**.

4 Tap to switch **Plot Item** to **RSSI** or **ACP**.

5 *Optional*: If **ACP** is selected, set the **Main Channel BW** and **Offset Limit**.

   a Tap **Main Channel BW** and input a value using the on-screen keyboard.

   b Tap **Offset Limit** and tap to switch the Offset to **On** to display or **Off** to hide the offset.

   c Tap **Integration Bandwidth** and input a value using the on-screen keyboard.

   d Tap **Offset Frequency** and input a value using the on-screen keyboard.

   e Tap **Offset Limit** and input a value using the on-screen keyboard.

6 Tap the **Start** button on the right panel of the map to start plotting for the Position or Time setting.

7 Touch directly on the screen and tap to collect data and plot points on the loaded map. For the Position setting, you can change the direction of the route with screen touch. For the Time setting, when you first touch screen a purple triangle appears on the point and the "Number of n" appears in the bottom left of the map. The instrument interpolates points in between two points on a straight dotted line. The max count is 2560, and the time interval is 0.5 s.

8 Tap the **Pause** button to pause plotting. The **Pause** button turns blue and GNSS cannot be plotted.

9 Tap to switch **Plot** to **Stop** to stop plotting.

10 Tap **Menu > Sweep > Gated Sweep** to set the Gated Sweep **On** or **Off**.

11 If you start testing and select **Setup > Plot Point > Position**, you can undo by tapping the **Start** button.

12 If you select the **Stop** button, the **Plot Stop** popup window appears.



NOTE

The instrument does not automatically save the collected data. It is recommended that you save the result. If not, you will lose all the collected data.

To set limit

You can set the thresholds for the four different color indicators.

1 Tap **Excellent** and set a value using the on-screen keyboard.

2 Tap **Very Good** and set a value using the on-screen keyboard.

3 Tap **Good** and set a value using the on-screen keyboard.

4 Tap **Poor** and set a value using the on-screen keyboard.

Online route map

The following sections describe how to perform online route map.

Online route map

Spectrum online route map enables you to download a map automatically when connected to the network then you can continue route map measurement using the downloaded map whether you are online or offline.

Figure 34 shows an example of Online Route Map measurement.

Figure 34 Online Route Map with Spectrum Analyzer



Controlling a map

To control a map

See the following table to control a map.

Table 19 Map control icons

Icon	Description
	Tap to go to your current location on the map. Once tapped, the purple icon appears on the map, indicating your current location.

Table 19 Map control icons

Icon	Description
	Tap to zoom in the map.
	Tap to zoom out the map.

The left-most cell-site icon is activated when you import the cell-site information file.

To set measurement setup



NOTE

Before starting the Route Map measurement, you need to set Spectrum measurements displayed on the quick access and display tab. See “Configuring spectrum measurements” on page 25 for more information.

1. Connect a GNSS receiver to your instrument for outdoor mapping.
2. Tap the **Setup** () icon on the side bar.
3. Tap to switch **Plot Item** to **RSSI**, **ACP**, or **Peak**.
4. *Optional*: If **ACP** is selected, set the **Main Channel BW** and **Offset Limit**.
   - **a** Tap **Main Channel BW** and input a value using the on-screen keyboard.
   - **b** Tap **Offset Limit** and tap to switch the Offset to **On** to display or **Off** to hide the offset.
   - **c** Tap **Integration Bandwidth** and input a value using the on-screen keyboard.
   - **d** Tap **Offset Frequency** and input a value using the on-screen keyboard.
   - **e** Tap **Offset Limit** and input a value using the on-screen keyboard.
5. Tap the **Start** button on the right panel of the map to start plotting for the Position or Time setting.
6. Touch directly on the screen and tap to collect data and plot points on the loaded map.
7. Tap the **Pause** button to pause plotting. The **Pause** button turns blue and GNSS cannot be plotted.
8. Tap to switch **Plot** to **Stop** to stop plotting.

9 Tap **Menu > Sweep > Gated Sweep** to set the Gated Sweep **On** or **Off**.

NOTE

The instrument does not automatically save the collected data. It is recommended that you save the result. Otherwise, you will lose all the collected data.

To set limit

You can set the thresholds for the two different color indicators, red and blue. The maximum value is the Limit for **Excellent**, and the minimum value is the Limit for **Poor**. See below to check the plot point color based on the Legend Color Table.

1 Tap the rectangle with value before color legend bar on the right panel.

2 Set a value for **Poor** (minimum value) using the on-screen keyboard.

3 Tap the rectangle with value after color legend bar on the right panel.

4 Set a value for **Excellent** (maximum value) using the on-screen keyboard.

Figure 35 shows a legend color table.

Figure 35 Legend color table

Red	Green	Blue	Color
0	0	255	Poor
0	32	255	
0	64	255	
0	128	255	
0	255	255	
0	255	170	
0	255	85	
0	255	0	
85	255	0	
170	255	0	
255	255	0	
255	128	0	
255	64	0	
255	32	0	
255	0	0	Excellent

Logging data

To log data

1 Follow **steps 1 to 3** in Setting measure setup.

2 Tap the **Testing** ( ) button on the right panel of the map to start plotting on the map. When you select a point on the map, a marker appears and the Information window appears on the right panel.

3 Tap the **Stop** ( ) button to stop plotting.

4 Tap the **Pause** button ( ) to pause plotting, then the GNSS point cannot be plotted.

5 If you select the **Stop** button, the Plot Stop pop-up window appears, then tap **Yes**.

6 Tap **Yes** when the Save pop-up window appears and save the logging file to your USB.

Viewing the logging data

To view the logging data

1 Load the saved logging file using the **Load** ( ) icon on the side bar. Make sure the file extension is .orr.

2 Tap the **Load** button in the file information window.

3 Tap to switch **Plot Item** to **RSSI**, **ACP**, or **Peak**.

Importing cellsite DB

You can import the site DB by creating the 5G site information form.

To import cellsite DB

1 Create the 5G site information with an excel file as below.

2 Input the two mandatory fields: **Lat (DecDeg)** and **Long (DecDeg)**.

3 Input the **Azimuth** field if you want to check the direction of antenna.

4 Make sure to save the file as (Comma delimited) (*.csv).

5 Copy the file to the USB memory stick and insert it to the **USB A** or **USB B** port of the instrument.

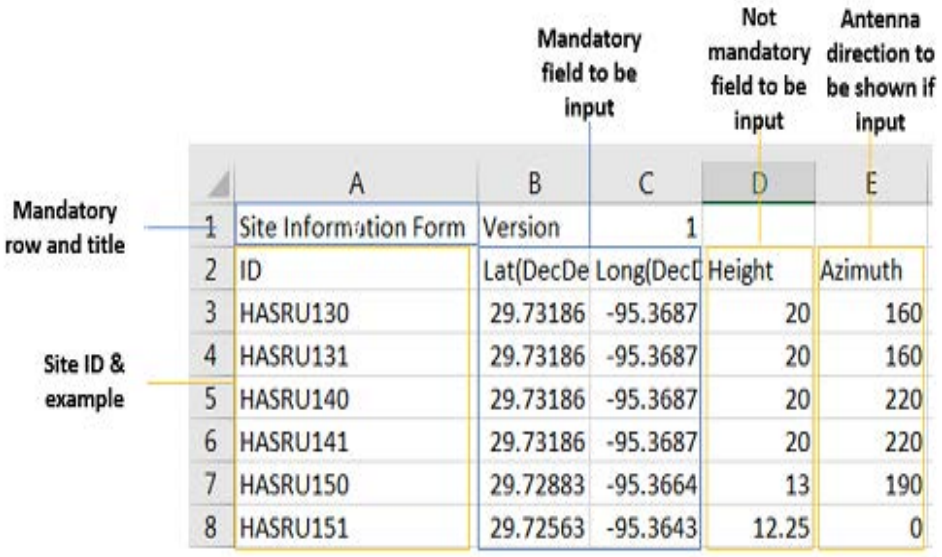
6 Tap the **Load** ( ) icon on the side bar.

7 Import the saved file.

Once the file is loaded, the following cellsite information appears with an icon.

Figure 36 shows an example of an importing cellsite DB.

Figure 36 Importing Cellsite DB



Creating a map

You can create a map online and continue conducting a route map analysis using the created map even when there is no Ethernet connection.

1 Tap the **Map Creator** button on the right panel at the bottom.

2 Tap the **Search** box and input the location using the on-screen keyboard and select one of the options as required.

3 Tap the **Zoom Level** box to capture the map with corresponding zoom level.

4 Tap the **Capture** button to start capturing the map.

Once the map is captured, the capturing completed pop-up will appear.

5 Select between the two options: Save in the system or Save as file.

6 Tap the **Done** button.

NOTE
If you have unsaved measurement data (map) and start measuring by tapping the Testing button or by tapping another measurement mode, a pop-up window will appear asking whether you will restore the unsaved data or not.

5

Using Real-Time Spectrum Analyzer

This chapter describes how to use the Real-Time Spectrum Analyzer. Topics covered in this chapter include:

- “Introduction” on page 78
- “Selecting mode and measure” on page 78
- “Interference analysis” on page 79
- “Online interference analysis” on page 103

Introduction

Real-time Spectrum Analysis (RTSA) is a method that leverages overlapping FFTs and high-speed memory to have a 100% probability of intercept (POI), even in extremely dense environments. Real-time bandwidth, the maximum frequency span offering gap-free overlapping FFT processing, is an important variable factor of an RTSA that can enable more detailed analysis of a spectrum, based on the type of signal content under scrutiny.

RTSA supports the following measurements:

- Interference Analysis
  - Persistent Spectrum
  - Persistent Spectrogram
  - Persistent RSSI
  - Persistent Interference Finder
  - Persistent Radar Chart
  - Real-time Spectrum Replayer
- Online Interference Analysis
  - Online Persistent Interference Finder
  - Online Persistent Radar Chart



NOTE

If you have an AntennaAdvisor Handle attached to your module, the Trigger button functions as Quick Save except for the measurements for Persistent Interference Finder, Persistent Radar Chart, Real-time Spectrum Replayer, Online Persistent Interference Finder, and Online Persistent Radar Chart.

Selecting mode and measure

The following procedure describes how to select the mode and measure.

To select mode and measure

1 Tap **Real-time Spectrum Analyzer** on the **Mode** panel.

2 Tap any measurement mode from the following choices:

- **Interference Analysis** > **Persistent Spectrum**, **Persistent Spectrogram**, **Persistent RSSI**, **Persistent Interference Finder**, **Persistent Radar Chart**, **Real-Time Spectrum Replayer**
- **Online Interference Analysis > Online Persistent Interference Finder or Online Persistent Radar Chart**



NOTE

If you have a CAA module with CAA-RFS license (enabled), the RF Source menu will be activated. Go to **Setup** > **RF Source** > **CAA RF Power**. And tap to switch **CAA RF Power** to **On**. Then you can tap to switch **RF Source** to **On** and set **Frequency**/**Power Level** as required. Note that if you have a CAA module with catalog number (CAA06MB with Bias Voltage option), you can tap to switch **Bias Voltage** to **On** and set the required **Bias Voltage**.

With this Bias Voltage, you can enhance the sensitivity while performing interference analysis on feeder of old BTS (Base Transceiver Station) without RRH.

Interference analysis

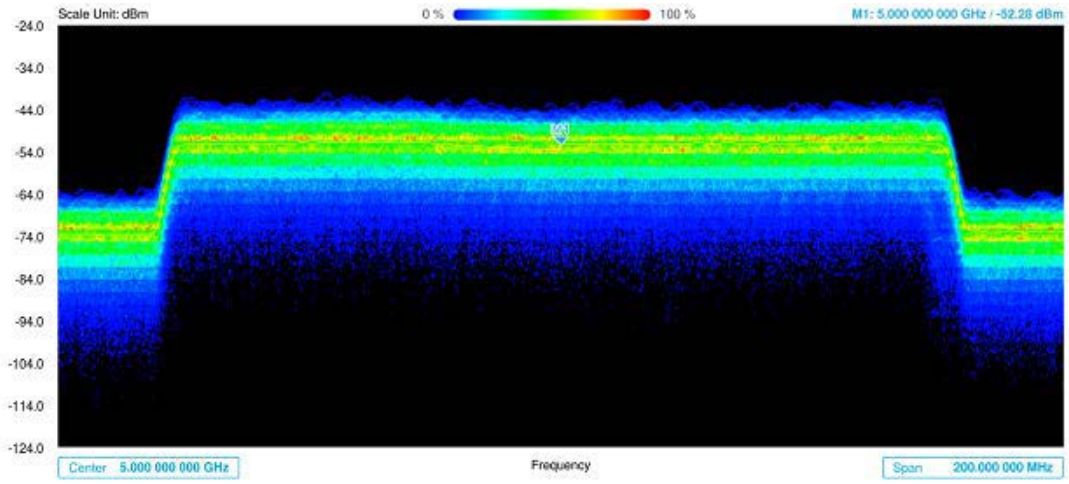
The following sections describe how to conduct interference measurements.

Persistent spectrum

The persistent spectrum of a signal is a time-frequency view that shows the percentage of the time that a given frequency is present in a signal. It is a histogram in power-frequency space. The longer a particular frequency persists in a signal as the signal evolves, the higher its time percentage, and thus the brighter or hotter its color in the display. The persistent spectrum is used to identify signals hidden in other signals.

Figure 37 displays a sample persistent spectrum measurement.

Figure 37 Persistent spectrum measurement



To set measure setup for Sound Indicator

If you have configured test parameters as described in “Configuring spectrum measurements” on page 25, continue to set measure setup. You can change Center Frequency and Span by tapping the icons right below the result chart screen.

1 Tap the **Setup** ( ) icon on the side bar.

2 Tap **Sound Indicator**:

- **a** Tap to switch the **Sound** between **On** and **Off** to enable and disable the alarm sound.
- **b** Tap to switch the **Alarm Reference** to **Marker** to set the active marker position as the alarm reference.
- **c** Tap to switch the **Alarm Reference** to **Line** to set the limit as the alarm reference. The Reference Line Mode menu becomes activated to be set.
- **d** Select the Reference Line to specify a threshold for the reference line using the on-screen keyboard.
- **e** *Optional*: To adjust the volume for alarm sound, tap **Volume** and input from 1 to 10 using the on-screen keyboard.

To set measure setup for Interference ID

The Interface ID automatically classifies interfering signals over a designated spectrum and displays the list of possible signal types corresponding to the selected signal.

1 Tap the **Setup** ( ) icon on the side bar.

2 Tap Interference ID.

- **a** Tap to switch the Interference ID between On and Off to turn the Interference ID on and off.
- **b** Tap Threshold and input a value using the on-screen keyboard.

To set measure setup for POI

POI (Probability of Intercept) measure setup lets you configure the Mode (High/Normal) and corresponding RBW/Span range for interception performance.

1 Tap the **Setup** ( ) icon on the side bar.

2 Tap **POI Mode**. You can also access this menu using the Quick Access and Display Tab on top.

a Tap to switch the Mode between High and Normal. The following table shows RBW and Span setup range per Normal and High mode.

Table 20 RBW and Span setup ranges

Mode		A	B	C	D
Normal	POI	100 to 34 µs	392 to 136.5 µs	800.5 to 270.5 µs	3200 to 1076 µs
	Bandwidth	100 to 20 MHz	19 to 5 MHz	4 and 3 MHz	2 and 1 MHz
	RBW	30 kHz to 10 MHz	10 kHz to 1 MHz	3 kHz to 1 MHz	1 kHz to 300 kHz

Mode		A	B	C	D	E	F
High	POI	18.5 to 2 µs	29.5 to 4 µs	73.5 to 7.5 µs	147 to 15 µs	284 to 28 µs	587 to 56.5 µs
	Effective Bandwidth	122.88 MHz	61.4 MHz	30.72 MHz	15.36 MHz	7.68 MHz	3.84 MHz
	Display Bandwidth	100 MHz	50 MHz	25 MHz	14 MHz	7 MHz	3 MHz
	RBW	100 kHz to 30 MHz	100 kHz to 10 MHz	30 kHz to 10 MHz	10 kHz to 3 MHz	10 kHz to 3 MHz	3 kHz to 1 MHz

b Tap **Speed** and input a value using the on-screen keyboard.

To set the DPX marker

1 Tap **Menu > Marker > Marker Table**.

The marker setting table appears.

2 Tap **DPX**.

The vertical bar and horizontal bar appear. A DPX marker shows the hit rate of X-axis (amplitude) and Y-Axis, whereas a normal trace marker shows a value of the X-axis.

3 Tap the chart screen to move the DPX marker or move the vertical bar and horizontal bar.



NOTE

If you select the DPX marker, you can only use the Peak Search and Always Peak options. Delta pair is not available. See “Using marker” on page 41 for more details.

To set bitmap

1 Tap **Menu > Bitmap**.

2 Tap **Dot Persistence Time** and input a value using the on-screen keyboard. This represents the time that accumulates DPX data.

3 Tap to switch **Bitmap Scale** to **On** to enable auto scale or **Off** to disable auto scale.

If the **Bitmap Scale** is **On**, the point where the maximum hit represents maximum colors. If the **Bitmap Scale** is **Off**, the bluer color (closer to 0% of the color bar) is mapped with hit.

4 Tap **Bitmap Min** and input **%** value using the on-screen keyboard.

Bitmap Min represents unused bitmap color range. If you set it to 10%, the color matched with 10% or below does not show.

5 Tap **Bitmap Max** and input % value using the on-screen keyboard.

Bitmap Max represents max range of bitmap colors to be used. If you set it to 90%, the color that exceeds 90% does not show.

6 Tap **Hit Min** and input % value using the on-screen keyboard.

Hit Min represents the minimum number of hits not to be converted to colors. If you set it to 10%, the hit matched with 10% or below is not converted to colors.

7 Tap **Hit Max** and input % value using the on-screen keyboard.

Hit Max represents the maximum number of hits to be converted to colors. If you set it to 90%, the hit matched with 90% or above shows with max colors.

To log multi-traces

When you finished setting trace view/trace type in Trace menu, you can log the trace data by going to the Save page. Make sure you need to select the trace view to on for more than 2 traces.

1 Tap the **Save** icon on the side bar.

2 Make sure the **Logging** is selected in the File Type.

3 Tap the **Save** button at the bottom.

4 The **Trace Selection** pop-up window displays.

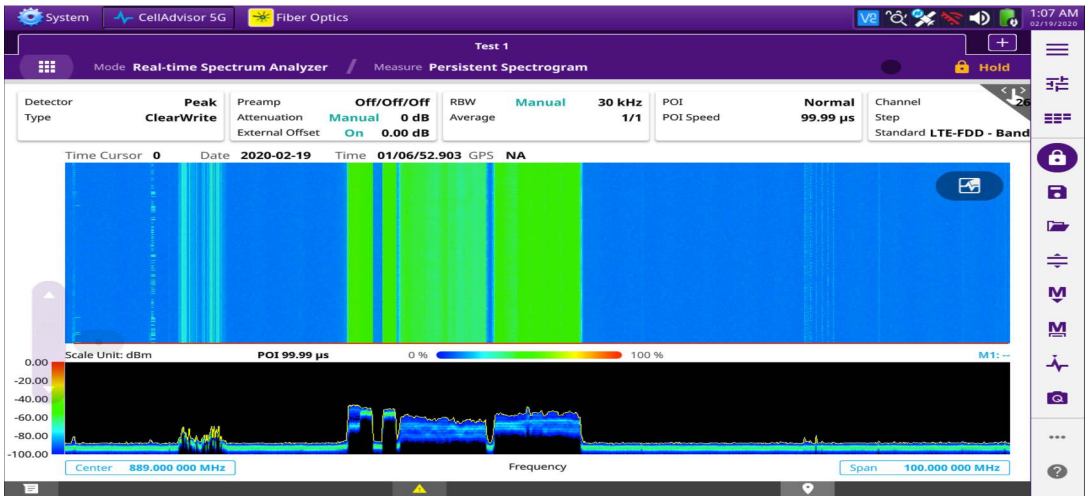
5 Tap the **Apply** button to apply the settings.

Persistent spectrogram

The persistent spectrogram is useful when attempting to identify periodic or intermittent signals as it captures spectrum actively over time and uses various colors to differentiate spectrum power levels. When the directional antenna is used to receive the signal, you will see a change in the amplitude of the tracked signal as you change the direction of the antenna and see a change in the Spectrogram colors. The source of the signal is located in the direction that results in the highest signal strength.

Figure 38 displays a sample persistent spectrogram measurement.

Figure 38 Persistent spectrogram measurement



To set measure setup

After configuring spectrum measurement as described in “Configuring spectrum measurements” on page 25, you can set the measure setup to continue your measurement.

1 Tap the **Setup** ( ) icon on the side bar.

2 Tap **Time Interval** to set the amount of time between each trace measurement using the on-screen keyboard.

3 Tap **Time Cursor** to **On** to set the time cursor on a specific trace position.

The Position menu becomes activated to be set. You can also move the time cursor up and down using the move bar on the left edge.

4 Tap **Position** to move the time cursor by inputting a value using the on-screen keyboard.

5 Tap **Type** to switch the chart view type to **3d Display** or **Normal**.

You can also change the chart view type using the icon on the chart screen.

6 Tap **POI Mode.** You can also access this menu via Quick Access and Display Tab on top.

a Tap to switch the Mode between High and Normal.The following table shows RBW and Span setup range per Normal and High Mode

Table 21 RBW and Span setup range

Mode		A	B	C	D
Normal	POI	100 to 34 µs	392 to 136.5 µs	800.5 to 270.5 µs	3200 to 1076 µs
	Bandwidth	100 to 20 MHz	19 to 5 MHz	4 and 3 MHz	2 and 1 MHz
	RBW	30 kHz to 10 MHz	10 kHz to 1 MHz	3 kHz to 1 MHz	1 kHz to 300 kHz

Mode		A	B	C	D	E	F
High	POI	18.5 to 2 µs	29.5 to 4 µs	73.5 to 7.5 µs	147 to 15 µs	284 to 28 µs	587 to 56.5 µs
	Effective Bandwidth	122.88 MHz	61.4 MHz	30.72 MHz	15.36 MHz	7.68 MHz	3.84 MHz
	Display Bandwidth	100 MHz	50 MHz	25 MHz	14 MHz	7 MHz	3 MHz
	RBW	100 kHz to 30 MHz	100 kHz to 10 MHz	30 kHz to 10 MHz	10 kHz to 3 MHz	10 kHz to 3 MHz	3 kHz to 1 MHz

b Tap **Speed** and input a value using the on-screen keyboard.

7 Tap **Reset/Restart** to start a new measurement.



NOTE

Enabling the time cursor puts the measurement on hold, allowing you to make post processing analysis for each measurement over time using the time cursor.

To set the DPX marker

1 Tap **Menu > Marker > Marker Table**.

The marker setting table appears.

2 Tap **DPX**.

The horizontal and vertical bars appear. A DPX marker shows the hit rate of X-axis (amplitude) and Y-axis whereas a normal trace marker shows a value of the x-axis.

3 Tap the chart screen to move the DPX marker or move the vertical bar and horizontal bar.



NOTE

If you select the DPX marker, you can only use Peak Search and Always Peak options. Delta pair is not available. See “Using marker” on page 41 for more information.

To set bitmap

1 Tap **Menu > Bitmap**.

2 Tap **Dot Persistence Time** and input a value using the on-screen keyboard. The dot persistence time represents the time that accumulates DPX data.

3 Tap to switch **Bitmap Scale** to **On** to enable auto scale or **Off** to disable auto scale. If the Bitmap Scale is On, the point where the maximum hit represents maximum colors. If the Bitmap Scale is Off, the bluer color (closer to 0% of the color bar) is mapped with a hit.

4 Tap Bitmap Min and input % value using the on-screen keyboard.

The Bitmap Min represents the unused bitmap color range. If you set it to 10%, the color matched with 10% or below does not show.

5 Tap Bitmap Max and input % value using the on-screen keyboard.

The Bitmap Max represents the maximum range of bitmap colors to be used. if you set it to 90%, the color that exceeds 90% does not show.

6 Tap **Hit Min** and input % value using the on-screen keyboard.

The Hit Min represents the minimum number of hits not to be converted to colors. If you set it to 10%, the hit matched with 10% or below is not converted to a color.

7 Tap Hit Max and input % value using the on-screen keyboard. The Hit Max represents the maximum number of hits to be converted to colors. If you set it to 90%, the hit matched with 90% or above shows with max colors.



NOTE

You can go to **Menu > Limit** to analyze your measurements with the reference line, multi-segment line, and channel limit table. See “Setting limit” on page 39 for more information.

To log multi-traces

When you finished setting trace view/trace type in Trace menu, you can log the trace data by going to the Save page. Make sure you need to select the trace view to on for more than 2 traces.

1 Tap the **Save** icon on the side bar.

2 Make sure the **Logging** is selected in the File Type.

3 Tap the **Save** button at the bottom.

4 The **Trace Selection** pop-up window displays.

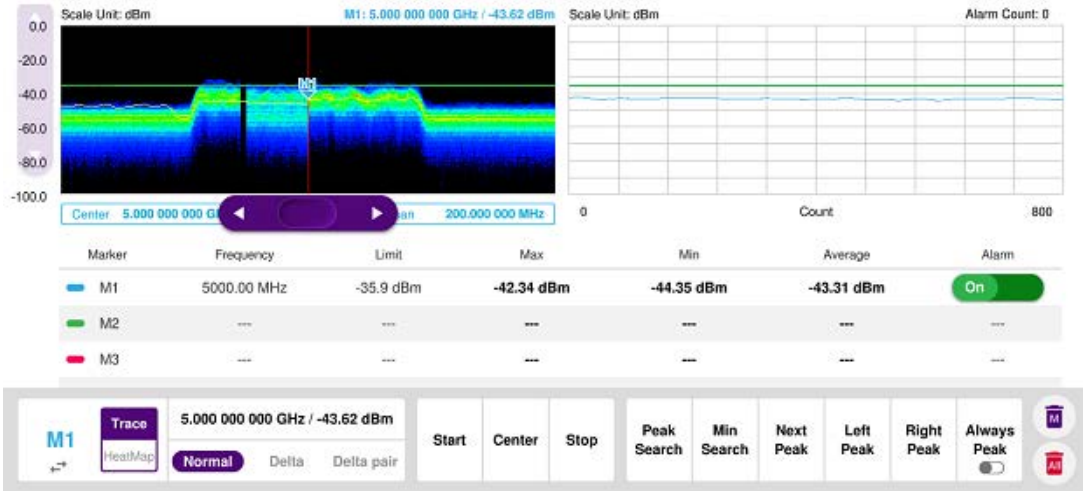
5 Tap the **Apply** button to apply the settings.

Persistent RSSI

The Received Signal Strength Indicator (RSSI) is a multi-signal tracking metric that is particularly useful for measuring power-level variations over time. The RSSI measurement lets you assign power limit line for audible alarms and increase alarm counters every time a signal exceeds a defined limit line. For long-term analysis, the spectrogram and RSSI measurements can be automatically saved into an external USB memory.

Figure 39 displays an example of a Persistent RSSI Measurement.

Figure 39 Persistent RSSI Measurement



After configuring spectrum measurement as described in “Configuring spectrum measurements” on page 25, you can set the measure setup to continue your measurement.

To set measure setup

1 Tap the **Setup** ( ) icon on the side bar.

2 Tap **Alarm** to set the alarm parameters.

3 Tap **Alarm at** and select the marker number from Marker 1 to Marker 6.

4 Tap **Reference Line** to set a threshold for the alarm and input a value using the on-screen keyboard.

5 Tap to switch **Alarm** to **On** or **Off** to turn the alarm feature on or off.

6 *Optional*: Tap **Volume** to adjust the volume from 1 to 10 using the on-screen keyboard.

NOTE

You must set the marker(s) for the alarm, as this feature uses the marker position to sound alarms. See “Using marker” on page 41 for more information.

You can go to **Menu > Limit** to analyze your measurements with the Reference Line, multi-segment line, and channel limit. See “Setting limit” on page 39 for more information. Once you tap the vertical move bar and move it up and down, the reference line value changes.

To set bitmap

1. Tap **Menu > Bitmap**.
2. Tap **Dot Persistence Time** and input a value using the on-screen keyboard. This represents the time that accumulates DPX data.
3. Tap to switch **Bitmap Scale** to **On** to enable auto scale or **Off** to disable auto scale.

   If the **Bitmap Scale** is **On**, the point where the maximum hit represents maximum colors. If the **Bitmap Scale** is **Off**, the bluer color (closer to 0% of the color bar) is mapped with hit.
4. Tap **Bitmap Min** and input **%** value using the on-screen keyboard.

   Bitmap Min represents unused bitmap color range. If you set it to 10%, the color matched with 10% or below does not show.
5. Tap **Bitmap Max** and input % value using the on-screen keyboard.

   Bitmap Max represents max range of bitmap colors to be used. If you set it to 90%, the color that exceeds 90% does not show.
6. Tap **Hit Min** and input % value using the on-screen keyboard.

   Hit Min represents the minimum number of hits not to be converted to colors. If you set it to 10%, the hit matched with 10% or below is not converted to colors.
7. Tap **Hit Max** and input % value using the on-screen keyboard.

   Hit Max represents the maximum number of hits to be converted to colors. If you set it to 90%, the hit matched with 90% or above shows with max colors.

To log multi-traces

When you finished setting trace view/trace type in Trace menu, you can log the trace data by going to the Save page. Make sure you need to select the trace view to on for more than 2 traces.

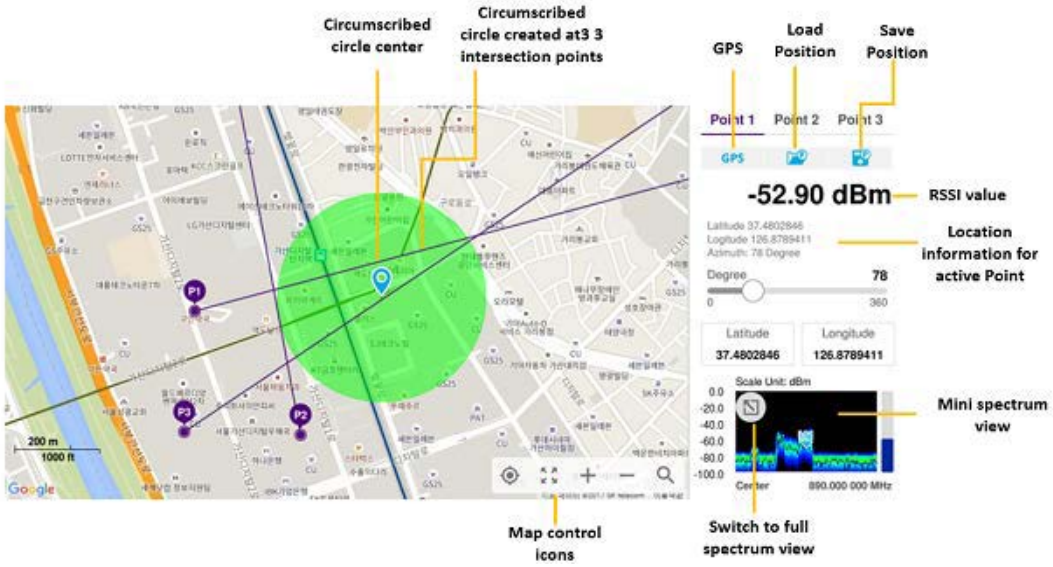
1. Tap the **Save** icon on the side bar.
2. Make sure the **Logging** is selected in the File Type.
3. Tap the **Save** button at the bottom.
4. The **Trace Selection** pop-up window displays.
5. Tap the **Apply** button to apply the settings.

Persistent interference finder

The Persistent Interference Finder is an automatic triangulation algorithm that uses GNSS coordinates to locate possible interference sources based on three measurements. The persistent interference finder calculates possible interference locations using its inscribed circle or circumscribed circle, based on measured intersection points. You can plot up to seven measurement points and select three that are more representative for triangulation. The instrument automatically logs measurement positions not to lose them while changing measurement modes. You can switch the main screen from persistent spectrum view to map view and vice versa using the icon on the persistent spectrum view screen. Before starting the Persistent Interference Finder, you need to configure spectrum measurements. See ““Configuring spectrum measurements” on page 25 for more information. Note that the purpose of the measurement is to monitor the intermittent and transient interfering signals.

Figure 40 shows an example of the Persistent Interference Finder.

Figure 40 Persistent Interference Finder



To make full use of the feature available in the map mode, you will need a GNSS receiver and an antenna. For more details, see “Antenna connection” below.

NOTE

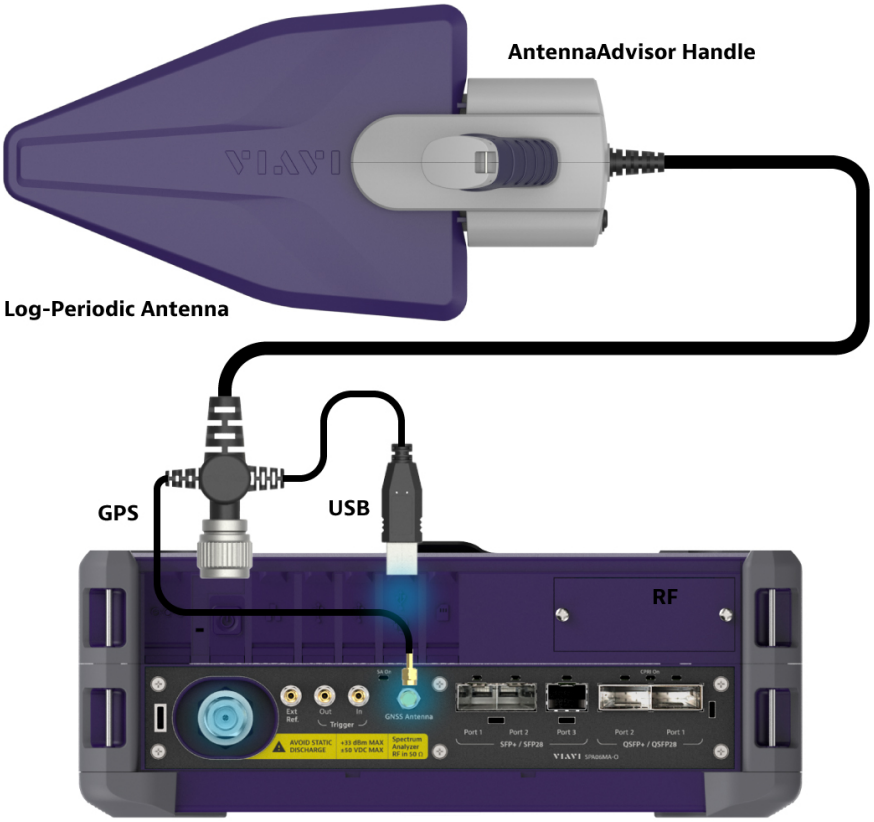
If you go to Setup > Bandwidth and set the required bandwidth, you can see the light blue bar chart with bandwidth in the current spectrum measurement screen. The above figure does not show the bar as it sets the bandwidth to 0.

Antenna connection

Before starting the instrument, you need to connect the Omni or Log periodic antenna to your instrument. In the Interference Finder Mode and the Radar Chart mode, you can perform interference hunting using the optional AntennaAdvisor Handle after attaching a broadband directional antenna to it. The handle is a device that has a built-in GNSS antenna and LNA.

Figure 41 shows an example of an antenna connection.

Figure 41 Antenna connection example



To connect an antenna

1. Mount a broadband antenna to your AntennaAdvisor Handle.
2. Connect the **RF Type-N Jack** of the handle to the **RF In** port of the instrument.
3. Connect the GNSS SMA jack of the handle to the GNSS port of the instrument. The GNSS status indicator appears on the instrument screen.
4. Connect the USB plug of the handle to the USB Host port of the instrument. The device icon appears in the system status bar on the screen.

NOTE

The AntennaAdvisor Handle is an optional item. It is recommended that you use a log periodic antenna with AntennaAdvisor handle to search more exact directional information. You can use a log periodic antenna or Omni antenna alone as well.

Loading a map

To use any features related to maps, you need to download and install the maps on the instrument. The **VIAVI JDMapCreator** will help you to download maps. Ensure the

JDMapCreator application on your computer is connected to the instrument via LAN. You can send a map file with a single layer to the instrument directly by using the **Send to EQP** menu in JDMapCreator. For information about how to use the JDMapCreator, see the *JDMapCreator 2.0 User Guide*.

To load a map

1 Plug in your USB flash drive that has a map file in .mcfv file type created in JDMapCreator.

2 Tap the **Load** icon on the side bar,

3 Navigate to the map you want to open. The **File Information** pane displays the file properties, including name, size, type, and date modified.

4 Tap the **Load** button on the screen.

Once you have loaded the map, you can also control the map using the following icons on the map.

Table 22 Map control icons

Icon	Description
	Tap to go to your current location on the map. Once tapped, the purple icon appears on the map, indicating your current location.
	Tap to switch to the full screen map view.
	Tap to zoom in the map.
	Tap to zoom out the map.
	Tap and select the area where you want to expand.

To load a JSON file from Spectrum Net Analyzer

When you load a JSON map file configured in Spectrum Net Analyzer, you can view the map with Cell Site icon, Interference Power, and Heat map (%) legend colors.

1 Plug in your USB flash drive that has a map file in .json file type created in Spectrum Net Analyzer.

2 Tap the **Load** icon on the side bar.

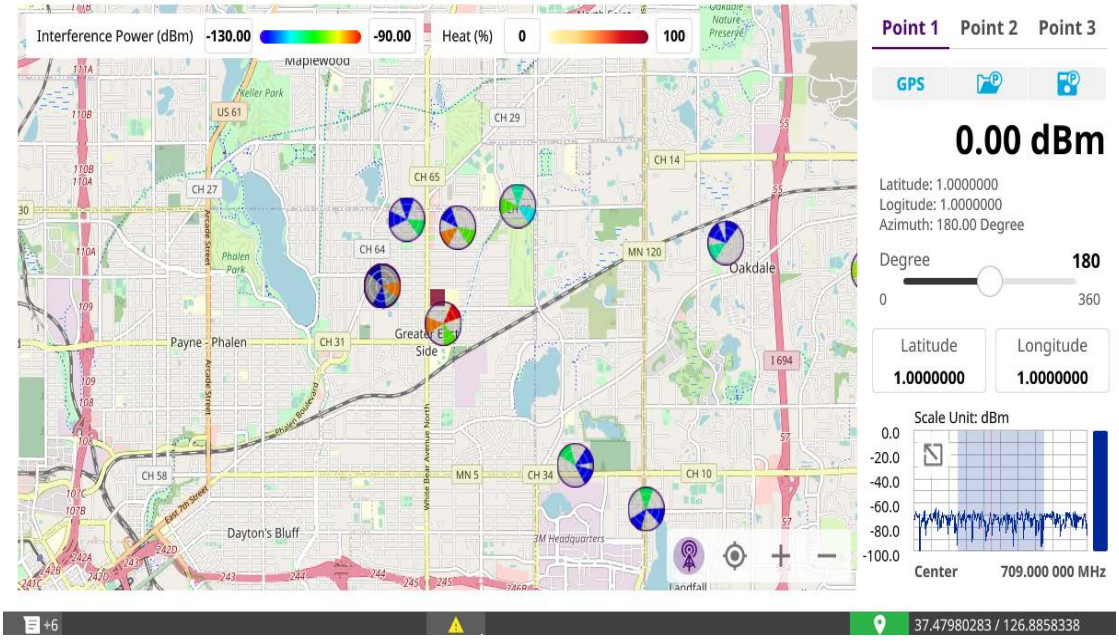
3 Navigate to the map you want to open. The **File Information** pane displays the file properties, including name, size, type, and date modified.

4 Tap the **Load** button on the screen.

5 Once the json file is successfully loaded, the **Cell Site** icon is enabled.

Figure 42 shows an example of the Persistent Interference Finder measurement from the JSON file loaded.

Figure 42 Persistent Interference Finder measurement from the JSON file loaded



NOTE

Based on the min/max value of the Interference Power, the cell site direction color changes, and based on the min/max value of the Heat, the heat map color changes.

Initializing AntennaAdvisor

Once you have connected the AntennaAdvisor Handle to your instrument, antenna initialization is required to get the right azimuth data. You need to initialize the antenna handle to calibrate the built-in compass by completing the following steps. Note that you can adjust Bandwidth based on the center frequency of the interfering signal that you have identified in the Spectrum view by tapping the Measure Setup > Bandwidth. A message appears at the bottom of the screen to alert you if you have not performed initialization of your connected antenna handle set.

To initialize AntennaAdvisor

1 Hold your antenna handle horizontally in its upright position.

2 Point the antenna to the north and tap **Measure Setup > Initialize AntennaAdvisor**.Point the antenna to the north and tap **Measure Setup > Initialize AntennaAdvisor**.

The message disappears and the red line for the current antenna direction moves to the 0° line and overlaps to let you know that the initialization is done successfully.



NOTE

It is recommended that you re-initialize the AntennaAdvisor Handle after measurements to re-calibrate the compass when you notice that the red line on the radar chart is not aligned with the north on the map even though you are pointing the antenna to the north.

Setting geographic location

A point is a particular location that contains information about that location. This information includes, for example, GNSS coordinates, the time of the measurement or level that has been measured. You can evaluate the Point information directly on-site or save the information for later evaluation.

With this functionality, you can mark locations where you have performed a measurement. Thus, you can analyze the geographical distribution of the received signal strength. This allows you to analyze, for example, the coverage conditions around a base station's coverage area.

In the map view, a point is displayed as a dot with a number. The straight line represents the direction you are facing.

To set the geographic location

1 Tap the **Point 1**, **Point 2** and **Point 3** on the map. Make sure to set three location points so that the straight lines started from the point can create three intersections.

2 Tap each point and use the **Degree** bar or button to change degrees.

3 Tap the **GNSS** icon to automatically get the selected point’s location information.

The instrument displays the latitude and longitude information of the signal received by the GNSS antenna. This function is only available when the GNSS antenna is connected.

4 Tap the **Latitude** and **Longitude** icon and enter the value using the on-screen keyboard to manually define a position.

The values should be input based on the Decimal Degrees.

5 Tap the **Apply** button.

Setting azimuth

There are three methods available for setting azimuth.

Method 1: AntennaAdvisor Handle

You can use the Antenna Advisor handle. Make sure you initialize AntennaAdvisor first to get more accurate directional information.

1 Press and hold the **TRIGGER** button on the handle then it finds the strongest RSSI value.

RSSI, polarization, elevation, and azimuth readings are continuously updated on the screen while pressing the physical button.

2 Release the **TRIGGER** button to stop scanning.

Method 2: Degree bar

The **Degree Bar** functions as a compass. You can use it to set azimuth by moving it right and left.

1 Tap the circle on the Degree bar and move it gently until you get the right azimuth.

Method 3: Log-periodic antenna

You can use the log-periodic antenna.

Pan your log-periodic antenna to find a signal with the highest RSSI value and measure an azimuth of the interfering signal.



NOTE

The AntennaAdvisor has a built-in low-noise amplifier (LNA) that can be turned on and off using the physical On/Off button located on the rear side of the handle unit. For example, if the received signal is weak, you can turn on the switch to improve S/N.

To save the defined position

1 Tap any point on the map where you want to save the position information.

2 Tap the **Save Position** icon.

The instrument stores the saved location points in the internal memory, allowing you to load them by using the **Load Position** icon. You can save and load up to 10 positions.

To set measure setup for POI

POI (Probability of Intercept) measure setup lets you configure the Mode (High/Normal) and corresponding RBW/Span range for interception performance..

1 Tap the **Setup** ( ) icon on the side bar.

2 Tap **POI Mode**. You can also access this menu using the Quick Access and Display Tab on top.

a Tap to switch the Mode between High and Normal. The following table shows RBW and Span setup range per Normal and High mode.

Table 23 RBW and Span setup ranges

Mode		A	B	C	D
Normal	POI	100 to 34 µs	392 to 136.5 µs	800.5 to 270.5 µs	3200 to 1076 µs
	Bandwidth	100 to 20 MHz	19 to 5 MHz	4 and 3 MHz	2 and 1 MHz
	RBW	30 kHz to 10 MHz	10 kHz to 1 MHz	3 kHz to 1 MHz	1 kHz to 300 kHz

Mode		A	B	C	D	E	F
High	POI	18.5 to 2 µs	29.5 to 4 µs	73.5 to 7.5 µs	147 to 15 µs	284 to 28 µs	587 to 56.5 µs
	Effective Bandwidth	122.88 MHz	61.4 MHz	30.72 MHz	15.36 MHz	7.68 MHz	3.84 MHz
	Display Bandwidth	100 MHz	50 MHz	25 MHz	14 MHz	7 MHz	3 MHz
	RBW	100 kHz to 30 MHz	100 kHz to 10 MHz	30 kHz to 10 MHz	10 kHz to 3 MHz	10 kHz to 3 MHz	3 kHz to 1 MHz

b Tap **Speed** and input a value using the on-screen keyboard.

Setting display mode

When the triangulation is done with three location points and azimuth for each point, you can view a circumscribed circle by default. You can change the display mode to inscribed circle or double circles to view a narrower area. The center of the green-shaded circle is determined to be where the source of the interfering signal resides.

To set display mode

1 Tap **Setup > Display**.

2 Select the option from the following choices:
   – **Circum**: displays a circumscribed circle that meets three vertices of the triangle.
   – **Inscribed**: displays an inscribed circle that meets the three vertices of the triangle.
   – **Double**: displays both circumscribed and inscribed circles.

3 Tap **Measure Setup > Screen Mode**.

4 Tap the **Screen Mode** to select **Map** or **Full**.
   – **Map**: displays what is inside the base map with the map image.
   – **Full**: displays three location points and defined circle without the map image.

To set bitmap

1 Tap **Menu > Bitmap**.

2 Tap **Dot Persistence Time** and input a value using the on-screen keyboard. This represents the time that accumulates DPX data.

3 Tap to switch **Bitmap Scale** to **On** to enable auto scale or **Off** to disable auto scale.

   If the **Bitmap Scale** is **On**, the point where the maximum hit represents maximum colors. If the **Bitmap Scale** is **Off**, the bluer color (closer to 0% of the color bar) is mapped with hit.

4 Tap **Bitmap Min** and input **%** value using the on-screen keyboard.

   Bitmap Min represents unused bitmap color range. If you set it to 10%, the color matched with 10% or below does not show.

5 Tap **Bitmap Max** and input % value using the on-screen keyboard.

   Bitmap Max represents max range of bitmap colors to be used. If you set it to 90%, the color that exceeds 90% does not show.

6 Tap **Hit Min** and input % value using the on-screen keyboard.

   Hit Min represents the minimum number of hits not to be converted to colors. If you set it to 10%, the hit matched with 10% or below is not converted to colors.

7 Tap **Hit Max** and input % value using the on-screen keyboard.

   Hit Max represents the maximum number of hits to be converted to colors. If you set it to 90%, the hit matched with 90% or above shows with max colors.

Persistent radar chart

If you have identified an interfering signal on your spectrum view, you can move to the Radar Chart mode and measure RSSI power levels through 360° at a location received by the connected broadband directional antenna so that you can determine the direction of the source of the interference. Using a set of the AntennaAdvisor Handle that holds a broadband directional antenna is mandatory in the Radar Chart mode and its built-in compass, GNSS Antenna, and built-in low noise amplifier (LNA) help to determine the direction of the interference.

You can switch the Main screen from Spectrum view to Map view and vice versa using the icon on the spectrum view screen. Before starting the Interference Finder, you need to set Spectrum measurements. See “Configuring spectrum measurements” on page 25 for more information.

For antenna connection, see “Antenna connection” on page 88.

Loading a map

To use any features related to maps, you need to download and install the maps on the instrument. The **VIAVI JDMapCreator** will help you to download maps. Ensure the JDMapCreator application on your computer is connected to the instrument via LAN. You can send a map file with a single layer to the instrument directly by using the **Send to EQP** menu in JDMapCreator. For information about how to use the JDMapCreator, see the *JDMapCreator 2.0 User Guide*.

To load a map

1. Plug in your USB flash drive that has a map file in .mcfv file type created in JDMapCreator.
2. Tap the **Load** icon on the side bar,
3. Navigate to the map you want to open. The **File Information** pane displays the file properties, including name, size, type, and date modified.
4. Tap the **Load** button on the screen.

Once you have loaded the map, you can also control the map using the following icons on the map.

Table 24 Map control icons

Icon	Description
	Tap to go to your current location on the map. Once tapped, the purple icon appears on the map, indicating your current location.
	Tap to switch to the full screen map view.
	Tap to zoom in the map.
	Tap to zoom out the map.

Table 24 Map control icons

Icon	Description
	Tap and select the area where you want to expand.

To load a JSON file from Spectrum Net Analyzer

When you load a JSON map file configured in Spectrum Net Analyzer, you can view the map with Cell Site icon, Interference Power, and Heat map (%) legend colors.

1 Plug in your USB flash drive that has a map file in .json file type created in Spectrum Net Analyzer.

2 Tap the **Load** icon on the side bar.

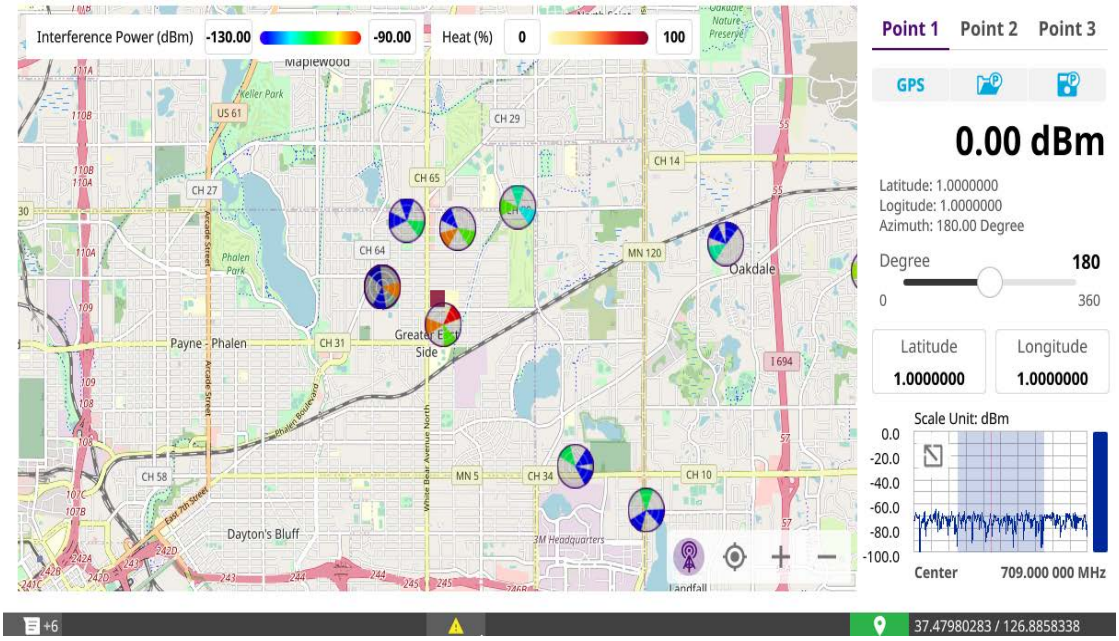
3 Navigate to the map you want to open. The **File Information** pane displays the file properties, including name, size, type, and date modified.

4 Tap the **Load** button on the screen.

5 Once the json file is successfully loaded, the **Cell Site** icon is enabled.

Figure 43 shows an example of the Persistent Radar Chart measurement from the JSON file loaded.

Figure 43 Persistent Radar Chart measurement from the JSON file loaded



NOTE

Based on the min/max value of the Interference Power, the cell site direction color changes, and based on the min/max value of the Heat, the heat map color changes.

Initializing AntennaAdvisor

Once you have connected the AntennaAdvisor Handle to your instrument, antenna initialization is required to get the right azimuth data. You need to initialize the antenna handle to calibrate the built-in compass by completing the following steps. Note that you can adjust Bandwidth based on the center frequency of the interfering signal that you have identified in the Spectrum view by tapping the Setup > Bandwidth. A message appears at the bottom of the screen to alert you if you have not performed initialization of your connected antenna handle set.

To initialize AntennaAdvisor

1. Hold your antenna handle horizontally in its upright position.

   To avoid unnecessary impact of external magnetic field, position yourself at the location where the value of magnetic field strength displayed on the instrument is green.

2. Point the antenna to the north and tap **Measure Setup > Initialize AntennaAdvisor**.

   The message disappears and the red line for the current antenna direction moves to the 0° line and overlaps to let you know that the initialization is done successfully.



NOTE

It is recommended that you re-initialize the AntennaAdvisor Handle after measurements to re-calibrate the compass when you notice that the red line on the radar chart is not aligned with the north on the map even though you are pointing the antenna to the north.

Obtaining persistent RSSI and direction data

Once you have connected your antenna handle set and done necessary setups, you can monitor the power level of the received signal, the amount of polarization, and elevation level real time. Using the Trigger button on the antenna handle set, you can plot the RSSI level and obtain current direction of antenna at your location.

To obtain Persistent RSSI and direction data

1. When you have the green GNSS indicator, tap the **GNSS** icon on the side panel to set your current location to the center of the radar chart. The latitude and longitude information at the side of the display changes from “Unknown Position” to the obtained position information.

2. Tap the **Save Position** icon on the side panel to save a position to recall for triangulation in the Interference Finder mode and select one that you want to save.

3 Monitor the RSSI reading of the received signal. If the signal is weak, turn on the LNA switch on the antenna handle set to improve S/N.



NOTE

The AntennaAdvisor Handle has a built-in low-noise amplifier (LNA) and you can turn it on and off by toggling the physical On/Off switch located on the rear side of the handle unit

4 Hold the antenna handle set horizontally and make the measurement.

5 To obtain a Persistent RSSI value and direction:

a Press the **Trigger** button located on the antenna handle.

A beep sounds and a power level of the received signal is plotted as a blue dot on the radar chart. Depending on the strength of the measured value, you may hear different tones of beeping.

b While receiving the power level, you can also obtain the current direction of the antenna. Repeat pressing the **TRIGGER** button to obtain at least five points if you want to do the localization.

6 To continuously obtain a Persistent RSSI values and direction:

a Press and hold the **TRIGGER** button located on the antenna handle to start a continuous measurement.

b A beep is sounded repeatedly to let you know that the measurement is continuing and measured values are plotted and lined on the radar chart.

c Release the **TRIGGER** button to stop the continuous measurement.



NOTE

The maximum number you can plot on the radar chart is 2500 points both in the single and continuous measurements. If your measurement reaches 2500 points, you need to reset the measurement by pressing the Localization soft key twice or performing the initialization of the AntennaAdvisor Handle. Concentric circles indicate different levels of RSSI. You can use the AMP/SCALE hard key to adjust the amplitude scale of the chart.

7 Tap **Setup** > **Screen Mode Full/Map** to change the display mode.

a **Map**: Displays measured points inside the base map image. If you are in the area outside the base map and continue your measurement with the Trigger button, the instrument continues obtaining data even though the radar chart disappears from the screen. You can view obtained data when you change this display option to Full.

b **Full**: Displays measured points without the base map image. In case that you made measurements in the area outside the map image, selecting this option moves your measured data to the center of the display so that you can view the result.

Localizing RSSI data

The Localization feature lets you view averaged and smoothed measurement data with a bold green line on the radar chart that helps you determine the direction of the highest RSSI value. When you have five or more data points plotted on the radar chart, you can perform this localization.

To localize RSSI data

1 Tap the Setup ( ) icon on the side bar.

2 Tap **Localization**. All the measured points turn to green color and you can view the bold green line that indicates the possible direction of the interference source.

3 Tap **Localization** again to clear all the data plots on the radar chart.

Figure 44 shows an example of the persistent radar chart. Figure 45 shows an example of the localized persistent radar chart.

Figure 44 Persistent Radar Chart



Figure 45 Persistent Radar Chart — localized



To set measure setup for POI

POI (Probability of Intercept) measure setup lets you configure the Mode (High/Normal) and corresponding RBW/Span range for interception performance.

1 Tap the **Setup** ( ) icon on the side bar.

2 Tap **POI Mode**. You can also access this menu using the Quick Access and Display Tab on top.

a Tap to switch the Mode between High and Normal. The following table shows RBW and Span setup range per Normal and High mode.

Table 25 RBW and Span setup ranges

Mode		A	B	C	D
Normal	POI	100 to 34 µs	392 to 136.5 µs	800.5 to 270.5 µs	3200 to 1076 µs
	Bandwidth	100 to 20 MHz	19 to 5 MHz	4 and 3 MHz	2 and 1 MHz
	RBW	30 kHz to 10 MHz	10 kHz to 1 MHz	3 kHz to 1 MHz	1 kHz to 300 kHz

Mode		A	B	C	D	E	F
High	POI	18.5 to 2 µs	29.5 to 4 µs	73.5 to 7.5 µs	147 to 15 µs	284 to 28 µs	587 to 56.5 µs
	Effective Bandwidth	122.88 MHz	61.4 MHz	30.72 MHz	15.36 MHz	7.68 MHz	3.84 MHz
	Display Bandwidth	100 MHz	50 MHz	25 MHz	14 MHz	7 MHz	3 MHz
	RBW	100 kHz to 30 MHz	100 kHz to 10 MHz	30 kHz to 10 MHz	10 kHz to 3 MHz	10 kHz to 3 MHz	3 kHz to 1 MHz

b Tap **Speed** and input a value using the on-screen keyboard.

To set bitmap

1 Tap **Menu > Bitmap**.

2 Tap **Dot Persistence Time** and input a value using the on-screen keyboard. This represents the time that accumulates DPX data.

3 Tap to switch **Bitmap Scale** to **On** to enable auto scale or **Off** to disable auto scale.

If the **Bitmap Scale** is **On**, the point where the maximum hit represents maximum colors. If the **Bitmap Scale** is **Off**, the bluer color (closer to 0% of the color bar) is mapped with hit.

4 Tap **Bitmap Min** and input **%** value using the on-screen keyboard.

Bitmap Min represents unused bitmap color range. If you set it to 10%, the color matched with 10% or below does not show.

5 Tap **Bitmap Max** and input % value using the on-screen keyboard.

Bitmap Max represents max range of bitmap colors to be used. If you set it to 90%, the color that exceeds 90% does not show.

6 Tap **Hit Min** and input % value using the on-screen keyboard.

Hit Min represents the minimum number of hits not to be converted to colors. If you set it to 10%, the hit matched with 10% or below is not converted to colors.

7 Tap **Hit Max** and input % value using the on-screen keyboard.

Hit Max represents the maximum number of hits to be converted to colors. If you set it to 90%, the hit matched with 90% or above shows with max colors.

Real-time spectrum replayer

The Real-time Spectrum Replayer allows you to retrieve and replay recorded real-time spectrum analyzer traces in interference analysis mode. These traces can be played back in the persistent spectrum, persistent spectrogram, or persistent RSSI. You can configure the limit line to create failure points when signals exceed it. The failure points are clearly displayed on the trace timeline for quick access during playback.

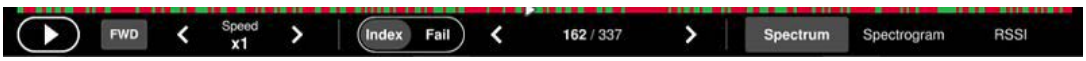
To replay a spectrum

1 Tap the **Setup** ( ) icon on the side bar.

2 Tap **Spectrum Replayer**. The **File Manager** window appears.

3 Select a file to be loaded and then tap **Load**. The replay bar appears on the bottom of the screen, as shown in Figure 46.

Figure 46 Replay bar



4 Tap **Play** to start playing.

5 Tap **FWD** or **REV** to change play direction to forward or reverse.

6 Tap the left or right arrow of **Speed** to select the speed option: **X1**, **X2**, **X3**, or **X4**.

7 Tap **Pause** to pause or stop playing data.

8 To move to a particular failure position directly and play from there, tap **Fail** on the **Index/Fail** switch and enter a value by using the on-screen keyboard.

9 Tap to change display mode to **spectrum**, **spectrogram**, or **RSSI**.

3D display (Waterfall) is not supported in case of spectrum logging.

10 *Optional*: Tap **Setup > Time Cursor On/Off** to display or dismiss the time cursor on the screen. This key becomes activated when you play logged data in the Spectrogram mode.

NOTE

If you connect a USB drive, do not remove it while playing to prevent freezing the USB port, which will require you to restart the instrument to get a USB drive recognized again.

Online interference analysis

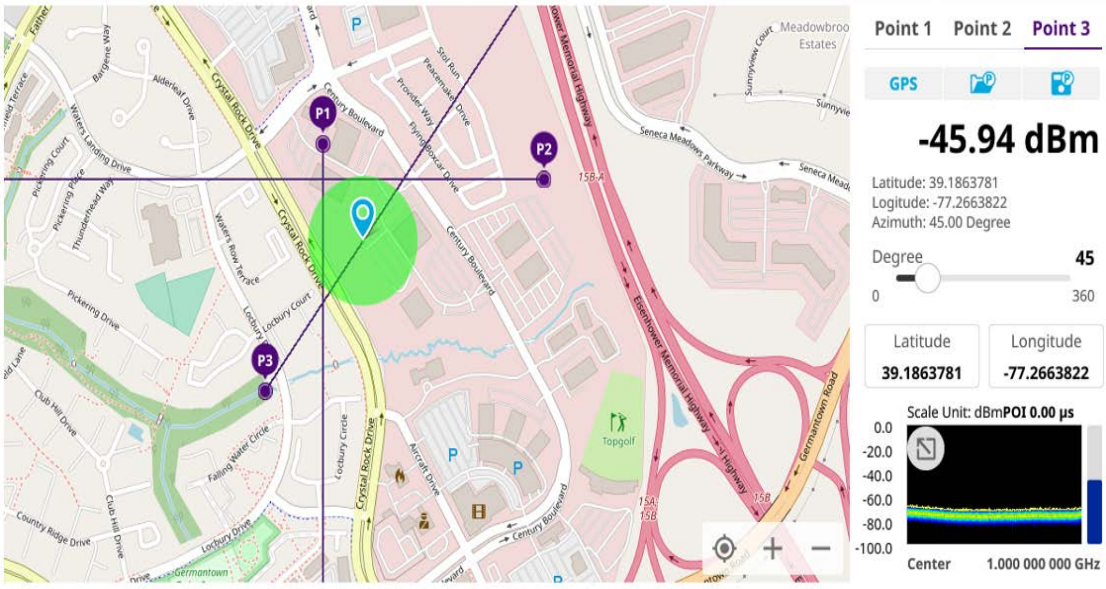
The following sections describe how to conduct online interference measurements.

Online persistent interference finder

The Online Persistent Interference Finder is an automatic triangulation algorithm that uses GNSS coordinates to locate possible interference sources based on three measurements. The online persistent interference finder calculates possible interference locations using its inscribed circle or circumscribed circle, based on measured intersection points. You can plot up to seven measurement points and select three that are more representative for triangulation. The instrument automatically logs measurement positions not to lose them while changing measurement modes. Before starting the Persistent Interference Finder, you need to configure spectrum measurements. See “Configuring spectrum measurements” on page 25 for more information. Note that the purpose of the measurement is to monitor the intermittent and transient interfering signals.

Figure 47 shows an example of the Online Persistent Interference Finder.

Figure 47 Online Persistent Interference Finder



To make full use of the feature available in the map mode, you will need a GNSS receiver and an antenna. For more details, see “Antenna connection” below.

NOTE

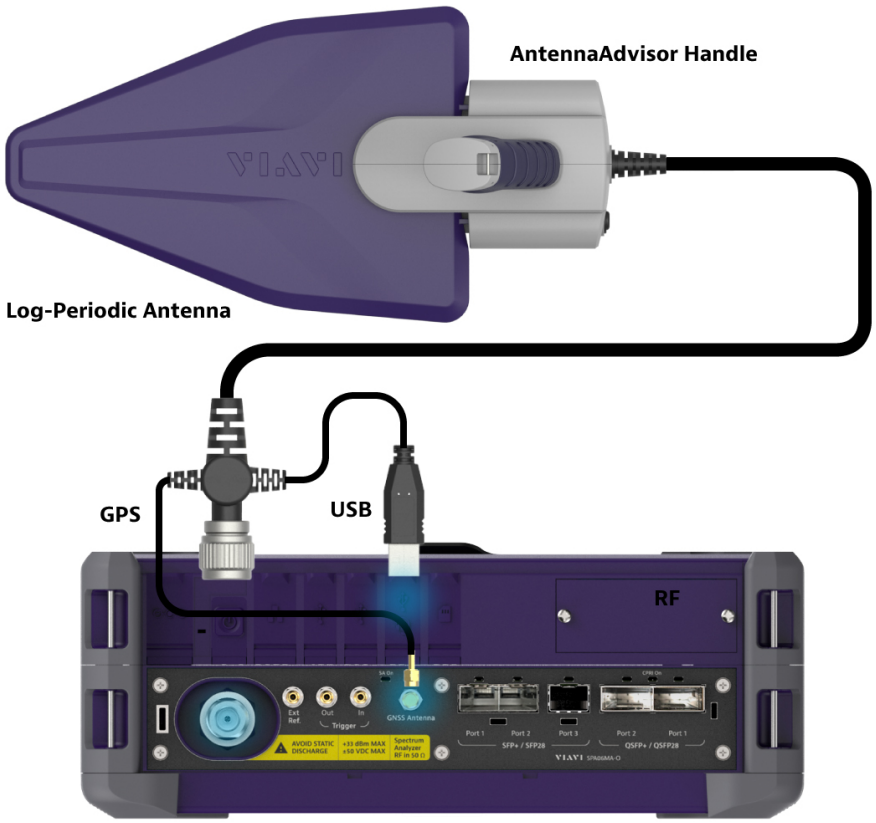
If you go to Setup > Bandwidth and set the required bandwidth, you can see the light blue bar chart with bandwidth in the current spectrum measurement screen. The above figure does not show the bar as it sets the bandwidth to 0.

Antenna connection

Before starting the instrument, you need to connect the Omni or Log periodic antenna to your instrument. In the Interference Finder Mode and the Radar Chart mode, you can perform interference hunting using the optional AntennaAdvisor Handle after attaching a broadband directional antenna to it. The handle is a device that has a built-in GNSS antenna and LNA.

Figure 48 shows an example of an antenna connection.

Figure 48 Antenna connection example



To connect an antenna

1 Mount a broadband antenna to your AntennaAdvisor Handle.

2 Connect the **RF Type-N Jack** of the handle to the **RF In** port of the instrument.

3 Connect the GNSS SMA jack of the handle to the GNSS port of the instrument. The GNSS status indicator appears on the instrument screen.

4 Connect the USB plug of the handle to the USB Host port of the instrument. The device icon appears in the system status bar on the screen.

NOTE

The AntennaAdvisor Handle is an optional item. It is recommended that you use a log periodic antenna with AntennaAdvisor handle to search more exact directional information. You can use a log periodic antenna or Omni antenna alone as well.

Controlling a map

To control a map

See the following table to control a map.

Table 26 Map control icons

Icon	Description
	Tap to go to your current location on the map. Once tapped, the purple icon appears on the map, indicating your current location.
	Tap to zoom in the map.
	Tap to zoom out the map.

To load a JSON file from Spectrum Net Analyzer

When you load a JSON map file configured in Spectrum Net Analyzer, you can view the map with Cell Site icon, Interference Power, and Heat map (%) legend colors.

1 Plug in your USB flash drive that has a map file in .json file type created in Spectrum Net Analyzer.

2 Tap the **Load** icon on the side bar.

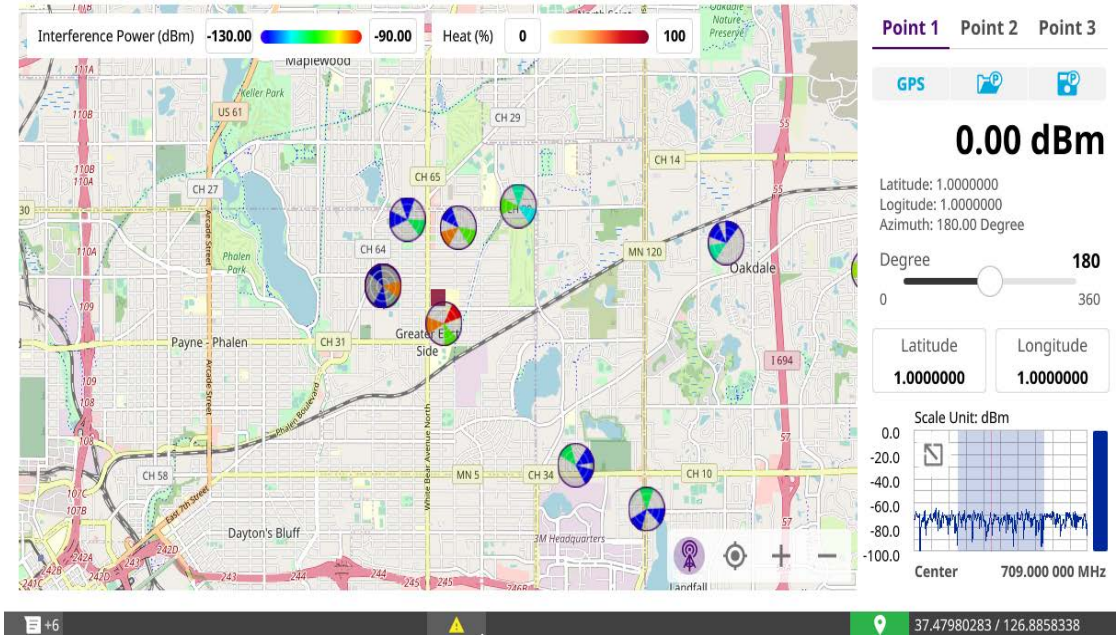
3 Navigate to the map you want to open. The **File Information** pane displays the file properties, including name, size, type, and date modified.

4 Tap the **Load** button on the screen.

5 Once the json file is successfully loaded, the **Cell Site** icon is enabled.

Figure 49 shows an example of the Online Persistent Interference Finder measurement from the JSON file loaded.

Figure 49 Online Persistent Interference Finder measurement from the JSON file



NOTE

Based on the min/max value of the Interference Power, the cell site direction color changes, and based on the min/max value of the Heat, the heat map color changes.

Initializing AntennaAdvisor

Once you have connected the AntennaAdvisor Handle to your instrument, antenna initialization is required to get the right azimuth data. You need to initialize the antenna handle to calibrate the built-in compass by completing the following steps. Note that you can adjust Bandwidth based on the center frequency of the interfering signal that you have identified in the Spectrum view by tapping the Measure Setup > Bandwidth. A message appears at the bottom of the screen to alert you if you have not performed initialization of your connected antenna handle set.

To initialize AntennaAdvisor

1 Hold your antenna handle horizontally in its upright position.

2 Point the antenna to the north and tap **Measure Setup > Initialize AntennaAdvisor**.

Setting geographic location

A point is a particular location that contains information about that location. This information includes, for example, GNSS coordinates, the time of the measurement or

level that has been measured. You can evaluate the Point information directly on-site or save the information for later evaluation.

With this functionality, you can mark locations where you have performed a measurement. Thus, you can analyze the geographical distribution of the received signal strength. This allows you to analyze, for example, the coverage conditions around a base station's coverage area.

In the map view, a point is displayed as a dot with a number. The straight line represents the direction you are facing.

To set the geographic location

1. Tap the **Point 1**, **Point 2** and **Point 3** on the map. Make sure to set three location points so that the straight lines started from the point can create three intersections.
2. Tap each point and use the **Degree** bar or button to change degrees.
3. Tap the **GNSS** icon to automatically get the selected point's location information.

   The instrument displays the latitude and longitude information of the signal received by the GNSS antenna. This function is only available when the GNSS antenna is connected.
4. Tap the **Latitude** and **Longitude** icon and enter the value using the on-screen keyboard to manually define a position.

   The values should be input based on the Decimal Degrees.
5. Tap the **Apply** button.

Setting azimuth

There are three methods available for setting azimuth.

Method 1: AntennaAdvisor Handle

You can use the Antenna Advisor handle. Make sure you initialize AntennaAdvisor first to get more accurate directional information.

1. Press and hold the **TRIGGER** button on the handle then it finds the strongest RSSI value.

   RSSI, polarization, elevation, and azimuth readings are continuously updated on the screen while pressing the physical button.
2. Release the **TRIGGER** button to stop scanning.

Method 2: Degree bar

The **Degree Bar** functions as a compass. You can use it to set azimuth by moving it right and left.

1. Tap the circle on the Degree bar and move it gently until you get the right azimuth.

Method 3: Log-periodic antenna

You can use the log-periodic antenna.

Pan your log-periodic antenna to find a signal with the highest RSSI value and measure an azimuth of the interfering signal.



NOTE

The AntennaAdvisor has a built-in low-noise amplifier (LNA) that can be turned on and off using the physical On/Off button located on the rear side of the handle unit. For example, if the received signal is weak, you can turn on the switch to improve S/N.

To save the defined position

1 Tap any point on the map where you want to save the position information.

2 Tap the **Save Position** icon.

The instrument stores the saved location points in the internal memory, allowing you to load them by using the **Load Position** icon. You can save and load up to 10 positions.

To set measure setup for POI

POI(Probability of Intercept) measure setup lets you configure the Mode (High/Normal) and corresponding RBW/Span range for interception performance.

1 Tap the **Setup** ( ) icon on the side bar.

2 Tap **POI Mode**. You can also access this menu using the Quick Access and Display Tab on top.

a Tap to switch the Mode between High and Normal. The following table shows RBW and Span setup range per Normal and High mode.

b Tap **Speed** and input a value using the on-screen keyboard.

Table 27 RBW and Span setup ranges

Mode		A	B	C	D
Normal	POI	100 to 34 µs	392 to 136.5 µs	800.5 to 270.5 µs	3200 to 1076 µs
	Bandwidth	100 to 20 MHz	19 to 5 MHz	4 and 3 MHz	2 and 1 MHz
	RBW	30 kHz to 10 MHz	10 kHz to 1 MHz	3 kHz to 1 MHz	1 kHz to 300 kHz

Mode		A	B	C	D	E	F
High	POI	18.5 to 2 µs	29.5 to 4 µs	73.5 to 7.5 µs	147 to 15 µs	284 to 28 µs	587 to 56.5 µs
	Effective Bandwidth	122.88 MHz	61.4 MHz	30.72 MHz	15.36 MHz	7.68 MHz	3.84 MHz
	Display Bandwidth	100 MHz	50 MHz	25 MHz	14 MHz	7 MHz	3 MHz
	RBW	100 kHz to 30 MHz	100 kHz to 10 MHz	30 kHz to 10 MHz	10 kHz to 3 MHz	10 kHz to 3 MHz	3 kHz to 1 MHz

Setting display mode

When the triangulation is done with three location points and azimuth for each point, you can view a circumscribed circle by default. You can change the display mode to inscribed circle or double circles to view a narrower area. The center of the green-shaded circle is determined to be where the source of the interfering signal resides.

To set display mode

1 Tap **Measure Setup > Display**.

2 Select the option from the following choices:

- **Circum**: displays a circumscribed circle that meets three vertices of the triangle.
- **Inscribed**: displays an inscribed circle that meets the three vertices of the triangle.
- **Double**: displays both circumscribed and inscribed circles.

To set bitmap

1 Tap **Menu > Bitmap**.

2 Tap **Dot Persistence Time** and input a value using the on-screen keyboard. This represents the time that accumulates DPX data.

3 Tap to switch **Bitmap Scale** to **On** to enable auto scale or **Off** to disable auto scale.

If the **Bitmap Scale** is **On**, the point where the maximum hit represents maximum colors. If the **Bitmap Scale** is **Off**, the bluer color (closer to 0% of the color bar) is mapped with hit.

4 Tap **Bitmap Min** and input **%** value using the on-screen keyboard.

Bitmap Min represents unused bitmap color range. If you set it to 10%, the color matched with 10% or below does not show.

5 Tap **Bitmap Max** and input % value using the on-screen keyboard.

Bitmap Max represents max range of bitmap colors to be used. If you set it to 90%, the color that exceeds 90% does not show.

6 Tap **Hit Min** and input % value using the on-screen keyboard.

Hit Min represents the minimum number of hits not to be converted to colors. If you set it to 10%, the hit matched with 10% or below is not converted to colors.

7 Tap **Hit Max** and input % value using the on-screen keyboard.

Hit Max represents the maximum number of hits to be converted to colors. If you set it to 90%, the hit matched with 90% or above shows with max colors.

Creating a map

You can create a map online and continue conducting a route map analysis using the created map even when there is no Ethernet connection.

1 Tap **Setup** > **Map Creator**.

2 Tap the **Search** box and input the location using the on-screen keyboard and select one of the options as required.

3 Tap the **Zoom Level** box to capture the map with corresponding zoom level.

4 Tap the **Capture** button to start capturing the map.

Once the map is captured, the capturing completed pop-up will appear.

5 Select between the two options: Save in the system or Save as file.

6 Tap the **Done** button.



NOTE
If you have unsaved measurement data (map) and start measuring by tapping the Testing button or by tapping another measurement mode, a pop-up window will appear asking whether you will restore the unsaved data or not.

Online persistent radar chart

If you have identified an interfering signal on your spectrum view, you can move to the Radar Chart mode and measure RSSI power levels through 360° at a location received by the connected broadband directional antenna so that you can determine the direction of the source of the interference. Using a set of the AntennaAdvisor Handle that holds a broadband directional antenna is mandatory in the Radar Chart mode and its built-in compass, GNSS Antenna, and built-in low noise amplifier (LNA) help to determine the direction of the interference.

Before starting the Interference Finder, you need to set Spectrum measurements. See “Configuring spectrum measurements” on page 25 for more information.

For antenna connection, see “Antenna connection” on page 88.

Controlling a map

To control a map

See the following table to control a map.

Table 28 Map control icons

Icon	Description
	Tap to go to your current location on the map. Once tapped, the purple icon appears on the map, indicating your current location.
	Tap to zoom in the map.
	Tap to zoom out the map.

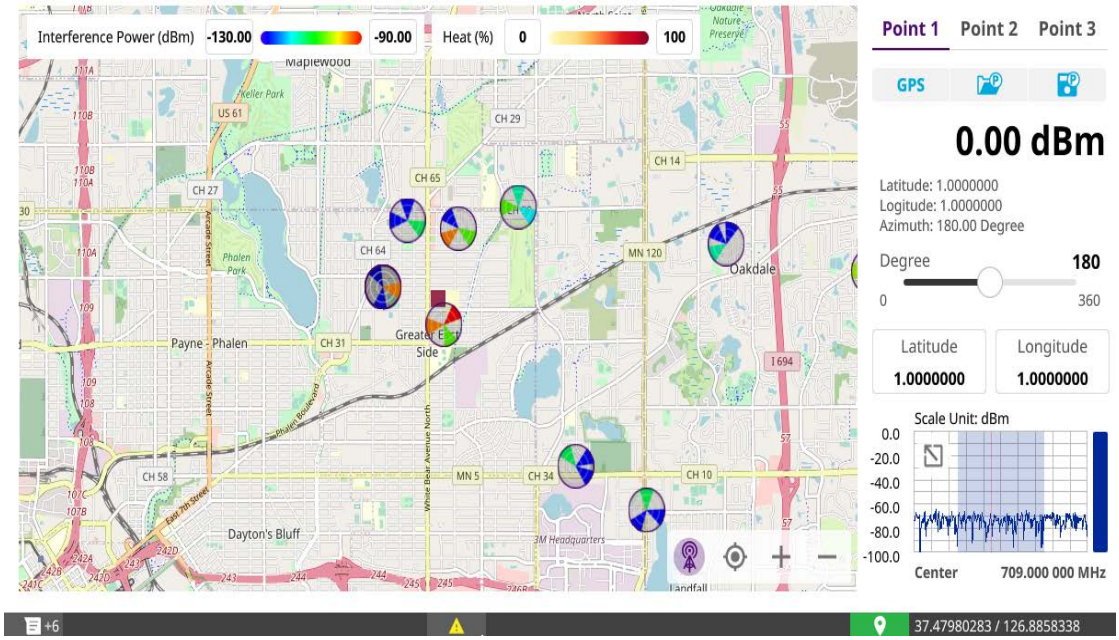
To load a JSON file from Spectrum Net Analyzer

When you load a JSON map file configured in Spectrum Net Analyzer, you can view the map with Cell Site icon, Interference Power, and Heat map (%) legend colors.

1. Plug in your USB flash drive that has a map file in .json file type created in Spectrum Net Analyzer.
2. Tap the **Load** icon on the side bar.
3. Navigate to the map you want to open. The **File Information** pane displays the file properties, including name, size, type, and date modified.
4. Tap the **Load** button on the screen.
5. Once the json file is successfully loaded, the **Cell Site** icon is enabled.

Figure 50 shows an example of the Online Persistent Radar Chart measurement from the JSON file loaded.

Figure 50 Online Persistent Radar Chart measurement from the JSON file loaded



NOTE

Based on the min/max value of the Interference Power, the cell site direction color changes, and based on the min/max value of the Heat, the heat map color changes.

Initializing AntennaAdvisor

Once you have connected the AntennaAdvisor Handle to your instrument, antenna initialization is required to get the right azimuth data. You need to initialize the antenna handle to calibrate the built-in compass by completing the following steps. Note that you can adjust Bandwidth based on the center frequency of the interfering signal that you have identified in the Spectrum view by tapping the Setup > Bandwidth. A message appears at the bottom of the screen to alert you if you have not performed initialization of your connected antenna handle set.

To initialize AntennaAdvisor

1 Hold your antenna handle horizontally in its upright position.

To avoid unnecessary impact of external magnetic field, position yourself at the location where the value of magnetic field strength displayed on the instrument is green.

2 Point the antenna to the north and tap **Measure Setup > Initialize AntennaAdvisor**.

The message disappears and the red line for the current antenna direction moves to the 0° line and overlaps to let you know that the initialization is done successfully.

NOTE

It is recommended that you re-initialize the AntennaAdvisor Handle after measurements to re-calibrate the compass when you notice that the red line on the radar chart is not aligned with the north on the map even though you are pointing the antenna to the north.

Obtaining persistent RSSI and direction data

Once you have connected your antenna handle set and done necessary setups, you can monitor the power level of the received signal, the amount of polarization, and elevation level real time. Using the Trigger button on the antenna handle set, you can plot the RSSI level and obtain current direction of antenna at your location.

To obtain persistent RSSI and direction data

1. When you have the green GNSS indicator, tap the **GNSS** icon on the side panel to set your current location to the center of the radar chart. The latitude and longitude information at the side of the display changes from “Unknown Position” to the obtained position information.
2. Tap the **Save Position** icon on the side panel to save a position to recall for triangulation in the Interference Finder mode and select one that you want to save.
3. Monitor the RSSI reading of the received signal. If the signal is weak, turn on the LNA switch on the antenna handle set to improve S/N.
4. The message disappears and the red line for the current antenna direction moves to the 0° line and overlaps to let you know that the initialization is done successfully.

NOTE

The AntennaAdvisor Handle has a built-in low-noise amplifier (LNA) and you can turn it on and off by toggling the physical On/Off switch located on the rear side of the handle unit

5. Hold the antenna handle set horizontally and make the measurement.
6. The message disappears and the red line for the current antenna direction moves to the 0° line and overlaps to let you know that the initialization is done successfully.
7. To obtain a Persistent RSSI value and direction:
   a. Press the **Trigger** button located on the antenna handle.

A beep sounds and a power level of the received signal is plotted as a blue dot on the radar chart. Depending on the strength of the measured value, you may hear different tones of beeping.

b While receiving the power level, you can also obtain the current direction of the antenna. Repeat pressing the **TRIGGER** button to obtain at least five points if you want to do the localization.

8 To continuously obtain a Persistent RSSI values and direction:

a Press and hold the **TRIGGER** button located on the antenna handle to start a continuous measurement.

b A beep is sounded repeatedly to let you know that the measurement is continuing and measured values are plotted and lined on the radar chart.

c Release the **TRIGGER** button to stop the continuous measurement.

NOTE

The maximum number you can plot on the radar chart is 2500 points both in the single and continuous measurements. If your measurement reaches 2500 points, you need to reset the measurement by pressing the Localization soft key twice or performing the initialization of the AntennaAdvisor Handle. Concentric circles indicate different levels of RSSI. You can use the AMP/SCALE hard key to adjust the amplitude scale of the chart.

Localizing RSSI data

The Localization feature lets you view averaged and smoothed measurement data with a bold green line on the radar chart that helps you determine the direction of the highest RSSI value. When you have five or more data points plotted on the radar chart, you can perform this localization.

To localize RSSI data

1 Tap the Setup ( ) icon on the side bar.

2 Tap **Localization**. All the measured points turn to green color and you can view the bold green line that indicates the possible direction of the interference source.

3 Tap **Localization** again to clear all the data plots on the radar chart.

Figure shows an example of the persistent radar chart. Figure shows an example of the localized persistent radar chart.

Figure 51 Online Persistent Radar Chart

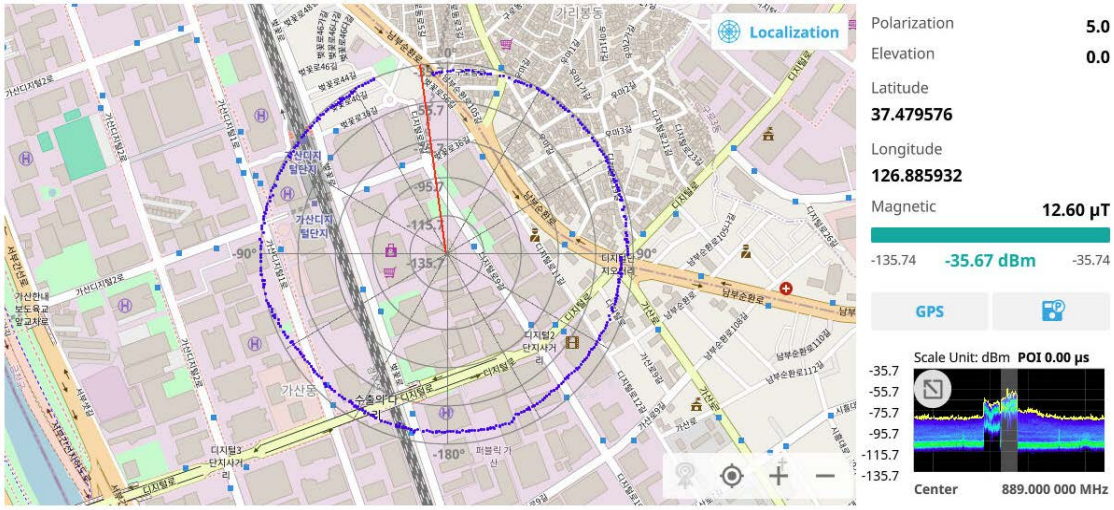
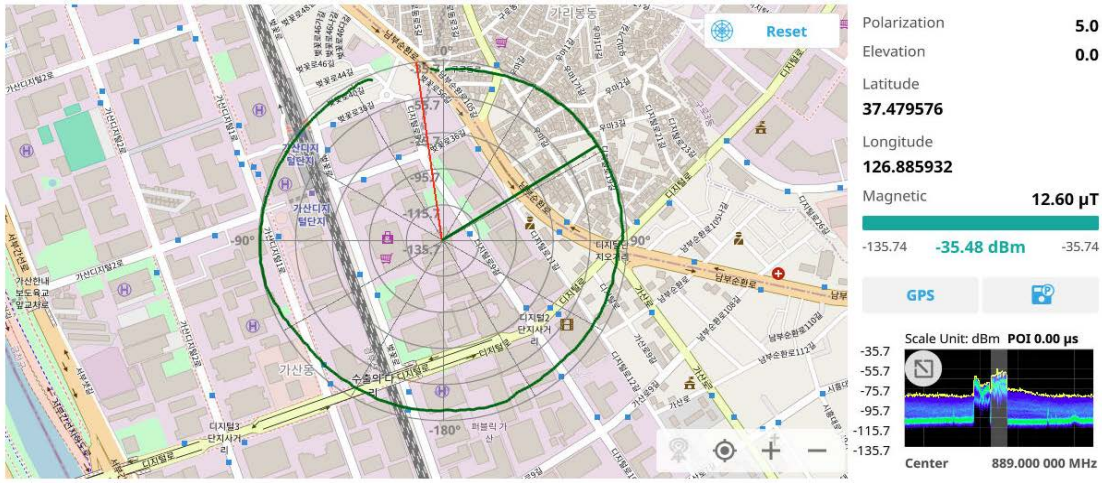


Figure 52 Online Persistent Radar Chart — localized



To set measure setup for POI

POI (Probability of Intercept) measure setup lets you configure the Mode (High/Normal) and corresponding RBW/Span range for interception performance.

1 Tap the **Setup** ( ) icon on the side bar.

2 Tap **POI Mode**. You can also access this menu using the Quick Access and Display Tab on top.

a Tap to switch the Mode between High and Normal. The following table shows RBW and Span setup range per Normal and High mode

b Tap **Speed** and input a value using the on-screen keyboard.

Table 29 RBW and Span setup ranges

Mode		A	B	C	D
Normal	POI	100 to 34 µs	392 to 136.5 µs	800.5 to 270.5 µs	3200 to 1076 µs
	Bandwidth	100 to 20 MHz	19 to 5 MHz	4 and 3 MHz	2 and 1 MHz
	RBW	30 kHz to 10 MHz	10 kHz to 1 MHz	3 kHz to 1 MHz	1 kHz to 300 kHz

Mode		A	B	C	D	E	F
High	POI	18.5 to 2 µs	29.5 to 4 µs	73.5 to 7.5 µs	147 to 15 µs	284 to 28 µs	587 to 56.5 µs
	Effective Bandwidth	122.88 MHz	61.4 MHz	30.72 MHz	15.36 MHz	7.68 MHz	3.84 MHz
	Display Bandwidth	100 MHz	50 MHz	25 MHz	14 MHz	7 MHz	3 MHz
	RBW	100 kHz to 30 MHz	100 kHz to 10 MHz	30 kHz to 10 MHz	10 kHz to 3 MHz	10 kHz to 3 MHz	3 kHz to 1 MHz

To set bitmap

1 Tap **Menu > Bitmap**.

2 Tap **Dot Persistence Time** and input a value using the on-screen keyboard. This represents the time that accumulates DPX data.

3 Tap to switch **Bitmap Scale** to **On** to enable auto scale or **Off** to disable auto scale.

If the **Bitmap Scale** is **On**, the point where the maximum hit represents maximum colors. If the **Bitmap Scale** is **Off**, the bluer color (closer to 0% of the color bar) is mapped with hit.

4 Tap **Bitmap Min** and input **%** value using the on-screen keyboard.

Bitmap Min represents unused bitmap color range. If you set it to 10%, the color matched with 10% or below does not show.

5 Tap **Bitmap Max** and input % value using the on-screen keyboard.

Bitmap Max represents max range of bitmap colors to be used. If you set it to 90%, the color that exceeds 90% does not show.

6 Tap **Hit Min** and input % value using the on-screen keyboard.

Hit Min represents the minimum number of hits not to be converted to colors. If you set it to 10%, the hit matched with 10% or below is not converted to colors.

7 Tap **Hit Max** and input % value using the on-screen keyboard.

Hit Max represents the maximum number of hits to be converted to colors. If you set it to 90%, the hit matched with 90% or above shows with max colors.

Creating a map

You can create a map online and continue conducting a route map analysis using the created map even when there is no Ethernet connection.

1 Tap **Setup** > **Map Creator**.

2 Tap the **Search** box and input the location using the on-screen keyboard and select one of the options as required.

3 Tap the **Zoom Level** box to capture the map with corresponding zoom level.

4 Tap the **Capture** button to start capturing the map.

Once the map is captured, the capturing completed pop-up will appear.

5 Select between the two options: Save in the system or Save as file.

6 Tap the **Done** button.



NOTE
If you have unsaved measurement data (map) and start measuring by tapping the Testing button or by tapping another measurement mode, a pop-up window will appear asking whether you will restore the unsaved data or not.

6

Using RFoCPRI Interference Analyzer

This chapter describes how to use the RFoCPRI Interference Analyzer. Topics covered in this chapter include:

- “Introduction” on page 120
- “Selecting mode and measure” on page 120
- “Connecting cables” on page 121
- “Configuring Auto CPRI” on page 122
- “Setting measure setup” on page 127
- “Configuring Rx parameters” on page 129
- “Conducting spectrum measurement” on page 139
- “Layer 2 CPRI testing” on page 142
- “Conducting spectrogram” on page 143
- “Using spectrum replayer” on page 144

Introduction

Cell sites today have a distributed architecture of the radio that consists of the radio equipment control (REC) or base band unit (BBU) installed at the bottom of the tower and the radio equipment (RE) or the remote radio head (RRH) installed at the top of the tower. These two elements communicate with each other via the Common Public Radio Interface (CPRI) protocol over fiber links.

This distributed architecture provides the benefit of replacing coax-based feeders with fiber-based feeders, significantly reducing the problems of signal loss and reflections. However, all the RF interfaces reside on the RRH. As a result, RF maintenance or troubleshooting requires climbing to the top of the tower to access the RRH, which increases operational cost and creates unnecessary safety issues.

The RFoCPRI Analyzer allows you to perform RF maintenance and troubleshooting activities on the ground using the fiber interfaces at the BBU, significantly reducing maintenance time and operational expenses. You can verify the CPRI control signals and extract the IQ data transmitted between the BBU and RRH to monitor and analyze the uplink interfaces and the downlink signals.

You can also monitor current and historic CPRI alarm status for LOS and LOF displayed on the interface measurement screen.

RFoCPRI testing provides the following measurements:

- Interference Analysis
  - Spectrum
  - Spectrogram
  - Spectrum Replayer
- Optics Test
  - Optical Test

Selecting mode and measure

The following procedure describes how to start measurement.

To start measurement

1 Tap **RFoCPRI** on the **MODE** panel.

2 Tap any measurement mode from the following choices:

- **Interference Analysis > Spectrum, Spectrogram, Spectrum Replayer**
- **Optics Test >Optical Test**

NOTE

If you have a CAA module with CAA-RFS license (enabled), the RF Source menu will be activated. Go to **Setup** > **RF Source** > **CAA RF Power**. And tap to switch **CAA RF Power** to **On**. Then you can tap to switch **RF Source** to **On** and set **Frequency**/**Power Level** as required. Note that if you have a CAA module with catalog number (CAA06MB with Bias Voltage option), you can tap to switch **Bias Voltage** to **On** and set the required **Bias Voltage**.

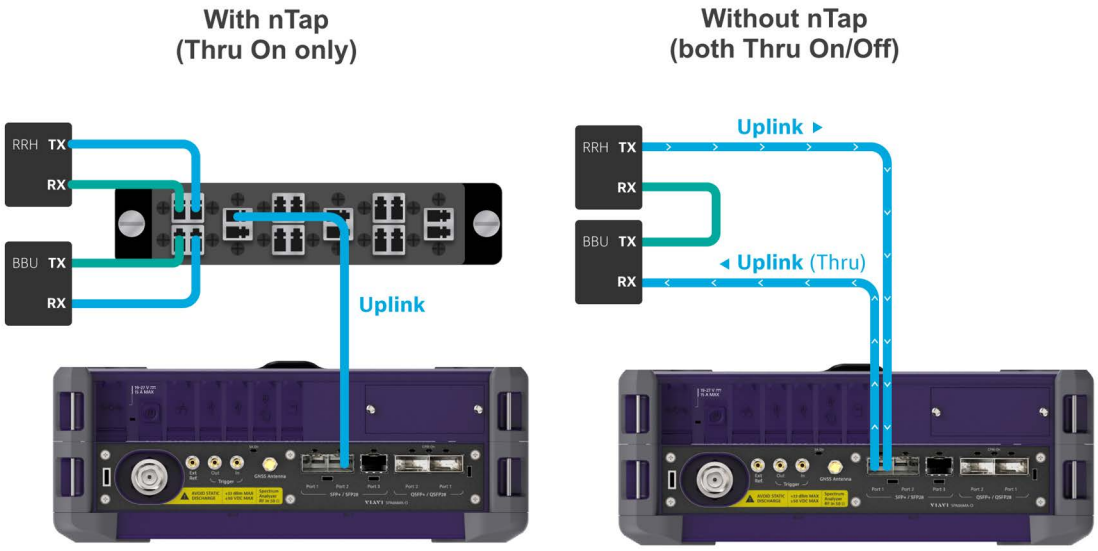
With this Bias Voltage, you can enhance the sensitivity while performing interference analysis on feeder of old BTS (Base Transceiver Station) without RRH.

Connecting cables

You can connect cables with or without a tap, as shown in Figure 53. If you have connected cables directly from RRH and BBU without using the nTap, you must turn on the through mode (Thru) in the CPRI parameter settings.

An SFP/SFP+ transceiver that is connected to your ONA-800 must be compatible with your DUT, and you must have your module information such as line rate, wavelength, and mode (MM or SM) handy.

Figure 53 Connection diagram for interface analysis



Selecting port

Each port can generate up to four different waveforms, both selectively and simultaneously. You can select the port to use for the measurement in any measurement mode of RFoCPRI.

To select the port

1 Tap the **Setup** ( ) icon on the side bar of each measurement mode and choose **Rx Settings** or **Port Configuration**.

2 Select **Port 1** or **Port 2** in **Select Port**.

Configuring Auto CPRI

Auto CPRI configuration lets you set link rate, antenna, and carrier search for Port 1 or Port 2 automatically and the detected values are automatically applied to the Rx Settings.

To search link rate and carrier

1 Go to measurement mode (Spectrum/ Spectrogram) then tap the **Setup** ( ) icon > **Auto CPRI Configuration** on the side bar.

2 Tap **Port 1** or **Port 2**.

3 Tap the **Configuration** icon then a Setting window appears.

a Tap the **Search** box and select from **Smart**, **Method 1**, **Sub-banding**, or **Method 3**. You need to select Sub-banding when NEM is Ericsson Legacy.

Smart is an AI-based auto configuration option and it is only available in the LTE Technology.

b If you select **Smart**, the **Mode** box appears, allowing you to select between **Auto** and **Manual**.

– **Auto**: Automatically detects carriers.

– **Manual**: Perform the following steps.

- Tap **IQ Sample Width** from 4 to 20 as required.
- Tap **Exponent** Bit from 0 to 2 as required.
- Tap **NEM** and select from the options as required.

c If you select the options other than Smart (**Method 1**, **Sub-banding**, or **Method 3**): tap **Trace Type** box and select the options from **RMS**, **Max**, or **Min**.

d Tap **Search Position** and select the options from **Forward** or **Backward**.

e Tap to switch **Technology** to **LTE** or **5GNR**.

5GNR is available only if you have a license option for 100 MHz bandwidth, ONA-SP-RFOCPRI100.

f Tap to switch the **Bandwidth** options to **On** or **Off**.

g Tap the **Done** button to apply the changes.

4 Tap the **Start** button on the right panel of the screen.

Link rate will be scanned and if LOS/LOF indicate pass, the instrument performs carrier search.

5 Once link rate and carrier search are successfully done, Optic Power and SFP information are displayed on the right panel of the screen.

NOTE

If the instrument detects more than one carrier or antenna, you can continue measuring another port and tap the Retest button to see the scanning result.

6 On the upper right side of the screen, the AxC Map button appears and you can continue measuring and checking AxC Map.

7 Tap the **Report** button to save it as a report at the bottom of the screen.

NOTE

If you tap the Report button, you will be able to create a report in pdf format. It includes user-defined Site Location, Site Information, Test Purpose, Test Result, and File Name. You can also designate File Location and select images (Fail Screenshots/All Screenshots) you will need to add in the report. The measurement screens for Interference Result and PIM Result for each carrier will be automatically saved in the report once you tap the Apply button.

Figure 54 Carrier search with RFoCPRI Interference Analyzer

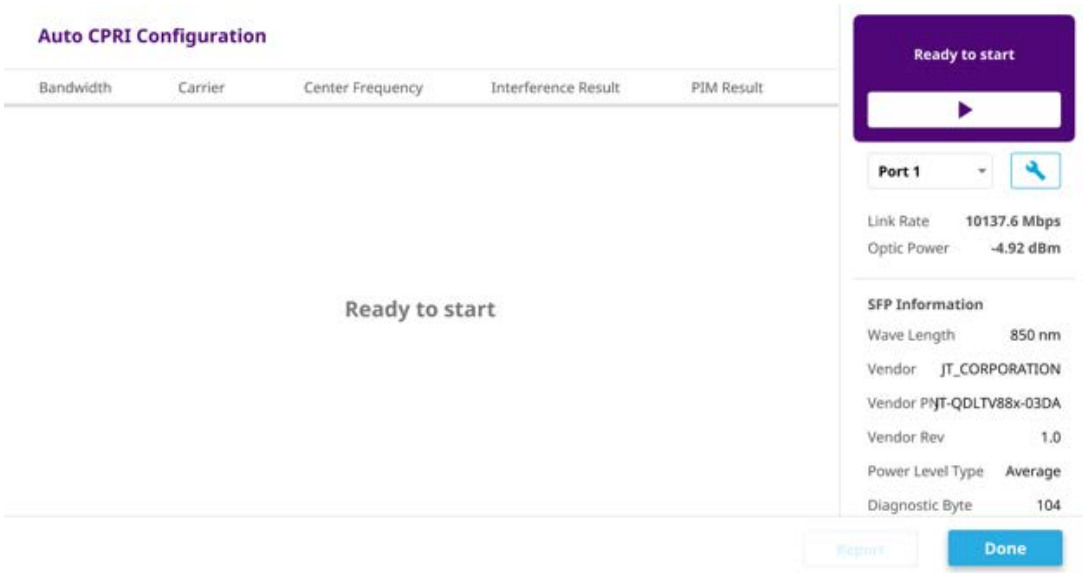
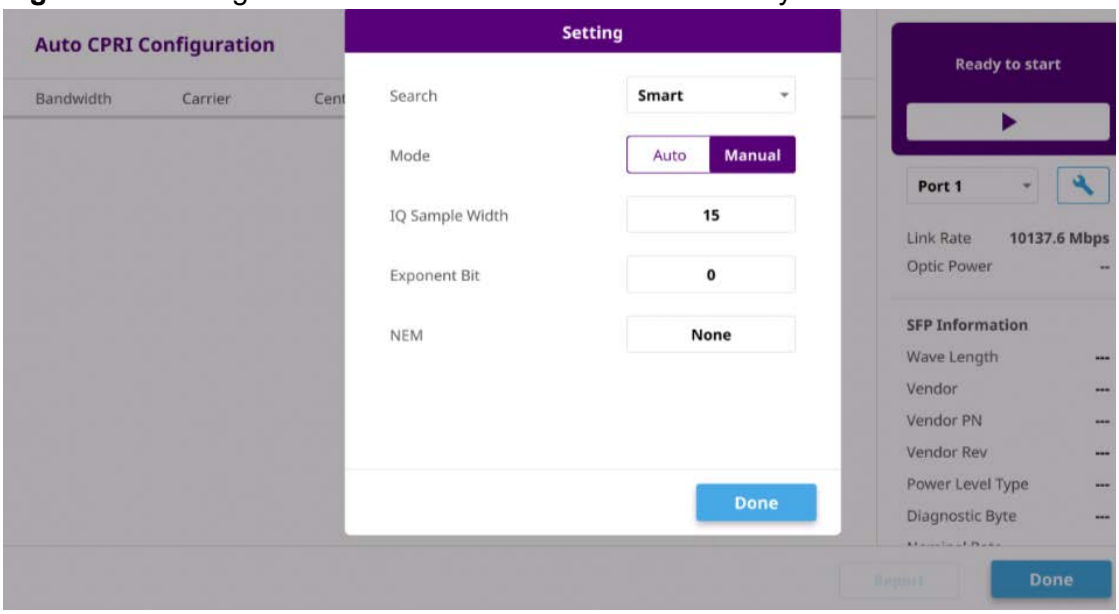


Figure 55 Setting window with RFoCPRI Interference Analyzer



To check AXC Map

1 Tap the **AXC**(AxC Map) button on the upper right of the screen.

2 AxC map screen appears and Carrier 1 and Antenna 1 are selected as default.
The selected antennas are active on the map.

3 On the right side of the screen, select Carrier/Antenna by tapping the **Arrow** (‹ Carrier 1 Antenna 1 ›) button to see the values and trace for selected carrier and antenna.
The active carrier and antenna are changed based on your selection.

To check Interference

1 From the carrier line in the detected carrier list, tap the **Chart** ( ) icon under the Interference Result.
The view mode changes based on the number of antennas under the selected carrier. For example, if the number of antennas is 4, it displays as Quad mode.

2 From the antenna line in the detected carrier list, tap the **Chart** ( ) icon under the Interference Result.
It moves to Single mode view.

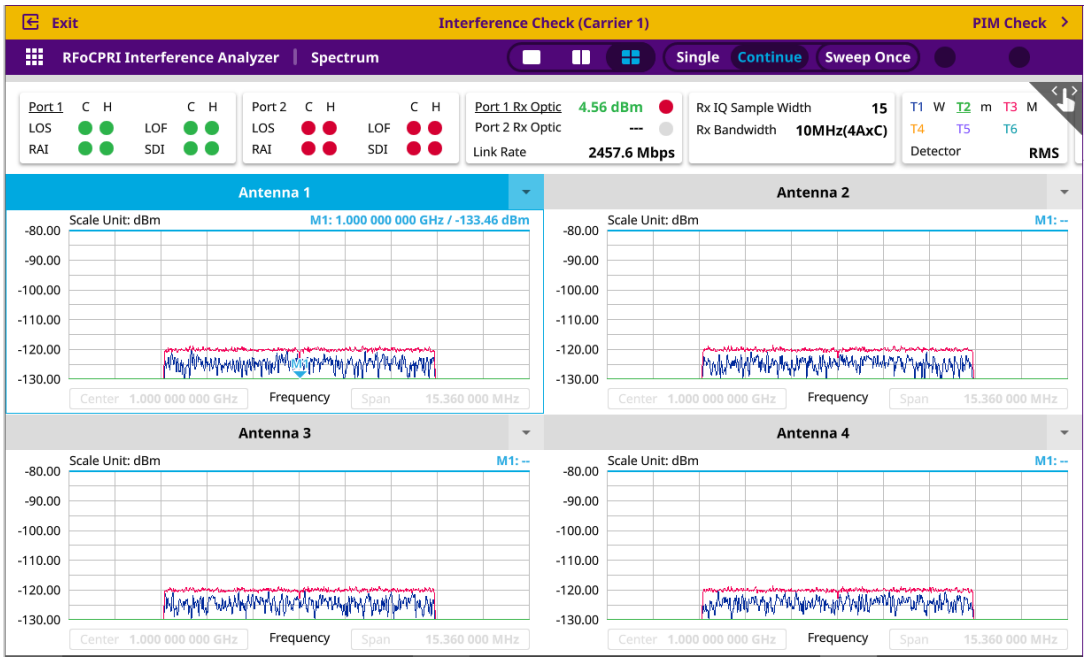
3 When the screen changes to a chart view, it displays 3 traces.
- Trace 1: Current trace
- Trace2: Max hold
- Trace3: Min hold

NOTE
When you tap the Chart view icon, the instrument turns limit line to on and performs auto leveling automatically.

4 Tap the **Exit** button on the top left side to go back to the detected carrier list screen.

5 Tap the **PIM Check** button on the top right side to continue PIM analysis.

Figure 56 Interference check chart view with RFoCPRI Interference Analyzer



To perform PIM Check

Before performing PIM check, you can set the display mode and parameters by going to Setup on the side bar and setting the corresponding values in the pop-up window.

1 Tap the **Setup** ( ) icon on the side bar.

A Display and Setting table appears.

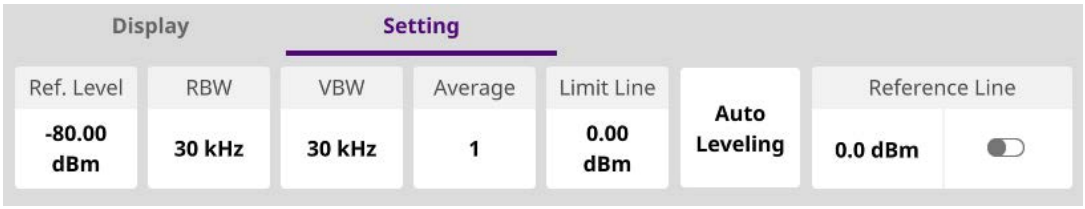
2 Tap **Display** > **Window Mode** and select from the following options: **Single**, **Dual**, or **Quad**.

3 Tap **Select Chart** or **Select 2nd Chart** as required.

When you select Window mode to Single or Quad, Select 2nd Chart will be grayed out. You can select from Antenna 1 to Antenna 4 in the pop-up window.



4 Tap **Setting** and set the following parameters as required: **Ref.**, **Level**, **RBW**, **VBW**, **Average**, **Limit Line**, **Auto Leveling**, and **Reference Line**.



5 From the carrier line in the detected carrier list, tap the **Chart** ( ) icon under the PIM Result.

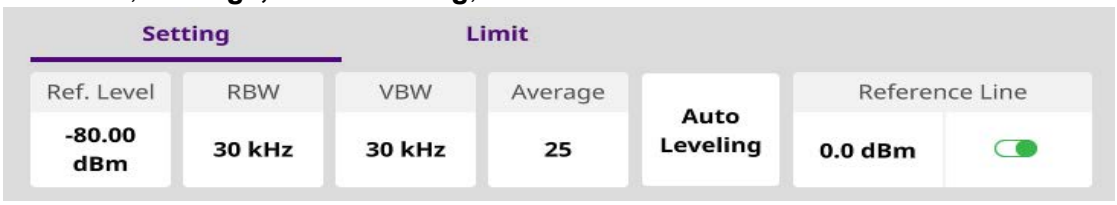
The number of traces changes based on the number of antennas under the selected carrier. For example, if the number of antennas is 4, the number of traces is also 4.

6 When the screen changes to a chart view, the instrument performs Auto Leveling and turns Flatness table to on.

7 Go back to **Setup** on the side bar.

A Setting and Limit table appears.

8 Tap **Setting** and set the following parameters as required: **Ref.**, **Level**, **RBW**, **VBW**, **Average, Auto Leveling**, and **Reference Line**.



9 Tap **Limit** and set the following parameters as required: **Flatness BW**, **RSSI BW**, **RSSI Limit (Low/High)**, **Slope Limit (Difference/Degree)**, and **Limit (Degree, Abs)**.

The RSSI Limit judges pass or fail.



To save PIM result

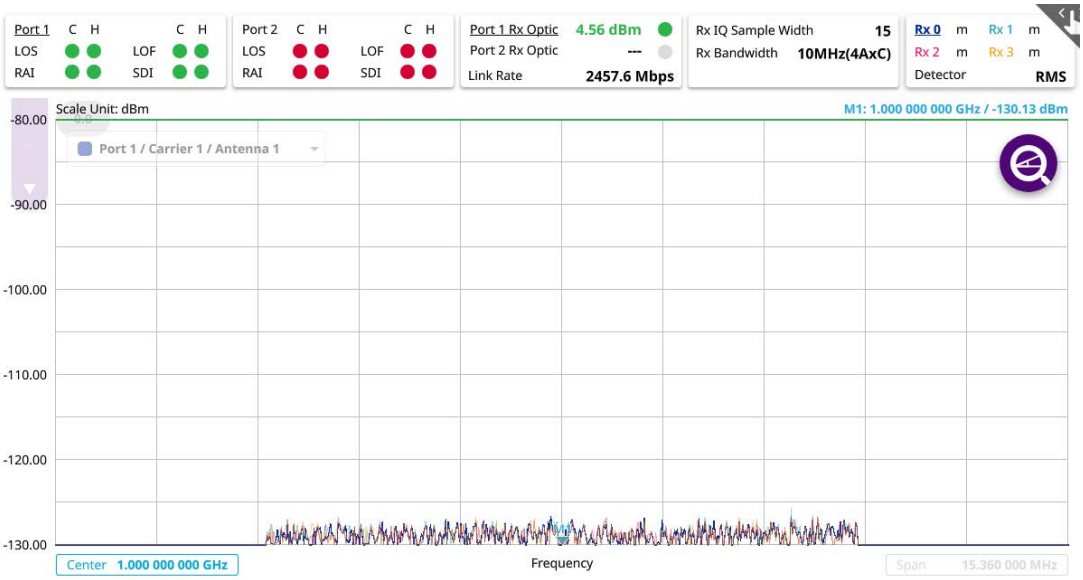
1 Tap the **Exit** button on the upper left side of the screen. The screen moves and you can check pass of fail indication for each carrier and antenna.

2 Tap the **Save** button to save the Interference and PIM result.

When you select Window mode to Single or Quad, Select 2nd Chart will be grayed out.

3 Tap **Done** to complete the measurement.

Figure 57 PIM check chart view with RFoCPRI Interference Analyzer



NOTE

You can turn Flatness Table to On or Off using the icon on the top right corner of the measurement screen.

Setting measure setup

The following procedure describes how to set measure setup.

To set measure setup

1 Tap the **Setup** ( ) icon on the side bar of each measurement mode.

2 Tap **Port Configuration**.

a To set the CPRI line bit rate, tap **Link Rate** under **Port Configuration** and select the CPRI link rate option from **614.4 Mbps**, **1228.8 Mbps**, **2457.6 Mbps**, **3072.0 Mbps**, **4915.2 Mbps**, **6144.0 Mbps**, **9830.4 Mbps**, **10137.6 Mbps**, **24330.2 Mbps** (license required), or **Auto**.

If you select Auto, the instrument will automatically search Auto Link Rate.

NOTE

It is important that you set the link rate correctly to avoid any misleading LOS and LOF alarms displayed on the screen. Make sure to get the ONA-SP-CPRI 10 license to activate and select the link rate, 24330.2 Mbps.

b To turn **Through Mode** on or off, tap **On** or **Off** in Thru line.

c To set the **Tx Clock**, tap **Recovered** (default) in the **Clock** box.

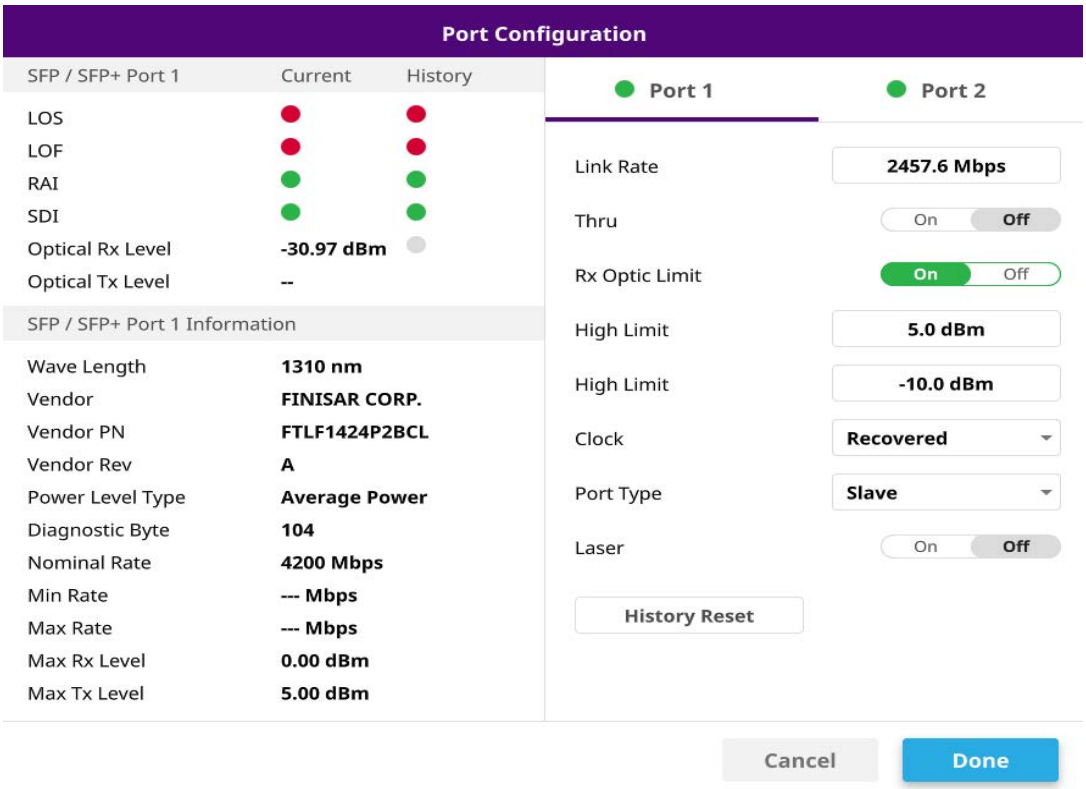
d Tap **Port Type** to **Slave** (default).

3 Tap **Global Settings** to configure each Rx carrier with the same parameter values especially when operating Dual or Quad windows screen.

– Frequency, Channel, Amp/Scale, BW/AVG, Trace and Limit settings are checked as default.

Figure 58 and Figure 59 show an example of Port Configuration with the RFoCPRI Analyzer and an example of Global Settings window.

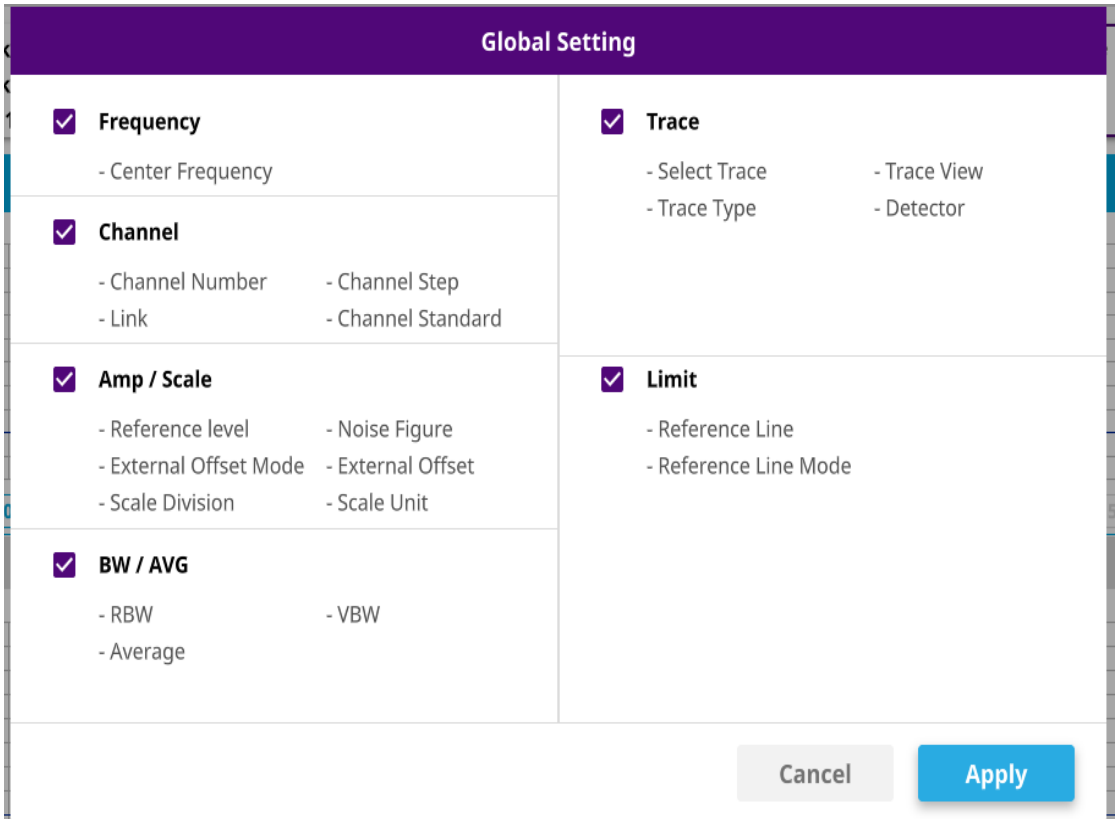
Figure 58 Port Configuration with RFoCPRI Interference Analyzer



NOTE

Power Saving mode is available in 44G Module only. If you check Power Saving on the right top of the Port Configuration window and select one of the ports, the other port will be disabled and be in a state of power saving.

Figure 59 Global Settings window



Configuring Rx parameters

As each network technology requires different Rx parameter settings, you need to configure the Rx parameters for the network technology you selected.

To configure the Rx parameters for LTE, 5GNR, and WCDMA

1 Tap the **Setup** ( ) icon on the side bar of each measurement mode.

2 Tap **Rx Settings**.

3 Tap the **Port** drop-down menu and select between **Port 1** and **Port2**.

4 Tap the **Carrier** drop-down menu and select a carrier from **1** to **4**.

5 Tap the **MIMO** drop-down menu and select **Disable**, **SISO**, **2xMIMO**, **4xMIMO**, or **8xMIMO**.

6 Set the antenna per carrier group by tapping one of the **Map Position (AxC 0 to AxC 31)** boxes and enter a value using the on-screen keyboard.

NOTE

Maximum number of the AxC Group is determined by the factors of technology link rate, sample width, oversampling, and signal bandwidth.

7 To set the I and Q sample widths, tap **IQ Sample Width** and enter a value between 4 and 20 by using the on-screen keyboard.



NOTE

According to the CPRI specification, the IQ sample width shall be between 4 and 20 bits for I and Q in the uplink and between 8 and 20 bits in the downlink.

8 Tap **Stuffing Bit** and enter a value between 0 and 20, using the on-screen keyboard.

9 Tap **Exponent Bit** and enter a value between 0 and 2, using the on-screen keyboard.



NOTE

This will be activated only if you choose NEM to None, this means you can test without any limitation for Sample Width or Stuffing Bit based on the NEM selection.

10 To set the first bit position of each **AxC Container** in the IQ data block of a basic frame, complete the following steps:

a Tap **Map Position**.

b Select the **AxC Container** number you want to set from: **AxC 0** to **AxC 31**. Not all of these are activated, depending on the bandwidth setting of the network technology you selected.

c Enter a value by using the on-screen keyboard.



NOTE

The Antenna-Carrier (AxC) is the amount of digital baseband (IQ) U-plane data necessary for either reception or transmission of one carrier at one independent antenna element. The number of required AxC Containers for a basic frame are two AxCs for 5 MHz, four AxCs for 10 MHz, and eight AxCs for 20 MHz.

11 Set the bandwidth of the downlink signal:

a Tap **Bandwidth**.

- If you set the Technology to LTE, select the bandwidth among 3 MHz (1 AxC), 5 MHz (2 AxC), 10 MHz (3 AxC), 10 MHz (4 AxC), 15 MHz (4 AxC), 15 MHz (5 AxC), 15 MHz (6 AxC), 20 MHz (5 AxC), or 20 MHz (6 AxC), 20 MHz (7 AxC), 20 MHz (8 AxC).



NOTE

The RBW range changes depending on the bandwidth you selected. Required number of AxC containers may vary depending on the bandwidth you selected.

12 To use the pre-configured settings for **NEM**, select one of: **None** (no pre-configuration), **Alcatel-Lucent (UL/DL)**, **Ericsson Legacy (UL)**, **Ericsson Legacy (DL)**, **Ericsson New (UL)**, **Ericsson New (DL)**, **Huawei (UL)**, **Huawei (DL)**, **Samsung (UL/DL)**, and **ZTE (UL/DL)**.

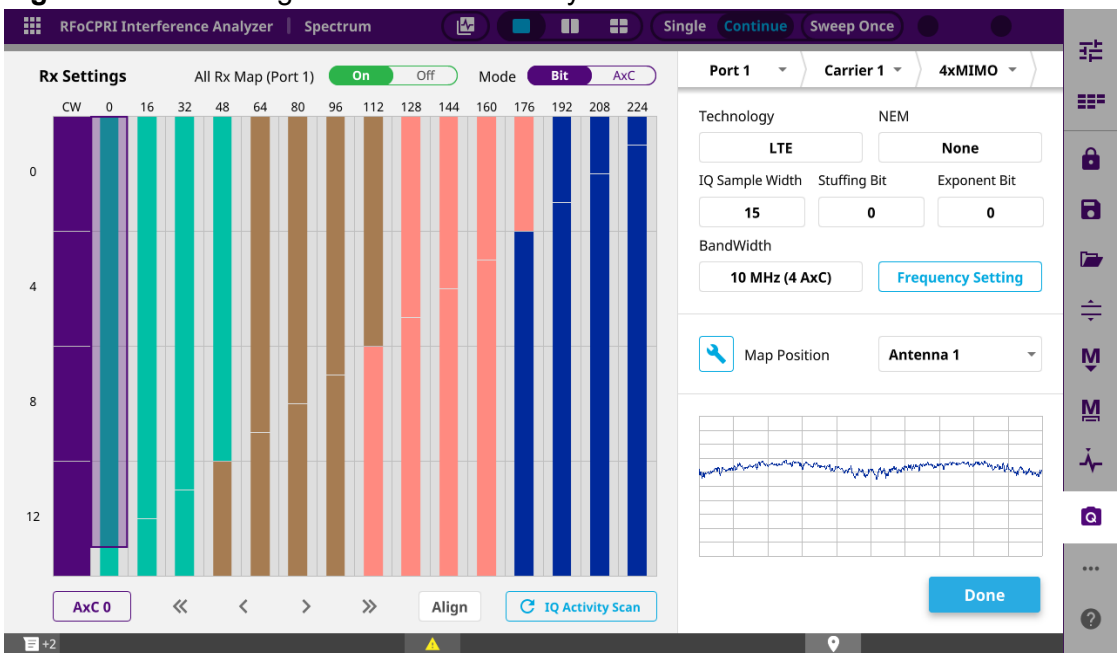
NOTE

If you have selected a NEM, the instrument sets the Map Position and other related settings automatically based on the selected NEM and you cannot edit the map position setting. The pre-configured information may be subject to changes at any time by NEMs.

13 To choose **Uplink** or **Downlink** and **Band** to be tested, tap the **Frequency Setting** button and select your preferred band after tapping **Channel Standard**.

Figure 60 and Figure 61 show an example of Rx Settings with the RFoCPRI Analyzer and an example of Rx settings for AxC mode.

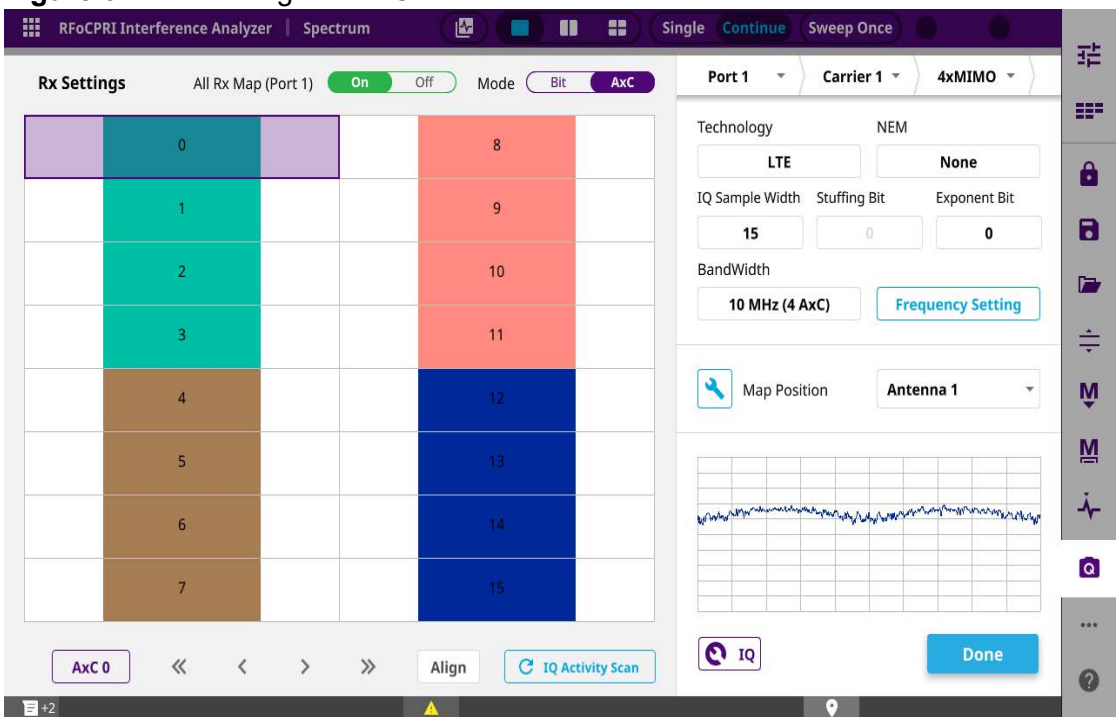
Figure 60 RX settings with RFoCPRI Analyzer



NOTE

You can quick save the RX settings window by tapping the **Camera** icon on the side bar.

Figure 61 RX settings for AxC Mode



Setting frequency

You can set the frequency with either frequency or channel number. If a frequency to be set matches to the frequency corresponding to the selected channel standard, the instrument calculates its channel number and updates the screen with it automatically.

To set the frequency with center frequency

1 Tap **Menu** > **Frequency**.

2 Tap **Center Frequency** and enter a value using the on-screen keyboard.

3 Select a unit from **GHz**, **MHz**, **kHz**, or **Hz** and tap **Apply**.

To set the frequency with channel number

1 Tap **Menu > Channel.**

2 Select the standard channel:

- **a** Tap **Channel Standard**. The standard channel window appears.
- **b** Tap the band to be measured.

3 Tap **Link** between **Uplink** and **Downlink**.

4 Tap **Channel Number**.

5 Enter a value by using the on-screen keyboard and tap **Apply**.

The ONA-800 automatically displays the corresponding frequency value for the selected channel number.

Setting reference level

You can set the reference level automatically or manually to optimize the display of the traces measured.

To automatically set the reference level

1 Tap **Menu > Amp/Scale**.

2 Tap **Auto Scale**.

Each time you tap, the Y-axis scale changes to be optimized with some margin.

To manually set the reference level

1 Tap **Menu > Amp/Scale**.

2 Set the maximum reference value on the Y-axis:

a Tap Reference Level.

b Enter a value using the on-screen keyboard and tap **Apply**.

To change the scale unit (optional)

1 Select **Menu > Amp/Scale > Scale Unit**.

2 Select the unit of the display scale from: **dBm**, **dBV**, **dBmV**, **dBµV**, **V**, or **W**.

The scale unit on the screen changes accordingly.

Setting scale per division

You can use the Scale Division feature to change the scale per division, representing the value of one division on the horizontal scale. The default setting is 10 dB per division and the maximum value can be set up to 20 dB.

To set scale per division.

1 Tap **Menu > Amp/Scale > Scale Division**.

2 Enter a value between 1 and 20 by using the on-screen keyboard and tap **Apply**.

Setting external offset

You can turn the External Offset on and manually set the external offset value. An offset consists of a cable loss and a user offset, and the measurement result shows the value reflecting both offset values. When the external offset value is set at 40 dB, the measurement result compensates 40 dB.

1 Tap **External Offset Mode** to **On** under **Amp/Scale**.

2 Tap **External Offset**.

3 Enter a value by using the on-screen keyboard and tap **Apply**.

4 To turn the external offset off, tap **External Offset Mode** to **Off**.

Enabling auto leveling

It is normal to see higher levels of RSSI in CPRI spectrum than you have seen in RF spectrum, as the digital signal has a different gain level from RF's. If you use the Auto Leveling feature and enter the Noise Figure (NF) for the system to be tested, the instrument calculates an offset that compensates the digital gain of RRH and applies it to the spectrum automatically to displace the level of spectrum to a known RSSI power even though its accuracy cannot be guaranteed. Offset calculation for Auto Leveling is based on the following:

Auto Level offset = (Noise Floor of RFoCPRI) – (Ideal Noise Floor of RRH)

where *(Ideal Noise Floor) = N.F (RRH) + Thermal Noise + 10log (RBW)*

To enable auto leveling



NOTE

Having the noise figure factored in the offset calculation for Auto Leveling will enable you to view the CPRI spectrum closer to what you view in the RF spectrum. If you do not know the noise figure, you can skip this noise figure setting.

1 Tap **Menu > Amp/Scale > Auto leveling**.

A calculated level of offset without NF is applied as the external offset and the user input field is activated for entry of the noise figure value.

2 Enter a noise figure value using the on-screen keyboard.

3 Tap **Apply** to complete the entry.

A new external value offset value appears in the **External Offset** menu box.

4 Tap **External Offset** to **Off**. **Auto Leveling** is turned off.

Figure 62 and Figure 63 show an example of before and after Auto Leveling is enabled.

Figure 62 Before enabling Auto Leveling

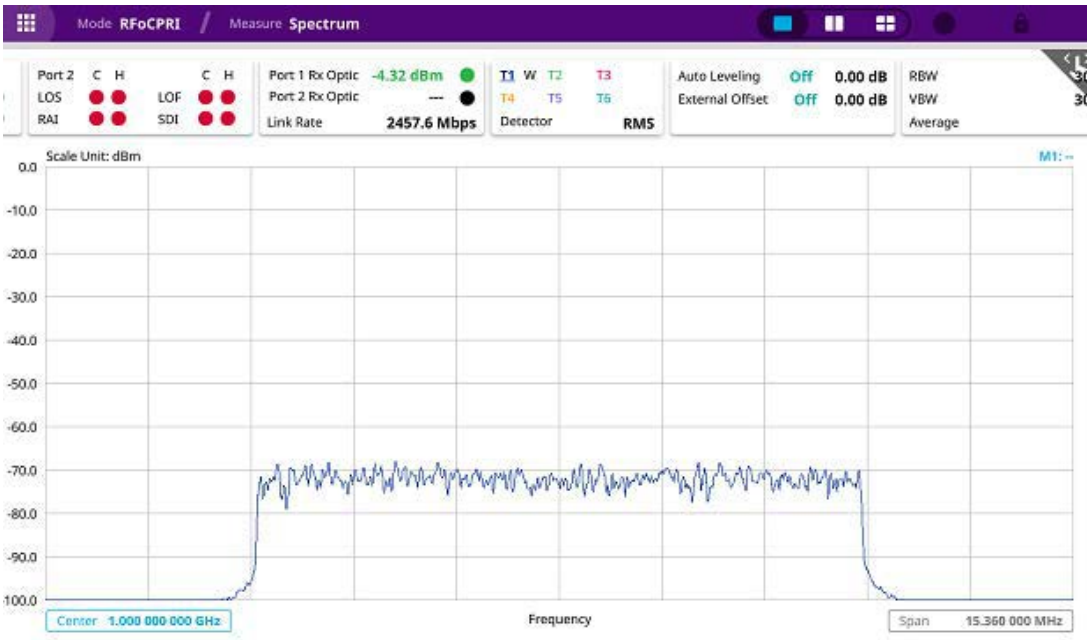


Figure 63 After enabling Auto Leveling



Setting RBW

You can set the RBW and VBW in the Spectrum and Spectrogram modes. The RBW range is limited as per the bandwidth of the signal under test.

1 Tap **Menu > BW/AVG**.

2 Tap **RBW** to set the resolution bandwidth.

3 Choose one of the following options: **100 kHz**, **30 kHz**, **10 kHz**, or **7.5 kHz**.
   – For signal bandwidths 1.4 MHz and 3 MHz: RBW from 1 kHz to 30 kHz
   – For signal bandwidths 5 MHz, 10 MHz, 15 MHz, and 20 MHz: RBW from 1 kHz to 100 kHz

4 Tap **VBW** to **set** the video bandwidth and choose one of the following options: **100 kHz**, **30 kHz**, **10 kHz** or **7.5 kHz**.

Setting average

You can set the number of measurements to be averaged for the trace presentation in the Spectrum and Spectrogram modes. A maximum of 100 times of averaging can be set. When the averaging reaches your setting, a new measurement value replaces the measurement value in sequence from the earliest.

To set average

1 Tap **Menu > Sweep**.

2 Select the desired sweep run mode by tapping the **Sweep Mode** between **Single** and **Continue**
   – **Single**: The instrument performs a single sweep and waits for further entries.
   – **Continue** (default): The instrument is continually measuring and updating results.

3 *Optional*: In Single Mode, tap **Sweep Once** to get a new measurement.

Setting sweep mode

Different sweep settings are available for RFoCPRI Spectrum and Spectrogram measurement modes for better measurement, including the sweep run mode (**Single, Continue**).

To set sweep mode

1 Tap **Menu > Sweep**.

2 Select the desired sweep run by tapping the **Sweep Mode** between **Single** and **Continue**:
   – **Single**: The instrument performs a single sweep and waits for further entries.
   – **Continue** (default): The Instrument is continuously measuring and updating the result.

3 *Optional:* In **Single** mode, tap **Sweep Once** to get a new measurement.

Setting limit

You can set limits on the measurement chart. Make sure to turn Multi Active Trace to On in Window Mode to set all the limits required.

To set limit

1 Tap **Menu > Limit**.

2 Tap to switch **Reference Line Mode** to **On**.

You can input the value using the on-screen keyboard or the move up and down the purple bar on the left of the measurement screen.

3 Tap to switch **Limit Line Mode** to **On**.

You can input the value using the on-screen keyboard.

4 Tap **RSSI Limit**.

You can set this limit only when you turn Multi Active Trace on.

a Tap to switch **RSSI Limit** to **On** or **Off**.

b Tap **High Limit/Low Limit** and input the required value using the on-screen keyboard.

5 Tap **Slope Limit**.

You can set this limit only when you turn Multi Active Trace on.

a Tap to switch **Slope Limit** to **On** or **Off**.

b Tap to switch **Limit Type** to **Difference** or **Degree**.

c Input the required value using the on-screen keyboard.

Setting trace

You can display up to six traces on the measurement chart simultaneously.

To set trace

1 Tap **Menu > Trace**.

2 Tap **Select Trace** and select the trace number: **Trace 1**, **Trace 2**, **Trace 3**, **Trace 4**, **Trace 5**, or **Trace 6**.

3 Complete one of the following by tapping Trace Type:

- **Clear Write**: Clear current data and display with new measurements
- **Max**: Display the input signal's maximum response only (unlimited or for a certain amount of time)
- **Min**: Display the input signal's minimum response only (unlimited or for a certain amount of time)
- **Capture**: Capture the selected trace and compare traces
- **Load**: Load a saved trace
- **Trace** View to Off: Hide the displayed trace
- **Trace** Set Max/Min: To set Trace 1, Trace 2, and Trace 3 to Clear Write, Max, and Min (only available in spectrum mode)

4 To remove all the traces and initialize the trace settings, tap **Trace Clear All**.



NOTE

For the **Max** and **Min**, your instrument compares newly acquired data with the active trace and displays larger maximum values or smaller minimum values on the screen.

5 Tap **Detectors** and select the detection option:

- **Normal**: Displays "Random noise better than the peak without missing signals"
- **Peak**: Displays "The highest value in each data point."
- **RMS**: Displays "The root mean squared average power across the spectrum."
- **Negative Peak**: Displays "The lowest value in each data point."
- **Sample**: Displays "The center value in each data point."

6 *Optional*: Select **Trace Info**, and then select the trace number to view the trace's parameter setting information stored at the time of measurement, or **None** to hide the information display.



NOTE

To be able to load a trace, the trace to be overlaid must be saved in the same measurement mode and frequency setting as the current measurement.

To log multi-traces

When you finished setting trace view/trace type, you can log the trace data by going to the Save page. Make sure you need to select the trace view to on for more than 2 traces.

1 Tap the **Save** icon on the side bar.

2 Make sure the **Logging** is selected in the File Type.

3 Tap the **Save** button at the bottom.

4 The **Trace Selection** pop-up window displays.

5 Tap the **Apply** button to apply the settings.

Selecting network technology

Before starting the RFoCPRI analysis, you need to choose a network technology to analyze.

To select network technology

1 Tap the **Setup** ( ) icon on the side bar of each measurement mode.

2 Tap **Rx Settings > Technology** and select a desired network technology from the menu bar: **LTE** (default) or **WCDMA**

Depending on the network technology you selected, the settings on the Rx Parameter menu change accordingly.

Conducting spectrum measurement

After setting test parameters as described in “Configuring Rx parameters” on page 129, you can perform spectrum measurements with an audible indicator. You can also turn on the interference ID.

Figure 64 and Figure 65 show examples of an RFoCPRI spectrum measurements.

Figure 64 RFoCPRI spectrum measurement

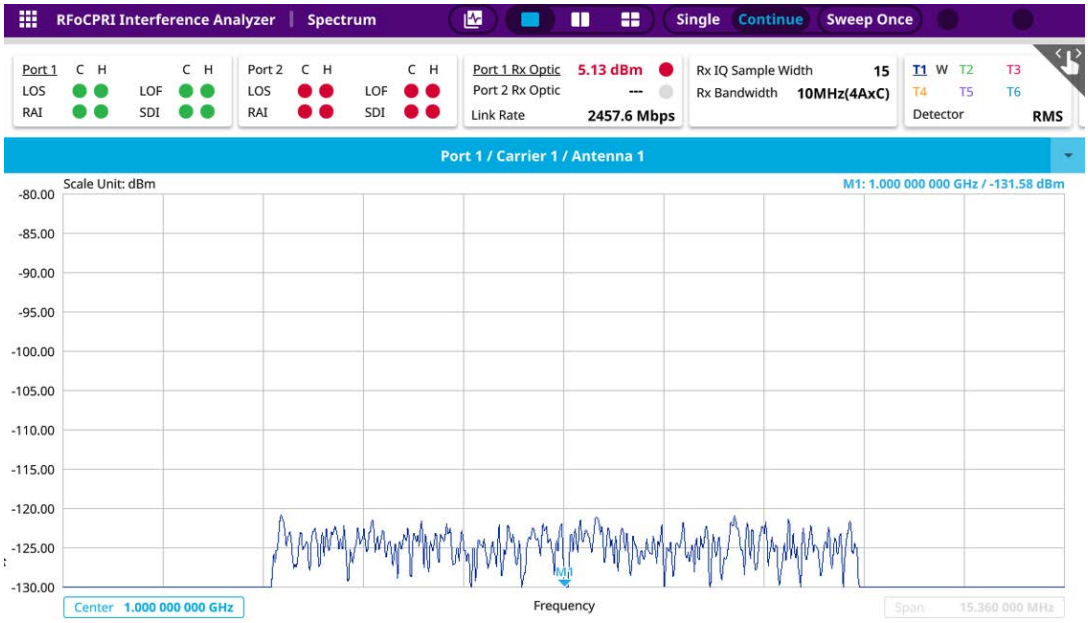
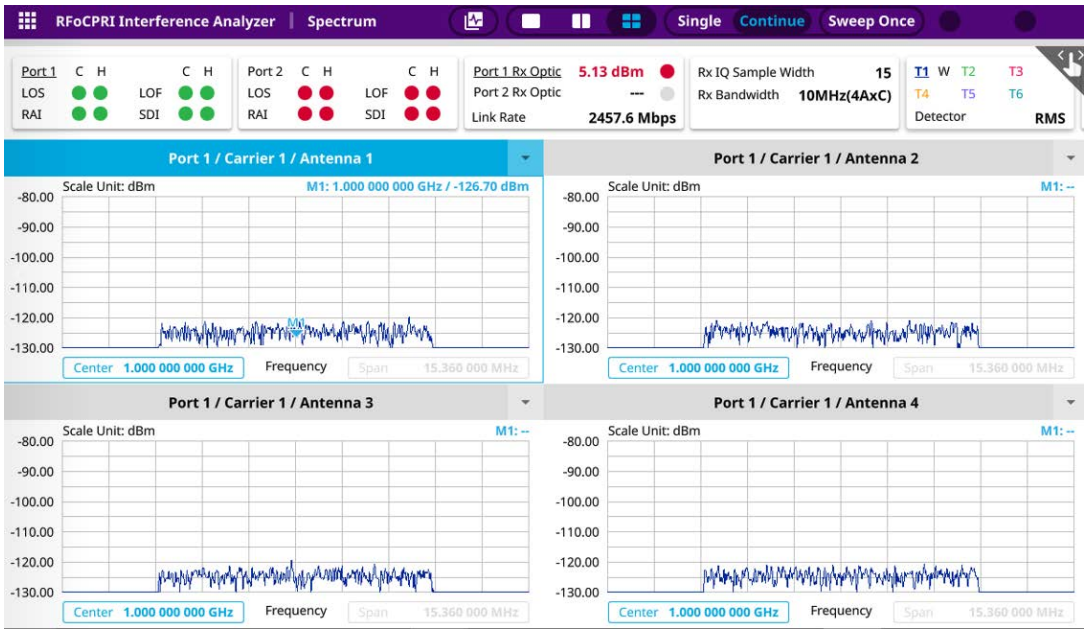


Figure 65 RFoCPRI spectrum measurement (Quad)



To perform spectrum measurements

1 Tap the **Setup** ( ) icon on the side bar of **Spectrum Measurement** mode.

2 Set the sound indicator:

a Tap **Sound Indicator > Alarm Reference**, then choose either **Marker** or **Line.**

- **Marker**: Sets the active marker position as the alarm reference if you have enabled a marker on the spectrum.
- **Line**: Makes the reference line as the alarm reference.

b If you have set the alarm reference to **Line**, tap the **Reference line** to set a threshold for an alarm.

c Enter a value by tapping + or -, and tap **Apply**.

d Tap **Sound** either **On** or **Off** to turn on/off the alarm sound.

e *Optional*: Tap **Volume** to adjust the alarm sound volume.

NOTE

The Sound Indicator is used to identify interfering signals with an alarm sound. This is useful for locating interferer sources with a directional antenna.

3 Set the interference ID:

   a Tap **Interference ID** and **Threshold**.

   b Enter a value and tap the **dBm**.

   c Tap **Interference ID** and choose either **On** or **Off** to turn the Interference ID on or off.

> **NOTE**
>
> The Interference ID automatically classifies interfering signals over a designated spectrum and displays a list of possible signal types corresponding to the selected signal.

4 Tap **Window Mode** and select from the options: **Single**, **Dual**, or **Quad**.

   a When you select **Dual**, you can select two Rx carriers to be seen for each chart. You can see the two charts at the same time only when you select Dual.

   b Tap to switch **Multi Active Trace** to **On** or **Off**.

   If turned on, you can view two sweeping traces, one from the top window and the other from the bottom window, overlapped on a single chart. This function is not enabled when you select Single.

5 To clear the current (C) and history (H) status of CPRI alarms on LOS and LOF and start a new monitoring, tap **Setup > Port Configuration > History Reset**.

6 *Optional*: Tap the **Save** icon on the side bar, and then select the save option from the choices available for your measurement mode.

To perform PIM detection

You can directly perform PIM detection using the icon () on the top middle without having to go through all the procedures. Or you can follow the procedure below.

1 Tap the **Setup** () icon on the side bar of **Spectrum Measurement** mode.

2 Tap **Windows Mode** and select **Dual** or **Quad**.

   a Tap **Multi-Active Trace** to **On**.

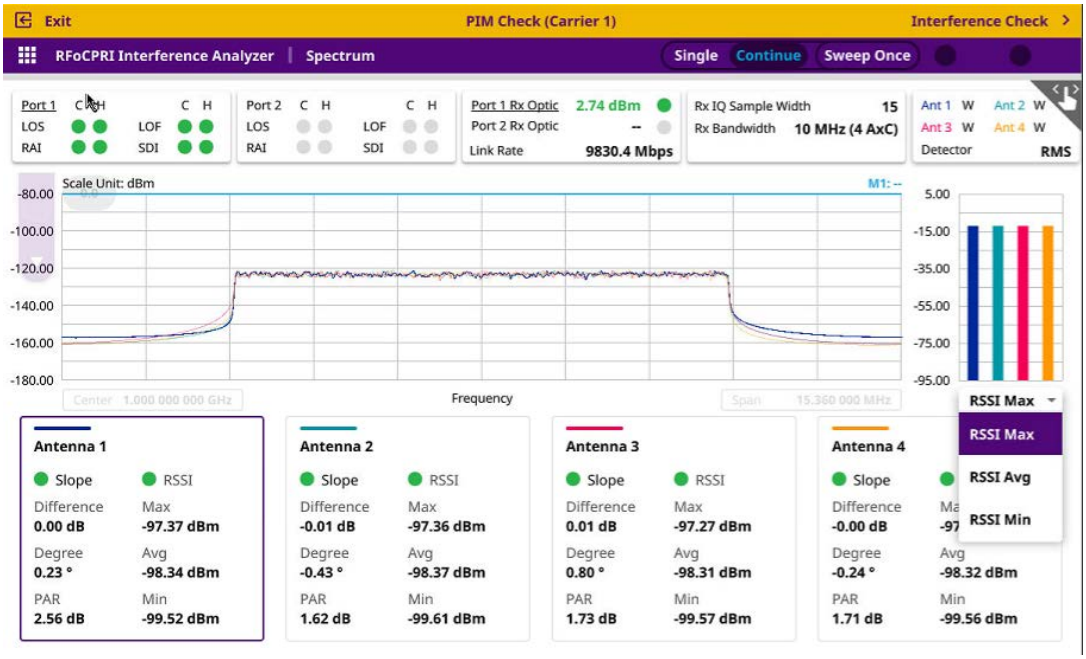
> **NOTE**
>
> You will find a combo box on the left side of the screen and you can select carriers from Rx0 to Rx3 to be shown in the screen.

3 Go to **Setup** and tap **Flatness Table** to **On** or tap the top right button in the screen.

a If you select **Dual**, tap **Rx0** and **Rx1 Flatness Bandwidth**, and **Rx0** and **Rx1 RSSI Bandwidth** then input the required bandwidth using the on-screen keyboard.

b If you select **Quad**, tap **Rx0**, **Rx1**, **Rx2**, and **Rx3 Flatness Bandwidth**, and tap **Rx0**, **Rx1**, **Rx2**, and **Rx3 RSSI Bandwidth** then input the required bandwidth using the on-screen keyboard.

Figure 66 RFoCPRI PIM measurement



NOTE

You can select options from RSSI Max, RSSI Avg, or RSSI Min power on the measurement screen.

Layer 2 CPRI testing

If your instrument is configured and optioned to do so, you can perform Bulk BER testing of your CPRI circuit.

Layer 2 CPRI BULK and Channelized BER testing

The following procedure explains how to configure and run Layer 2 BULK and Channelized BER tests.

To configure and run a Layer 2 CPRI BER test

1 Using the Test Menu or Quick Launch screen, select a CPRI Layer 2 BERT Terminate application.

Protocol	Frequency	Layer 2 Applications
CPRI	Rates 1-7	Layer 2 BERT Terminate
	Rate 8	Layer 2 BERT Terminate

Rates 1-7 are line rates that include the frequencies from 614.4 to 9830.4M. If you select one of these rates, you can specify the desired frequency in the **Line Rate** drop-down box on the Results screen. This enables you to change frequency rates without exiting the application. It also includes option to perform auto line rate negotiation with the far-end.

2 Select the **Setup** soft key, and then select the **CPRI** tab and **Control Word** subtab.

3 Select the **CPRI** tab, then select the **User Plane** sub-tab.

4 In User Plane Payload, select **Bulk BERT**, then do the following:

a In **BERT Pattern Mode**, select the mode (ITU or ANSI).

b In **BERT Payload Pattern**, select the pattern to transmit during testing.

5 If a timed or delayed start test is required, select the **Timed Test** tab and specify the desired start times and duration.

6 Select the **Results** soft key to return to the Main screen, then do the following:

a Select the Laser tab (located at the bottom of the screen), then click the **Laser** button.

b Verify that the green Signal Present LED illuminates.

c If you selected **Channelized BERT** as the payload, select the **Actions** tab, then click the **Start User Plane Payload** button.

d Verify that the **Sync Acquired** and **Frame Sync LEDs** illuminate.

7 Select the CPRI result group and then choose a category to view:

– Error Stats

– Counts

– L1 Inband Protocol

You are BER testing CPRI layer 2.

Conducting spectrogram

The Spectrogram is particularly useful when attempting to identify periodic or intermittent signals as it captures spectrum activity over time and uses various color to differentiate spectrum power levels. When the directional antenna is used to receive the

signal, you will see a change in the amplitude of the tracked signal as you change the location of the antenna and see a change in the Spectrogram colors. The source of the signal is located in the direction that results in the highest signal strength.

To conduct spectrogram

1 Tap the **Setup** ( ) icon on the side bar of **Spectrogram Measure** mode.

2 Tap **Time Interval** and enter a value by using the on-screen keyboard to set the amount of time between each trace measurement.

3 Set the time cursor on a specific trace position:

   a Tap **Time Cursor** to **On**.

   b Tap **Position** to enter a value. You can also use the move bar (up and down arrows) in the lower left screen to move the time cursor.

   c To turn the time cursor off, tap **Time Cursor** to **Off**.

NOTE

Enabling the Time Cursor puts the measurement on hold, allowing you to make post-processing analysis for each measurement over time using the time cursor.

4 Tap **Reset/Restart** to start a new measurement.

5 Tap to switch **Type** to **3D** to **Normal**.

6 Tap **Setup > Port Configuration > History Reset** to clear current (C) and history (H) status of CPRI alarms on LOS and LOF and start a new monitoring.

7 *Optional*: Tap the **Save** icon on the side bar and select a desired save option for your measurement mode.

Using spectrum replayer

The Spectrum Replayer allows you to retrieve and replay recorded spectrum analyzer traces in interference analysis mode. These traces can be played back in the spectrogram or RSSI. You can configure the limit line to create failure points when signals exceed it. The failure points are clearly displayed on the trace timeline for quick access during playback.

Figure 67 shows an example of the RFoCPRI spectrum replay.

Figure 67 RFoCPRI spectrum replay



To replay a spectrum

1. Select a file to be loaded, and then tap **Load**. The measure setup menu appears below on the screen.
2. Tap **FWD** or **REV** to change play direction to forward or reverse.
3. Tap the left or right arrow of Speed to select the speed option: **X1**, **X2**, **X3**, or **X4**.
4. Tap **Play** to start playing.
5. Tap **Pause** to pause or stop playing data.
6. To move to a particular failure position directly and play from there, tap **Fail** on the **Index/Fail** switch and enter a value by using the on-screen keyboard.
7. *Optional*: Tap **Setup > Time Cursor On/Off** to display or dismiss the time cursor on the screen. This key becomes activated when you play logged data in the Spectrogram mode.

NOTE

If you connect a USB drive, do not remove it while playing to prevent freezing the USB port, which will require you to restart the instrument to get a USB drive recognized again.

Setting display

You can select the display and view the PRB (Physical Resource Block) per selected trace. You can only check the PRB table when you are seeing Single Chart.

To set display

1 Tap **Menu** > **Display**.

2 Tap to switch the **PRB table** to **On** or **Off**.

   a Tap the **PRB No** box and input the value from 0 to 49.

   b You can check the selected PRB's min/current/max power in channel power.

Figure 68 shows an example of the PRB power.

Figure 68 RFoCPRI PRB power



NOTE

You can change the Marker position with the purple bar by moving right and left.

Conducting optics test

The optics test in the CPRI Analyzer verifies that optical links meet the necessary standards for performance, reliability, and efficiency. Ensuring proper optical link performance is essential to prevent issues such as dropped calls, reduced data rates, or network outages, thereby maintaining the quality of mobile network services.

To conduct optical test

To enable the optical test, the ONA-SP-OPTIC license is required.

1 Ensure that the fiber optic cable is connected to SFP/SFP+ Port 1 and SFP/SFP+ Port 2 as shown in the figure displayed at the top left of the screen.

2 Tap **Link Rate** and select the desired option from the drop-down menu.

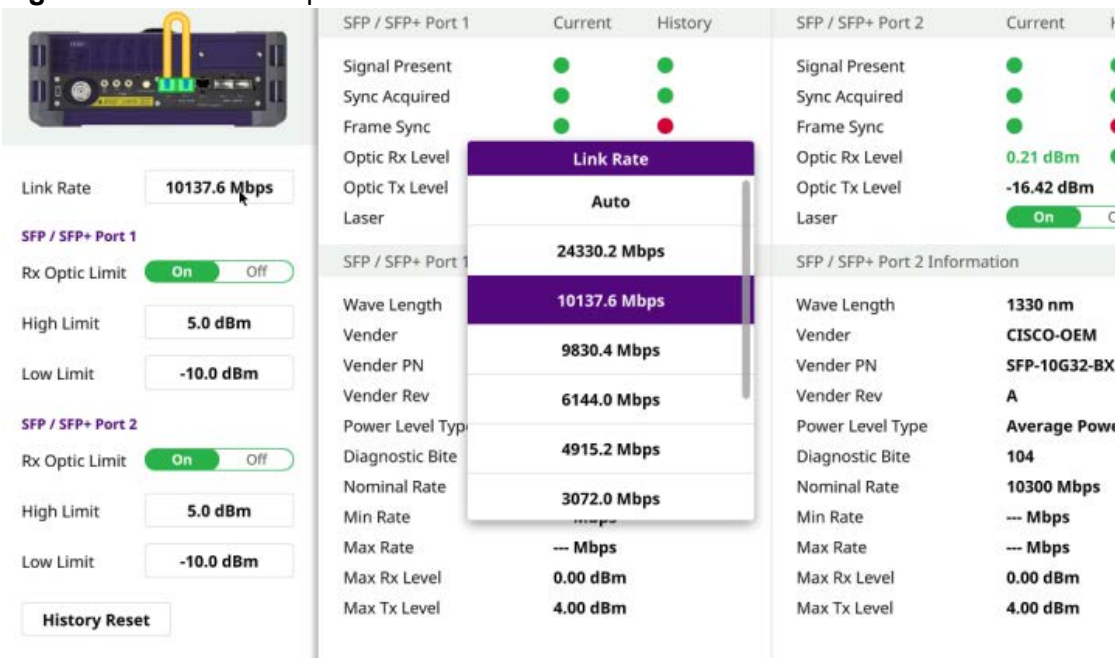
3 Tap 'Rx Optic Limit On' to input High Limit and Low Limit as required.

4 Tap ‘Laser On’ to get the correct signal.

5 The right pane of the screen displays the optical test results and port information.

Figure 69 shows an example of the optical test.

Figure 69 RFoCPRI optical test



7

Using TDD Auto Gated Spectrum Analyzer

This chapter describes how to use the TDD Auto Gated Spectrum Analyzer. Topics covered in this chapter include:

- “Introduction” on page 150
- “Selecting mode and measure” on page 150
- “Auto configuring parameters” on page 151
- “Interference analysis” on page 158
- “Online interference analysis” on page 187
- “RF Viewer analysis” on page 201

Introduction

TDD Auto Gated Spectrum (TAGS) allows to detect interference signals on the TDD band by gating on the Guard Period. In case of intervals where signal changes from uplink to downlink, there exists no signal (Guard Period). The TAGS is designed to find unwanted or interfering signals.

TAGS supports the following measurements:

- Interference Analysis
  - Spectrum
  - Spectrogram
  - Persistent Spectrum
  - Persistent Spectrogram
  - RSSI
  - Interference Finder
  - Radar Chart
  - Spectrum Replayer
- Online Interference Analysis
  - Online Interference Finder
  - Online Radar Chart
- RF Viewer Analysis (Only available with the license, ONA-SP-VIEWER)
  - Directional Antenna



NOTE

If you have an AntennaAdvisor Handle attached to your module, the Trigger button functions as Quick Save except for the measurements for Interference Finder, Radar Chart, Spectrum Replayer, RF Viewer, Online Interference Finder, and Online Radar Chart.

Selecting mode and measure

The following procedure describes how to select the mode and measure.

To select mode and measure

1 Tap **TDD Auto Gated Spectrum Analyzer** on the **Mode** panel.

2 Tap any measurement mode from the following choices:

- **Interference Analysis > Spectrum, Spectrogram, Persistent Spectrum, or Persistent Spectrogram, RSSI, Interference Finder, Spectrum Replayer**, **Radar Chart**, or **RF Viewer**
- **Online Interference Analysis > Online Interference Finder** or **Online Interference Radar Chart**
- **RF Viewer Analysis > Directional Antenna**

NOTE

If you have a CAA module with CAA-RFS license (enabled), the RF Source menu will be activated. Go to **Setup** > **RF Source** > **CAA RF Power**. And tap to switch **CAA RF Power** to **On**. Then you can tap to switch **RF Source** to **On** and set **Frequency**/**Power Level** as required. Note that if you have a CAA module with catalog number (CAA06MB with Bias Voltage option), you can tap to switch **Bias Voltage** to **On** and set the required **Bias Voltage**.

With this Bias Voltage, you can enhance the sensitivity while performing interference analysis on feeder of old BTS (Base Transceiver Station) without RRH.

Auto configuring parameters

For each measurement of TAGS, you can configure parameters automatically in the pop-up window.

To set auto configuration

1 Go to any measurement, then tap the **Setup** ( ) icon on the side bar.

2 Tap to switch **Technology** between **NR** and **LTE**.

a If you select **NR**, do the following steps:

- Tap **Auto Configuration**.
- Select the parameters as required in the pop-up window: Center Frequency, Case, Bandwidth, SSB Periodicity.
- Click **SSB Auto Search** then tap the **Search** button. You can also type in SSB Frequency or GSCN manually.
- Once SSB is obtained, Sync LED at the background turns to green.
- Once the Frame and Slot format has been identified, it shows the values detected: Down Link Slot, Down Link Symbol, Up Link Slot, and Uplink Symbol.
- Tap the **Run** button to start TDD Auto Gated Spectrum when the auto detection is successful.
- Tap to start the **Analysis Mode** to determine the Frame and Slot Format manually.

b If you select **LTE**, do the following steps:

- Tap **Auto Configuration**.
- Tap the **Center Frequency** box and input the required value using the on-screen keyboard.
- Tap the **Channel Number** box and input the required value using the on-screen keyboard.
- Tap the **Search** button.
- Once the search is successful, Sync LED at the background turns to green.
- Once the Frame and Slot format has been identified, it shows the values detected: Bandwidth, Uplink-Downlink Config, Special Subframe Assignment.
- Tap the **Run** button to start TDD Auto Gated Spectrum when the auto detection is successful.
- Tap to start the **Analysis Mode** to determine the Frame and Slot Format manually.

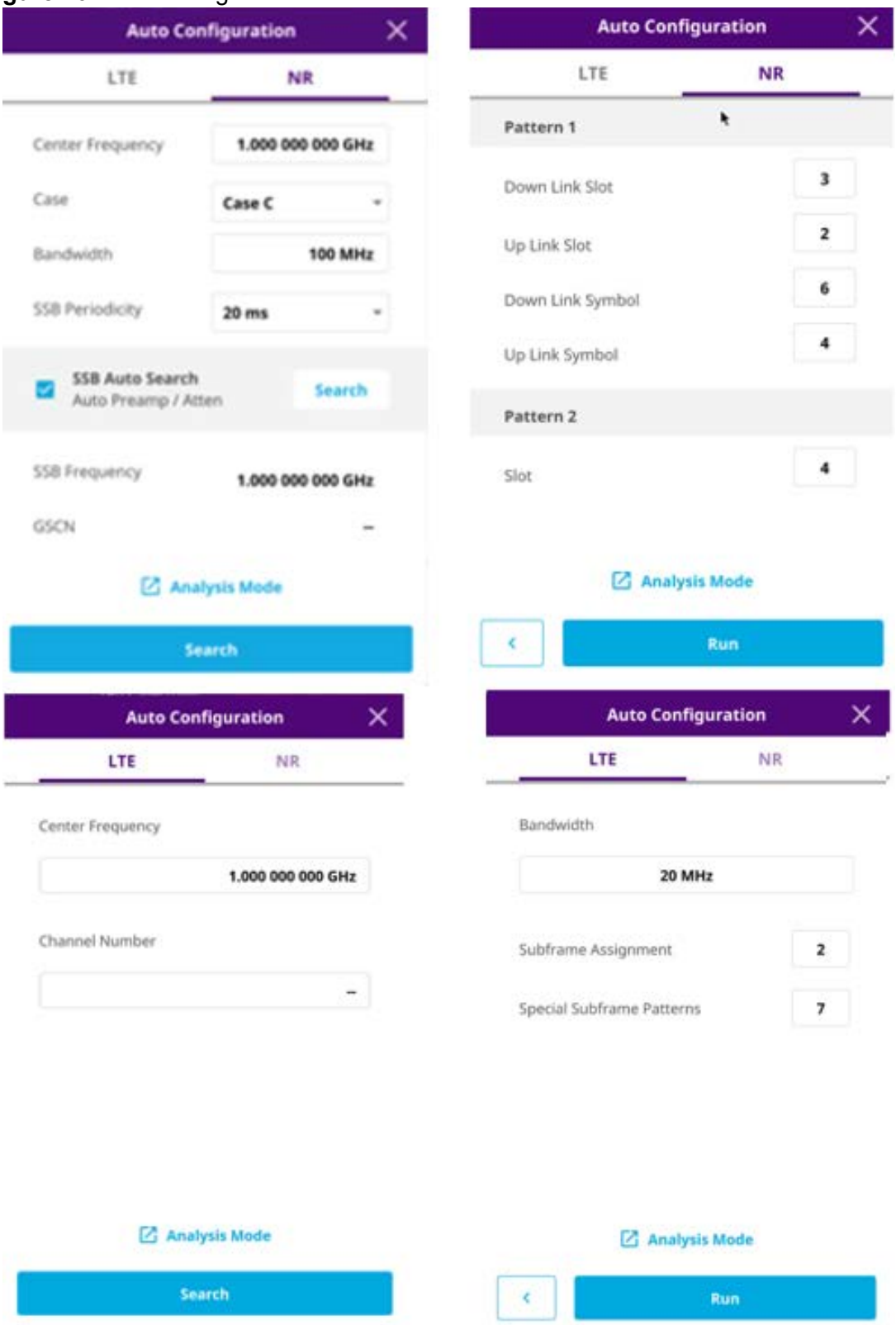


NOTE

Auto Search works with Standalone 5G NR network only. You need to check the deployment mode of your 5G NR Network if Auto Search does not work even with a strong RSRP.

Figure 70 displays a sample auto configuration.

Figure 70 Auto configuration



NOTE

Once you tap the Analysis Mode in the Auto Configuration Window, you can identify frame and slot formats.

To identify frame format

1 Tap **Deviation** to see the slot activity. Each bar represents the peak power of each slot.

2 Analyze the height variation of each bar.

3 When selecting **NR** tech, do the followings:

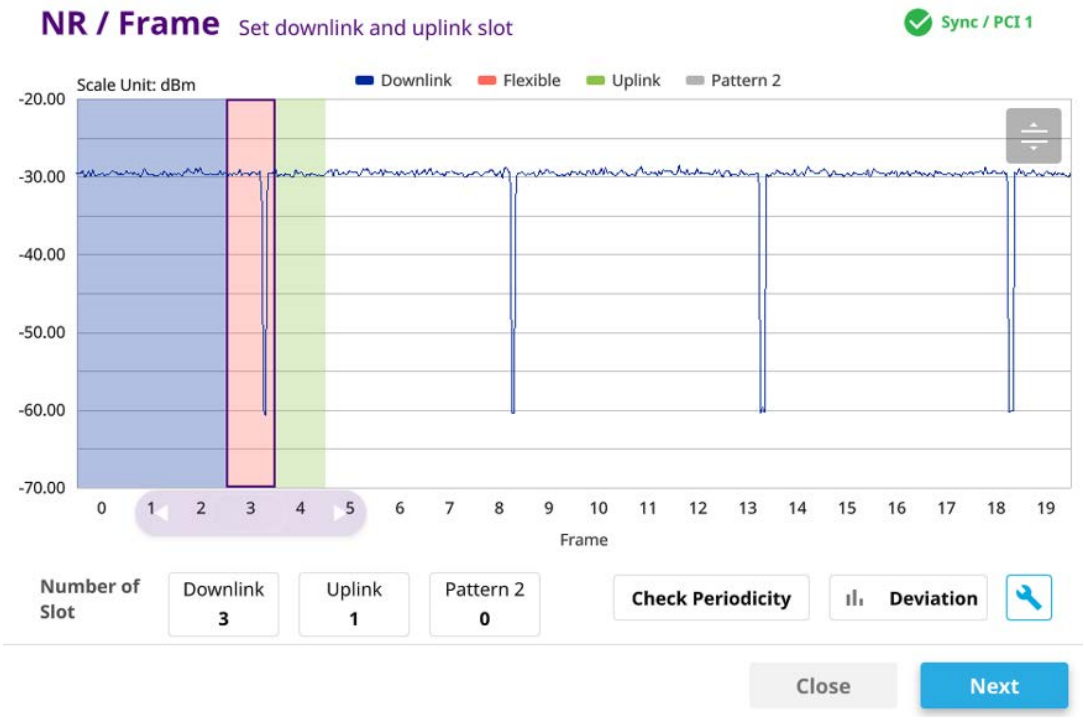
- **a** Configure **Number of Downlink Slot** and **Number of Uplink Slot**.
- **b** Tap **Check Periodicity**.
- **c** Verify if all UL slots assigned (in green color) shows relatively less power variation.
- **d** Select **Next** to move to Slot Format analysis.

4 When selecting **LTE** tech, do the followings:

- **a** Tap **Uplink-Downlink Config**.
- **b** Select the required assignment then tap the **Apply** button.
- **c** Select **Next** to move to Slot Format analysis.

Figure 71 displays a P vs T frame chart view.

Figure 71 P vs T frame chart view



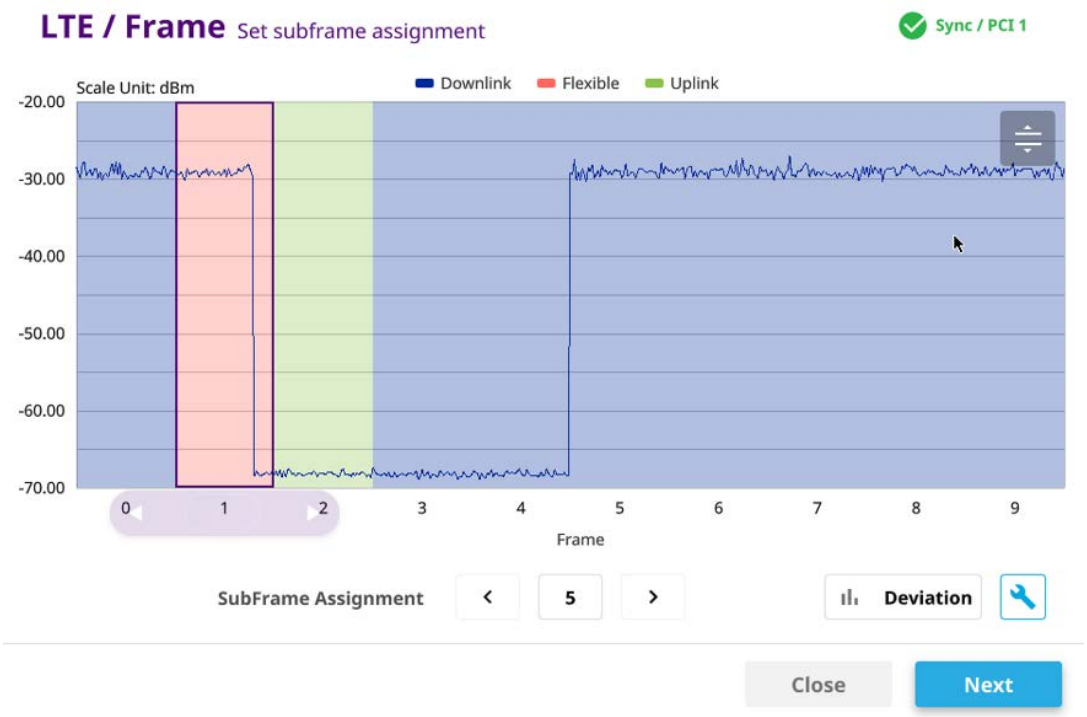
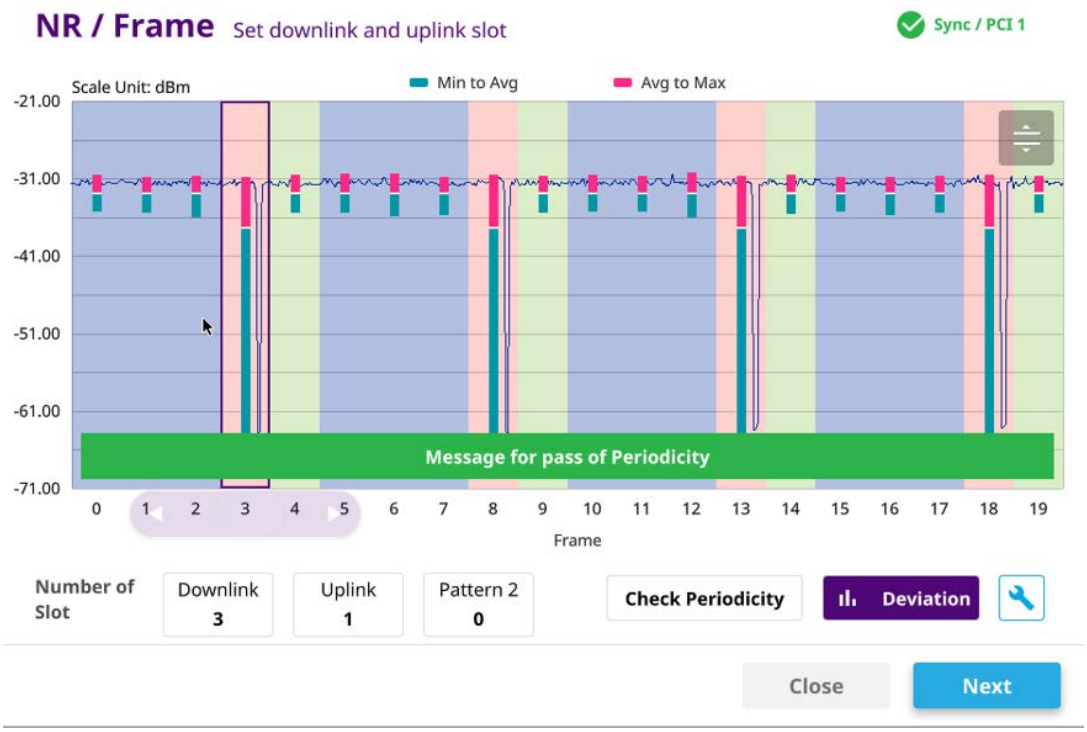
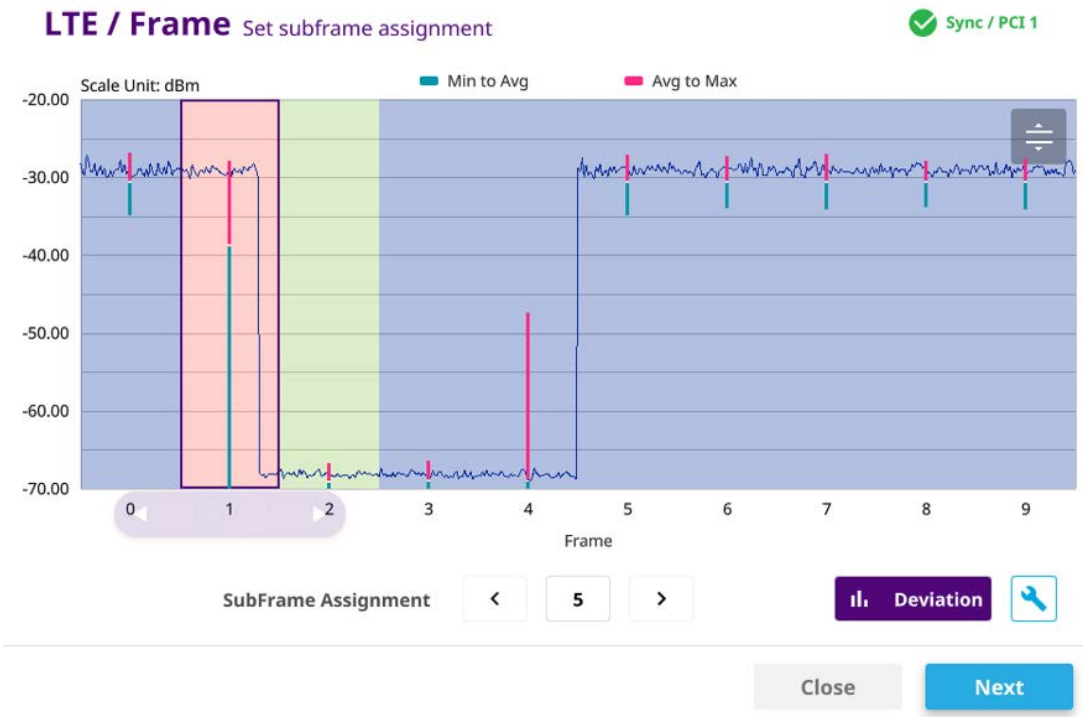


Figure 72 P vs T frame Deviation bar





NOTE
Figure 72 is an example of Check Periodicity with a success message.

To identify slot format

1 When selecting NR tech, do the followings:

   a Top chart shows symbol power variation for one special slot period where the DL to UL transition is made.

   b Check the Symbol Power activity and assign the number of DL symbol and UL symbol.

2 When selecting LTE tech, do the followings:

   a Top chart shows symbol power variation for one special slot period where the DL to UL transition is made.

   b Check the Symbol Power activity and assign the special subframe patterns (SPP).

NOTE
DL Symbols always start from the beginning of the slot and extended to the right, whereas the UL symbols start from the end of slot and extended to the left. The rest symbols are for FF and placed in between DL and UL symbols.

Figure 73 Slot format



To set gate window

1 Set the number of symbols to monitor.

By increasing the number of symbol width, ONA can provide RTSA Persistent Spectrum with better POI.

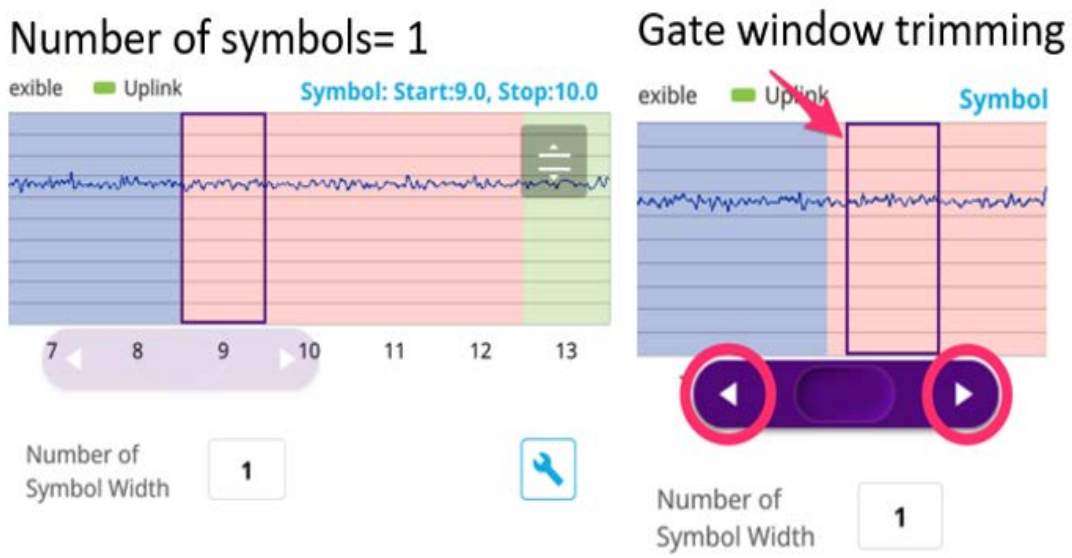
NOTE

Make sure that your Gate window is free from UL or DL signal activities as tradeoff is increasing possibility of involving delayed DL or UL.

2 Trim the start point of Gate window by using the control bar to avoid DL or UL signal activity caused by the propagation delay of DL signal and advanced signaling from UE to compensate the delay.

3 Tap the **Apply** button to run Gated Spectrum with a full chart view.

Figure 74 Slot format



NOTE

When you enter into Analysis Mode to identify frame/slot format, make sure to set four key parameters: number of downlink slot/uplink slot, number of downlink symbol/uplink symbol.

Interference analysis

The following sections describe how to conduct interference measurements for manual configuration.

Spectrum

You will be able to perform Spectrum Analysis in Guard Period for a specific measuring area. Before starting the measurement, you can set test parameters such as Amp/

Scale, Average, Trace, Trigger, Limit, and Marker as described in “Configuring spectrum measurements” on page 25.



NOTE

Make sure to keep on gating on the GP of TDD signal, sync with SSB should be maintained. Therefore, Carrier & SSB frequency shouldn’t be changed, RBW should be Auto, and Span is to set 10 MHz to Carrier BW.

The spectrum measurement with an audible indicator is especially useful for locating interferer sources with a directional antenna.

To set measure setup for sound indicator

1 Tap the **Setup** ( ) icon on the side bar.

2 Tap **Sound Indicator**.

- **a** Tap to switch the **Sound** between **On** and **Off** to enable and disable the alarm sound.
- **b** Tap to switch the **Alarm Reference** to **Marker** to set the active marker position as the alarm reference.
- **c** Tap to switch the **Alarm Reference** to **Line** to set the limit as the alarm reference.
- **d** Select **Reference Line** to specify a threshold for the reference line using the on-screen keyboard.
- **e** *Optional:* To adjust the volume for alarm sound, tap **Volume** and input a value from 1 to 10 using the on-screen keyboard.

To set manual configuration for NR

1 Tap the **Setup** ( ) icon > **Manual Configuration (NR)** on the side bar.

2 Tap **Bandwidth/SSB SCS** then a Setting window appears.

- **a** If you select the operating frequency as FR1, select from the following:
  - SCS 15 kHz: 5, 10, 15, 20, 25, 30, 40, 50 MHz
  - SCS 30 kHz: 5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 MHz

3 Tap **SSB Center Frequency** and input the value using the on-screen keyboard.

4 Tap **GSCN** and input the value using the on-screen keyboard.

5 Tap **TDD Formats** then set **Downlink Slot**, **Downlink Symbol**, **Uplink Slot**, **Uplink Symbol** as required.

6 Tap **SSB Auto Search Mode** and do the following steps:

- **a** Tap **Auto Preamp/Atten** and switch **SSB Auto Search** to **Start** to set preamp and attenuation automatically.
- **b** Tap **Manual** and switch **SSB Auto Search** to **Start** for manually setting based on your need.

7 Tap **SSB Auto Search** between **Start** and **Stop**.

   a **Start**: to search SCS, type, and the number of SSB automatically. Once Start is selected, the progress bar appears. If it fails to perform the auto search, a fail message appears and the SSB switches to Manual.

   b **Stop**: to set the SSB periodicity based on the base station.

8 Tap **SSB Periodicity** and select the options from **5 ms**, **10 ms**, **20 ms**, **40 ms**, **80 ms**, **160 ms**. The SS burst period (SSB periodicity) is defined by each base station and network configurable. 20 ms is the default for the initial cell selection.

9 Tap to switch **PCI (Physical Cell ID)** to **Manual** or **Auto**.

10 Tap **PCI** and input a value from 0 to 1007 using the on-screen keyboard. The PCI switches to **Manual**.

11 Tap **Gate Window Settings** and input **Slot No**, **Start Symbol No**, and **Symbol Width**.

   You can view P vs T Slot format measurement screen once you tap **P vs T Slot view**.

12 Tap **Miscellaneous** > **Symbol Phase Comp** and select from the following choices: **Auto**, **Manual**, or **Off**.

   Symbol Phase Compensation is used to compensate for phase differences between symbols caused by upconversion. Users do not always use the instrument based on RF frequency. In this case, you can set it to Manual or Off.

   – **Auto**: Setting radio frequency to center frequency
   – **Manual**: Setting radio frequency as required
   – **Off**: Setting radio frequency to 0

To set manual configuration for LTE

1 Tap the **Setup** (⚙) icon > **Manual Configuration (LTE)** on the side bar.

2 Tap **Uplink-Downlink Config** then input the required value using the on-screen keyboard.

3 Tap **Special Subframe Patterns** then input the required value using the on-screen keyboard.

4 Tap **Bandwidth** and select from the options: **1.4 MHz**, **3 MHz**, **5 MHz**, **10 MHz**, **15 MHz**, or **20 MHz**.

Figure 75 displays Spectrum measurement with TAGS.

Figure 75 Spectrum measurement with TAGS



Spectrogram

You will be able to perform Spectrogram Analysis in Guard Period for a specific measuring area. Before starting the measurement, you can set test parameters such as Amp/Scale, Average, Trace, Trigger, Limit, and Marker as described in “Configuring spectrum measurements” on page 25.

NOTE

Make sure to keep on gating on the GP of TDD signal, sync with SSB should be maintained. Therefore, Carrier & SSB frequency shouldn’t be changed, RBW should be Auto, and Span is to set 10 MHz to Carrier BW.

To conduct spectrogram

1 Tap the **Setup** (⚙) icon on the side bar of **Spectrogram Measure** mode.

2 Tap **Time Interval** and enter a value by using the on-screen keyboard to set the amount of time between each trace measurement.

3 Set the time cursor on a specific trace position:

   a Tap **Time Cursor** to **On**.

   b Tap **Position** to enter a value. You can also use the move bar (up and down arrows) in the lower left screen to move the time cursor.

   c To turn the time cursor off, tap **Time Cursor** to **Off**.



NOTE

Enabling the Time Cursor puts the measurement on hold, allowing you to make post-processing analysis for each measurement over time using the time cursor.

4 Tap **Reset/Restart** to start a new measurement.

5 Tap to switch **Type** to **3D** to **Normal**.

To set manual configuration for NR

1 Tap the **Setup** ( ) icon > **Manual Configuration (NR)** on the side bar.

2 Tap **Bandwidth/SSB SCS** then a Setting window appears.

   a If you select the operating frequency as FR1, select from the following:
   - SCS 15 kHz: 5, 10, 15, 20, 25, 30, 40, 50 MHz
   - SCS 30 kHz: 5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 MHz

3 Tap **SSB Center Frequency** and input the value using the on-screen keyboard.

4 Tap **GSCN** and input the value using the on-screen keyboard.

5 Tap **TDD Formats** then set **Downlink Slot**, **Downlink Symbol**, **Uplink Slot**, **Uplink Symbol** as required.

6 Tap **SSB Auto Search Mode** and do the following steps:

   a Tap **Auto Preamp/Atten** and switch **SSB Auto Search** to **Start** to set preamp and attenuation automatically.

   b Tap **Manual** and switch **SSB Auto Search** to **Start** for manually setting based on your need.

7 Tap **SSB Auto Search** between **Start** and **Stop**.

   a **Start**: to search SCS, type, and the number of SSB automatically. Once Start is selected, the progress bar appears. If it fails to perform the auto search, a fail message appears and the SSB switches to Manual.

   b **Stop**: to set the SSB periodicity based on the base station.

8 Tap **SSB Periodicity** and select the options from **5 ms**, **10 ms**, **20 ms**, **40 ms**, **80 ms**, **160 ms**. The SS burst period (SSB periodicity) is defined by each base station and network configurable. 20 ms is the default for the initial cell selection.

9 Tap to switch **PCI (Physical Cell ID)** to **Manual** or **Auto**.

10 Tap **PCI** and input a value from 0 to 1007 using the on-screen keyboard. The PCI switches to **Manual**.

11 Tap **Gate Window Settings** and input **Slot No**, **Start Symbol No**, and **Symbol Width**.

You can view P vs T Slot format measurement screen once you tap **P vs T Slot view**.

12 Tap **Miscellaneous** > **Symbol Phase Comp** and select from the following choices: **Auto**, **Manual**, or **Off**.

Symbol Phase Compensation is used to compensate for phase differences between symbols caused by up-conversion. Users do not always use the instrument based on RF frequency. In this case, you can set it to Manual or Off.

- **Auto**: Setting radio frequency to center frequency
- **Manual**: Setting radio frequency as required
- **Off**: Setting radio frequency to 0

To set manual configuration for LTE

1 Tap the **Setup** ( ) icon > **Manual Configuration (LTE)** on the side bar.

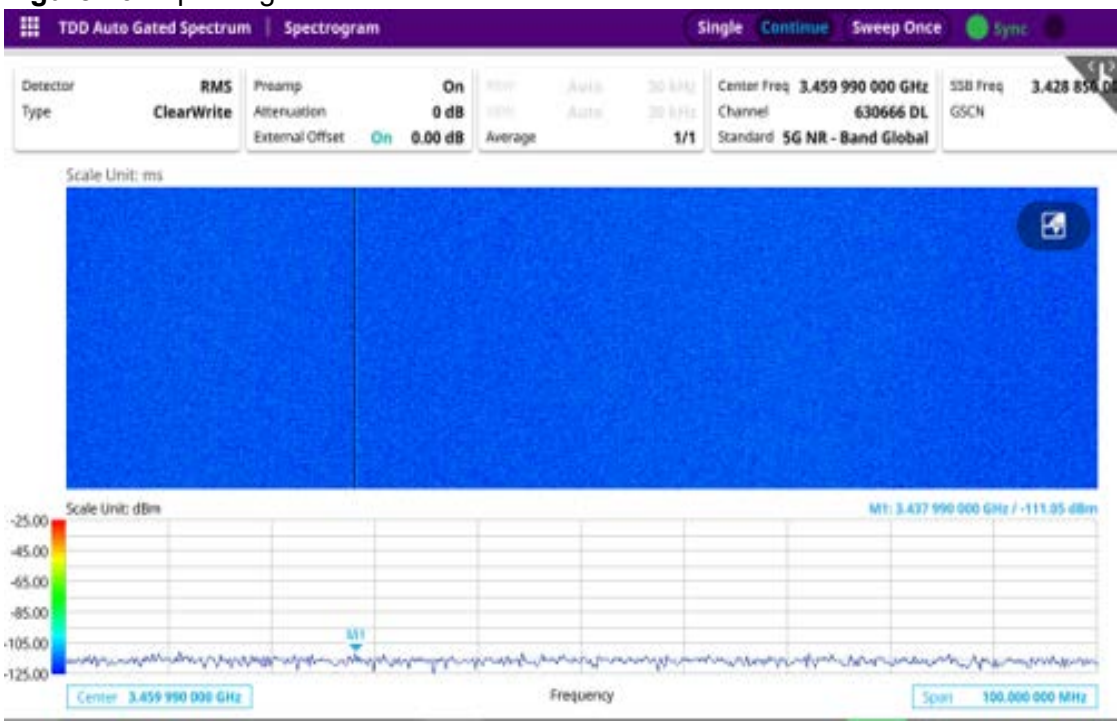
2 Tap **Uplink-Downlink Confi**g then input the required value using the on-screen keyboard.

3 Tap **Special Subframe Patterns** then input the required value using the on-screen keyboard.

4 Tap **Bandwidth** and select from the options: **1.4 MHz**, **3 MHz**, **5 MHz**, **10 MHz**, **15 MHz**, or **20 MHz**.

Figure 76 displays Spectrogram measurement with TAGS.

Figure 76 Spectrogram measurement



Persistent spectrum

You will be able to perform Persistent Spectrum Analysis in Guard Period for a specific measuring area. Before starting the measurement, you can set test parameters such as Amp/Scale, Average, Trace, Trigger, Limit, and Marker as described in "Configuring spectrum measurements" on page 25.

NOTE

Make sure to keep on gating on the GP of TDD signal, sync with SSB should be maintained. Therefore, Carrier & SSB frequency shouldn't be changed, RBW should be Auto, and Span is to set 10 MHz to Carrier BW.

To set manual configuration for NR

1 Tap the **Setup** ( ) icon > **Manual Configuration (NR)** on the side bar.

2 Tap **Bandwidth/SSB SCS** then a Setting window appears.

   a If you select the operating frequency as FR1, select from the following:
   - SCS 15 kHz: 5, 10, 15, 20, 25, 30, 40, 50 MHz
   - SCS 30 kHz: 5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 MHz

3 Tap **SSB Center Frequency** and input the value using the on-screen keyboard.

4 Tap **GSCN** and input the value using the on-screen keyboard.

5 Tap **TDD Formats** then set **Downlink Slot**, **Downlink Symbol**, **Uplink Slot**, **Uplink Symbol**, **Slot No.**, **Start Symbol No.**, and **Symbol Width** as required.

6 Tap **SSB Auto Search Mode** and do the following steps:

   a Tap **Auto Preamp/Atten** and switch **SSB Auto Search** to **Start** to set preamp and attenuation automatically.

   b Tap **Manual** and switch **SSB Auto Search** to **Start** for manually setting based on your need.

7 Tap **SSB Auto Search** between **Start** and **Stop**.

   a **Start**: to search SCS, type, and the number of SSB automatically. Once Start is selected, the progress bar appears. If it fails to perform the auto search, a fail message appears and the SSB switches to Manual.

   b **Stop**: to set the SSB periodicity based on the base station.

8 Tap **SSB Periodicity** and select the options from **5 ms**, **10 ms**, **20 ms**, **40 ms**, **80 ms**, **160 ms**. The SS burst period (SSB periodicity) is defined by each base station and network configurable. 20 ms is the default for the initial cell selection.

9 Tap to switch **PCI (Physical Cell ID)** to **Manual** or **Auto**.

10 Tap **PCI** and input a value from 0 to 1007 using the on-screen keyboard. The PCI switches to **Manual**.

11 Tap **Symbol Phase Comp** and select from the following choices: **Auto**, **Manual**, or **Off**.

Symbol Phase Compensation is used to compensate for phase differences between symbols caused by up-conversion. Users do not always use the instrument based on RF frequency. In this case, you can set it to Manual or Off.

- **Auto**: Setting radio frequency to center frequency
- **Manual**: Setting radio frequency as required
- **Off**: Setting radio frequency to 0

To set manual configuration for LTE

1. Tap the **Setup** ( ) icon > **Manual Configuration (LTE)** on the side bar.
2. Tap **Uplink-Downlink Config** then input the required value using the on-screen keyboard.
3. Tap **Special Subframe Patterns** then input the required value using the on-screen keyboard.
4. Tap **Bandwidth** and select from the options: **1.4 MHz**, **3 MHz**, **5 MHz**, **10 MHz**, **15 MHz**, or **20 MHz**.

To set the DPX marker

1. Tap the **Marker setting** ( ) icon on the side bar. The marker setting table appears.
2. Tap **DPX**.

   The horizontal and vertical bars appear. A DPX marker shows the hit rate of X-axis (amplitude) and Y-axis whereas a normal trace marker shows a value of the x-axis.
3. Tap the chart screen to move the DPX marker or move the vertical bar and horizontal bar.

NOTE

If you select the DPX marker, you can only use Peak Search and Always Peak options. Delta pair is not available. See “Using marker” on page 41 for more information.

To set bitmap

1. Tap **Menu > Bitmap**.
2. Tap **Dot Persistence Time** and input a value using the on-screen keyboard. The dot persistence time represents the time that accumulates DPX data.
3. Tap to switch **Bitmap Scale** to **On** to enable auto scale or **Off** to disable auto scale. If the Bitmap Scale is On, the point where the maximum hit represents maximum colors. If the Bitmap Scale is Off, the bluer color (closer to 0% of the color bar) is mapped with a hit.
4. Tap **Bitmap Min** and input % value using the on-screen keyboard.

The Bitmap Min represents the unused bitmap color range. If you set it to 10%, the color matched with 10% or below does not show.

5 Tap **Bitmap Max** and input % value using the on-screen keyboard.

The Bitmap Max represents the maximum range of bitmap colors to be used. If you set it to 90%, the color that exceeds 90% does not show.

6 Tap **Hit Min** and input % value using the on-screen keyboard.

The Hit Min represents the minimum number of hits not to be converted to colors. If you set it to 10%, the hit matched with 10% or below is not converted to a color.

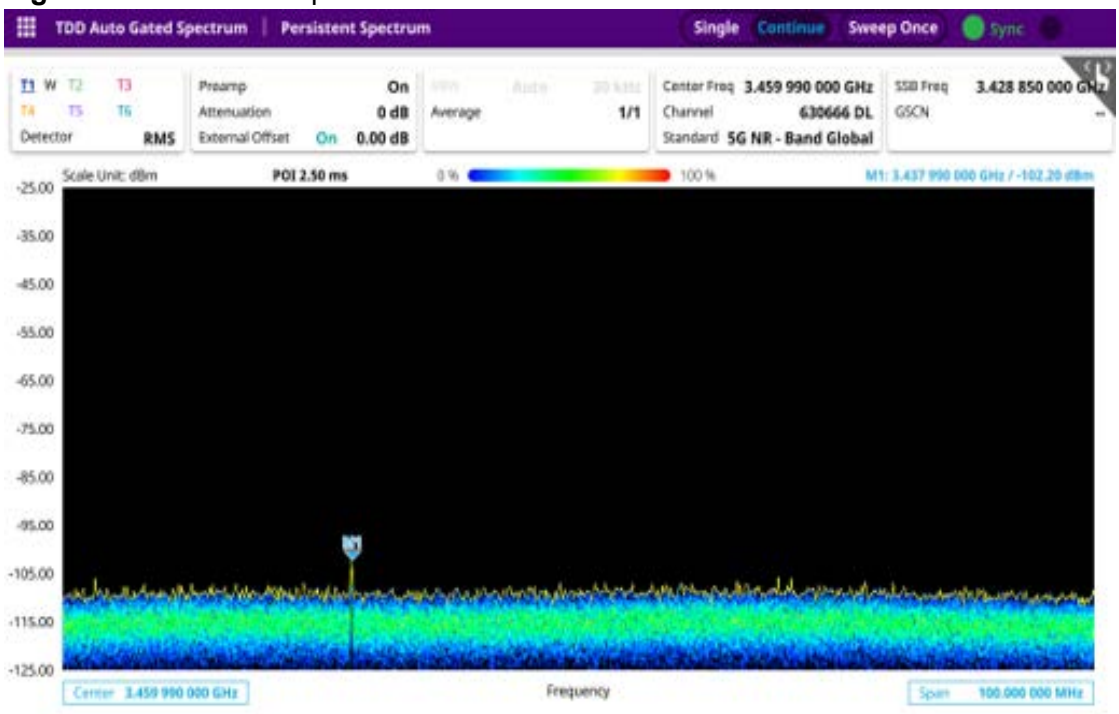
7 Tap **Hit Max** and input % value using the on-screen keyboard. The Hit Max represents the maximum number of hits to be converted to colors. If you set it to 90%, the hit matched with 90% or above shows with max colors.

NOTE

You can go to **Menu > Limit** to analyze your measurements with the reference line, multi-segment line, and channel limit table. See “Setting limit” on page 39 for more information.

Figure 77 displays a sample persistent spectrum measurement with TAGS.

Figure 77 Persistent spectrum measurement



NOTE

Compared to Persistent Spectrum in RTSA, Persistent Spectrum in TAGS is especially useful when tracking the level of weak interference to find interference source.

Persistent spectrogram

You will be able to perform Persistent Spectrogram Analysis in Guard Period for a specific measuring area. Before starting the measurement, you can set test parameters such as Amp/Scale, Average, Trace, Trigger, Limit, and Marker as described in "Configuring spectrum measurements" on page 25.

NOTE

Make sure to keep on gating on the GP of TDD signal, sync with SSB should be maintained. Therefore, Carrier & SSB frequency shouldn't be changed, RBW should be Auto, and Span is to set 10 MHz to Carrier BW.

To conduct persistent spectrogram

1 Tap the **Setup** ( ) icon on the side bar of **Spectrogram Measure** mode.

2 Tap **Time Interval** and enter a value by using the on-screen keyboard to set the amount of time between each trace measurement.

3 Set the time cursor on a specific trace position:

- **a** Tap **Time Cursor** to **On**.
- **b** Tap **Position** to enter a value. You can also use the move bar (up and down arrows) in the lower left screen to move the time cursor.
- **c** To turn the time cursor off, tap **Time Cursor** to **Off**.

NOTE

Enabling the Time Cursor puts the measurement on hold, allowing you to make post-processing analysis for each measurement over time using the time cursor.

4 Tap **Reset/Restart** to start a new measurement.

5 Tap to switch **Type** to **3D** to **Normal**.

To set manual configuration for NR

1 Tap the **Setup** ( ) icon > **Manual Configuration (NR)** on the side bar.

2 Tap **Bandwidth/SSB SCS** then a Setting window appears.

- **a** If you select the operating frequency as FR1, select from the following:
  - SCS 15 kHz: 5, 10, 15, 20, 25, 30, 40, 50 MHz
  - SCS 30 kHz: 5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 MHz

3 Tap **SSB Center Frequency** and input the value using the on-screen keyboard.

4 Tap **GSCN** and input the value using the on-screen keyboard.

5 Tap **TDD Formats** then set **Downlink Slot**, **Downlink Symbol**, **Uplink Slot**, **Uplink Symbol** as required.

6 Tap **SSB Auto Search Mode** and do the following steps:

   a Tap **Auto Preamp/Atten** and switch **SSB Auto Search** to **Start** to set preamp and attenuation automatically.

   b Tap **Manual** and switch **SSB Auto Search** to **Start** for manually setting based on your need.

7 Tap **SSB Auto Search** between **Start** and **Stop**.

   a **Start**: to search SCS, type, and the number of SSB automatically. Once Start is selected, the progress bar appears. If it fails to perform the auto search, a fail message appears and the SSB switches to Manual.

   b **Stop**: to set the SSB periodicity based on the base station.

8 Tap **SSB Periodicity** and select the options from **5 ms**, **10 ms**, **20 ms**, **40 ms**, **80 ms**, **160 ms**. The SS burst period (SSB periodicity) is defined by each base station and network configurable. 20 ms is the default for the initial cell selection.

9 Tap to switch **PCI (Physical Cell ID)** to **Manual** or **Auto**.

10 Tap **PCI** and input a value from 0 to 1007 using the on-screen keyboard. The PCI switches to **Manual**.

11 Tap **Gate Window Settings** and input **Slot No**, **Start Symbol No**, and **Symbol Width**.

   You can view P vs T Slot format measurement screen once you tap **P vs T Slot view**.

12 Tap **Miscellaneous** > **Symbol Phase Comp** and select from the following choices: **Auto**, **Manual**, or **Off**.

   Symbol Phase Compensation is used to compensate for phase differences between symbols caused by upconversion. Users do not always use the instrument based on RF frequency. In this case, you can set it to Manual or Off.

   – **Auto**: Setting radio frequency to center frequency
   – **Manual**: Setting radio frequency as required
   – **Off**: Setting radio frequency to 0

To set manual configuration for LTE

1 Tap the **Setup** ( ) icon > **Manual Configuration (LTE)** on the side bar.

2 Tap **Uplink-Downlink Config** then input the required value using the on-screen keyboard.

3 Tap **Special Subframe Patterns** then input the required value using the on-screen keyboard.

4 Tap **Bandwidth** and select from the options: **1.4 MHz**, **3 MHz**, **5 MHz**, **10 MHz**, **15 MHz**, or **20 MHz**.

To set the DPX marker

1 Tap the **Marker setting** ( ) icon on the side bar. The marker setting table appears.

2 Tap **DPX**.

The horizontal and vertical bars appear. A DPX marker shows the hit rate of X-axis (amplitude) and Y-axis whereas a normal trace marker shows a value of the x-axis.

3 Tap the chart screen to move the DPX marker or move the vertical bar and horizontal bar.

NOTE

If you select the DPX marker, you can only use Peak Search and Always Peak options. Delta pair is not available. See “Using marker” on page 41 for more information.

To set bitmap

1 Tap **Menu > Bitmap**.

2 Tap **Dot Persistence Time** and input a value using the on-screen keyboard. The dot persistence time represents the time that accumulates DPX data.

3 Tap to switch **Bitmap Scale** to **On** to enable auto scale or **Off** to disable auto scale. If the Bitmap Scale is On, the point where the maximum hit represents maximum colors. If the Bitmap Scale is Off, the bluer color (closer to 0% of the color bar) is mapped with a hit.

4 Tap **Bitmap Min** and input % value using the on-screen keyboard.

The Bitmap Min represents the unused bitmap color range. If you set it to 10%, the color matched with 10% or below does not show.

5 Tap **Bitmap Max** and input % value using the on-screen keyboard.

The Bitmap Max represents the maximum range of bitmap colors to be used. If you set it to 90%, the color that exceeds 90% does not show.

6 Tap **Hit Min** and input % value using the on-screen keyboard.

The Hit Min represents the minimum number of hits not to be converted to colors. If you set it to 10%, the hit matched with 10% or below is not converted to a color.

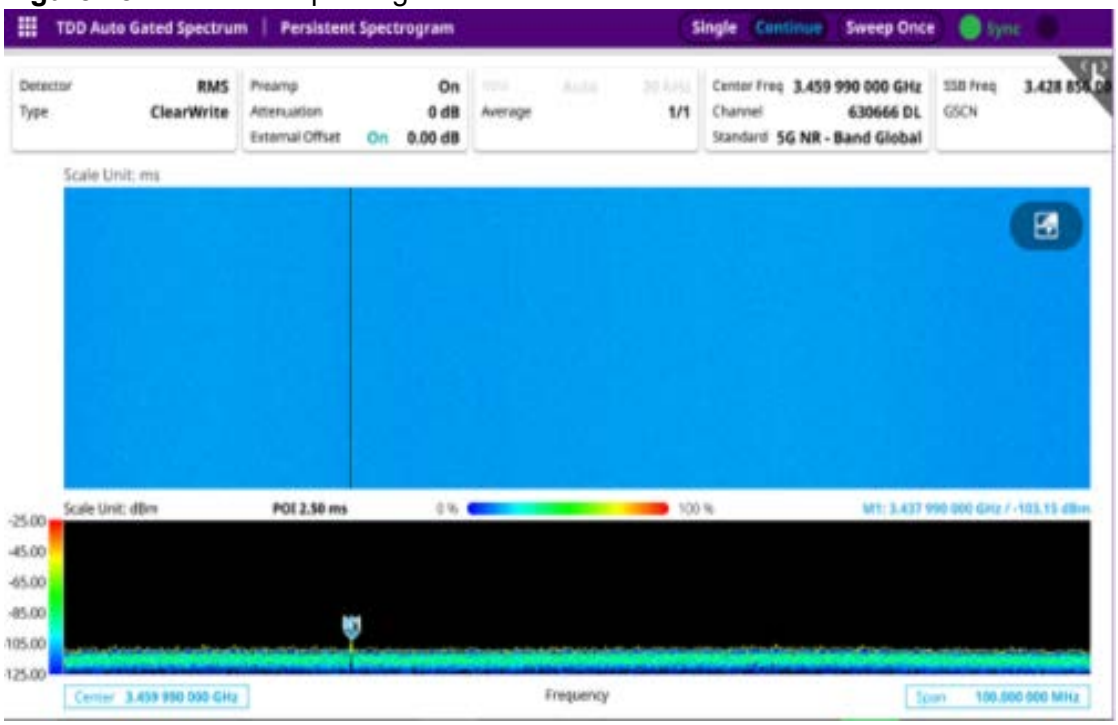
7 Tap **Hit Max** and input % value using the on-screen keyboard. The Hit Max represents the maximum number of hits to be converted to colors. If you set it to 90%, the hit matched with 90% or above shows with max colors.

NOTE

You can go to **Menu > Limit** to analyze your measurements with the reference line, multi-segment line, and channel limit table. See “Setting limit” on page 39 for more information.

Figure 78 displays a sample persistent spectrogram measurement with TAGS.

Figure 78 Persistent spectrogram measurement



NOTE

Compared to Persistent Spectrum in RTSA, Persistent Spectrum in TAGS is especially useful when tracking the level of weak interference to find interference source.

RSSI

The Received Signal Strength Indicator (RSSI) is a multi-signal tracking metric that is particularly useful for measuring power-level variations over time. The RSSI measurement lets you assign power limit line for audible alarms and increase alarm counters every time a signal exceeds a defined limit line.

After configuring spectrum measurement as described in “Configuring spectrum measurements” on page 25, you can set the measure setup to continue your measurement.

To set measure setup

1. Tap the **Setup** ( ) icon on the side bar.
2. Tap **Alarm** to set the alarm parameters.
3. Tap **Alarm at** and select the marker number from Marker 1 to Marker 6.
4. Tap **Reference Line** to set a threshold for the alarm and input a value using the on-screen keyboard.
5. Tap to switch **Alarm** to **On** or **Off** to turn the alarm feature on or off.

6 *Optional*: Tap **Volume** to adjust the volume from 1 to 10 using the on-screen keyboard.

NOTE

You must set the marker(s) for the alarm, as this feature uses the marker position to sound alarms. See “Using marker” on page 41 for more information.

NOTE

You can go to **Menu > Limit** to analyze your measurements with the Reference Line, multi-segment line, and channel limit. See “Setting limit” on page 39 for more information. Once you tap the vertical move bar and move it up and down, the reference line value changes.

To set manual configuration for NR

1 Tap the **Setup** ( ) icon > **Manual Configuration (NR)** on the side bar.

2 Tap **Bandwidth/SSB SCS** then a Setting window appears.

   a If you select the operating frequency as FR1, select from the following:
   - SCS 15 kHz: 5, 10, 15, 20, 25, 30, 40, 50 MHz
   - SCS 30 kHz: 5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 MHz

3 Tap **SSB Center Frequency** and input the value using the on-screen keyboard.

4 Tap **GSCN** and input the value using the on-screen keyboard.

5 Tap **TDD Formats** then set **Downlink Slot**, **Downlink Symbol**, **Uplink Slot**, **Uplink Symbol** as required.

6 Tap **SSB Auto Search Mode** and do the following steps:

   a Tap **Auto Preamp/Atten** and switch **SSB Auto Search** to **Start** to set preamp and attenuation automatically.

   b Tap **Manual** and switch **SSB Auto Search** to **Start** for manually setting based on your need.

7 Tap **SSB Auto Search** between **Start** and **Stop**.

   a **Start**: to search SCS, type, and the number of SSB automatically. Once Start is selected, the progress bar appears. If it fails to perform the auto search, a fail message appears and the SSB switches to Manual.

   b **Stop**: to set the SSB periodicity based on the base station.

8 Tap **SSB Periodicity** and select the options from **5 ms**, **10 ms**, **20 ms**, **40 ms**, **80 ms**, **160 ms**. The SS burst period (SSB periodicity) is defined by each base station and network configurable. 20 ms is the default for the initial cell selection.

9 Tap to switch **PCI (Physical Cell ID)** to **Manual** or **Auto**.

10 Tap **PCI** and input a value from 0 to 1007 using the on-screen keyboard. The PCI switches to **Manual**.

11 Tap **Gate Window Settings** and input **Slot No**, **Start Symbol No**, and **Symbol Width**.

You can view P vs T Slot format measurement screen once you tap **P vs T Slot view**.

12 Tap **Miscellaneous** > **Symbol Phase Comp** and select from the following choices: **Auto**, **Manual**, or **Off**.

Symbol Phase Compensation is used to compensate for phase differences between symbols caused by upconversion. Users do not always use the instrument based on RF frequency. In this case, you can set it to Manual or Off.

- **Auto**: Setting radio frequency to center frequency
- **Manual**: Setting radio frequency as required
- **Off**: Setting radio frequency to 0

To set manual configuration for LTE

1 Tap the **Setup** (⚙) icon > **Manual Configuration (LTE)** on the side bar.

2 Tap **Uplink-Downlink Config** then input the required value using the on-screen keyboard.

3 Tap **Special Subframe Patterns** then input the required value using the on-screen keyboard.

4 Tap **Bandwidth** and select from the options: **1.4 MHz**, **3 MHz**, **5 MHz**, **10 MHz**, **15 MHz**, or **20 MHz**.

Figure 79 displays a sample RSSI measurement with TAGS.

Figure 79 RSSI measurement



Interference finder

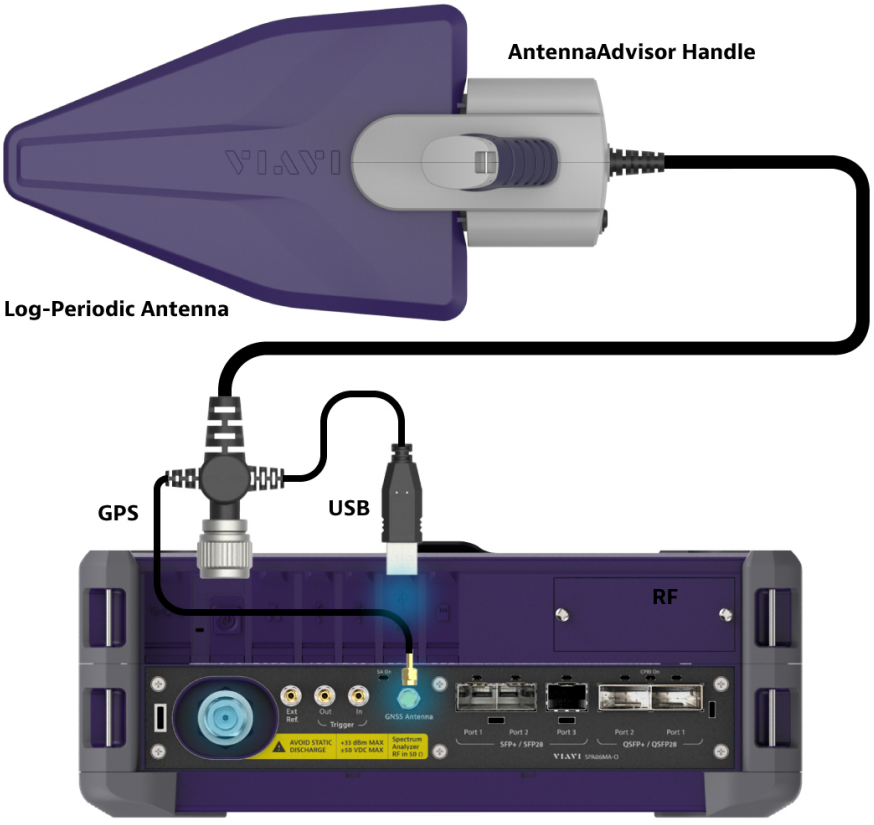
The Interference Finder is an automatic triangulation algorithm that uses GNSS coordinates to locate possible interference sources based on three measurements. The interference finder calculates possible interference locations using its inscribed circle or circumscribed circle, based on measured intersection points. You can plot up to seven measurement points and select three that are more representative for triangulation. The instrument automatically logs measurement positions not to lose them while changing measurement modes. You can switch the main screen from spectrum view to map view and vice versa using the icon on the spectrum view screen. Before starting the Persistent Interference Finder, you need to configure spectrum measurements. See “Configuring spectrum measurements” on page 25 for more information. Note that the purpose of the measurement is to monitor the intermittent and transient interfering signals.

Antenna connection

Before starting the instrument, you need to connect the Omni or Log periodic antenna to your instrument. In the Interference Finder Mode and the Radar Chart mode, you can perform interference hunting using the optional AntennaAdvisor Handle after attaching a broadband directional antenna to it. The handle is a device that has a built-in GNSS antenna and LNA.

Figure 80 shows an example of an antenna connection.

Figure 80 Antenna connection example



To connect an antenna

1 Mount a broadband antenna to your AntennaAdvisor Handle.

2 Connect the **RF Type-N Jack** of the handle to the **RF In** port of the instrument.

3 Connect the GNSS SMA jack of the handle to the GNSS port of the instrument. The GNSS status indicator appears on the instrument screen.

4 Connect the USB plug of the handle to the USB Host port of the instrument. The device icon appears in the system status bar on the screen.

NOTE

The AntennaAdvisor Handle is an optional item. It is recommended that you use a log periodic antenna with AntennaAdvisor handle to search more exact directional information. You can use a log periodic antenna or Omni antenna alone as well.

Loading a map

To use any features related to maps, you need to download and install the maps on the instrument. The **VIAVI JDMapCreator** will help you to download maps. Ensure the JDMapCreator application on your computer is connected to the instrument via LAN. You can send a map file with a single layer to the instrument directly by using the **Send to EQP** menu in JDMapCreator. For information about how to use the JDMapCreator, see the *JDMapCreator 2.0 User Guide*.

To load a map

1 Plug in your USB flash drive that has a map file in .mcfv file type created in JDMapCreator.

2 Tap the **Load** icon on the side bar,

3 Navigate to the map you want to open. The **File Information** pane displays the file properties, including name, size, type, and date modified.

4 Tap the **Load** button on the screen.

Once you have loaded the map, you can also control the map using the following icons on the map.

Table 30 Map control icons

Icon	Description
	Tap to go to your current location on the map. Once tapped, the purple icon appears on the map, indicating your current location.
	Tap to switch to the full screen map view.

Table 30 Map control icons

Icon	Description
	Tap to zoom in the map.
	Tap to zoom out the map.
	Tap and select the area where you want to expand.

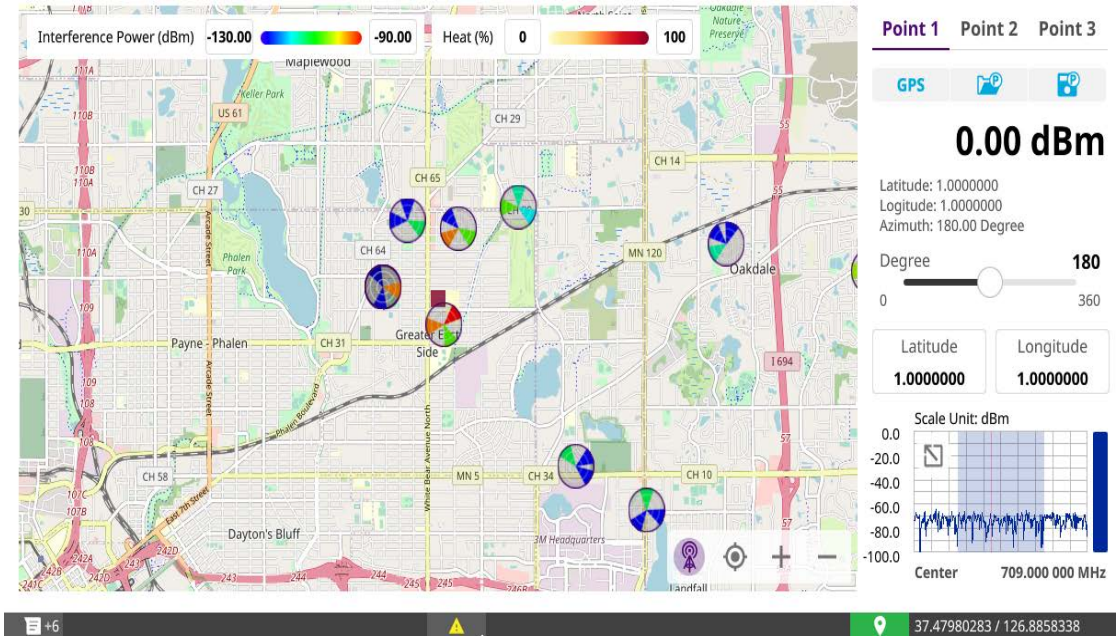
To load a JSON file from Spectrum Net Analyzer

When you load a JSON map file configured in Spectrum Net Analyzer, you can view the map with Cell Site icon, Interference Power, and Heat map (%) legend colors.

1. Plug in your USB flash drive that has a map file in .json file type created in Spectrum Net Analyzer.
2. Tap the **Load** icon on the side bar.
3. Navigate to the map you want to open. The **File Information** pane displays the file properties, including name, size, type, and date modified.
4. Tap the **Load** button on the screen.
5. Once the json file is successfully loaded, the **Cell Site** icon is enabled.

Figure 81 shows an example of the Interference Finder measurement from the JSON file loaded.

Figure 81 Interference Finder measurement from the JSON file loaded



NOTE

Based on the min/max value of the Interference Power, the cell site direction color changes, and based on the min/max value of the Heat, the heat map color changes.

Initializing AntennaAdvisor

Once you have connected the AntennaAdvisor Handle to your instrument, antenna initialization is required to get the right azimuth data. You need to initialize the antenna handle to calibrate the built-in compass by completing the following steps. Note that you can adjust Bandwidth based on the center frequency of the interfering signal that you have identified in the Spectrum view by tapping the Measure Setup > Bandwidth. A message appears at the bottom of the screen to alert you if you have not performed initialization of your connected the antenna handle set.

To initialize AntennaAdvisor

1 Hold your antenna handle horizontally in its upright position.

2 Point the antenna to the north and tap **Measure Setup > Initialize AntennaAdvisor**.

Setting geographic location

A point is a particular location that contains information about that location. This information includes, for example, GNSS coordinates, the time of the measurement or level that has been measured. You can evaluate the Point information directly on-site or save the information for later evaluation.

With this functionality, you can mark locations where you have performed a measurement. Thus, you can analyze the geographical distribution of the received signal strength. This allows you to analyze, for example, the coverage conditions around a base station's coverage area.

In the map view, a point is displayed as a dot with a number. The straight line represents the direction you are facing.

To set the geographic location

1. Tap the **Point 1**, **Point 2** and **Point 3** on the map. Make sure to set three location points so that the straight lines started from the point can create three intersections.
2. Tap each point and use the **Degree** bar or button to change degrees.
3. Tap the **GNSS** icon to automatically get the selected point’s location information.

   The instrument displays the latitude and longitude information of the signal received by the GNSS antenna. This function is only available when the GNSS antenna is connected.
4. Tap the **Latitude** and **Longitude** icon and enter the value using the on-screen keyboard to manually define a position.

   The values should be input based on the Decimal Degrees.
5. Tap the **Apply** button.

Setting azimuth

There are three methods available for setting azimuth.

Method 1: AntennaAdvisor Handle

You can use the Antenna Advisor handle. Make sure you initialize AntennaAdvisor first to get more accurate directional information.

1. Press and hold the **TRIGGER** button on the handle then it finds the strongest RSSI value.

   RSSI, polarization, elevation, and azimuth readings are continuously updated on the screen while pressing the physical button.
2. Release the **TRIGGER** button to stop scanning.

Method 2: Degree bar

The **Degree Bar** functions as a compass. You can use it to set azimuth by moving it right and left.

1. Tap the circle on the Degree bar and move it gently until you get the right azimuth.

Method 3: Log-periodic antenna

You can use the log-periodic antenna.

Pan your log-periodic antenna to find a signal with the highest RSSI value and measure an azimuth of the interfering signal.



NOTE

The AntennaAdvisor has a built-in low-noise amplifier (LNA) that can be turned on and off using the physical On/Off button located on the rear side of the handle unit. For example, if the received signal is weak, you can turn on the switch to improve S/N.

To save the defined position

1. Tap any point on the map where you want to save the position information.
2. Tap the **Save Position** icon.

   The instrument stores the saved location points in the internal memory, allowing you to load them by using the **Load Position** icon. You can save and load up to 10 positions.

Setting display mode

When the triangulation is done with three location points and azimuth for each point, you can view a circumscribed circle by default. You can change the display mode to inscribed circle or double circles to view a narrower area. The center of the green-shaded circle is determined to be where the source of the interfering signal resides.

To set display mode

1. Tap **Measure Setup > Display**.
2. Select the option from the following choices:
   - **Circum**: displays a circumscribed circle that meets three vertices of the triangle.
   - **Inscribed**: displays an inscribed circle that meets the three vertices of the triangle.
   - **Double**: displays both circumscribed and inscribed circles.
3. Tap **Measure Setup > Screen Mode**.
4. Tap the **Screen Mode** to select **Map** or **Full**.
   - **Map**: displays what is inside the base map with the map image.
   - **Full**: displays three location points and defined circle without the map image.

To set manual configuration

1. Tap the **Setup** (⚙) icon > **Manual Configuration (NR)** on the side bar.

2 Tap **Bandwidth/SSB SCS** then a Setting window appears.

   a If you select the operating frequency as FR1, select from the following:
   - SCS 15 kHz: 5, 10, 15, 20, 25, 30, 40, 50 MHz
   - SCS 30 kHz: 5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 MHz

3 Tap **SSB Center Frequency** and input the value using the on-screen keyboard.

4 Tap **GSCN** and input the value using the on-screen keyboard.

5 Tap **TDD Formats** then set **Downlink Slot**, **Downlink Symbol**, **Uplink Slot**, **Uplink Symbol** as required.

6 Tap **SSB Auto Search Mode** and do the following steps:

   a Tap **Auto Preamp/Atten** and switch **SSB Auto Search** to **Start** to set preamp and attenuation automatically.

   b Tap **Manual** and switch **SSB Auto Search** to **Start** for manually setting based on your need.

7 Tap **SSB Auto Search** between **Start** and **Stop**.

   a **Start**: to search SCS, type, and the number of SSB automatically. Once Start is selected, the progress bar appears. If it fails to perform the auto search, a fail message appears and the SSB switches to Manual.

   b **Stop**: to set the SSB periodicity based on the base station.

8 Tap **SSB Periodicity** and select the options from **5 ms**, **10 ms**, **20 ms**, **40 ms**, **80 ms**, **160 ms**. The SS burst period (SSB periodicity) is defined by each base station and network configurable. 20 ms is the default for the initial cell selection.

9 Tap to switch **PCI (Physical Cell ID)** to **Manual** or **Auto**.

10 Tap **PCI** and input a value from 0 to 1007 using the on-screen keyboard. The PCI switches to **Manual**.

11 Tap **Gate Window Settings** and input **Slot No**, **Start Symbol No**, and **Symbol Width**.

   You can view P vs T Slot format measurement screen once you tap **P vs T Slot view**.

12 Tap **Miscellaneous** > **Symbol Phase Comp** and select from the following choices: **Auto**, **Manual**, or **Off**.

   Symbol Phase Compensation is used to compensate for phase differences between symbols caused by upconversion. Users do not always use the instrument based on RF frequency. In this case, you can set it to Manual or Off.

   – **Auto**: Setting radio frequency to center frequency
   – **Manual**: Setting radio frequency as required
   – **Off**: Setting radio frequency to 0

To set manual configuration for LTE

1 Tap the **Setup** (⚙) icon > **Manual Configuration (LTE)** on the side bar.

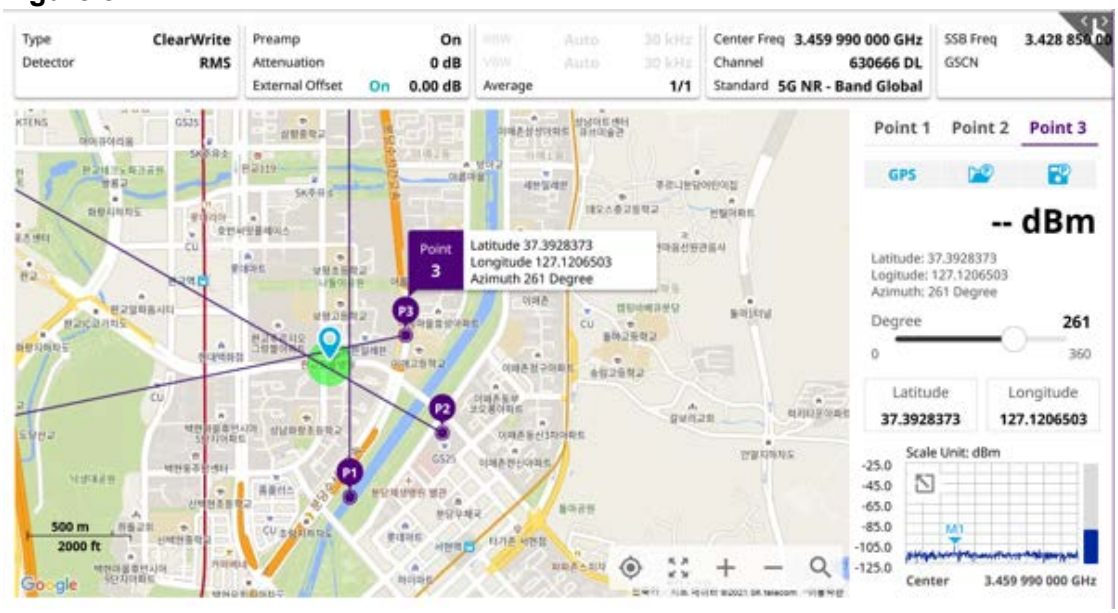
2 Tap **Uplink-Downlink Config** then input the required value using the on-screen keyboard.

3 Tap **Special Subframe Patterns** then input the required value using the on-screen keyboard.

4 Tap **Bandwidth** and select from the options: **1.4 MHz**, **3 MHz**, **5 MHz**, **10 MHz**, **15 MHz**, or **20 MHz**.

Figure 82 shows an example of the Interference Finder with TAGS.

Figure 82 Interference Finder



To make full use of the feature available in the map mode, you will need a GNSS receiver and an antenna. For more details, see “Antenna connection” below.

NOTE

If you go to Setup > Bandwidth and set the required bandwidth, you can see the light blue bar chart with bandwidth in the current spectrum measurement screen. The above figure does not show the bar as it sets the bandwidth to 0.

Radar chart

If you have identified an interfering signal on your spectrum view, you can move to the Radar Chart mode and measure RSSI power levels through 360° at a location received by the connected broadband directional antenna so that you can determine the direction of the source of the interference. Using a set of the AntennaAdvisor Handle that holds a broadband directional antenna is mandatory in the Radar Chart mode and its built-in compass, GNSS Antenna, and built-in low noise amplifier (LNA) help to determine the direction of the interference.

You can switch the Main screen from Spectrum view to Map view and vice versa using the icon on the spectrum view screen. Before starting the Interference Finder, you need to set Spectrum measurements. See “Configuring spectrum measurements” on page 25 for more information.

For antenna connection, see “Antenna connection” on page 173.

Loading a map

To use any features related to maps, you need to download and install the maps on the instrument. The **VIAVI JDMapCreator** will help you to download maps. Ensure the JDMapCreator application on your computer is connected to the instrument via LAN. You can send a map file with a single layer to the instrument directly by using the **Send to EQP** menu in JDMapCreator. For information about how to use the JDMapCreator, see the *JDMapCreator 2.0 User Guide*.

To load a map

1. Plug in your USB flash drive that has a map file in .mcfv file type created in JDMapCreator.
2. Tap the **Load** icon on the side bar.
3. Navigate to the map you want to open. The **File Information** pane displays the file properties, including name, size, type, and date modified.
4. Tap the **Load** button on the screen.

Once you have loaded the map, you can also control the map using the following icons on the map.

Table 31 Map control icons

Icon	Description
	Tap to go to your current location on the map. Once tapped, the purple icon appears on the map, indicating your current location.
	Tap to switch to the full screen map view.
	Tap to zoom in the map.
	Tap to zoom out the map.
	Tap and select the area where you want to expand.

To load a JSON file from Spectrum Net Analyzer

When you load a JSON map file configured in Spectrum Net Analyzer, you can view the map with Cell Site icon, Interference Power, and Heat map (%) legend colors.

1 Plug in your USB flash drive that has a map file in .json file type created in Spectrum Net Analyzer.

2 Tap the **Load** icon on the side bar.

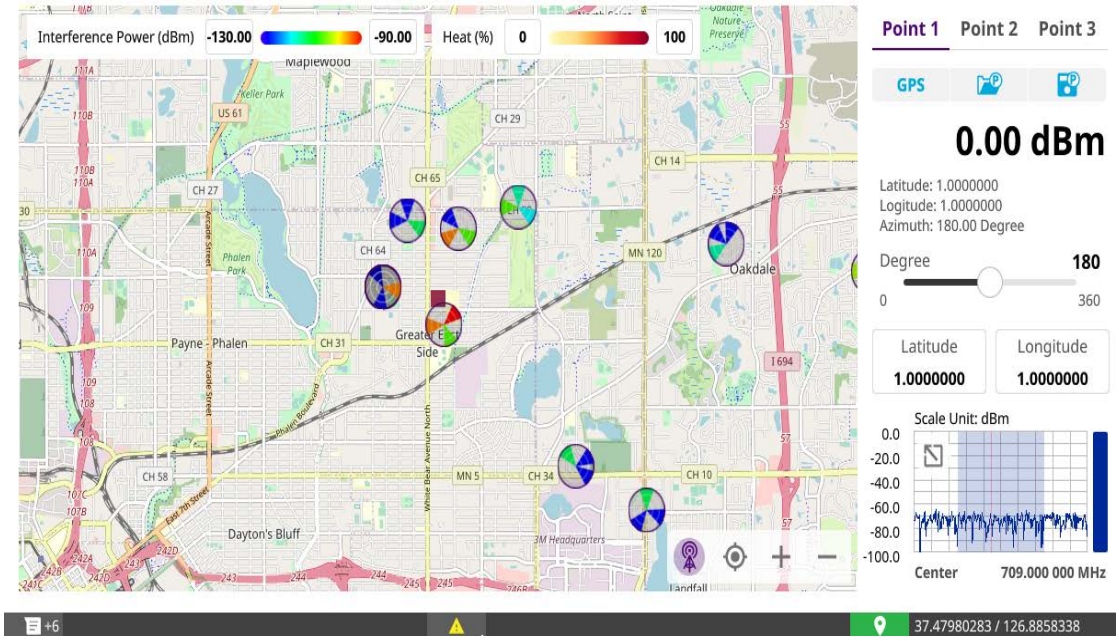
3 Navigate to the map you want to open. The **File Information** pane displays the file properties, including name, size, type, and date modified.

4 Tap the **Load** button on the screen.

5 Once the json file is successfully loaded, the **Cell Site** icon is enabled.

Figure 83 shows an example of the Radar Chart measurement from the JSON file loaded.

Figure 83 Radar Chart measurement from the JSON file loaded



NOTE

Based on the min/max value of the Interference Power, the cell site direction color changes, and based on the min/max value of the Heat, the heat map color changes.

Initializing AntennaAdvisor

Once you have connected the AntennaAdvisor Handle to your instrument, antenna initialization is required to get the right azimuth data. You need to initialize the antenna handle to calibrate the built-in compass by completing the following steps. Note that you can adjust Bandwidth based on the center frequency of the interfering signal that you have identified in the Spectrum view by tapping the Setup > Bandwidth. A message

appears at the bottom of the screen to alert you if you have not performed initialization of your connected the antenna handle set.

To initialize AntennaAdvisor

1. Hold your antenna handle horizontally in its upright position.

   To avoid unnecessary impact of external magnetic field, position yourself at the location where the value of magnetic field strength displayed on the instrument is green.

2. Point the antenna to the north and tap **Measure Setup > Initialize AntennaAdvisor**.

   The message disappears and the red line for the current antenna direction moves to the 0° line and overlaps to let you know that the initialization is done successfully.



NOTE

It is recommended that you re-initialize the AntennaAdvisor Handle after measurements to re-calibrate the compass when you notice that the red line on the radar chart is not aligned with the north on the map even though you are pointing the antenna to the north.

Obtaining RSSI and direction data

Once you have connected your antenna handle set and done necessary setups, you can monitor the power level of the received signal, the amount of polarization, and elevation level real time. Using the Trigger button on the antenna handle set, you can plot the RSSI level and obtain current direction of antenna at your location.

To obtain RSSI and direction data

1. When you have the green GNSS indicator, tap the **GNSS** icon on the side panel to set your current location to the center of the radar chart. The latitude and longitude information at the side of the display changes from “Unknown Position” to the obtained position information.
2. Tap the **Save Position** icon on the side panel to save a position to recall for triangulation in the Interference Finder mode and select one that you want to save.
3. Monitor the RSSI reading of the received signal. If the signal is weak, turn on the LNA switch on the antenna handle set to improve S/N.



NOTE

The AntennaAdvisor Handle has a built-in low-noise amplifier (LNA) and you can turn it on and off by toggling the physical On/Off switch located on the rear side of the handle unit

4. Hold the antenna handle set horizontally and make the measurement.

The message disappears and the red line for the current antenna direction moves to the 0° line and overlaps to let you know that the initialization is done successfully.

5 To obtain RSSI value and direction:

a Press the **Trigger** button located on the antenna handle.

Each time you press the physical button on the handle, a beep sounds and a power level of the received signal is plotted as a blue dot on the radar chart. Depending on the strength of the measured value, you may hear different tones of beeping.

b While receiving the power level, you can also obtain the current direction of the antenna. Repeat pressing the **TRIGGER** button to obtain at least five points if you want to do the localization.

6 To continuously obtain RSSI values and direction:

a Press and hold the **TRIGGER** button located on the antenna handle to start a continuous measurement.

b A beep is sounded repeatedly to let you know that the measurement is continuing and measured values are plotted and lined on the radar chart.

c Release the **TRIGGER** button to stop the continuous measurement.



NOTE

The maximum number you can plot on the radar chart is 2500 points both in the single and continuous measurements. If your measurement reaches 2500 points, you need to reset the measurement by pressing the Localization soft key twice or performing the initialization of the AntennaAdvisor Handle. Concentric circles indicate different levels of RSSI. You can use the AMP/SCALE hard key to adjust the amplitude scale of the chart.

7 Tap **Setup** > **Screen Mode Full/Map** to change the display mode.

a **Map**: Displays measured points inside the base map image. If you are in the area outside the base map and continue your measurement with the Trigger button, the instrument continues obtaining data even though the radar chart disappears from the screen. You can view obtained data when you change this display option to Full.

b **Full**: Displays measured points without the base map image. In case that you made measurements in the area outside the map image, selecting this option moves your measured data to the center of the display so that you can view the result.

Localizing RSSI data

The Localization feature lets you view averaged and smoothed measurement data with a bold green line on the radar chart that helps you determine the direction of the highest RSSI value. When you have five or more data points plotted on the radar chart, you can perform this localization.

To localize RSSI data

1 Tap the Setup ( ) icon on the side bar.

2 Tap **Localization**. All the measured points turn to green color and you can view the bold green line that indicates the possible direction of the interference source.

3 Tap **Localization** again to clear all the data plots on the radar chart.

To set manual configuration for NR

1 Tap the **Setup** ( ) icon > **Manual Configuration (NR)** on the side bar.

2 Tap **Bandwidth/SSB SCS** then a Setting window appears.

   a If you select the operating frequency as FR1, select from the following:
   - SCS 15 kHz: 5, 10, 15, 20, 25, 30, 40, 50 MHz
   - SCS 30 kHz: 5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 MHz

3 Tap **SSB Center Frequency** and input the value using the on-screen keyboard.

4 Tap **GSCN** and input the value using the on-screen keyboard.

5 Tap **TDD Formats** then set **Downlink Slot**, **Downlink Symbol**, **Uplink Slot**, **Uplink Symbol** as required.

6 Tap **SSB Auto Search Mode** and do the following steps:

   a Tap **Auto Preamp/Atten** and switch **SSB Auto Search** to **Start** to set preamp and attenuation automatically.

   b Tap **Manual** and switch **SSB Auto Search** to **Start** for manually setting based on your need.

7 Tap **SSB Auto Search** between **Start** and **Stop**.

   a **Start**: to search SCS, type, and the number of SSB automatically. Once Start is selected, the progress bar appears. If it fails to perform the auto search, a fail message appears and the SSB switches to Manual.

   b **Stop**: to set the SSB periodicity based on the base station.

8 Tap **SSB Periodicity** and select the options from **5 ms**, **10 ms**, **20 ms**, **40 ms**, **80 ms**, **160 ms**. The SS burst period (SSB periodicity) is defined by each base station and network configurable. 20 ms is the default for the initial cell selection.

9 Tap to switch **PCI (Physical Cell ID)** to **Manual** or **Auto**.

10 Tap **PCI** and input a value from 0 to 1007 using the on-screen keyboard. The PCI switches to **Manual**.

11 Tap **Gate Window Settings** and input **Slot No**, **Start Symbol No**, and **Symbol Width**.

   You can view P vs T Slot format measurement screen once you tap **P vs T Slot view**.

12 Tap **Miscellaneous** > **Symbol Phase Comp** and select from the following choices: **Auto**, **Manual**, or **Off**.

Symbol Phase Compensation is used to compensate for phase differences between symbols caused by upconversion. Users do not always use the instrument based on RF frequency. In this case, you can set it to Manual or Off.

– **Auto**: Setting radio frequency to center frequency
– **Manual**: Setting radio frequency as required
– **Off**: Setting radio frequency to 0

To set manual configuration for LTE

1 Tap the **Setup** ( ) icon > **Manual Configuration (LTE)** on the side bar.

2 Tap **Uplink-Downlink Config** then input the required value using the on-screen keyboard.

3 Tap **Special Subframe Patterns** then input the required value using the on-screen keyboard.

4 Tap **Bandwidth** and select from the options: **1.4 MHz**, **3 MHz**, **5 MHz**, **10 MHz**, **15 MHz**, or **20 MHz**.

Figure 84 shows an example of the Radar Chart with TAGS.

Figure 84 Radar Chart



Spectrum replayer

The TDD Auto Gated Spectrum Replayer allows you to retrieve and replay recorded spectrum or real-time spectrum analyzer traces in interference analysis mode. The spectrum analyzer traces can be played back in the spectrum, spectrogram or RSSI and the real-time spectrum analyzer traces can be played back in persistent spectrum and persistent spectrogram. You can configure the limit line to create failure points when signals exceed it. The failure points are clearly displayed on the trace timeline for quick access during playback.

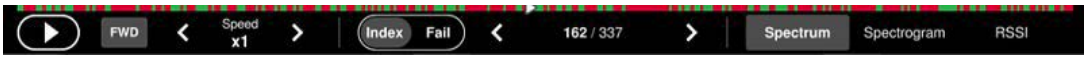
To replay a spectrum

1 Tap the **Setup** ( ) icon on the side bar.

2 Tap **Spectrum Replayer**. The **File Manager** window appears.

3 Select a file to be loaded and then tap **Load**. The replay bar appears on the bottom of the screen, as shown in Figure 85.

Figure 85 Replay bar



4 Tap **Play** to start playing.

5 Tap **FWD** or **REV** to change play direction to forward or reverse.

6 Tap the left or right arrow of **Speed** to select the speed option: **X1**, **X2**, **X3**, or **X4**.

7 Tap **Pause** to pause or stop playing data.

8 To move to a particular failure position directly and play from there, tap **Fail** on the **Index/Fail** switch and enter a value by using the on-screen keyboard.

9 Tap to change display mode to **spectrum**, **spectrogram**, or **RSSI**.

3D display (Waterfall) is not supported in case of spectrogram logging.

10 *Optional*: Tap **Setup > Time Cursor On/Off** to display or dismiss the time cursor on the screen. This key becomes activated when you play logged data in the Spectrogram mode.

NOTE

If you connect a USB drive, do not remove it while playing to prevent freezing the USB port, which will require you to restart the instrument to get a USB drive recognized again.

Online interference analysis

The following sections describe how to conduct online interference measurements for manual configuration.

Online interference finder

The Online Interference Finder is an automatic triangulation algorithm that uses GNSS coordinates to locate possible interference sources based on three measurements. The online interference finder calculates possible interference locations using its inscribed circle or circumscribed circle, based on measured intersection points. You can plot up to seven measurement points and select three that are more representative for triangulation. The instrument automatically logs measurement positions not to lose them while changing measurement modes.

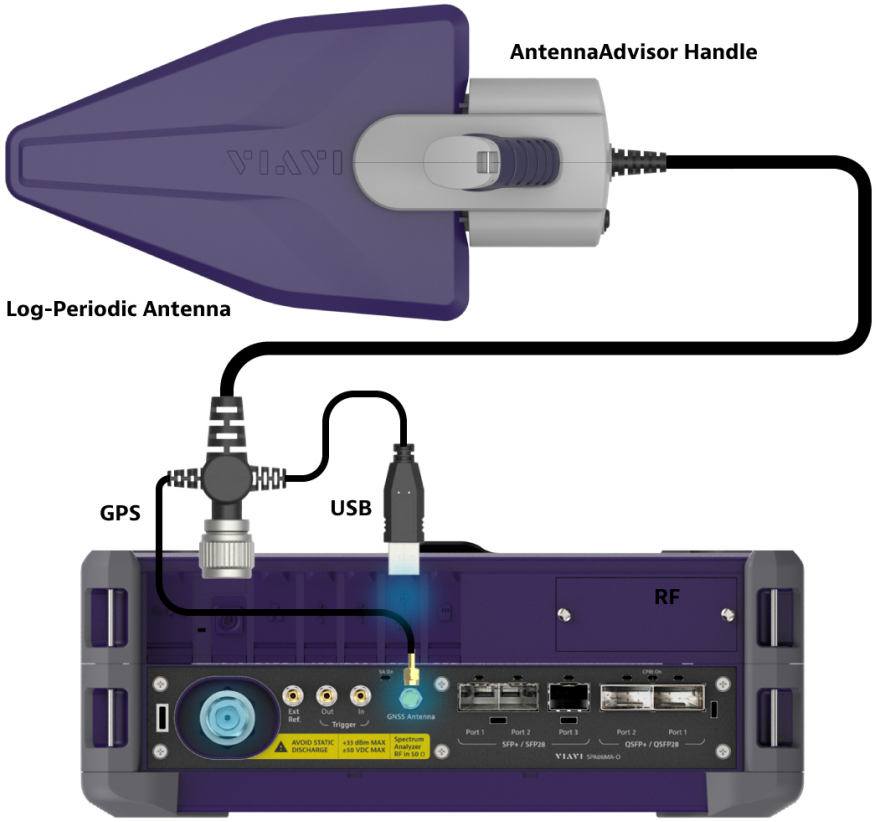
Before starting the online Interference Finder, you need to configure spectrum measurements. See “Configuring spectrum measurements” on page 25 for more information. Note that the purpose of the measurement is to monitor the intermittent and transient interfering signals.

Antenna connection

Before starting the instrument, you need to connect the Omni or Log periodic antenna to your instrument. In the Interference Finder Mode and the Radar Chart mode, you can perform interference hunting using the optional AntennaAdvisor Handle after attaching a broadband directional antenna to it. The handle is a device that has a built-in GNSS antenna and LNA.

Figure 86 shows an example of an antenna connection.

Figure 86 Antenna connection example



To connect an antenna

1. Mount a broadband antenna to your AntennaAdvisor Handle.
2. Connect the **RF Type-N Jack** of the handle to the **RF In** port of the instrument.
3. Connect the GNSS SMA jack of the handle to the GNSS port of the instrument. The GNSS status indicator appears on the instrument screen.

4 Connect the USB plug of the handle to the USB Host port of the instrument. The device icon appears in the system status bar on the screen.

NOTE

The AntennaAdvisor Handle is an optional item. It is recommended that you use a log periodic antenna with AntennaAdvisor handle to search more exact directional information. You can use a log periodic antenna or Omni antenna alone as well.

Controlling a map

To control a map

See the following table to control a map.

Table 32 Map control icons

Icon	Description
	Tap to go to your current location on the map. Once tapped, the purple icon appears on the map, indicating your current location.
	Tap to zoom in the map.
	Tap to zoom out the map.

To load a JSON file from Spectrum Net Analyzer

When you load a JSON map file configured in Spectrum Net Analyzer, you can view the map with Cell Site icon, Interference Power, and Heat map (%) legend colors.

1 Plug in your USB flash drive that has a map file in .json file type created in Spectrum Net Analyzer.

2 Tap the **Load** icon on the side bar.

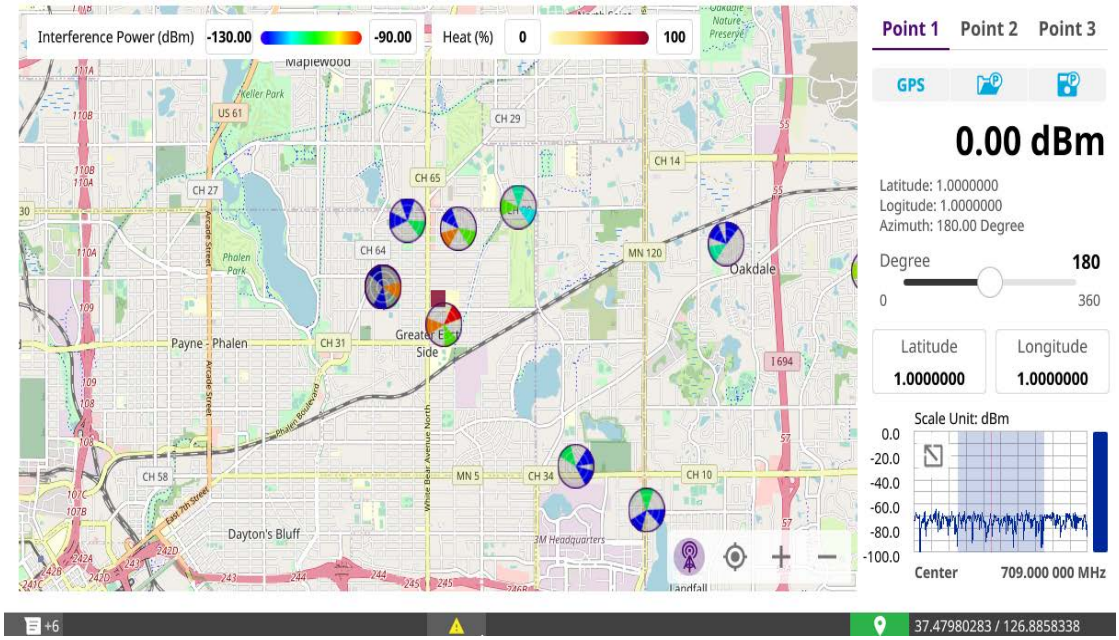
3 Navigate to the map you want to open. The **File Information** pane displays the file properties, including name, size, type, and date modified.

4 Tap the **Load** button on the screen.

5 Once the json file is successfully loaded, the **Cell Site** icon is enabled.

Figure 87 shows an example of the Online Interference Finder measurement from the JSON file loaded.

Figure 87 Online Interference Finder measurement from the JSON file loaded



NOTE

Based on the min/max value of the Interference Power, the cell site direction color changes, and based on the min/max value of the Heat, the heat map color changes.

Initializing AntennaAdvisor

Once you have connected the AntennaAdvisor Handle to your instrument, antenna initialization is required to get the right azimuth data. You need to initialize the antenna handle to calibrate the built-in compass by completing the following steps. Note that you can adjust Bandwidth based on the center frequency of the interfering signal that you have identified in the Spectrum view by tapping the Measure Setup > Bandwidth. A message appears at the bottom of the screen to alert you if you have not performed initialization of your connected the antenna handle set.

To initialize AntennaAdvisor

1 Hold your antenna handle horizontally in its upright position.

2 Point the antenna to the north and tap **Measure Setup > Initialize AntennaAdvisor**.

Setting geographic location

A point is a particular location that contains information about that location. This information includes, for example, GNSS coordinates, the time of the measurement or level that has been measured. You can evaluate the Point information directly on-site or save the information for later evaluation.

With this functionality, you can mark locations where you have performed a measurement. Thus, you can analyze the geographical distribution of the received signal strength. This allows you to analyze, for example, the coverage conditions around a base station's coverage area.

In the map view, a point is displayed as a dot with a number. The straight line represents the direction you are facing.

To set the geographic location

1. Tap the **Point 1**, **Point 2** and **Point 3** on the map. Make sure to set three location points so that the straight lines started from the point can create three intersections.
2. Tap each point and use the **Degree** bar or button to change degrees.
3. Tap the **GNSS** icon to automatically get the selected point’s location information.

   The instrument displays the latitude and longitude information of the signal received by the GNSS antenna. This function is only available when the GNSS antenna is connected.
4. Tap the **Latitude** and **Longitude** icon and enter the value using the on-screen keyboard to manually define a position.

   The values should be input based on the Decimal Degrees.
5. Tap the **Apply** button.

Setting azimuth

There are three methods available for setting azimuth.

Method 1: AntennaAdvisor Handle

You can use the Antenna Advisor handle. Make sure you initialize AntennaAdvisor first to get more accurate directional information.

1. Press and hold the **TRIGGER** button on the handle then it finds the strongest RSSI value.

   RSSI, polarization, elevation, and azimuth readings are continuously updated on the screen while pressing the physical button.
2. Release the **TRIGGER** button to stop scanning.

Method 2: Degree bar

The **Degree Bar** functions as a compass. You can use it to set azimuth by moving it right and left.

1. Tap the circle on the Degree bar and move it gently until you get the right azimuth.

Method 3: Log-periodic antenna

You can use the log-periodic antenna.

Pan your log-periodic antenna to find a signal with the highest RSSI value and measure an azimuth of the interfering signal.



NOTE

The AntennaAdvisor has a built-in low-noise amplifier (LNA) that can be turned on and off using the physical On/Off button located on the rear side of the handle unit. For example, if the received signal is weak, you can turn on the switch to improve S/N.

To save the defined position

1. Tap any point on the map where you want to save the position information.
2. Tap the **Save Position** icon.

   The instrument stores the saved location points in the internal memory, allowing you to load them by using the **Load Position** icon. You can save and load up to 10 positions.

Setting display mode

When the triangulation is done with three location points and azimuth for each point, you can view a circumscribed circle by default. You can change the display mode to inscribed circle or double circles to view a narrower area. The center of the green-shaded circle is determined to be where the source of the interfering signal resides.

To set display mode

1. Tap **Measure Setup > Display**.
2. Select the option from the following choices:
   - **Circum**: displays a circumscribed circle that meets three vertices of the triangle.
   - **Inscribed**: displays an inscribed circle that meets the three vertices of the triangle.
   - **Double**: displays both circumscribed and inscribed circles.

To set manual configuration

1. Tap the **Setup** (⚙) icon > **Manual Configuration (NR)** on the side bar.
2. Tap **Bandwidth/SSB SCS** then a Setting window appears.
   - **a** If you select the operating frequency as FR1, select from the following:
     - SCS 15 kHz: 5, 10, 15, 20, 25, 30, 40, 50 MHz
     - SCS 30 kHz: 5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 MHz

3 Tap **SSB Center Frequency** and input the value using the on-screen keyboard.

4 Tap **GSCN** and input the value using the on-screen keyboard.

5 Tap **TDD Formats** then set **Downlink Slot**, **Downlink Symbol**, **Uplink Slot**, **Uplink Symbol** as required.

6 Tap **SSB Auto Search Mode** and do the following steps:

   a Tap **Auto Preamp/Atten** and switch **SSB Auto Search** to **Start** to set preamp and attenuation automatically.

   b Tap **Manual** and switch **SSB Auto Search** to **Start** for manually setting based on your need.

7 Tap **SSB Auto Search** between **Start** and **Stop**.

   a **Start**: to search SCS, type, and the number of SSB automatically. Once Start is selected, the progress bar appears. If it fails to perform the auto search, a fail message appears and the SSB switches to Manual.

   b **Stop**: to set the SSB periodicity based on the base station.

8 Tap **SSB Periodicity** and select the options from **5 ms**, **10 ms**, **20 ms**, **40 ms**, **80 ms**, **160 ms**. The SS burst period (SSB periodicity) is defined by each base station and network configurable. 20 ms is the default for the initial cell selection.

9 Tap to switch **PCI (Physical Cell ID)** to **Manual** or **Auto**.

10 Tap **PCI** and input a value from 0 to 1007 using the on-screen keyboard. The PCI switches to **Manual**.

11 Tap **Gate Window Settings** and input **Slot No**, **Start Symbol No**, and **Symbol Width**.

   You can view P vs T Slot format measurement screen once you tap **P vs T Slot view**.

12 Tap **Miscellaneous** > **Symbol Phase Comp** and select from the following choices: **Auto**, **Manual**, or **Off**.

   Symbol Phase Compensation is used to compensate for phase differences between symbols caused by upconversion. Users do not always use the instrument based on RF frequency. In this case, you can set it to Manual or Off.

   – **Auto**: Setting radio frequency to center frequency
   – **Manual**: Setting radio frequency as required
   – **Off**: Setting radio frequency to 0

To set manual configuration for LTE

1 Tap the **Setup** (⚙) icon > **Manual Configuration (LTE)** on the side bar.

2 Tap **Uplink-Downlink Config** then input the required value using the on-screen keyboard.

3 Tap **Special Subframe Patterns** then input the required value using the on-screen keyboard.

4 Tap **Bandwidth** and select from the options: **1.4 MHz**, **3 MHz**, **5 MHz**, **10 MHz**, **15 MHz**, or **20 MHz**.

Creating a map

You can create a map online and continue conducting a route map analysis using the created map even when there is no Ethernet connection.

1 Tap **Setup** > **Map Creator**.

2 Tap the **Search** box and input the location using the on-screen keyboard and select one of the options as required.

3 Tap the **Zoom Level** box to capture the map with corresponding zoom level.

4 Tap the **Capture** button to start capturing the map.

Once the map is captured, the capturing completed pop-up will appear.

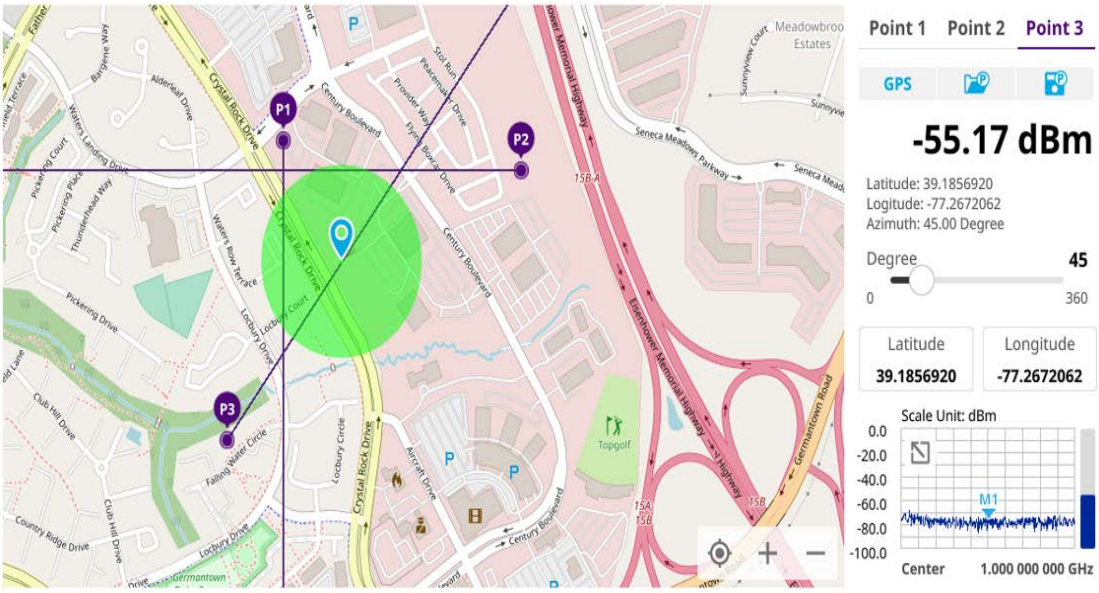
5 Select between the two options: Save in the system or Save as file.

6 Tap the **Done** button.

NOTE
If you have unsaved measurement data (map) and start measuring by tapping the Testing button or by tapping another measurement mode, a pop-up window will appear asking whether you will restore the unsaved data or not.

Figure 88 shows an example of the Online Interference Finder with TAGS.

Figure 88 Online Interference Finder



To make full use of the feature available in the map mode, you will need a GNSS receiver and an antenna. For more details, see “Antenna connection” below.

NOTE
If you go to Setup > Bandwidth and set the required bandwidth, you can see the light blue bar chart with bandwidth in the current spectrum measurement screen. The above figure does not show the bar as it sets the bandwidth to 0.

Online radar chart

If you have identified an interfering signal on your spectrum view, you can move to the Radar Chart mode and measure RSSI power levels through 360° at a location received by the connected broadband directional antenna so that you can determine the direction of the source of the interference. Using a set of the AntennaAdvisor Handle that holds a broadband directional antenna is mandatory in the Radar Chart mode and its built-in compass, GNSS Antenna, and built-in low noise amplifier (LNA) help to determine the direction of the interference.

Before starting the Interference Finder, you need to set Spectrum measurements. See “Configuring spectrum measurements” on page 25 for more information.

For antenna connection, see “Antenna connection” on page 173.

Controlling a map

To control a map

See the following table to control a map.

Table 33 Map control icons

Icon	Description
	Tap to go to your current location on the map. Once tapped, the purple icon appears on the map, indicating your current location.
	Tap to zoom in the map.
	Tap to zoom out the map.

To load a JSON file from Spectrum Net Analyzer

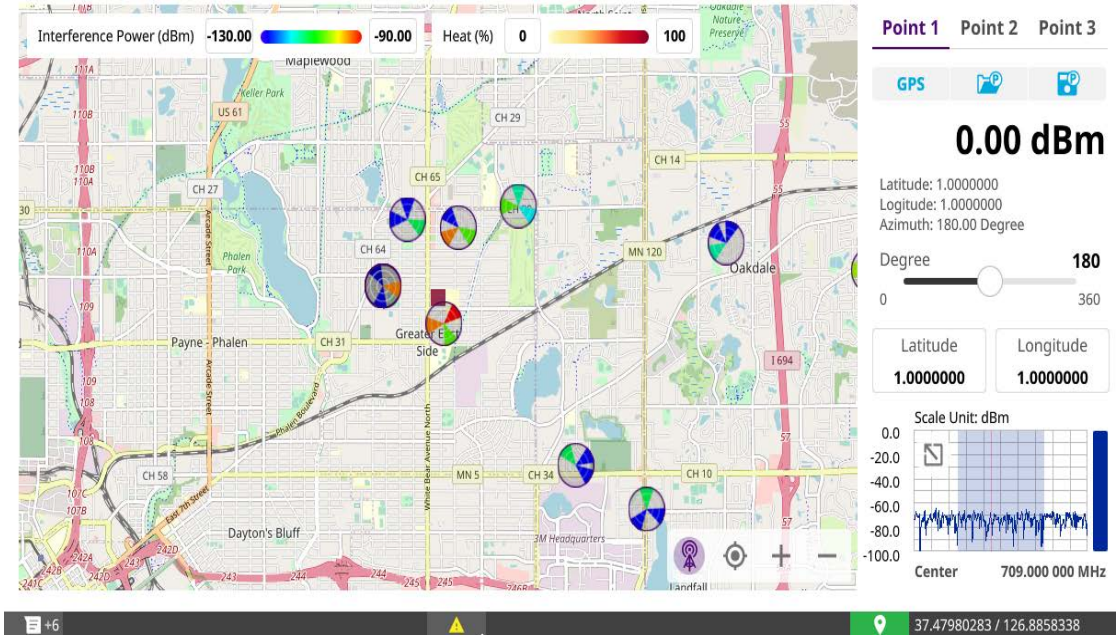
When you load a JSON map file configured in Spectrum Net Analyzer, you can view the map with Cell Site icon, Interference Power, and Heat map (%) legend colors.

1. Plug in your USB flash drive that has a map file in .json file type created in Spectrum Net Analyzer.
2. Tap the **Load** icon on the side bar.
3. Navigate to the map you want to open. The **File Information** pane displays the file properties, including name, size, type, and date modified.
4. Tap the **Load** button on the screen.

5 Once the json file is successfully loaded, the **Cell Site** icon is enabled.

Figure 89 shows an example of the Online Radar Chart measurement from the JSON file loaded.

Figure 89 Online Radar Chart measurement from the JSON file loaded



NOTE

Based on the min/max value of the Interference Power, the cell site direction color changes, and based on the min/max value of the Heat, the heat map color changes.

Initializing AntennaAdvisor

Once you have connected the AntennaAdvisor Handle to your instrument, antenna initialization is required to get the right azimuth data. You need to initialize the antenna handle to calibrate the built-in compass by completing the following steps. Note that you can adjust Bandwidth based on the center frequency of the interfering signal that you have identified in the Spectrum view by tapping the Setup > Bandwidth. A message appears at the bottom of the screen to alert you if you have not performed initialization of your connected the antenna handle set.

To initialize AntennaAdvisor

1 Hold your antenna handle horizontally in its upright position.

To avoid unnecessary impact of external magnetic field, position yourself at the location where the value of magnetic field strength displayed on the instrument is green.

2 Point the antenna to the north and tap **Measure Setup > Initialize AntennaAdvisor**.

The message disappears and the red line for the current antenna direction moves to the 0° line and overlaps to let you know that the initialization is done successfully.

NOTE

It is recommended that you re-initialize the AntennaAdvisor Handle after measurements to re-calibrate the compass when you notice that the red line on the radar chart is not aligned with the north on the map even though you are pointing the antenna to the north.

Obtaining RSSI and direction data

Once you have connected your antenna handle set and done necessary setups, you can monitor the power level of the received signal, the amount of polarization, and elevation level real time. Using the Trigger button on the antenna handle set,you can plot the RSSI level and obtain current direction of antenna at your location.

To obtain RSSI and direction data

1. When you have the green GNSS indicator, tap the **GNSS** icon on the side panel to set your current location to the center of the radar chart. The latitude and longitude information at the side of the display changes from “Unknown Position” to the obtained position information.
2. Tap the **Save Position** icon on the side panel to save a position to recall for triangulation in the Interference Finder mode and select one that you want to save.
3. Monitor the RSSI reading of the received signal. If the signal is weak, turn on the LNA switch on the antenna handle set to improve S/N.

NOTE

The AntennaAdvisor Handle has a built-in low-noise amplifier (LNA) and you can turn it on and off by toggling the physical On/Off switch located on the rear side of the handle unit

4. Hold the antenna handle set horizontally and make the measurement.

   The message disappears and the red line for the current antenna direction moves to the 0° line and overlaps to let you know that the initialization is done successfully.
5. To obtain RSSI value and direction:
   a. Press the **Trigger** button located on the antenna handle.

      Each time you press the physical button on the handle, a beep sounds and a power level of the received signal is plotted as a blue dot on the radar chart. Depending on the strength of the measured value, you may hear different tones of beeping.

   b. While receiving the power level, you can also obtain the current direction of the antenna. Repeat pressing the **TRIGGER** button to obtain at least five points if you want to do the localization.

6 To continuously obtain RSSI values and direction:

   a Press and hold the **TRIGGER** button located on the antenna handle to start a continuous measurement.

   b A beep is sounded repeatedly to let you know that the measurement is continuing and measured values are plotted and lined on the radar chart.

   c Release the **TRIGGER** button to stop the continuous measurement.



NOTE

The maximum number you can plot on the radar chart is 2500 points both in the single and continuous measurements. If your measurement reaches 2500 points, you need to reset the measurement by pressing the Localization soft key twice or performing the initialization of the AntennaAdvisor Handle. Concentric circles indicate different levels of RSSI. You can use the AMP/SCALE hard key to adjust the amplitude scale of the chart.

Localizing RSSI data

The Localization feature lets you view averaged and smoothed measurement data with a bold green line on the radar chart that helps you determine the direction of the highest RSSI value. When you have five or more data points plotted on the radar chart, you can perform this localization.

To localize RSSI data

1 Tap the Setup ( ) icon on the side bar.

2 Tap **Localization**. All the measured points turn to green color and you can view the bold green line that indicates the possible direction of the interference source.

3 Tap **Localization** again to clear all the data plots on the radar chart.

To set manual configuration for NR

1 Tap the **Setup** ( ) icon > **Manual Configuration (NR)** on the side bar.

2 Tap **Bandwidth/SSB SCS** then a Setting window appears.

   a If you select the operating frequency as FR1, select from the following:

   - SCS 15 kHz: 5, 10, 15, 20, 25, 30, 40, 50 MHz
   - SCS 30 kHz: 5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 MHz

3 Tap **SSB Center Frequency** and input the value using the on-screen keyboard.

4 Tap **GSCN** and input the value using the on-screen keyboard.

5 Tap **TDD Formats** then set **Downlink Slot**, **Downlink Symbol**, **Uplink Slot**, **Uplink Symbol** as required.

6 Tap **SSB Auto Search Mode** and do the following steps:

   a Tap **Auto Preamp/Atten** and switch **SSB Auto Search** to **Start** to set preamp and attenuation automatically.

   b Tap **Manual** and switch **SSB Auto Search** to **Start** for manually setting based on your need.

7 Tap **SSB Auto Search** between **Start** and **Stop**.

   a **Start**: to search SCS, type, and the number of SSB automatically. Once Start is selected, the progress bar appears. If it fails to perform the auto search, a fail message appears and the SSB switches to Manual.

   b **Stop**: to set the SSB periodicity based on the base station.

8 Tap **SSB Periodicity** and select the options from **5 ms**, **10 ms**, **20 ms**, **40 ms**, **80 ms**, **160 ms**. The SS burst period (SSB periodicity) is defined by each base station and network configurable. 20 ms is the default for the initial cell selection.

9 Tap to switch **PCI (Physical Cell ID)** to **Manual** or **Auto**.

10 Tap **PCI** and input a value from 0 to 1007 using the on-screen keyboard. The PCI switches to **Manual**.

11 Tap **Gate Window Settings** and input **Slot No**, **Start Symbol No**, and **Symbol Width**.

   You can view P vs T Slot format measurement screen once you tap **P vs T Slot view**.

12 Tap **Miscellaneous** > **Symbol Phase Comp** and select from the following choices: **Auto**, **Manual**, or **Off**.

   Symbol Phase Compensation is used to compensate for phase differences between symbols caused by upconversion. Users do not always use the instrument based on RF frequency. In this case, you can set it to Manual or Off.

   – **Auto**: Setting radio frequency to center frequency
   – **Manual**: Setting radio frequency as required
   – **Off**: Setting radio frequency to 0

To set manual configuration for LTE

1 Tap the **Setup** ( ) icon > **Manual Configuration (LTE)** on the side bar.

2 Tap **Uplink-Downlink Config** then input the required value using the on-screen keyboard.

3 Tap **Special Subframe Patterns** then input the required value using the on-screen keyboard.

4 Tap **Bandwidth** and select from the options: **1.4 MHz**, **3 MHz**, **5 MHz**, **10 MHz**, **15 MHz**, or **20 MHz**.

Creating a map

You can create a map online and continue conducting a route map analysis using the created map even when there is no Ethernet connection.

1 Tap **Setup** > **Map Creator**.

2 Tap the **Search** box and input the location using the on-screen keyboard and select one of the options as required.

3 Tap the **Zoom Level** box to capture the map with corresponding zoom level.

4 Tap the **Capture** button to start capturing the map.
Once the map is captured, the capturing completed pop-up will appear.

5 Select between the two options: Save in the system or Save as file.

6 Tap the **Done** button.

NOTE
If you have unsaved measurement data (map) and start measuring by tapping the Testing button or by tapping another measurement mode, a pop-up window will appear asking whether you will restore the unsaved data or not.

Figure 90 shows an example of the Online Radar Chart with TAGS.

Figure 90 Online Radar Chart

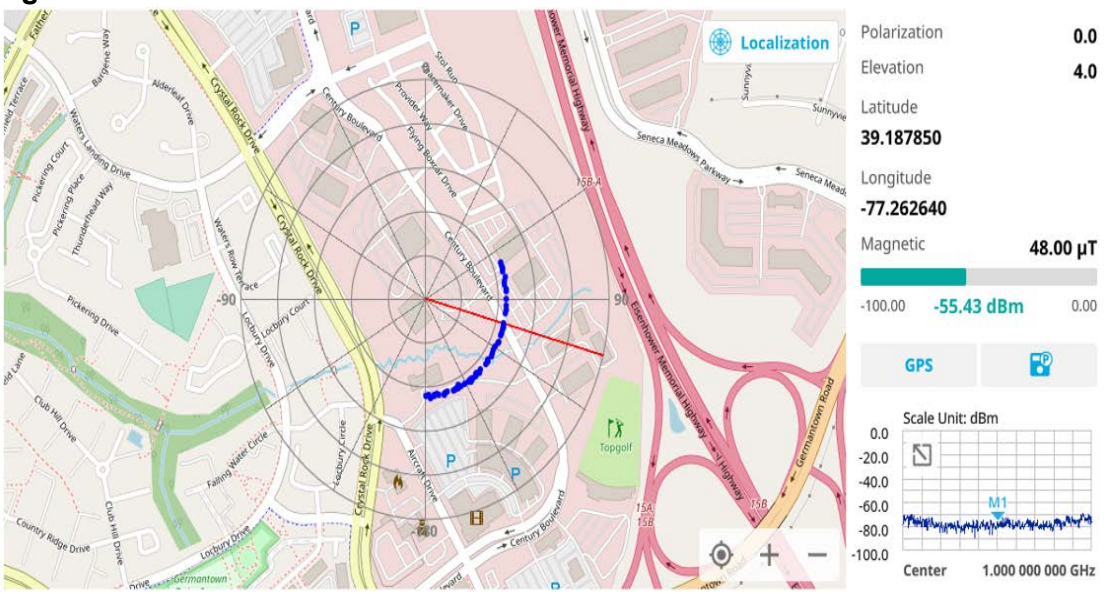
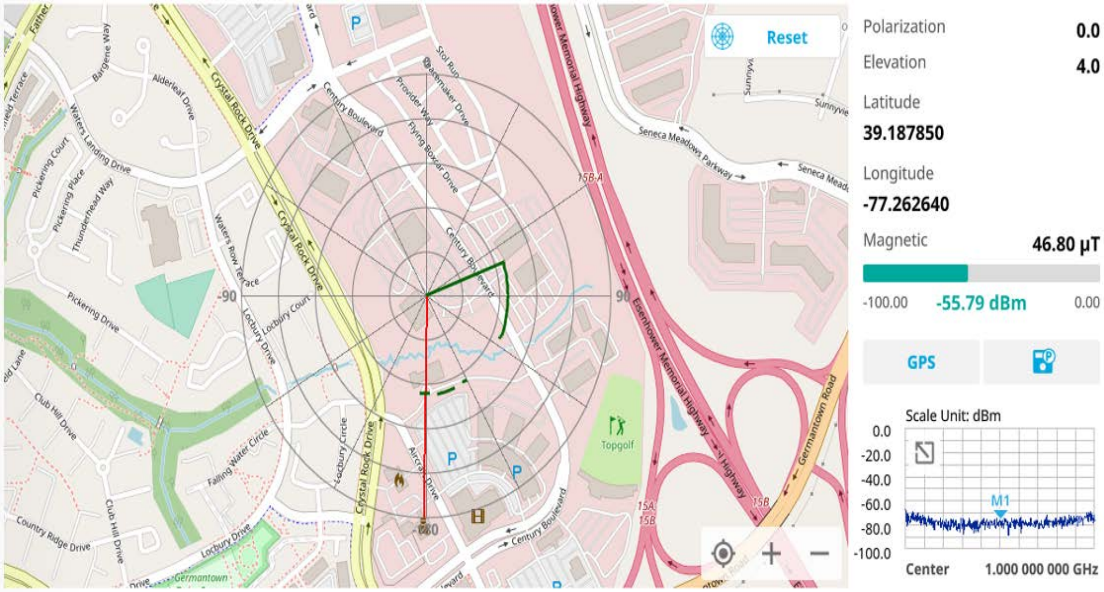


Figure 91 shows an example of the Localized Online Radar Chart with TAGS.

Figure 91 Localized Online Radar Chart



RF Viewer analysis

Directional antenna

The directional antenna is used to monitor and analyze radio frequency (RF) signals in real time, helping users observe spectrum characteristics, signal strength, and interference.

Antenna connection

Before starting the measurement, you need to connect the Omni or Log periodic antenna to your instrument. In the Interference Finder and the Radar Chart modes, you can perform interference hunting using the optional AntennaAdvisor Handle after attaching a broadband directional antenna to it. The handle is a device that has a built-in GNSS antenna and LNA. The following are examples of the antenna and camera connection.

To connect an antenna and a camera

1. Mount a broadband antenna and a camera to your AntennaAdvisor Handle
2. Connect the **RF Type-N Jack** of the handle to the **RF In** port of the instrument.
3. Connect the **GNSS SMA** jack of the handle to the **GNSS port** of the instrument. The GNSS status indicator appears on the instrument screen.

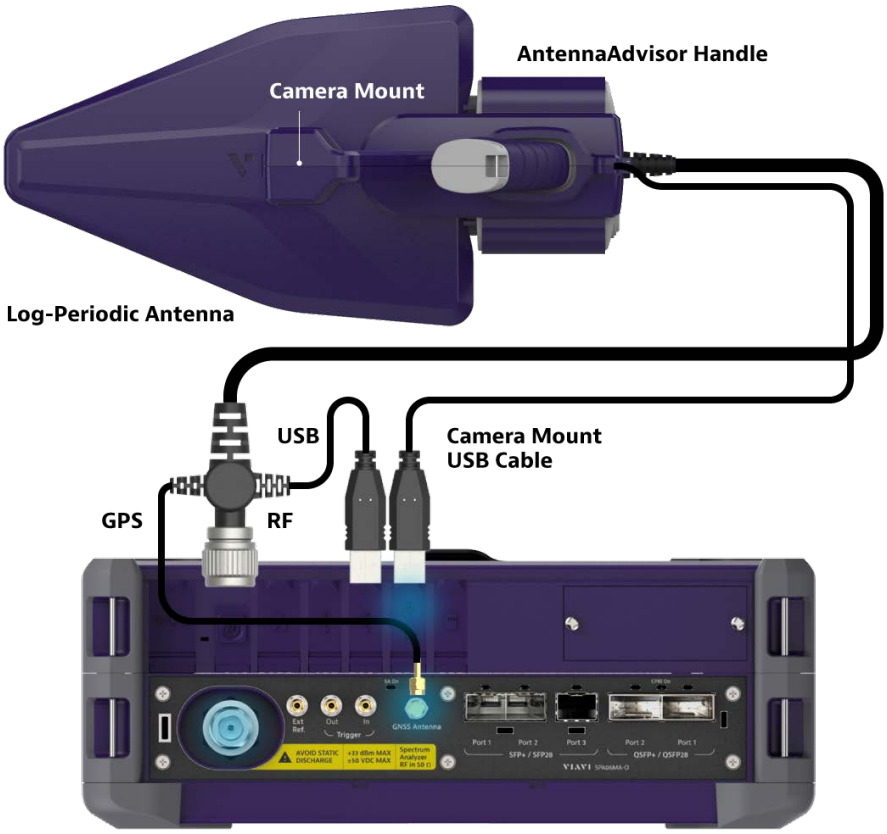
4 Connect the **USB plug** of the handle and the camera to the **USB Host port** of the instrument. The device icon appears in the system status bar on the screen.

NOTE

The AntennaAdvisor Handle is an optional item. It is recommended that you use a log periodic antenna with AntennaAdvisor handle to search more exact directional information. You can use a log periodic antenna or Omni antenna alone as well.

Figure 92 shows an example of an antenna and a camera connection.

Figure 92 Antenna and camera connection example



Initializing AntennaAdvisor

Once you have connected the AntennaAdvisor Handle to your instrument, antenna initialization is required to get the right azimuth data. You need to initialize the antenna handle to calibrate the built-in compass by completing the following steps. Note that you can adjust Bandwidth based on the center frequency of the interfering signal that you have identified in the Spectrum view by tapping **Setup > Bandwidth**. A message appears at the bottom of the screen to alert you if you have not performed initialization of your connected the antenna handle set.

To initialize AntennaAdvisor

1 Hold your antenna handle horizontally in its upright position.

2 Point the antenna to the north and tap **Setup > Initialize AntennaAdvisor**.

The message disappears and the red line for the current antenna direction moves to the 0° line and overlaps to let you know that the initialization has completed successfully.

To set measure setup

Once the antenna and camera are connected and initializing AntennaAdvisor, continue to set up the instrument as required.

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap **Bandwidth** and select the value from the following choices: **1.4 MHz**, **3 MHz**, **5 MHz**, **10 MHz**, **15 MHz** or **20 MHz**.

3 Tap **Dot Type** from the options: **Center**, **Channel**, or **Pick**

- Center: Displays the value at the center of the chart as a dot
- Channel: Displays the total power of the entire channel as a dot
- Peak: Displays the highest value within the channel as a dot

4 Tap **Reset** to clear the current setting or operations.

5 Tap **Transparency** to adjust the screen transparency.

6 Tap **Sound Indicator**.

a Tap to switch the **Sound** between **On** and **Off** to enable and disable the alarm sound.

b Tap to switch the **Alarm Reference** to **Marker** to set the active marker position as the alarm reference.

c Tap to switch the **Alarm Reference** to **Line** to set the limit as the alarm reference.

d Select **Reference Line** to specify a threshold for the reference line using the on-screen keyboard.

e *Optional:* To adjust the volume for alarm sound, tap **Volume** and input a value from 1 to 10 using the on-screen keyboard.

To set manual configuration for NR

1 Tap the **Setup** ( ) icon > **Manual Configuration (NR)** on the side bar.

2 Tap **Bandwidth/SSB SCS** then a Setting window appears.

a If you select the operating frequency as FR1, select from the following:

- SCS 15 kHz: 5, 10, 15, 20, 25, 30, 40, 50 MHz
- SCS 30 kHz: 5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 MHz

3 Tap **SSB Center Frequency** and input the value using the on-screen keyboard.

4 Tap **GSCN** and input the value using the on-screen keyboard.

5 Tap **TDD Formats** then set **Downlink Slot**, **Downlink Symbol**, **Uplink Slot**, **Uplink Symbol** as required.

6 Tap **SSB Auto Search Mode** and do the following steps:

   a Tap **Auto Preamp/Atten** and switch **SSB Auto Search** to **Start** to set preamp and attenuation automatically.

   b Tap **Manual** and switch **SSB Auto Search** to **Start** for manually setting based on your need.

7 Tap **SSB Auto Search** between **Start** and **Stop**.

   a **Start**: to search SCS, type, and the number of SSB automatically. Once Start is selected, the progress bar appears. If it fails to perform the auto search, a fail message appears and the SSB switches to Manual.

   b **Stop**: to set the SSB periodicity based on the base station.

8 Tap **SSB Periodicity** and select the options from **5 ms**, **10 ms**, **20 ms**, **40 ms**, **80 ms**, **160 ms**. The SS burst period (SSB periodicity) is defined by each base station and network configurable. 20 ms is the default for the initial cell selection.

9 Tap to switch **PCI (Physical Cell ID)** to **Manual** or **Auto**.

10 Tap **PCI** and input a value from 0 to 1007 using the on-screen keyboard. The PCI switches to **Manual**.

11 Tap **Gate Window Settings** and input **Slot No**, **Start Symbol No**, and **Symbol Width**.

   You can view P vs T Slot format measurement screen once you tap **P vs T Slot view**.

To set manual configuration for LTE

1 Tap the **Setup** (⚙) icon > **Manual Configuration (LTE)** on the side bar.

2 Tap **Uplink-Downlink Config** then input the required value using the on-screen keyboard.

3 Tap **Special Subframe Patterns** then input the required value using the on-screen keyboard.

4 Tap **Bandwidth** and select from the options: **1.4 MHz**, **3 MHz**, **5 MHz**, **10 MHz**, **15 MHz**, or **20 MHz**.

To start a test

You can use the AntennaAdvisor to set the azimuth and elevation. Initialize AntennaAdvisor first to ensure accurate directional information.

1 When the **TRIGGER** button is pressed, the camera screen is captured and aligned to the center of the display.

2 While holding the **TRIGGER** button, moving the antenna displays a dot on the screen.

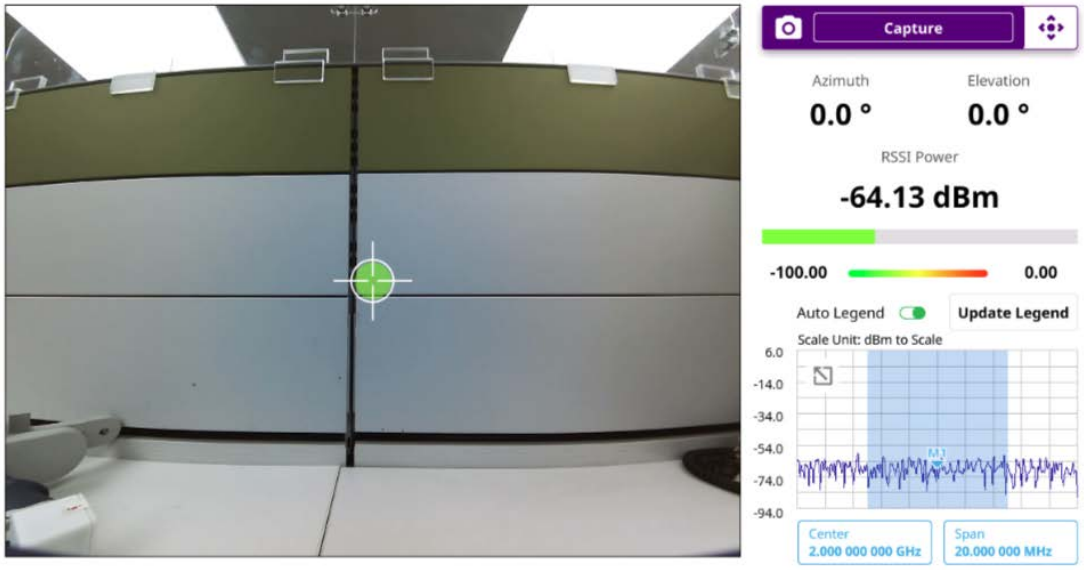
3 When the **TRIGGER** button is released, the measured screen is automatically saved.

4 RF power is displayed using legend colors, and the cross mark indicates the strongest power.

5 Pressing the **TRIGGER** button again returns to Step 1.

Figure 93 shows an example of an RF Viewer measurement.

Figure 93 RF Viewer measurement



NOTE

You can set Center Frequency and Span Frequency using the button.

8

Using Interference Analyzer

This chapter describes how to use the Interference Analyzer. Topics covered in this chapter include:

- “Introduction” on page 208
- “Selecting mode and measure” on page 208
- “Interference analysis” on page 209
- “Online interference analysis” on page 229
- “RF Viewer analysis” on page 241

Introduction

Interference is becoming more prevalent in the wireless community with the increasing number of transmitters coming on the air. Wireless service providers have traditionally used spectrum analyzers to monitor service channels, frequencies, and adjacent spectrum and to locate sources of interference. A spectrum analyzer can only show you an interfering signal and you require determining the source of the interference. To solve interference problems, you must understand the RF environment, know adjacent operating transmitters, and identify any new or unlicensed emitters.

Once a potential interfering signal is identified in the Spectrum Analyzer mode, you can monitor the signal further in the Interference Analyzer mode. The Interference Analyzer provides two different methodologies to identify and determine interference signals: Spectrogram and Received Signal Strength Indicator (RSSI). Locating the source of interference signal can be done with geographical information received from the built-in GNSS receiver.

The Interference Analyzer provides following measurements for interference analysis:

- Interference Analysis
  - RSSI (Received Signal Strength Indicator)
  - Interference Finder
  - Radar Chart
  - Spectrum
  - Spectrogram
  - Spectrum Replayer
  - PIM Detection Single Carrier
  - PIM Detection Multi Carrier
- Online Interference Analysis
  - Online Interference Finder
  - Online Radar Chart
- RF Viewer Analysis
  - Directional Antenna (Only available with the license, ONA-SP-RFVIEWER)

Using a set of the AntennaAdvisor Handle that holds a broadband directional antenna is mandatory in the Radar Chart mode and its built-in compass, GNSS antenna, gyro sensor, and low-noise amplifier (LNA) benefits you to determine the direction of the interference.

Selecting mode and measure

The following procedure describes how to start measurement.

To select mode and measure

1 Tap Interference Analyzer on the MODE panel.

2 Tap any measurement mode from the following choices:

- **Interference Analysis > Spectrum**, **Spectrogram**, **RSSI**, **Interference Finder**, **Radar Chart**, **Spectrum Replayer**, **PIM Detection Single Carrier**, or **PIM Detection Multi Carrier**
- **Online Interference Analysis > Online Interference Finder** or **Online Radar Chart**
- **RF Viewer Analysis > Directional Antenna**



NOTE

If you have a CAA module with CAA-RFS license (enabled), the RF Source menu will be activated. Go to **Setup** > **RF Source** > **CAA RF Power**. And tap to switch **CAA RF Power** to **On**. Then you can tap to switch **RF Source** to **On** and set **Frequency**/**Power Level** as required. Note that if you have a CAA module with catalog number (CAA06MB with Bias Voltage option), you can tap to switch **Bias Voltage** to **On** and set the required **Bias Voltage**.

With this Bias Voltage, you can enhance the sensitivity while performing interference analysis on feeder of old BTS (Base Transceiver Station) without RRH.

Interference analysis

The following sections describe how to conduct interference measurements.

Spectrum

Most spectrum measurements of the interference analyzer are also available in Spectrum mode. Using these measurements allows you to locate interferences in the frequency spectrum. You can configure the measurements just as in Spectrum mode. For more information, see “Configuring spectrum measurements” on page 25.

The spectrum measurement with an audible indicator is especially useful for locating interferer sources with a directional antenna.

To set measure setup for sound indicator

1 Tap the **Setup** ( ) icon on the side bar.

2 Tap **Sound Indicator**.

a Tap to switch the **Sound** between **On** and **Off** to enable and disable the alarm sound.

b Tap to switch the **Alarm Reference** to **Marker** to set the active marker position as the alarm reference.

c Tap to switch the **Alarm Reference** to **Line** to set the limit as the alarm reference.

d Select **Reference Line** to specify a threshold for the reference line using the on-screen keyboard.

e *Optional:* To adjust the volume for alarm sound, tap **Volume** and input a value from 1 to 10 using the on-screen keyboard.

To set measure setup for Interference ID

The Interference ID automatically classifies interfering signals over a designated spectrum and displays the list of possible signal types corresponding to the selected signal.

1 Tap the **Setup** ( ) icon on the side bar.

2 Tap **Interference ID**.

a Tap to switch the **Interference ID** between **On** and **Off** to turn the Interference ID on or off.

b Tap **Threshold** and input a value using the on-screen keyboard.

NOTE

You can go to **Menu > Limit** to analyze your measurements with the Reference Line, multi-segment line, and channel limit table. See “Setting limit” on page 39 for more information.

To log multi-traces

When you finished setting trace view/trace type in Trace menu, you can log the trace data by going to the Save page. Make sure you need to select the trace view to on for more than 2 traces.

1 Tap the **Save** icon on the side bar.

2 Make sure the **Logging** is selected in the File Type.

3 Tap the **Save** button at the bottom.

4 The **Trace Selection** pop-up window displays.

5 Tap the **Apply** button to apply the settings.

Spectrogram

The Spectrogram is particularly useful when attempting to identify periodic or intermittent signals as it captures spectrum activity over time and uses various colors to differentiate spectrum power levels. When the directional antenna is used to receive the signal, you will see a change in the amplitude of the tracked signal as you change the direction of the antenna and see a change in the Spectrogram colors. The source of the signal is located in the direction that results in the highest signal strength.

Setting measure setup

After configuring the spectrum measurement in "Configuring spectrum measurements" on page 25, you can set the measure setup to continue your measurement.

To set measure setup

1. Tap the **Setup** ( ) icon on the side bar.
2. Tap **Time Interval** to set the amount of time between each trace measurement using the on-screen keyboard.
3. Tap **time Cursor** to **On** to set the time cursor on a specific trace position.

   The **Position** menu becomes activated.
4. Tap **Position** to move the time cursor by inputting a value using the on-screen keyboard.

   You can also move the time cursor up and down using the move bar on the left edge.
5. Tap **Type** to switch the chart view type to **3d Display** or **Normal**. You can also change the chart view type by using the icon on the chart screen.
6. Tap **Reset/Restart** to start a new measurement.



NOTE

Enabling the time cursor puts the measurement on hold, allowing you to make post-processing analysis for each measurement over time using the time cursor.

To log multi-traces

When you finished setting trace view/trace type in Trace menu, you can log the trace data by going to the Save page. Make sure you need to select the trace view to on for more than 2 traces.

1. Tap the **Save** icon on the side bar.
2. Make sure the **Logging** is selected in the File Type.
3. Tap the **Save** button at the bottom.
4. The **Trace Selection** pop-up window displays.
5. Tap the **Apply** button to apply the settings.

Interference measurement in spectrogram

The Spectrogram shows a vertical line on the chart when the marker is enabled on the screen. Figure 94 shows the Normal chart view, and Figure 95 shows the Waterfall (3D display) chart view.

Figure 94 Interference measurement in spectrogram- Normal view

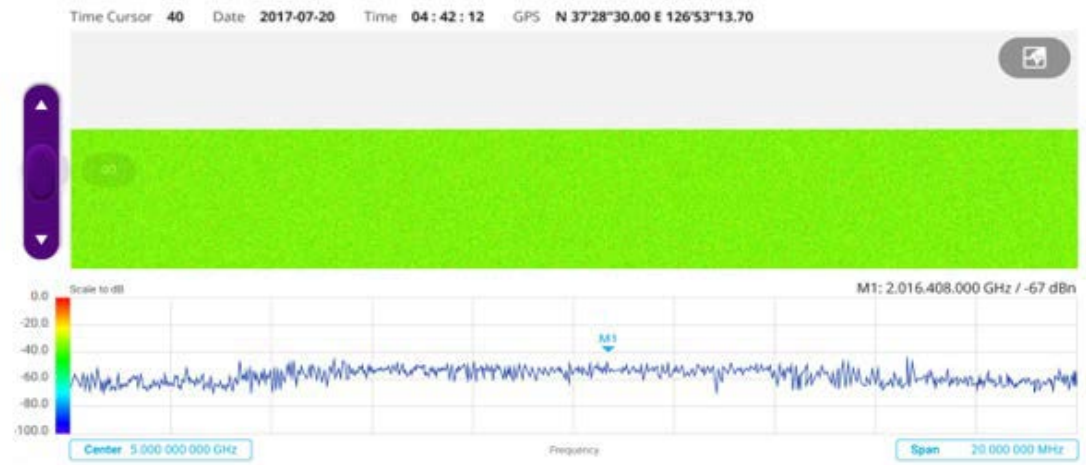
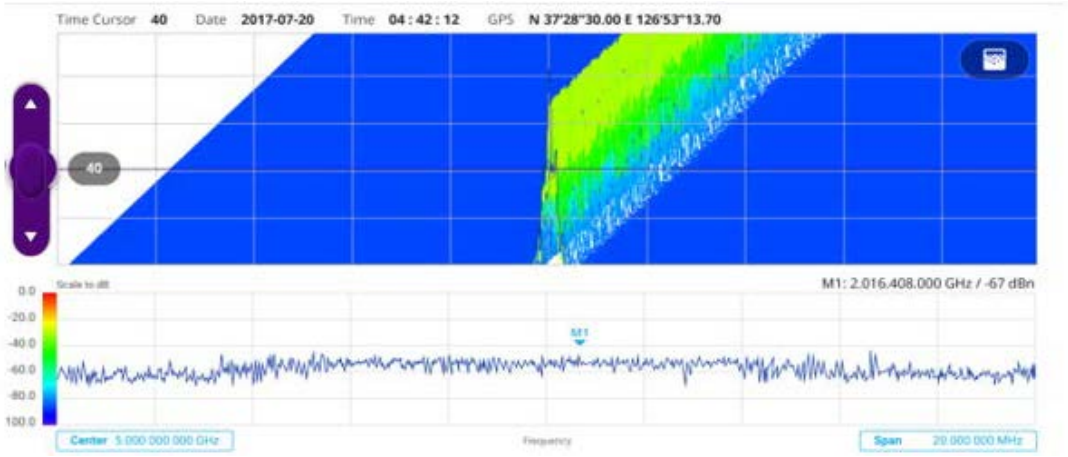


Figure 95 Interference measurement in spectrogram- Waterfall (3D Display) view



In the spectrogram chart:

- The horizontal line (X-axis) indicates frequency.
- The vertical line (Y-axis) indicates time.
- The color identification (Spectrogram) indicates the power level of the tracked signal. As the signal strength increases, the color on the spectrogram changes accordingly.
- Once you set the reference line to On, the purple move bar becomes active and the green line appears. You can set the reference line by moving up or down in the spectrum chart below the spectrogram chart.
- You can set the GNSS by selecting **Frequency Reference** as GNSS on the System Settings page.

RSSI

The Received Signal Strength Indicator (RSSI) is a multi-signal tracking metric that is particularly useful for measuring power-level variations over time. The RSSI measurement allows you to assign power limit lines for audible alarms, and increase alarm counters every time a signal exceeds a defined limit line. The spectrogram and RSSI measurements can be automatically saved to an external USB drive for long term analysis.

Setting measure setup

After configuring the spectrum measurement in "Configuring spectrum measurements" on page 25, you can set the measure setup to continue your measurement.

To set measure setup

1. Tap the **Setup** ( ) icon in the side bar.
2. Tap **Alarm** to set the alarm parameters.
3. Tap **Alarm at** and select the marker number from Marker 1 to Marker 6.
4. Tap **Reference Line** to set a threshold for the alarm, and input a value using the on-screen keyboard.
5. Tap to switch **Alarm** to **On** or **Off** to turn the alarm feature on or off.
6. *Optional*: Tap **Volume** to adjust the volume from 1 to 10 using the on-screen keyboard.

NOTE

You must set the marker(s) for the alarm as this feature uses the marker position to sound alarm. See "Using marker" on page 41 for more information.

To log multi-traces

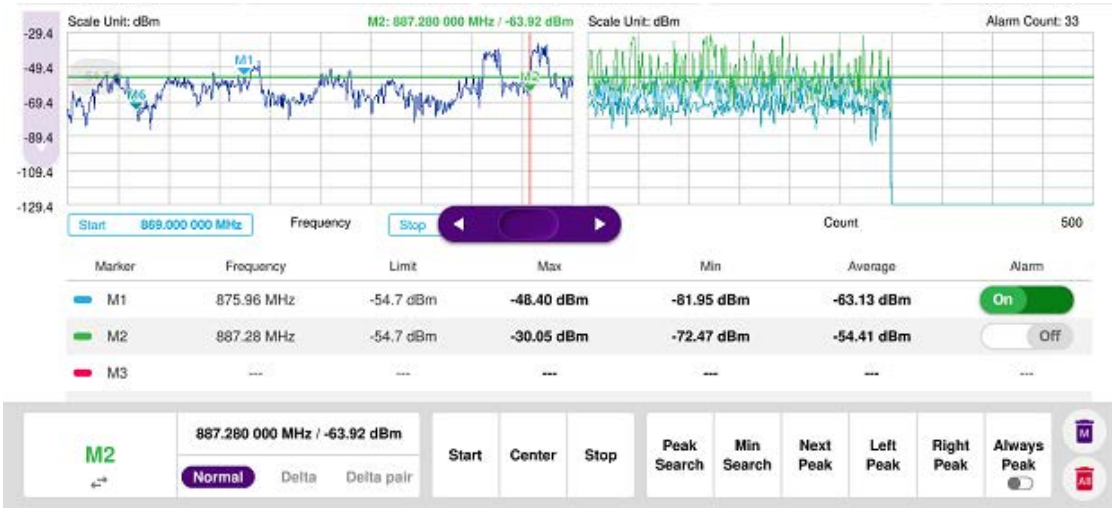
When you finished setting trace view/trace type in Trace menu, you can log the trace data by going to the Save page. Make sure you need to select the trace view to on for more than 2 traces.

1. Tap the **Save** icon on the side bar.
2. Make sure the **Logging** is selected in the File Type.
3. Tap the **Save** button at the bottom.
4. The **Trace Selection** pop-up window displays.
5. Tap the **Apply** button to apply the settings.

Interference measurement in RSSI

Figure 96 shows an example of interference measurement in RSSI.

Figure 96 Interference measurement in RSSI



You can go to **Menu > Limit** to analyze your measurements with the Reference Line, multi-segment line, and channel limit. See “Setting limit” on page 39 for more information.

Interference finder

The Interference Finder is an automatic triangulation algorithm that uses GNSS coordinates to locate possible interference sources based on the three measurements. The interference finder calculates possible interference locations using its inscribed circle or circumscribed circle based on measured intersection points. You can plot up to seven measurement points and select three that are more representative for triangulation. The instrument automatically logs measurement positions so as to prevent their loss while changing measurement modes. You can switch the main screen from spectrum view to map view and vice versa using the icon on the spectrum view screen. Before starting the Interference Finder, you need to set spectrum measurements, as described in “Configuring spectrum measurements” on page 25.

To make full use of the functions available in map mode, you will need a GNSS receiver and antenna.

Antenna connection

Before starting the measurement, you need to connect the Omni or Log periodic antenna to your instrument. In the Interference Finder and the Radar Chart modes, you can perform interference hunting using the optional AntennaAdvisor Handle after attaching a broadband directional antenna to it. The handle is a device that has a built-in GNSS antenna and LNA. The following are examples of the antenna connection.

To connect an antenna

1 Mount a broadband antenna to your AntennaAdvisor Handle.

2 Connect the **RF Type-N Jack** of the handle to the **RF In** port of the instrument.

3 Connect the **GNSS SMA** jack of the handle to the **GNSS port** of the instrument. The GNSS status indicator appears on the instrument screen.

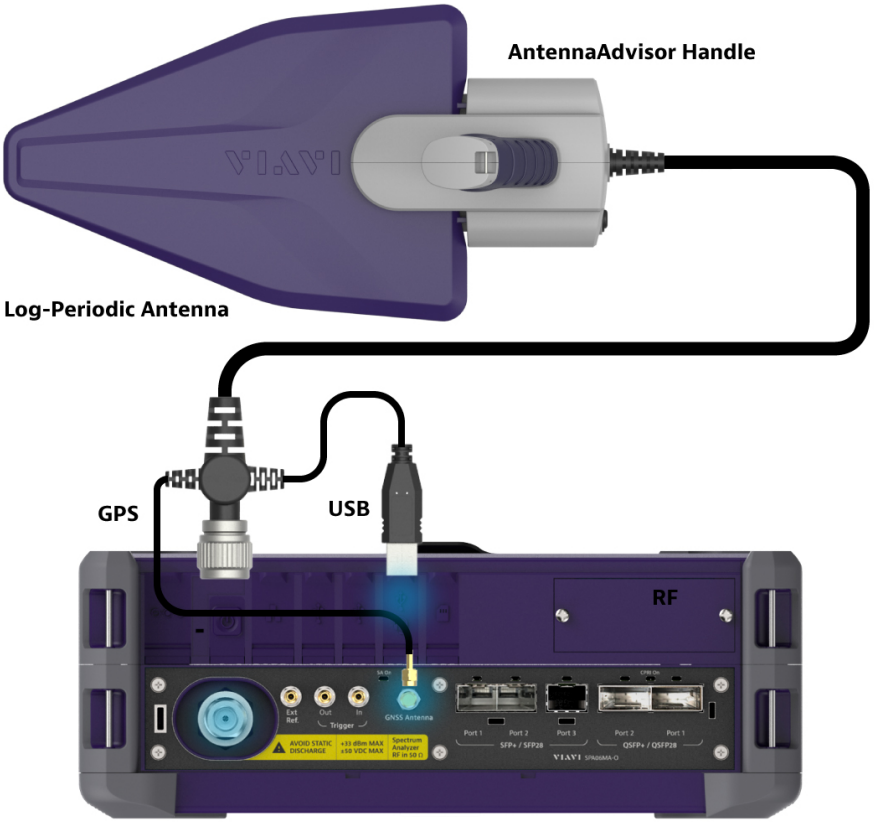
4 Connect the **USB plug** of the handle to the **USB Host port** of the instrument. The device icon appears in the system status bar on the screen.

NOTE

The AntennaAdvisor Handle is an optional item. It is recommended that you use a log periodic antenna with AntennaAdvisor handle to search more exact directional information. You can use a log periodic antenna or Omni antenna alone as well.

Figure 97 shows an example of an antenna connection.

Figure 97 Antenna connection example



Loading a map

To use any features related to maps, you need to download and install the maps on the instrument. The **VIAVI JDMapCreator** will help you to download maps. Ensure the JDMapCreator application on your computer is connected to the instrument via LAN. You can send a map file with a single layer to the instrument directly by using the **Send to EQP** menu in JDMapCreator. For information about how to use the JDMapCreator, see the *JDMapCreator 2.0 User Guide*.

To load a map

1 Plug in your USB flash drive that has a map file in .mcfv file type created in JDMapCreator.

2 Tap the **Load** icon on the side bar.

3 Navigate to the map you want to open. The **File Information** pane displays the file properties, including name, size, type, and date modified.

4 Tap the **Load** button on the screen.

Once you have loaded the map, you can also control the map using the following icons on the map.

Table 34 Map control icons

Icon	Description
	Tap to go to your current location on the map. Once tapped, the purple icon appears on the map, indicating your current location.
	Tap to switch to the full screen map view.
	Tap to zoom in the map.
	Tap to zoom out the map.
	Tap and select the area where you want to expand.

To load a JSON file from Spectrum Net Analyzer

When you load a JSON map file configured in Spectrum Net Analyzer, you can view the map with Cell Site icon, Interference Power, and Heat map (%) legend colors.

1 Plug in your USB flash drive that has a map file in .json file type created in Spectrum Net Analyzer.

2 Tap the **Load** icon on the side bar.

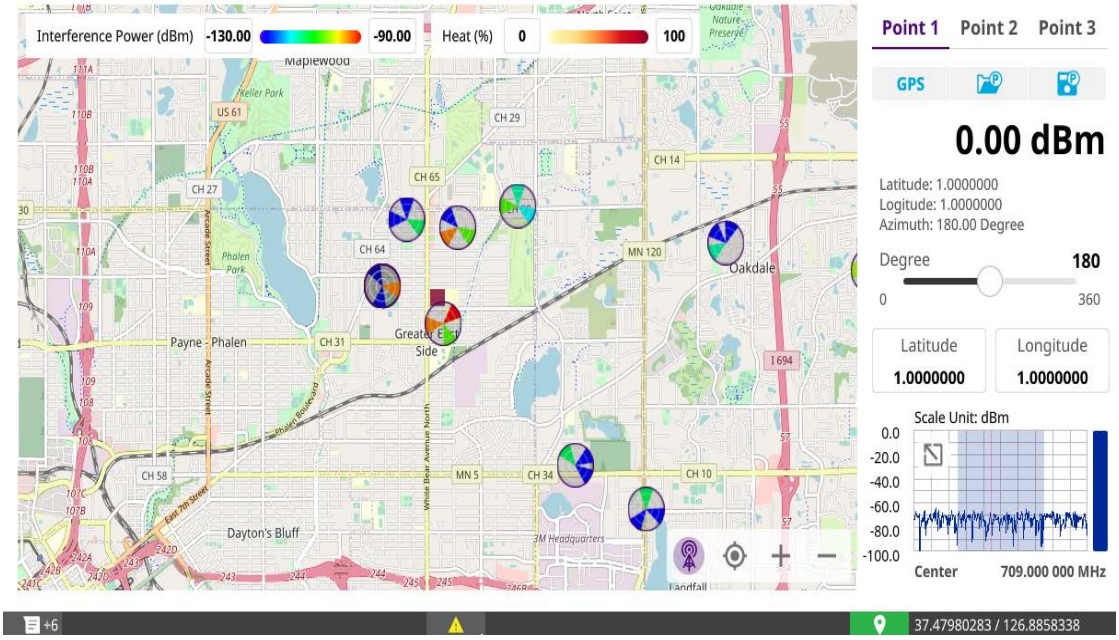
3 Navigate to the map you want to open. The **File Information** pane displays the file properties, including name, size, type, and date modified.

4 Tap the **Load** button on the screen.

5 Once the json file is successfully loaded, the **Cell Site** icon is enabled.

Figure 98 shows an example of the Interference Finder measurement from the JSON file loaded.

Figure 98 Interference Finder measurement from the JSON file loaded



NOTE

Based on the min/max value of the Interference Power, the cell site direction color changes, and based on the min/max value of the Heat, the heat map color changes.

Initializing AntennaAdvisor

Once you have connected the AntennaAdvisor Handle to your instrument, antenna initialization is required to get the right azimuth data. You need to initialize the antenna handle to calibrate the built-in compass by completing the following steps. Note that you can adjust Bandwidth based on the center frequency of the interfering signal that you have identified in the Spectrum view by tapping **Measure Setup > Bandwidth**. A message appears at the bottom of the screen to alert you if you have not performed initialization of your connected the antenna handle set.

To initialize AntennaAdvisor

1 Hold your antenna handle horizontally in its upright position.

To avoid the unnecessary impact of an external magnetic field, position yourself at the location where the value of the magnetic field strength displayed on the instrument screen is green.

2 Point the antenna to the north and tap **Setup > Initialize AntennaAdvisor**.

The message disappears and the red line for the current antenna direction moves to the 0° line and overlaps to let you know that the initialization has completed successfully.

Setting geographic location

A point is a particular location that contains information about that location. This information includes, for example, GNSS coordinates, the time of the measurement or level that has been measured. You can evaluate the Point information directly on-site or save the information for later evaluation.

With this functionality, you can mark locations where you have performed a measurement. Thus, you can analyze the geographical distribution of the received signal strength. This allows you to analyze, for example, the coverage conditions around a base station's coverage area.

In the map view, a point is displayed as a dot with a number. The straight line represents the direction you are facing.

To set the geographic location

1. Tap the **Point 1**, **Point 2** and **Point 3** on the map. Make sure to set three location points so that the straight lines started from the point can create three intersections.
2. Tap each point and use the **Degree** bar or button to change degrees.
3. Tap the **GNSS** icon to automatically get the selected point’s location information.

   The instrument displays the latitude and longitude information of the signal received by the GNSS antenna. This function is only available when the GNSS antenna is connected.
4. Tap the **Latitude** and **Longitude** icon and enter the value using the on-screen keyboard to manually define a position.

   The input values are in decimal degrees.
5. Tap the **Apply** button.

Setting azimuth

There are three methods available for setting azimuth:

Method 1: AntennaAdvisor Handle

You can use the Antenna Advisor handle. Make sure you initialize AntennaAdvisor first to get more accurate directional information.

1. Press and hold the **TRIGGER** button on the handle then it finds the strongest RSSI value.

   RSSI, polarization, elevation, and azimuth readings are continuously updated on the screen while pressing the physical button.
2. Release the **TRIGGER** button to stop scanning.

Method 2: Degree bar

The **Degree Bar** functions as a compass. You can use it to set azimuth by moving it right and left.

Tap the circle on the Degree bar and move it gently until you get the right azimuth.

Method 3: Log-periodic antenna

You can use the log-periodic antenna.

Pan your log-periodic antenna to find a signal with the highest RSSI value and measure an azimuth of the interfering signal.



NOTE

The AntennaAdvisor has a built-in low-noise amplifier (LNA) that can be turned on and off using the physical On/Off button located on the rear side of the handle unit. For example, if the received signal is weak, you can turn on the switch to improve S/N.

To save the defined position

1. Tap any point on the map where you want to save the position information.
2. Tap the **Save Position** icon.

   The instrument stores the saved location points in the internal memory, allowing you to load them by using the **Load Position** icon. You can save and load up to 10 positions.

Setting display mode

When the triangulation is done with three location points and azimuth for each point, you can view a circumscribed circle by default. You can change the display mode to inscribed circle or double circles to view a narrower area. The center of the green-shaded circle is determined to be where the source of the interfering signal resides.

To set display mode

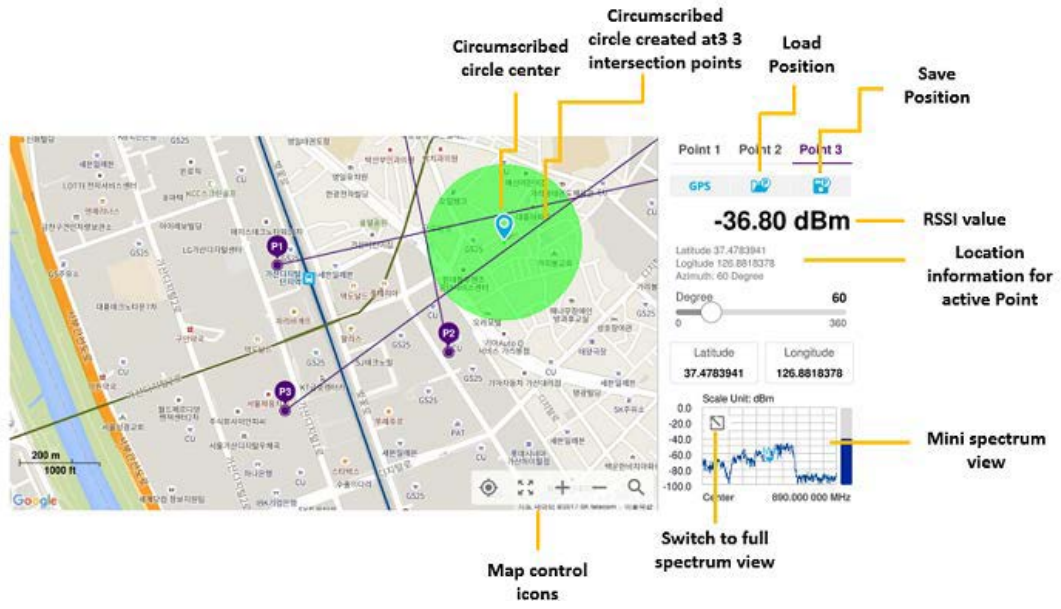
1. Tap **Measure Setup > Display**.
2. Select the option from the following choices:
   - **Circum**: displays a circumscribed circle that meets three vertices of the triangle.
   - **Inscribed**: displays an inscribed circle that meets the three vertices of the triangle.
   - **Double**: displays both circumscribed and inscribed circles.
3. Tap **Measure Setup > Screen Mode**.

4 Tap the **Screen Mode** to select **Map** or **Full**.

- **Map**: displays what is inside the base map with the map image.
- **Full**: displays three location points and defined circle without the map image.

Figure 99 shows an example of the Interference Finder measurement in map view.

Figure 99 Interference Finder measurement in map view



NOTE

If you go to Setup > Bandwidth and set the required bandwidth, you can see the light blue bar chart with bandwidth in the current spectrum measurement screen. The above figure does not show the bar as it sets the bandwidth to 0.

Radar chart

If you have identified an interfering signal in your spectrum view, you can move to the Radar Chart mode and measure RSSI power level through 360° at a location received by the connected broadband directional antenna so that you can determine the direction of the source of the interference. Using a set of the AntennaAdvisor Handle that holds a broadband directional antenna is mandatory in the Radar Chart mode. The built-in compass, GNSS antenna, and built-in low-noise amplifier (LNA) allow you to determine the direction of the interference. You can switch the main screen from spectrum view to map view and vice versa using the icon on the spectrum view screen. Before starting the Interference Finder, you need to set Spectrum measurements. See “Configuring spectrum measurements” on page 25 for more information.

For information about connecting the antenna, see “Antenna connection” on page 214.

Loading a map

To use any features related to maps, you need to download and install the maps on the instrument. The **VIAVI JDMapCreator** will help you to download maps. Ensure the JDMapCreator application on your computer is connected to the instrument via LAN. You can send a map file with a single layer to the instrument directly by using the **Send to EQP** menu in JDMapCreator. For information about how to use the JDMapCreator, see the *JDMapCreator 2.0 User Guide*.

To load a map

1. Plug in your USB flash drive that has a map file in.mcfv file type created in JDMapCreator.
2. Tap the **Load** icon on the side bar.
3. Navigate to the map you want to open. The **File Information** pane displays the file properties, including name, size, type, and date modified.
4. Tap the **Load** button on the screen.

Once you have loaded the map, you can also control the map using the following icons on the map.

Table 35 Map control icons

Icon	Description
	Tap to go to your current location on the map. Once tapped, the purple icon appears on the map, indicating your current location.
	Tap to switch to the full screen map view.
	Tap to zoom in the map.
	Tap to zoom out the map.
	Tap and select the area where you want to expand.

To load a JSON file from Spectrum Net Analyzer

When you load a JSON map file configured in Spectrum Net Analyzer, you can view the map with Cell Site icon, Interference Power, and Heat map (%) legend colors.

1 Plug in your USB flash drive that has a map file in .json file type created in Spectrum Net Analyzer.

2 Tap the **Load** icon on the side bar.

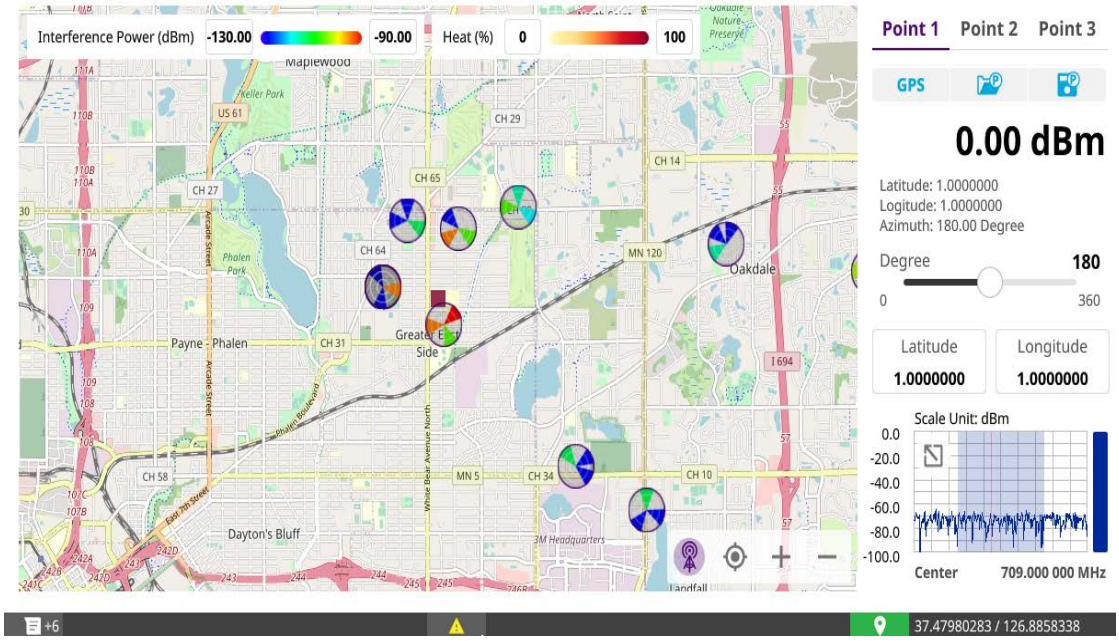
3 Navigate to the map you want to open. The **File Information** pane displays the file properties, including name, size, type, and date modified.

4 Tap the **Load** button on the screen.

5 Once the json file is successfully loaded, the **Cell Site** icon is enabled.

Figure 100 shows an example of the Radar Chart measurement from the JSON file loaded.

Figure 100 Radar Chart measurement from the JSON file loaded



NOTE

Based on the min/max value of the Interference Power, the cell site direction color changes, and based on the min/max value of the Heat, the heat map color changes.

Initializing AntennaAdvisor

Once you have connected the AntennaAdvisor Handle to your instrument, antenna initialization is required to obtain the correct azimuth data. You need to initialize the antenna handle to calibrate the built-in compass by completing the following procedure. You can adjust bandwidth based on the center frequency of the interfering signal that you have identified in the Spectrum view by tapping S**etup > Bandwidth**. A message

appears at the bottom of the screen to alert you if you have not performed initialization of your connected the antenna handle set.

To initialize AntennaAdvisor

1 Hold your antenna handle horizontally in its upright position.

To avoid the unnecessary impact of an external magnetic field, position yourself location where the value of magnetic field strength displayed on the instrument is green.

2 Point the antenna to the north and tap **Setup > Initialize AntennaAdvisor**.

The message disappears, and the red line for the current antenna direction moves to the 0° line and overlaps to let you know that the initialization was done successfully.

NOTE

It is recommended that you re-initialize the AntennaAdvisor Handle after measurements to re-calibrate the compass when you notice that the red line on the radar chart is not aligned with the north on the map, even though you are pointing the antenna to the north.

Obtaining RSSI and direction data

Once you have connected your antenna handle set and done necessary setups, you can monitor the power level of the received signal, the amount of polarization, and elevation level real time. Using the Trigger button on the antenna handle set, you can plot the RSSI level and obtain current direction of antenna at your location.

To obtain RSSI and direction data

1 When you have the green GNSS indicator, tap the **GNSS** icon on the side panel to set your current location to the center of the radar chart. The latitude and longitude information at the side of the display changes from “Unknown Position” to the obtained position information.

2 Tap the **Save Position** icon on the side panel to save a position to recall for triangulation in the Interference Finder mode and select one that you want to save.

3 Monitor the RSSI reading of the received signal. If the signal is weak, turn on the LNA switch on the antenna handle set to improve S/N.

NOTE

The AntennaAdvisor Handle has a built-in low-noise amplifier (LNA) and you can turn it on and off by toggling the physical On/Off switch located on the rear side of the handle unit

4 Hold the antenna handle set horizontally and make the measurement.

The message disappears and the red line for the current antenna direction moves to the 0° line and overlaps to let you know that the initialization is done successfully.

5 Obtain a RSSI value and direction:

   a Press the **Trigger button** located on the antenna handle.

   Each time you press the physical button on the handle, a beep sounds and a power level of the received signal is plotted as a blue dot on the radar chart. Depending on the strength of the measured value, you may hear different tones of beeping.

   b While receiving the power level, you can also obtain the current direction of the antenna. Repeat pressing the TRIGGER button to obtain at least five points if you want to do the localization.

6 To continuously obtain RSSI values and direction:

   a Press and hold the **TRIGGER** button located on the antenna handle to start a continuous measurement.

   b A beep is sounded repeatedly to let you know that the measurement is continuing and measured values are plotted and lined on the radar chart.

   c Release the TRIGGER button to stop the continuous measurement.



NOTE

The maximum number you can plot on the radar chart is 2500 points both in the single and continuous measurements. If your measurement reached to 500 points, you need to reset the measurement by pressing the Localization soft key twice or performing the initialization of the AntennaAdvisor Handle. Concentric circles indicate different levels of RSSI. You can use the AMP/SCALE hard key to adjust the amplitude scale of the chart.

7 Tap **Setup** > **Screen Mode Full/Map** to change the display mode.

   a **Map**: Displays measured points inside the base map image. If you are in the area outside the base map and continue your measurement with the Trigger button, the instrument continues obtaining data even though the radar chart disappears from the screen. You can view obtained data when you change this display option to Full.

   b **Full**: Displays measured points without the base map image. In case that you made measurements in the area outside the map image, selecting this option moves your measured data to the center of the display so that you can view the result.

Localizing RSSI data

The Localization feature allows you to view averaged and smoothed measurement data with a bold green line on the radar chart that helps you determine the direction of the highest RSSI value. When you have five or more data points plotted on the radar chart, you can perform this localization.

To localize RSSI data

1 Tap the **Setup** ( ) icon on the side bar.

2 Tap **Localization**.

All measured points turn green and a bold green line appears, indicating the possible direction of the interference source.

3 Tap Localization again to clear all the data plots on the radar chart.

Figure 101 shows an example of the Radar Chart. Figure 102 shows an example of the radar chart with localized data.

Figure 101 Radar Chart



Figure 102 Radar Chart localized



Spectrum Replayer

The Spectrum Replayer allows you to retrieve and replay recorded spectrum analyzer traces in interference analysis mode. These traces can be played back in the spectrogram or RSSI. You can configure the limit line to create failure points when signals exceed it. The failure points are clearly displayed on the trace timeline for quick access during playback.

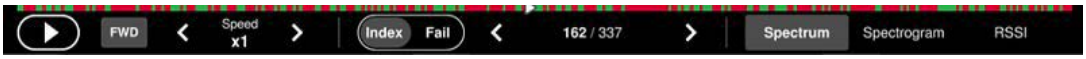
To replay a spectrum

1 Tap the **Setup** ( ) icon on the side bar.

2 Tap **Spectrum Replayer**. The **File Manager** window appears.

3 Select a file to be loaded and then tap **Load**. The replay bar appears on the bottom of the screen, as shown in Figure 103.

Figure 103 Replay bar



4 Tap **Play** to start playing.

5 Tap **FWD** or **REV** to change play direction to forward or reverse.

6 Tap the left or right arrow of **Speed** to select the speed option: **X1**, **X2**, **X3**, or **X4**.

7 Tap **Pause** to pause or stop playing data.

8 To move to a particular failure position directly and play from there, tap **Fail** on the **Index/Fail** switch and enter a value by using the on-screen keyboard.

9 Tap to change display mode to **spectrum**, **spectrogram**, or **RSSI**.

3D display (Waterfall) is not supported in case of spectrum logging.

10 *Optional*: Tap **Setup > Time Cursor On/Off** to display or dismiss the time cursor on the screen. This key becomes activated when you play logged data in the Spectrogram mode.

NOTE

If you connect a USB drive, do not remove it while playing to prevent freezing the USB port, which will require you to restart the instrument to get a USB drive recognized again.

PIM detection

Passive Intermodulation (PIM) Detection allows you to detect Uplink PIM across the full spectrum for any technology. When PIM is detected, the normal repair practice is to replace the offending cable, irrespective of the location of the fault.

To make a single carrier measurement

1 Connect the cables as instructed on the screen.

2 *Optional*: Check for PIM existence in red by calculation.

   a Tap **Calculated PIM**.

   b Check the Radio 1 Band and its information in the table.

   c Tap **Channel Standard** and select **Technology** and **Band**.

   d Tap the **Apply** button.

   e Tap the **X** button to return to the previous screen.

3 Tap **Uplink Center Frequency** and input a value using the on-screen keyboard.

4 Tap **Uplink Span** and input a value using the on-screen keyboard.

5 Tap **Channel Standard**, select **Technology** and **Band**, and then the **Apply** button.

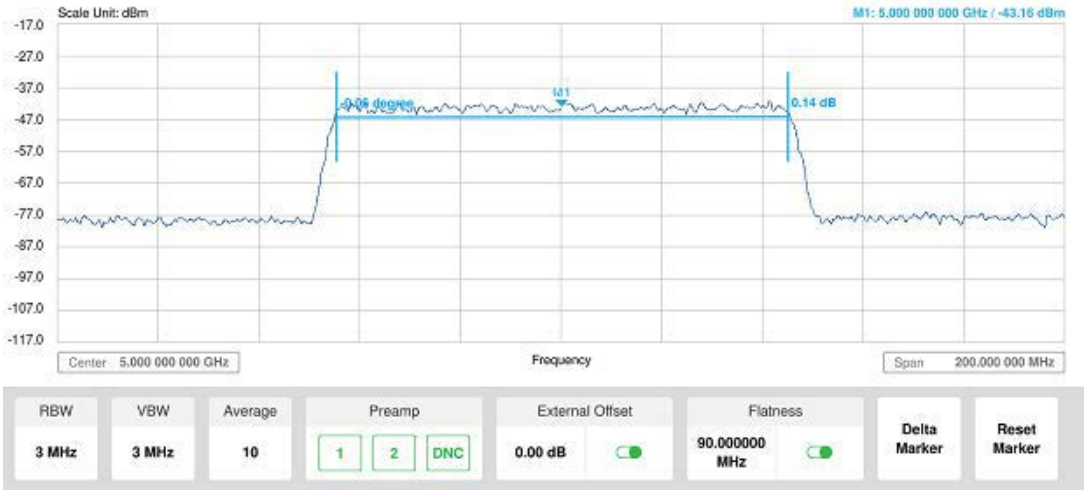
6 Tap **Channel Number** and input a value using the on-screen keyboard.

7 Tap the **Continue** button on the right edge to continue.

8 Set the parameters that appear in the table below the chart screen as needed.

Figure 104 shows an example of a single carrier PIM Detection measurement.

Figure 104 PIM detection — single carrier



To make a multi carrier measurement

1 Connect the cables as instructed on the screen.

2 *Optional*: Check for PIM existence in red by calculation.

   a Tap **Calculated PIM**.

   b Check the Radio 2 Band and its information in the table.

   c Tap to switch **Mode** to **Band** or **Frequency**.

   d If **Band** is selected:

   - Tap **Radio 1 Band** and select the technology and band from the channel list.
   - Tap **Radio 2 Band** and select the technology and band from the channel list.

   e If **Frequency** is selected:

   - Tap **Frequency 1 Band** and select the technology and band from the channel list.
   - Tap **Frequency 2 Band** and select the technology and band from the channel list.

   f Tap the **X** button to return to the previous screen.

3 Tap **Uplink Center Frequency** and input a value using the on-screen keyboard.

4 Tap **Uplink Span** and input a value using the on-screen keyboard.

5 Tap **Channel Standard**, select **Technology** and **Band**, and then the **Apply** button.

6 Tap **Channel Number** and input a value using the on-screen keyboard.

7 Tap the **Continue Step 2/4** button on the right edge to continue.

8 Set the parameters that appear in the table below the chart screen as needed.

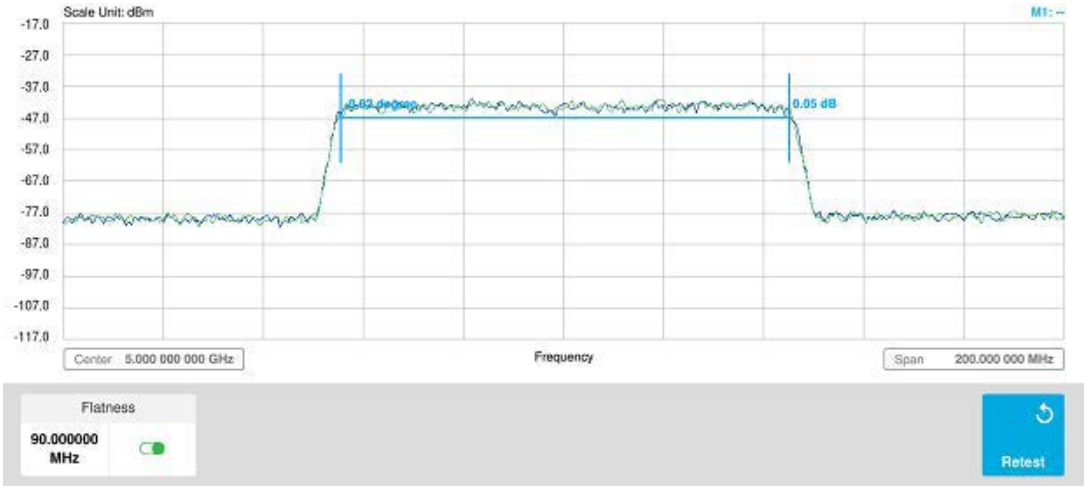
9 Tap the **Continue Step3/4** button on the right edge to continue.

10 Follow the instructions on the screen and tap the **Continue Step4/4** button on the right edge to continue.

11 Tap to enable **Flatness**.

Figure 105 shows an example of a multi carrier PIM Detection measurement.

Figure 105 PIM detection — multi carrier



Online interference analysis

The following sections describe how to conduct online interference measurements.

Online interference finder

The Interface Finder is an automatic triangulation algorithm that uses GNSS coordinates to locate possible interference sources based on the three measurements. The interference finder calculates possible interference locations using its inscribed circle or circumscribed circle based on measured intersection points. You can plot up to seven measurement points and select three that are more representative for triangulation. The instrument automatically logs measurement positions so as to prevent their loss while changing measurement modes. Before starting the Interference Finder, you need to set spectrum measurements, as described in “Configuring spectrum measurements” on page 25.

To make full use of the functions available in map mode, you will need a GNSS receiver and antenna.

Antenna connection

Before starting the measurement, you need to connect the Omni or Log periodic antenna to your instrument. In the Interference Finder and the Radar Chart modes, you can perform interference hunting using the optional AntennaAdvisor Handle after attaching a broadband directional antenna to it. The handle is a device that has a built-in GNSS antenna and LNA. The following are examples of the antenna connection.

To connect an antenna

1 Mount a broadband antenna to your AntennaAdvisor Handle.

2 Connect the **RF Type-N Jack** of the handle to the **RF In** port of the instrument.

3 Connect the **GNSS SMA** jack of the handle to the **GNSS port** of the instrument. The GNSS status indicator appears on the instrument screen.

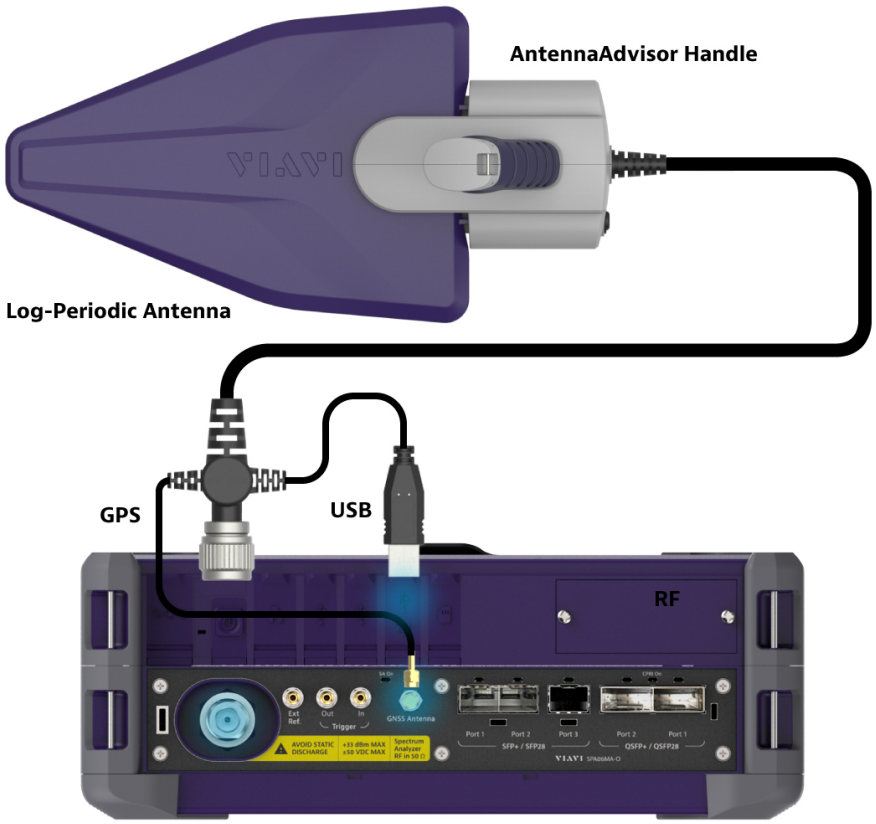
4 Connect the **USB plug** of the handle to the **USB Host port** of the instrument. The device icon appears in the system status bar on the screen.

NOTE

The AntennaAdvisor Handle is an optional item. It is recommended that you use a log periodic antenna with AntennaAdvisor handle to search more exact directional information. You can use a log periodic antenna or Omni antenna alone as well.

Figure 106 shows an example of an antenna connection.

Figure 106 Antenna connection example



Controlling a map

To control a map

See the following table to control a map.

Table 36 Map control icons

Icon	Description
	Tap to go to your current location on the map. Once tapped, the purple icon appears on the map, indicating your current location.
	Tap to zoom in the map.
	Tap to zoom out the map.

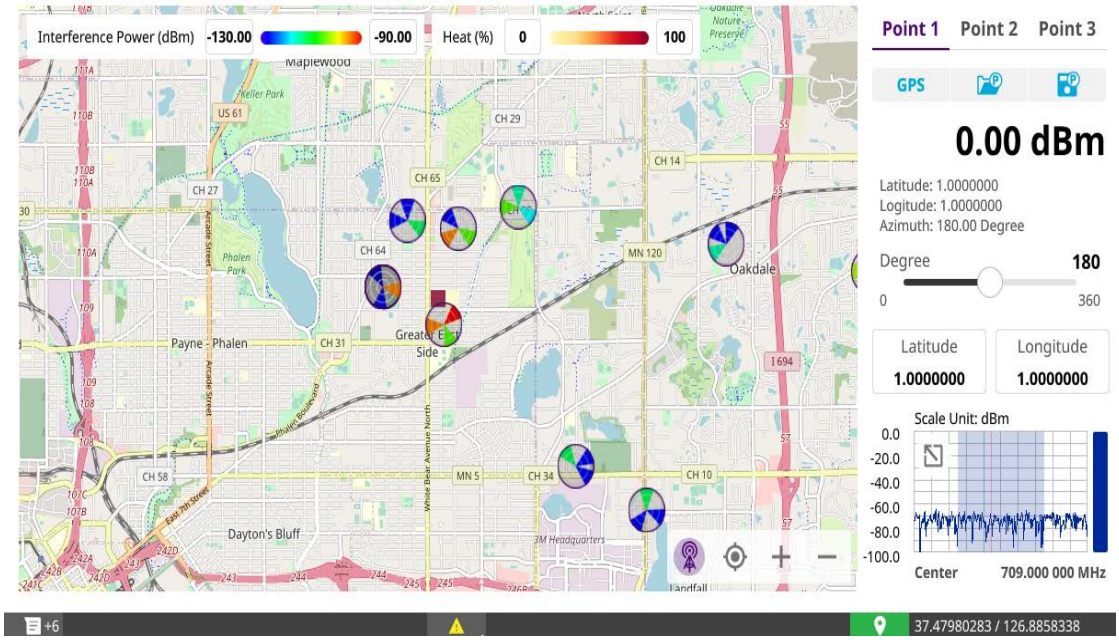
To load a JSON file from Spectrum Net Analyzer

When you load a JSON map file configured in Spectrum Net Analyzer, you can view the map with Cell Site icon, Interference Power, and Heat map (%) legend colors.

1. Plug in your USB flash drive that has a map file in.json file type created in Spectrum Net Analyzer.
2. Tap the **Load** icon on the side bar.
3. Navigate to the map you want to open. The **File Information** pane displays the file properties, including name, size, type, and date modified.
4. Tap the **Load** button on the screen.
5. Once the json file is successfully loaded, the **Cell Site** icon is enabled.

Figure 107 shows an example of the Online Interference Finder measurement from the JSON file loaded.

Figure 107 Online Interference Finder measurement from the JSON file loaded



NOTE

Based on the min/max value of the Interference Power, the cell site direction color changes, and based on the min/max value of the Heat, the heat map color changes.

Initializing AntennaAdvisor

Once you have connected the AntennaAdvisor Handle to your instrument, antenna initialization is required to get the right azimuth data. You need to initialize the antenna handle to calibrate the built-in compass by completing the following steps. Note that you can adjust Bandwidth based on the center frequency of the interfering signal that you have identified in the Spectrum view by tapping **Measure Setup > Bandwidth**. A message appears at the bottom of the screen to alert you if you have not performed initialization of your connected the antenna handle set.

To initialize AntennaAdvisor

1 Hold your antenna handle horizontally in its upright position.

To avoid the unnecessary impact of an external magnetic field, position yourself at the location where the value of the magnetic field strength displayed on the instrument screen is green.

2 Point the antenna to the north and tap **Measure Setup > Initialize AntennaAdvisor**.

The message disappears and the red line for the current antenna direction moves to the 0° line and overlaps to let you know that the initialization has completed successfully.

Setting geographic location

A point is a particular location that contains information about that location. This information includes, for example, GNSS coordinates, the time of the measurement or level that has been measured. You can evaluate the Point information directly on-site or save the information for later evaluation.

With this functionality, you can mark locations where you have performed a measurement. Thus, you can analyze the geographical distribution of the received signal strength. This allows you to analyze, for example, the coverage conditions around a base station's coverage area.

In the map view, a point is displayed as a dot with a number. The straight line represents the direction you are facing.

To set the geographic location

1. Tap the **Point 1**, **Point 2** and **Point 3** on the map. Make sure to set three location points so that the straight lines started from the point can create three intersections.
2. Tap each point and use the **Degree** bar or button to change degrees.
3. Tap the **GNSS** icon to automatically get the selected point’s location information.

   The instrument displays the latitude and longitude information of the signal received by the GNSS antenna. This function is only available when the GNSS antenna is connected.
4. Tap the **Latitude** and **Longitude** icon and enter the value using the on-screen keyboard to manually define a position.

   The input values are in decimal degrees.
5. Tap the **Apply** button.

Setting azimuth

There are three methods available for setting azimuth:

Method 1: AntennaAdvisor Handle

You can use the Antenna Advisor handle. Make sure you initialize AntennaAdvisor first to get more accurate directional information.

1. Press and hold the **TRIGGER** button on the handle then it finds the strongest RSSI value.

   RSSI, polarization, elevation, and azimuth readings are continuously updated on the screen while pressing the physical button.
2. Release the **TRIGGER** button to stop scanning.

Method 2: Degree bar

The **Degree Bar** functions as a compass. You can use it to set azimuth by moving it right and left.

Tap the circle on the Degree bar and move it gently until you get the right azimuth.

Method 3: Log-periodic antenna

You can use the log-periodic antenna.

Pan your log-periodic antenna to find a signal with the highest RSSI value and measure an azimuth of the interfering signal.



NOTE

The AntennaAdvisor has a built-in low-noise amplifier (LNA) that can be turned on and off using the physical On/Off button located on the rear side of the handle unit. For example, if the received signal is weak, you can turn on the switch to improve S/N.

To save the defined position

1. Tap any point on the map where you want to save the position information.
2. Tap the **Save Position** icon.

   The instrument stores the saved location points in the internal memory, allowing you to load them by using the **Load Position** icon. You can save and load up to 10 positions.

Setting display mode

When the triangulation is done with three location points and azimuth for each point, you can view a circumscribed circle by default. You can change the display mode to inscribed circle or double circles to view a narrower area. The center of the green-shaded circle is determined to be where the source of the interfering signal resides.

To set display mode

1. Tap **Measure Setup > Display**.
2. Select the option from the following choices:
   - **Circum**: displays a circumscribed circle that meets three vertices of the triangle.
   - **Inscribed**: displays an inscribed circle that meets the three vertices of the triangle.
   - **Double**: displays both circumscribed and inscribed circles.

To set sound indicator

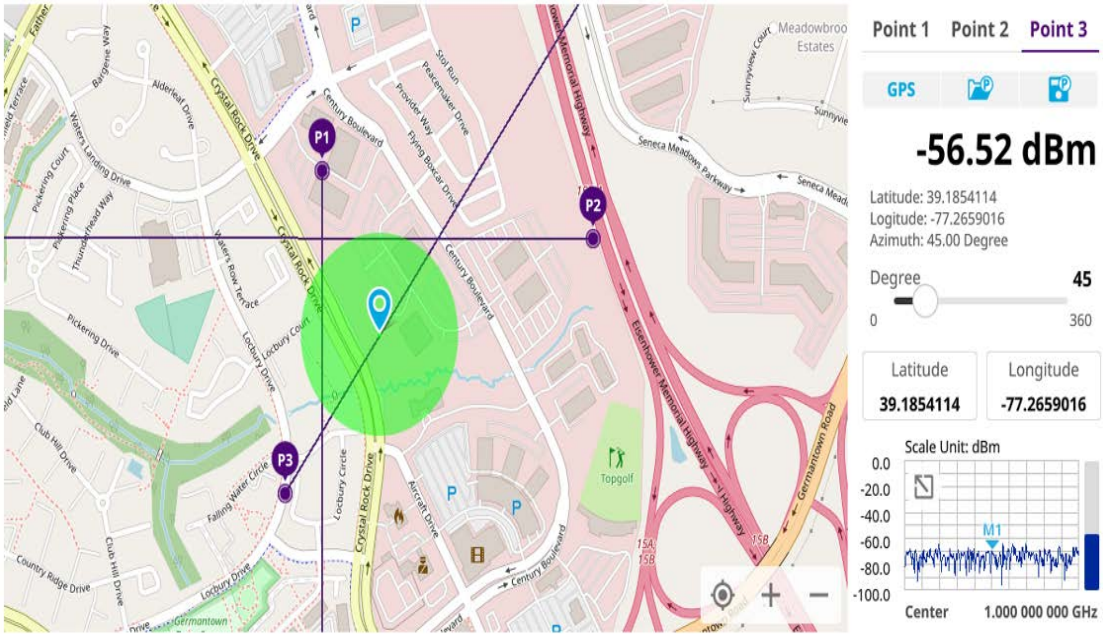
1 Tap the **Setup** ( ) icon on the side bar.

2 Tap **Sound Indicator**.

- **a** Tap to switch the **Sound** between **On** and **Off** to enable and disable the alarm sound.
- **b** Tap to switch the **Alarm Reference** to **Marker** to set the active marker position as the alarm reference.
- **c** Tap to switch the **Alarm Reference** to **Bar** to set the bar's level as the alarm reference.
- **d** *Optional:* To adjust the volume for alarm sound, tap **Volume** and input a value from 1 to 10 using the on-screen keyboard.

Figure 108 shows an example of the Online Interference Finder measurement in map view.

Figure 108 Online Interference Finder measurement in map view



NOTE

If you go to Setup > Bandwidth and set the required bandwidth, you can see the light blue bar chart with bandwidth in the current spectrum measurement screen. The above figure does not show the bar as it sets the bandwidth to 0.

Creating a map

You can create a map online and continue conducting a route map analysis using the created map even when there is no Ethernet connection.

1 Tap **Setup** > **Map Creator**.

2 Tap the **Search** box and input the location using the on-screen keyboard and select one of the options as required.

3 Tap the **Zoom Level** box to capture the map with corresponding zoom level.

4 Tap the **Capture** button to start capturing the map.

Once the map is captured, the capturing completed pop-up will appear.

5 Select between the two options: Save in the system or Save as file.

6 Tap the **Done** button.

NOTE
If you have unsaved measurement data (map) and start measuring by tapping the Testing button or by tapping another measurement mode, a pop-up window will appear asking whether you will restore the unsaved data or not.

Online radar chart

If you have identified an interfering signal in your spectrum view, you can move to the Radar Chart mode and measure RSSI power level through 360° at a location received by the connected broadband directional antenna so that you can determine the direction of the source of the interference. Using a set of the AntennaAdvisor Handle that holds a broadband directional antenna is mandatory in the Radar Chart mode. The built-in compass, GNSS antenna, and built-in low-noise amplifier (LNA) allow you to determine the direction of the interference. Before starting the Interference Finder, you need to set Spectrum measurements. See “Configuring spectrum measurements” on page 25 for more information.

For information about connecting the antenna, see “Antenna connection” on page 214.

Controlling a map

To control a map

See the following table to control a map.

Table 37 Map control icons

Icon	Description
	Tap to go to your current location on the map. Once tapped, the purple icon appears on the map, indicating your current location.
	Tap to zoom in the map.

Table 37 Map control icons

Icon	Description
	Tap to zoom out the map.

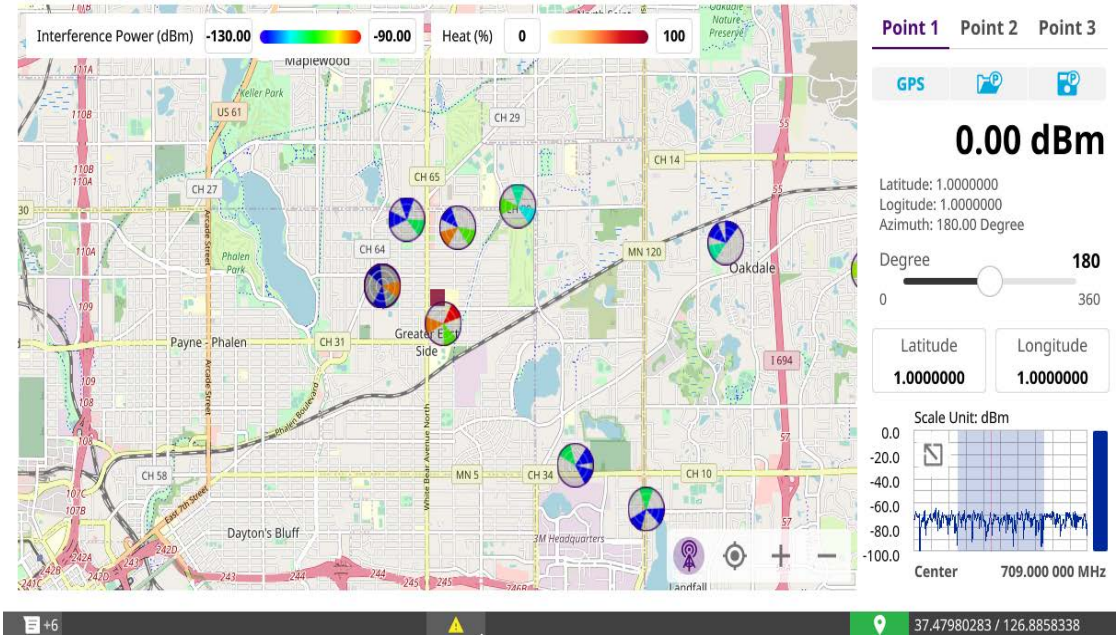
To load a JSON file from Spectrum Net Analyzer

When you load a JSON map file configured in Spectrum Net Analyzer, you can view the map with Cell Site icon, Interference Power, and Heat map (%) legend colors.

1. Plug in your USB flash drive that has a map file in .json file type created in Spectrum Net Analyzer.
2. Tap the **Load** icon on the side bar.
3. Navigate to the map you want to open. The **File Information** pane displays the file properties, including name, size, type, and date modified.
4. Tap the **Load** button on the screen.
5. Once the json file is successfully loaded, the **Cell Site** icon is enabled.

Figure 109 shows an example of the Online Radar Chart measurement from the JSON file loaded.

Figure 109 Online Radar Chart measurement from the JSON file loaded



NOTE

Based on the min/max value of the Interference Power, the cell site direction color changes, and based on the min/max value of the Heat, the heat map color changes.

Initializing AntennaAdvisor

Once you have connected the AntennaAdvisor Handle to your instrument, antenna initialization is required to obtain the correct azimuth data. You need to initialize the antenna handle to calibrate the built-in compass by completing the following procedure. You can adjust bandwidth based on the center frequency of the interfering signal that you have identified in the Spectrum view by tapping **Setup > Bandwidth**. A message appears at the bottom of the screen to alert you if you have not performed initialization of your connected the antenna handle set.

To initialize AntennaAdvisor

1. Hold your antenna handle horizontally in its upright position.

   To avoid the unnecessary impact of an external magnetic field, position yourself at location where the value of magnetic field strength displayed on the instrument is green.

2. Point the antenna to the north and tap **Setup > Initialize AntennaAdvisor**.

   The message disappears, and the red line for the current antenna direction moves to the 0° line and overlaps to let you know that the initialization was done successfully.



NOTE

It is recommended that you re-initialize the AntennaAdvisor Handle after measurements to re-calibrate the compass when you notice that the red line on the radar chart is not aligned with the north on the map, even though you are pointing the antenna to the north.

Obtaining RSSI and direction data

Once you have connected your antenna handle set and done necessary setups, you can monitor the power level of the received signal, the amount of polarization, and elevation level real time. Using the Trigger button on the antenna handle set, you can plot the RSSI level and obtain current direction of antenna at your location.

To obtain RSSI and direction data

1. When you have the green GNSS indicator, tap the **GNSS** icon on the side panel to set your current location to the center of the radar chart. The latitude and longitude information at the side of the display changes from “Unknown Position” to the obtained position information.

2. Tap the **Save Position** icon on the side panel to save a position to recall for triangulation in the Interference Finder mode and select one that you want to save.

3 Monitor the RSSI reading of the received signal. If the signal is weak, turn on the LNA switch on the antenna handle set to improve S/N.



NOTE

The AntennaAdvisor Handle has a built-in low-noise amplifier (LNA) and you can turn it on and off by toggling the physical On/Off switch located on the rear side of the handle unit

4 Hold the antenna handle set horizontally and make the measurement.

The message disappears and the red line for the current antenna direction moves to the 0° line and overlaps to let you know that the initialization is done successfully.

5 Obtain a RSSI value and direction:

a Press the **Trigger button** located on the antenna handle.

Each time you press the physical button on the handle, a beep sounds and a power level of the received signal is plotted as a blue dot on the radar chart. Depending on the strength of the measured value, you may hear different tones of beeping.

b While receiving the power level, you can also obtain the current direction of the antenna. Repeat pressing the TRIGGER button to obtain at least five points if you want to do the localization.

6 To continuously obtain RSSI values and direction:

a Press and hold the **TRIGGER** button located on the antenna handle to start a continuous measurement.

b A beep is sounded repeatedly to let you know that the measurement is continuing and measured values are plotted and lined on the radar chart.

c Release the TRIGGER button to stop the continuous measurement.



NOTE

The maximum number you can plot on the radar chart is 2500 points both in the single and continuous measurements. If your measurement reached to 500 points, you need to reset the measurement by pressing the Localization soft key twice or performing the initialization of the AntennaAdvisor Handle. Concentric circles indicate different levels of RSSI. You can use the AMP/SCALE hard key to adjust the amplitude scale of the chart.

Localizing RSSI data

The Localization feature allows you to view averaged and smoothed measurement data with a bold green line on the radar chart that helps you determine the direction of the highest RSSI value. When you have five or more data points plotted on the radar chart, you can perform this localization.

To localize RSSI data

1 Tap the **Setup** ( ) icon on the side bar.

2 Tap **Localization**.

All measured points turn green and a bold green line appears, indicating the possible direction of the interference source.

3 Tap Localization again to clear all the data plots on the radar chart.

Figure 110 shows an example of the Online Radar Chart. Figure 111 shows an example of the online radar chart with localized data.

Figure 110 Online Radar Chart

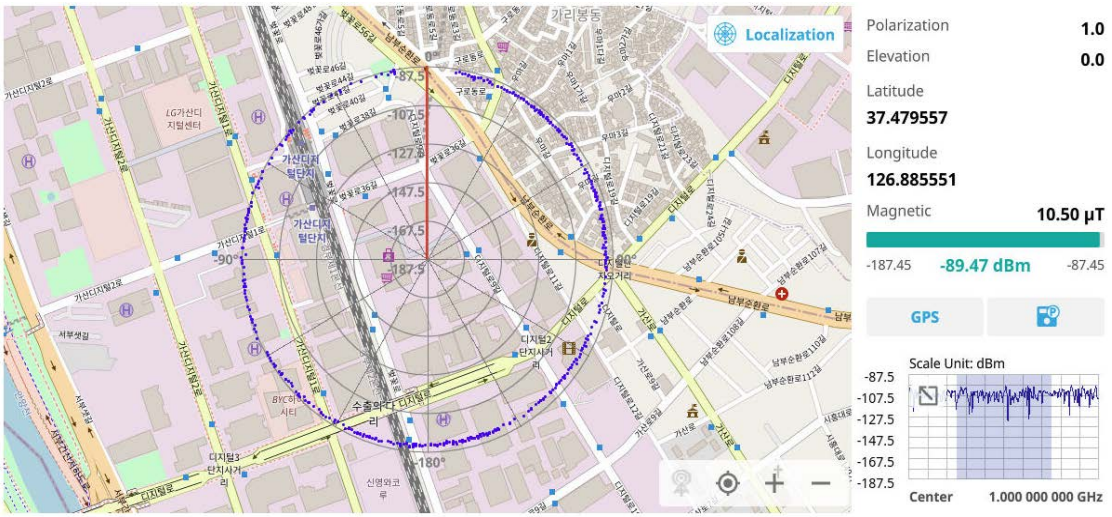
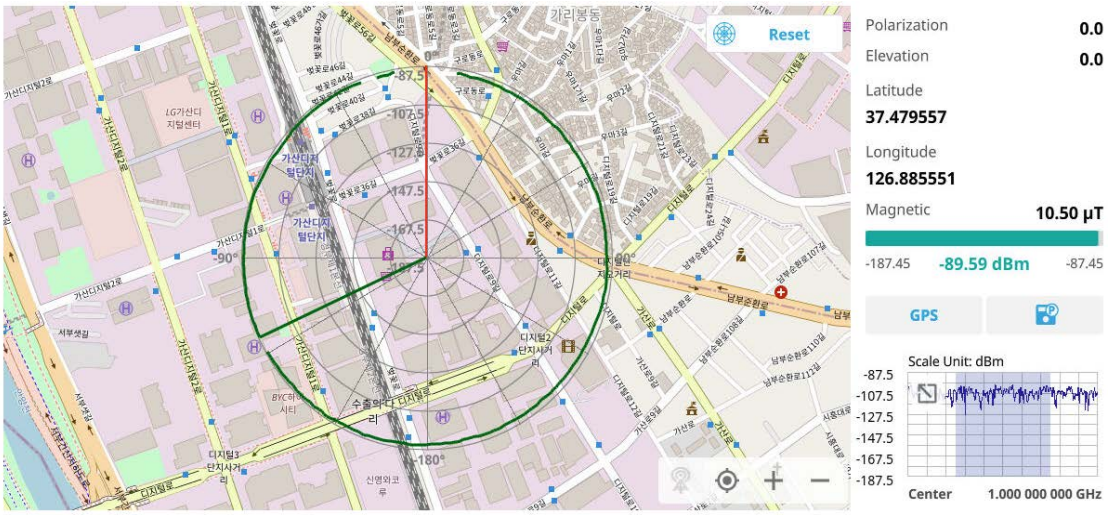


Figure 111 Online Radar Chart localized



Creating a map

You can create a map online and continue conducting a route map analysis using the created map even when there is no Ethernet connection.

1 Tap **Setup** > **Map Creator**.

2 Tap the **Search** box and input the location using the on-screen keyboard and select one of the options as required.

3 Tap the **Zoom Level** box to capture the map with corresponding zoom level.

4 Tap the **Capture** button to start capturing the map.

Once the map is captured, the capturing completed pop-up will appear.

5 Select between the two options: Save in the system or Save as file.

6 Tap the **Done** button.



NOTE
If you have unsaved measurement data (map) and start measuring by tapping the Testing button or by tapping another measurement mode, a pop-up window will appear asking whether you will restore the unsaved data or not.

RF Viewer analysis

The following sections describe how to conduct RF Viewer measurements.

RF Viewer

The RF Viewer is used to monitor and analyze radio frequency (RF) signals in real time, helping users observe spectrum characteristics, signal strength, and interference.

Antenna connection

Before starting the measurement, you need to connect the Omni or Log periodic antenna to your instrument. In the Interference Finder and the Radar Chart modes, you can perform interference hunting using the optional AntennaAdvisor Handle after attaching a broadband directional antenna to it. The handle is a device that has a built-in GNSS antenna and LNA. The following are examples of the antenna and camera connection.

To connect an antenna and a camera

1 Mount a broadband antenna and a camera to your AntennaAdvisor Handle.

2 Connect the **RF Type-N Jack** of the handle to the **RF In** port of the instrument.

3 Connect the **GNSS SMA** jack of the handle to the **GNSS port** of the instrument. The GNSS status indicator appears on the instrument screen.

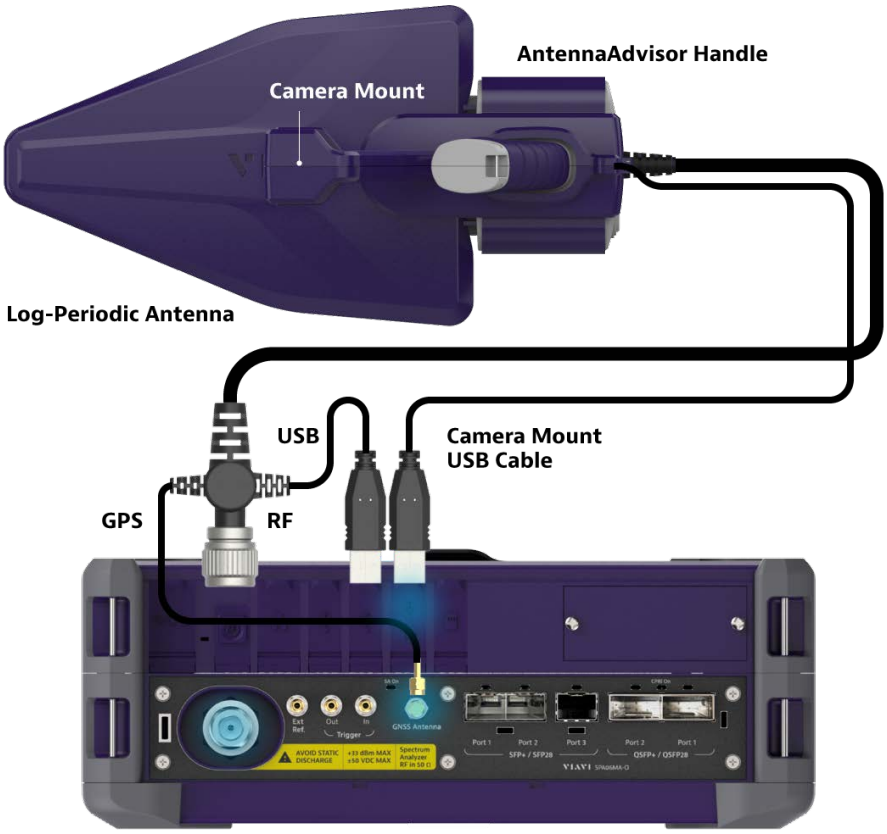
4 Connect the **USB plug** of the handle and the camera to the **USB Host port** of the instrument. The device icon appears in the system status bar on the screen.

NOTE

The AntennaAdvisor Handle is an optional item. It is recommended that you use a log periodic antenna with AntennaAdvisor handle to search more exact directional information. You can use a log periodic antenna or Omni antenna alone as well.

Figure 112 shows an example of an antenna and a camera connection.

Figure 112 Antenna and camera connection example



Initializing AntennaAdvisor

Once you have connected the AntennaAdvisor Handle to your instrument, antenna initialization is required to get the right azimuth data. You need to initialize the antenna handle to calibrate the built-in compass by completing the following steps. Note that you can adjust Bandwidth based on the center frequency of the interfering signal that you have identified in the Spectrum view by tapping **Setup > Bandwidth**. A message appears at the bottom of the screen to alert you if you have not performed initialization of your connected the antenna handle set.

To initialize AntennaAdvisor

1 Hold your antenna handle horizontally in its upright position.

2 Point the antenna to the north and tap **Setup > Initialize AntennaAdvisor**.

The message disappears and the red line for the current antenna direction moves to the 0° line and overlaps to let you know that the initialization has completed successfully.

To set measure setup

Once the antenna and camera are connected and initializing AntennaAdvisor, continue to set up the instrument as required.

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap **Bandwidth** and select the value from the following choices: **1.4 MHz**, **3 MHz**, **5 MHz**, **10 MHz**, **15 MHz** or **20 MHz**.

3 Tap **Dot Type** from the options: **Center**, **Channel**, or **Pick**

- Center: Displays the value at the center of the chart as a dot
- Channel: Displays the total power of the entire channel as a dot
- Peak: Displays the highest value within the channel as a dot

4 Tap **Reset** to clear the current setting or operations.

5 Tap **Transparency** to adjust the screen transparency.

6 Tap **Sound Indicator**.

a Tap to switch the **Sound** between **On** and **Off** to enable and disable the alarm sound.

b Tap to switch the **Alarm Reference** to **Marker** to set the active marker position as the alarm reference.

c Tap to switch the **Alarm Reference** to **Line** to set the limit as the alarm reference.

d Select **Reference Line** to specify a threshold for the reference line using the on-screen keyboard.

e *Optional:* To adjust the volume for alarm sound, tap **Volume** and input a value from 1 to 10 using the on-screen keyboard.

To start a test

You can use the AntennaAdvisor to set the azimuth and elevation. Initialize AntennaAdvisor first to ensure accurate directional information.

1 When the **TRIGGER** button is pressed, the camera screen is captured and aligned to the center of the display.

2 While holding the **TRIGGER** button, moving the antenna displays a dot on the screen.

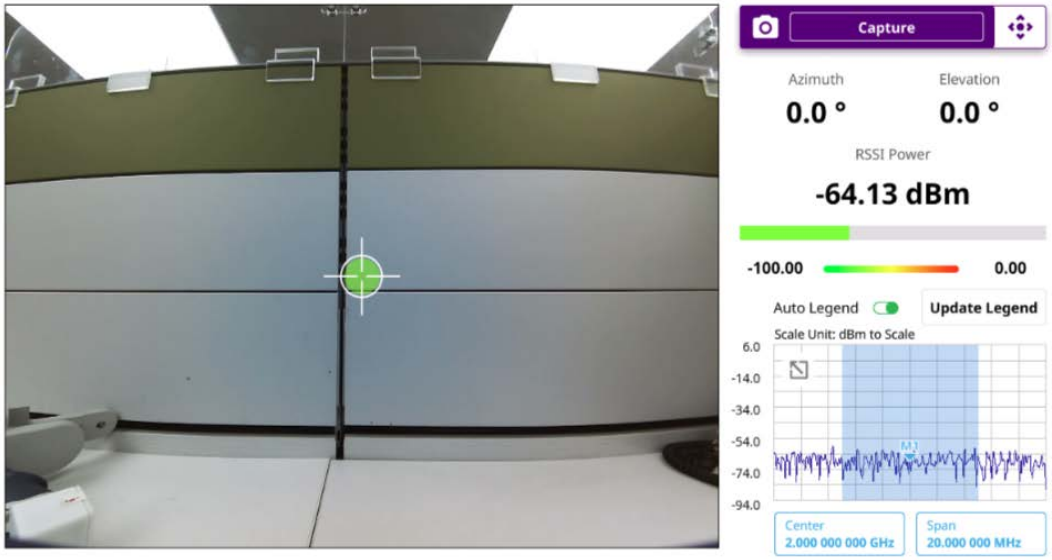
3 When the **TRIGGER** button is released, the measured screen is automatically saved.

4 RF power is displayed using legend colors, and the cross mark indicates the strongest power.

5 Pressing the **TRIGGER** button again returns to Step 1.

Figure 113 shows an example of an RF Viewer measurement.

Figure 113 RF Viewer measurement



NOTE

You can set Center Frequency and Span Frequency using the button.

9

Using EMF Analyzer

This chapter describes how to use the EMF Analyzer. Topics covered in this chapter include:

- “Introduction” on page 246
- “Connecting antenna” on page 246
- “Selecting mode and measure” on page 248
- “RF analysis” on page 248
- “5G NR analysis” on page 268
- “LTE analysis” on page 290
- “Real-time analysis” on page 306

Introduction

Base stations emit electro-magnetic fields (EMF) of high frequency, which varies between wireless technologies and countries. As personal exposure to high frequency fields from base stations can provoke health effect, the International Commission on Non-Ionizing Radiation Protection (ICNIRP) has provided general guidelines on limitations regarding high frequency exposure. Using the EMF Analyzer in JD700B series with an isotropic antenna connected, you can now measure the level of EMF onsite in the field in order to verify if the level of emission from of your base station is compliant with the guidelines.

The EMF Analyzer can perform the following measurement and analysis:

- RF Analysis
  - Spectrum
  - Scanner
- 5G NR Analysis
  - 5G NR Beam Analysis
  - 5G NR Traffic Analysis
- LTE Analysis
  - LTE FDD Analysis
  - LTE TDD Analysis
- Real-time Analysis
  - Spectrum
  - Scanner

Connecting antenna

In the EMF Analyzer mode, connecting an isotropic antenna (omni antenna) or a log-periodic antenna (yagi antenna) is mandatory. Using these antennas, you can make three-dimensional measurements.

To connect an isotropic antenna

1. Connect the **RF Type-N** connector of the isotropic antenna to the **RF In port** of the instrument.
2. Connect the **USB plug** of the isotropic antenna to the **USB Host port** of the instrument. The device icon appears in the system status bar on the screen.

Figure 114 shows an example of an isotropic antenna connection.

Figure 114 Connecting an isotropic antenna



To connect a log-periodic antenna

1 Mount a broadband antenna to your AntennaAdvisor Handle.

2 Connect the **RF Type-N Jack** of the handle to the **RF In port** of the instrument.

3 Connect the **GNSS SMA** jack of the handle to the **GNSS port** of the instrument. The GNSS status indicator appears on the instrument screen.

NOTE

If GNSS cable is connected successfully, you can see latitude/longitude/altitude at the bottom right of the measurement screen.

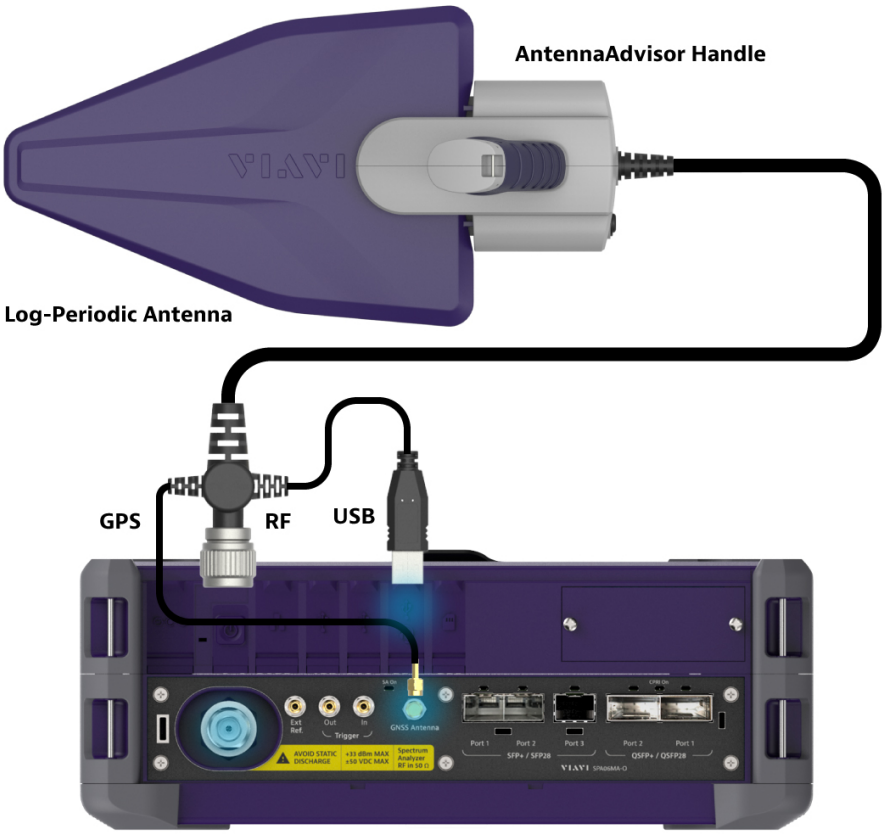
4 Connect the **USB plug** of the handle to the **USB Host port** of the instrument. The device icon appears in the system status bar on the screen.

NOTE

The AntennaAdvisor Handle is an optional item. It is recommended that you use a log periodic antenna with AntennaAdvisor handle to search more exact directional information. You can use a log periodic antenna or Omni antenna alone as well.

Figure 115 shows an example of a log-periodic antenna connection.

Figure 115 Connecting a log-periodic antenna



Selecting mode and measure

The following procedure describes how to start measurement.

To start measurement

1 Tap **EMF Analyzer** on the **MODE** panel.

2 Tap any measurement mode from the following choices:
- RF Analysis > Spectrum or Scanner
- 5G NR Analysis > 5G NR Beam Analysis or 5G NR Traffic Analysis

RF analysis

The following sections describe how to perform RF analysis.

Spectrum

After setting test parameters as described in "Configuring spectrum measurements" on page 25, you can start your EMF measurements.

To set measure setup

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap **Test Configuration**.

a Tap **Dwell Time** to specify the amount of measurement time that you want the instrument to stay for on each axis and input the value from 0.1 to 60 (second) using the on-screen keyboard.

b Tap **Measurement Mode** to switch between **Live** and **Timed**.

- Select **Live** to view the measurement results in real time as the test runs continuously.
- Select **Timed** to run the test with the time limit you set. When selected, specify the **Measurement Time**.

c Tap **Measurement Time** to specify the amount of measurement time that you want the instrument to stay for on all three axes in order to display current and accumulated EMF power and set this up to 48 hours using the on-screen keyboard.

NOTE

If you set the measurement time, the count which means the number of EMF measurements on the right panel of the measurement screen is changed corresponding to the measurement time you have set.

3 Tap to switch **Axis** to **Manual** or **Auto**.

If you set it to **Manual**, Axis setting is available and if you set it to **Auto**, Axis setting is unavailable.

– **Manual**: When using isotropic EMF antenna, you can manually set x, y, and z axis. You can set Manual as a diagnosis mode whether you can receive correct signal based on each axis: X, Y, or Z.

– **Auto**: Each axis of antenna is automatically changed and measured.

4 When selected as **Manual**, tap **Axis** and select from: **X**, **Y**, or **Z**.

You can also select it from the right panel of the measurement screen.

5 When selected as **Manual**, tap Manual Axis **Capture** to **On**.

a Select the desired **Detector**: **Both**, **Peak**, or **RMS**, to capture the current EMF power for each axis.

- **Both**: Captures and displays both Peak and RMS EMF power for each axis (X, Y, and Z).
- **Peak**: Captures and displays the Peak EMF power for each axis.
- **RMS**: Captures and displays the RMS EMF power for each axis.



NOTE

The **Live** button on the right panel of the measurement screen must be tapped to start the measurement before the captured EMF power values can be displayed.

6 Tap **Move to RtSA** to view the real-time spectrum measurement mode.

7 Tap to switch **Moving Average** to **On** or **Off**.

When enabled, the Moving Average function averages EMF measurements over a set time duration, reducing momentary variations and improving readability of typical EMF levels.



NOTE

When Moving Average is turned On, the **Moving Average Power Max Reference** and **Moving Average Power Min Reference** settings become available under Menu > Amp/Scale, allowing you to define the upper and lower reference levels used for the moving average power trace.

8 When selected as On, Tap **Moving Average Time** and set a time duration.

9 Go back to **Setup** and tap **Antenna & Cable Loss**.

a *Optional.* Tap to switch **Antenna Gain** to **On** or **Off**.

b When the Antenna Gain is on, tap **Antenna Gain Value** and input the required value using the on-screen keyboard.

NOTE

You need to be cautious when using this value as the instrument applies not an antenna gain value selected from Antenna List but applies this setting. This may cause measurement errors.

c Tap **Antenna List EMF** and select the required antenna from the pop-up window. Based on the antenna list you selected, you need to check the Axis mode and do the following:

- When selecting G700050381 or G700050382 (Isotropic E-Field) Antenna and Axis to Auto, the Current on the measurement screen indicates as x, y, or z automatically and the Isotropic EMF Power is measured.
- When selecting Yagi antenna (Log Periodic Broadband) and Axis to Auto, the Current on the measurement screen indicates YAGI and the EMF Power is measured.
- When tapping Custom > Configuration icon, an Antenna List Editor window appears and you can customize Frequency and Antenna Factor. You can add up to 500 customized antennas.

NOTE

When selecting Omni antenna (Isotropic E Field) and Axis to Manual, the Current on the measurement screen indicates as your choice (x, y, or z) and the EMF Power is measured.

The instrument supports an engineering mode as ‘Axis Mode: Manual’ to inspect G700050381 and G700050382 antenna. You must not use this mode for a general purpose to measure EMF Power. It does not guarantee the accuracy of the measurement result.

d *Optional.* Tap to Switch **Cable Loss** to **On** or **Off**.

NOTE

When the isotropic antenna is changed to a different antenna, set Cable Loss to On. In this case, the Cable List menu is disabled (grayed out), as the cable loss value is entered manually and does not require selection from the Cable List.

e When the Cable Loss is On, tap **Cable Loss Value** and input the required value using the on-screen keyboard.

The entered value is displayed in the antenna information area at the top right of the instrument.

NOTE

When you need to use an antenna that is not listed in Antenna List EMF, connect your antenna and then set the Antenna Gain and Cable Loss required for your measurement.

10 Tap **Cable List** and select between **Standard** and **Custom**.

a Tap **Standard** and select a cable from the options.

- Select **AGOS (1.6m)** as required if you use a cable provided with G700050381 (Isotropic E-Field) antenna.
- Select **WaveControl** as required if you use a cable provided with G700050382 (Isotropic E-Field) antenna.
- Select **G700050551** as required.
- Select **G700050552** as required.

b Tap **Custom** and select a registered cable if you use a cable that you registered.

c Once tapped, a Cable List Editor window pops up.

- Tap **Add** (+) button to add a new cable. This will add to a new cable list.
- Tap the **Configuration** icon to edit a cable shown in the 'Cable List'. After designating the cable name by selecting the Configuration icon, you need to input the real loss value of the cable measured between the bandwidth from 1 GHz to 2 GHz. This will automatically compensate the measurement result by calculating the input cable loss.
- Tap the **Delete** icon to delete the customized cable that you have set.

11 Tap the **Display Mode** icon between **Spectrum** and **Level Recorder**. Refer to Figure 117 and Figure 118.

Based on the selection, the measurement screen will change.

12 On the right panel of the screen, do the following steps:

a Tap the **Testing** ( ) button to start the measurement.

The instrument displays measurement results on the screen.

b Tap the **Hold** icon on the side bar to hold the display.

c Tap the **Hold** icon again to release the display.

d Tap the **Stop** ( ) button to stop the measurement.

The alert message pops up to confirm whether you want to stop now or not.

- The (Isotropic) EMF Power is the sum of EMF power measured with three axes for the specified dwell time for the axis, and the maximum/ minimum powers are measured based on the current measuring power.
- Spectral density displays the current signal within the integration bandwidth on the measurement screen.

NOTE
If you have unsaved measurement data and start measuring by tapping the Testing button or by tapping another measurement mode, a pop-up window will appear asking whether you will restore the unsaved data or not.

Figure 116 Antenna connected screen.

Figure 116 Antenna connected screen



NOTE
Once the antenna is successfully connected, the antenna name with a green indicator will appear at the top-right corner of the screen and the setup values (Axis, Cable List, and Standard Limit Line) you have set will be displayed at the top of the screen.

To configure Telecom Service Table

1 Tap the **Configuration** icon to set **Telecom Service Table**.

The telecom service table is a frequency/band editor that users can set and select frequency/band they want in advance.

a Tap the **Configuration** icon on the bottom left to edit the parameters: **Start Frequency**, **Stop Frequency**, **Technology**, and **Minimum BW**.

b Tap the **Channel Standard** button and select from the pop-up window.

c Tap the **Apply** button to apply the settings.

d Tap the **Save** icon to save the applied settings.

e Tap the **Load** icon to load the saved settings.



NOTE

Make sure to go to Menu > Frequency and set the proper Integrated Bandwidth based on the frequency bandwidth for technology in service to get the right measurement result.

To set trace

If you set Axis to Manual, you can see only whether T1 displays with a selected axis correctly and Current displays as a selected antenna in the Antenna List EMF. The following is the case of setting trace if you set Axis to Auto and enter into measurement mode.

1 Tap **Menu > Trace** in the side bar.

2 Tap **Select Trace** from 1 to 4.

- **T1**: Maximum Hold
- **T2**: Minimum Hold
- **T3**: Current (I: When connected to an Isotropic Antenna, E: When not connected to an Isotropic Antenna)
- **T4**: Average

3 Tap to switch **Trace View** to **On** or **Off**.

If you set the Trace from 1 to 4 to off, the trace information in Top Info will indicate it as F (false).

4 Tap **Trace Clear All** to clear Min/Max/Isotropic EMF/Spectral Density traces.



NOTE

Trace Clear All resets traces you have set and it also affects overall measurement (Max, Min, etc...) and measurement result. Therefore, you need to be cautious when using this function.

To set detector

1 Tap to switch **Detector** to **Both**, **RMS**, or **Peak** on the middle of the measurement screen.

   a Tap **RMS** to display 'The root mean squared average power across the spectrum'.

   b Tap **Peak** to display 'The highest value in each data point'.

   c Tap **Both** to display both **RMS** and **Peak**.

To set limit

1 Tap **Menu > Limit** in the side bar.

2 Tap **Reference Line**, and then enter a value that you want to set as a reference. The unit will vary depending on your selection of the unit in the Units setting in Amp/Scale.

   You can also scroll up and down the purple bar on the measurement screen.

3 Tap to switch **Reference Line Mode** to **On** or **Off**.

   If you set it to On, the reference line will appear with the purple bar on the measurement screen and set it to Off, the reference line will disappear with the purple bar on the measurement screen.

4 Tap to switch **Standard Line Mode** to **On** to display the standard line on the screen or **Off** to hide the standard line on the screen.

   Make sure to set it to On and set Scale Unit to % (V/m) or %(W/m²) in Amp/Scale. Then the EMF power will be shown as % in the measurement screen.

5 Tap **Standard Limit Line** and select from the following options:

   Standard Line is displayed on the screen based on the pre-defined standard. If you select ICNIRP Occupational or ICNIRP General Public, the Standard Line is automatically displayed with automatically calculated value defined in the ICNIRP

guideline. Make sure you change the Scale Unit to V/m in this case to follow the guideline. Other standard limit lines listed in the pop-up window indicate specific standard applied to each country.

a Select a required standard line from the list.

b Tap **ICNIRP Occupational** and **Apply** when EMF power is measured in a site where people work for long hours (occupational).

c Tap **ICNIRP General Public** and **Apply** when EMF power is measured in a public site where unspecified people come and go.

d Tap **Custom Limit** and then tap the **Configuration** icon if you want to customize setting and measure EMF power based on your need.

- A **Standard** window appears.
- Tap **Lower Frequency** and input a desired value using the on-screen keyboard.
- Tap **Upper Frequency** and input a desired value using the on-screen keyboard.
- Tap **Value for Frequency Range** and input a desired value using the on-screen keyboard. It sets coefficient of function.
- Tap **Formula** and select from the following choices: **f^n, /f^n, NA**. It defines an operator between coefficient and frequency. The operator to be defined is multiplication or division.
- Tap **Exponent Value** and input a desired value using the on-screen keyboard. It defines an exponent of the frequency.
- Tap the **Save** button if you want to save the setting.
- Optional. Tap the **Add** button to add Custom Limit.
- *Optional.* Tap the **Delete** button to delete the defined Custom Limit.



NOTE

If you set Formula to f^n or /f^n, you can define the limit line as frequency of function. If you set it to NA, you can define the limit line as a constant.

To save measurement file

You can save your current screen, result, and setup into the internal memory or your external USB memory drive, **USB A** or **USB B** or **SD card.** Make sure to insert a USB memory drive to USB A or B port and insert the SD card to MicroSD port to enable the option. After insertion, you'll have access to the external storage, where you can find a sub-directory corresponding to the instrument you're using. When you are using the Save feature, Hold is automatically enabled.

1 Tap the **Save** () icon on the side bar.

2 Tap the **File Name** input field.

3 Enter the file name you want using the on-screen keyboard.

4 To know and how to save, see the following options:

   a Select **Screen (.png)** to save the current screen with a file type, .png.

   b Select **Report (.pdf)** to save the measurement result in a report format with comments and captured screen images with a file type, .pdf

   If you select Screen or Report in the save options, you can automatically save setup information with screenshots.

   c Select **Result (.csv)** to save the current measurement result displayed on the screen as a .csv file.

   The saved file will include the antenna factor information in Excel (.csv) format.

   d Select **Setup (.stav)** to save the setup and test configuration with a file type, .stav.

   e Select **Logging (.csv)** to save all measurement results with a file type, .csv.

5 *Optional.* Tap to switch the **Color Inversions** to **On** to invert the image color (only available to save as Screen or Report).

6 *Optional.* Tap **Report Setup** to create a report.

   You can add image files and edit information such as Site Location, Site Information, Test Purpose, and Test Result as needed.

To load measurement file

You can load your saved screen, result, and setup from the internal memory or your external USB memory drive, **USB A** or **USB B** or **SD card.** Make sure to insert a USB memory drive to USB A or B port and insert the SD card to MicroSD port to enable the option. After insertion, you'll have access to the external storage, where you can find a sub-directory corresponding to the instrument you're using.

1 Tap the **Load** ( ) icon on the side bar.

2 Select the file to be loaded from the internal memory or from your USB drive.

   Information of your selected file appears in the File Information pane.

3 Check the file information on the right pane.

4 Tap the **Load** button to load the file.

NOTE

When you load CSV file (.csv), you can check the data that you have set up during the measurement. You can search specific information that you want using the on-screen keyboard or exit by using the Exit button.

Figure 117 shows an example of EMF spectrum measurement.

Figure 117 EMF spectrum measurement (When selecting Detector to Both)



NOTE

The selected antenna, whether it's **Standard** or **Custom** in **Antenna List EMF**, will appear on the top right panel of the screen.

Figure 118 EMF level recorder measurement (When selecting Detector to Both)

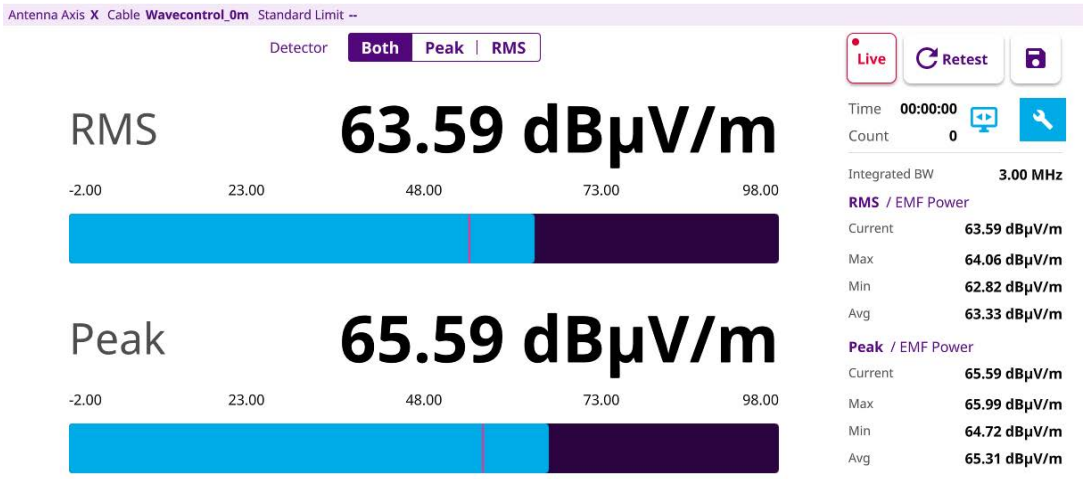


Figure 119 EMF spectrum measurement (When selecting moving average)



NOTE

EMF Moving Average Max Power is displayed on the chart as an orange triangular marker.

Scanner

You can set frequency to be scanned. You can measure up to 100 channels with this scanner. Using existing format-based or custom parameters, you can measure the integrated EMF power for each frequency band sequentially and continuously for predefined measurement time.

To set measure setup

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap **Test Configuration**.

a Tap **Dwell Time** to specify the amount of measurement time that you want the instrument to stay for on each axis and input the value from 0.1 to 60 (second) using the on-screen keyboard.

b Tap **Measurement Mode** to switch between **Live** and **Timed**.

- Select **Live** to view the measurement results in real time as the test runs continuously.
- Select **Timed** to run the test with the time limit you set. When selected, specify the **Measurement Time**.

c Tap **Measurement Time** to specify the amount of measurement time that you want the instrument to stay for on all three axes in order to display current and accumulated EMF power and set this up to 48 hours using the on-screen keyboard.



NOTE

If you set the measurement time, the count which means the number of EMF measurements on the right panel of the measurement screen is changed corresponding to the measurement time you have set.

3 Tap to switch **Axis** to **Manual** or **Auto**.

If you set it to **Manual**, Axis setting is available and if you set it to **Auto**, Axis setting is unavailable.

– **Manual**: When using isotropic EMF antenna, you can manually set x, y, and z axis. You can set Manual as a diagnosis mode whether you can receive correct signal based on each axis: X, Y, or Z.

– **Auto**: Each axis of antenna is automatically changed and measured.

4 When selected as **Manual**, tap **Axis** and select from: **X**, **Y**, or **Z**.

You can also select it from the right panel of the measurement screen.

5 When selected as **Manual**, tap **Manual Axis Capture** to **On**.

a Select the desired **Detector**: **Both**, **Peak**, or **RMS**, to capture the current EMF power for each axis.

- **Both**: Captures and displays both Peak and RMS EMF power for each axis (X, Y, and Z).
- **Peak**: Captures and displays the Peak EMF power for each axis.
- **RMS**: Captures and displays the RMS EMF power for each axis.



NOTE

The **Live** button on the right panel of the measurement screen must be tapped to start the measurement before the captured EMF power values can be displayed.

6 Tap **Move to RtSA** to view the real-time spectrum measurement mode.

7 Go back to **Setup** and tap **Antenna & Cable Loss**.

a *Optional.* Tap to switch **Antenna Gain** to **On** or **Off**.

b When the Antenna Gain is on, tap **Antenna Gain Value** and input the required value using the on-screen keyboard.

NOTE

You need to be cautious when using this value as the instrument applies not an antenna gain value selected from Antenna List EMF but applies this setting. This may cause measurement errors.

c Tap **Antenna List EMF** and select the required antenna from the pop-up window. Based on the antenna list you selected, you need to check the Axis mode and do the following:

- When selecting G700050381 or G700050382 (Isotropic E-Field) Antenna and Axis to Auto, the Current on the measurement screen indicates as x, y, or z automatically and the Isotropic EMF Power is measured.
- When selecting Yagi antenna (Log Periodic Broadband) and Axis to Auto, the Current on the measurement screen indicates YAGI and the EMF Power is measured.
- When tapping Custom > Configuration icon, an Antenna List Editor window appears and you can customize Frequency and Antenna Factor. You can add up to 500 customized antennas.

NOTE

When selecting Omni antenna (Isotropic E Field) and Axis to Manual, the Current on the measurement screen indicates as your choice (x, y, or z) and the EMF Power is measured.

The instrument supports an engineering mode as ‘Axis Mode: Manual’ to inspect G700050381 and G700050382 antenna. You must not use this mode for a general purpose to measure EMF Power. It does not guarantee the accuracy of the measurement result.

d *Optional.* Tap to Switch **Cable Loss** to **On** or **Off**.

NOTE

When the isotropic antenna is changed to a different antenna, set Cable Loss to On. In this case, the Cable List menu is disabled (grayed out), as the cable loss value is entered manually and does not require selection from the Cable List.

e When the Cable Loss is On, tap **Cable Loss Value** and input the required value using the on-screen keyboard.

The entered value is displayed in the antenna information area at the top right of the instrument.

NOTE

When you need to use an antenna that is not listed in Antenna List EMF, connect your antenna and then set the Antenna Gain and Cable Loss required for your measurement.

8 Tap **Cable List** and select between **Standard** and **Custom**.

a Tap **Standard** and select a cable from the options.

- Select **AGOS (1.6m)** as required if you use a cable provided with G700050381 (Isotropic E-Field) antenna.
- Select **WaveControl** as required if you use a cable provided with G700050382 (Isotropic E-Field) antenna.
- Select **G700050551** as required.
- Select **G700050552** as required.

b Tap **Custom** and select a registered cable if you use a cable that you registered.

c Once tapped, a Cable List Editor window pops up.

- Tap **Add** (+) button to add a new cable. This will add to a new cable list.
- Tap the **Configuration** icon to edit a cable shown in the 'Cable List'. After designating the cable name by selecting the Configuration icon, you need to input the real loss value of the cable measured between the bandwidth from 1 GHz to 2 GHz. This will automatically compensate the measurement result by calculating the input cable loss.
- Tap the **Delete** icon to delete the customized cable that you have set.

9 On the right panel of the screen, tap the **Display Mode** icon between **Table** and **bar**.

Based on the selection, the measurement screen will change. Refer to Figure 120 and Figure 121.

10 On the right panel of the screen, do the following steps:

a Tap the **Testing** ( ) button to start the measurement.

The instrument displays measurement results on the screen.

b Tap the **Hold** icon on the side bar to hold the display.

c Tap the **Hold** icon again to release the display.

d Tap the **Stop** ( ) button to stop the measurement.

The alert message pops up to confirm whether you want to stop now or not.

- The Total indicates the quadratic sum of user-defined Average, Maximum and Minimum Integrated EMF Power and Others indicate not user-defined Integrated EMF Power taken from the counts of measurements.

NOTE
If you have unsaved measurement data and start measuring by tapping the Testing button or by tapping another measurement mode, a pop-up window will appear asking whether you will restore the unsaved data or not.

NOTE
If you go to Menu > Trace > Trace Clear All, it resets traces you have set and it also affects overall measurement (Max, Min, etc...) and measurement result. Therefore, you need to be cautious when using this function.

To configure telecom service table

1 Tap the **Configuration** icon to set **Telecom Service Table**.

The telecom service table is a frequency/band editor that users can set and select frequency/band they want in advance.

a Tap the **Add** (+) button to add a band based on the previous selection.

b Tap the **Configuration** icon on the bottom left to edit the parameters: **Start Frequency**, **Stop Frequency**, **Technology**, **Minimum BW**, and **Individual Limit** (**V/m**).

c Tap the **Channel Standard** button and select from the pop-up window.

d Tap the **Apply** button to apply the settings.

e Once all set, select the **Test Range** using the on-screen keyboard.

f Tap **Set** to use this settings.

Based on the **Display Mode** you have set, the measurement screen changes.

g Tap **Clear All** to deselect all the selected lists.

NOTE
You can save and load the telecom service table setup using the Save or Load icon at the bottom.

To set limit

1 Tap **Menu > Limit** in the side bar.

2 Tap **Reference Line**, and then enter a value that you want to set as a reference. The unit will vary depending on your selection of the unit in the Units setting in Amp/Scale.

You can also scroll up and down the purple bar on the measurement screen.

3 Tap to switch **Reference Line Mode** to **On** or **Off**.

If you set it to On, the reference line will appear with the purple bar on the measurement screen and set it to Off, the reference line will disappear with the purple bar on the measurement screen.

4 Optional. Tap to switch **Scanner Limit Mode** to **On** or **Off**. Make sure to set it to On and set Scale Unit to % (V/m) or %(W/m²) in Amp/Scale. Then the EMF power will be shown as % in the chart.

If you set it to On, the measurement screen displays the **Filter** ()icon for filtering failure items.

NOTE

Tap the Filter icon to see the filtered failure items only.

5 Tap to switch **Limit Type** to **Individual** or **Standard**.

NOTE

Based on the Individual Limit set in Telecom Service Table, the instrument judges Pass (Black) or Fail (Red).

6 Tap **Standard Limit Line** and select from the following options:

Standard Line is displayed on the screen based on the pre-defined standard. If you select ICNIRP Occupational or ICNIRP General Public, the Standard Line is automatically displayed with automatically calculated value defined in the ICNIRP

guideline. Make sure you change the Scale Unit to V/m in this case to follow the guideline. Other standard limit lines listed in the pop-up window indicate specific standard applied to each country.

a Select a required standard line from the list.

b Tap **ICNIRP Occupational** and **Apply** when EMF power is measured in a site where people work for long hours (occupational).

c Tap **ICNIRP General Public** and **Apply** when EMF power is measured in a public site where unspecified people come and go.

d Tap **Custom Limit** and then tap the **Configuration** icon if you want to customize setting and measure EMF power based on your need. You can set and add up to 10 custom limit values.

- A **Standard** window appears.
- Tap **Lower Frequency** and input a desired value using the on-screen keyboard.
- Tap **Upper Frequency** and input a desired value using the on-screen keyboard.
- Tap **Value for Frequency Range** and input a desired value using the on-screen keyboard. It sets coefficient of function.
- Tap **Formula** and select from the following choices: **f^n, /f^n, NA**. It defines an operator between coefficient and frequency. The operator to be defined is multiplication or division.
- Tap **Exponent Value** and input a desired value using the on-screen keyboard. It defines an exponent of the frequency.
- Tap the **Save** button if you want to save the setting.
- Optional. Tap the **Add** button to add Custom Limit.
- *Optional.* Tap the **Delete** button to delete the defined Custom Limit.



NOTE

If you set Formula to f^n or /f^n, you can define the limit line as frequency of function. If you set it to NA, you can define the limit line as a constant.

To save measurement file

You can save your current screen, result, and setup into the internal memory or your external USB memory drive, **USB A** or **USB B** or **SD card.** Make sure to insert a USB memory drive to USB A or B port and insert the SD card to MicroSD port to enable the option. After insertion, you'll have access to the external storage, where you can find a sub-directory corresponding to the instrument you're using. When you are using the Save feature, Hold is automatically enabled.

1 Tap the **Save** () icon on the side bar.

2 Tap the **File Name** input field.

3 Enter the file name you want using the on-screen keyboard.

4 To know and how to save, see the following options:

   a Select **Screen (.png)** to save the current screen with a file type, .png.

   b Select **Report (.pdf)** to save the measurement result in a report format with comments and captured screen images with a file type, .pdf

   If you select Screen or Report in the save options, you can automatically save setup information with screenshots.

   c Select **Result (.csv)** to save the number of points displayed on the screen with a file type, .csv.

   d Select **Setup (.stav)** to save the setup and test configuration with a file type, .stav.

   e Select **Logging (.csv)** to save all measurement results with a file type, .csv.

5 *Optional.* Tap to switch the **Color Inversions** to **On** to invert the image color (only available to save as Screen or Report).

6 *Optional.* Tap **Report Setup** to create a report.

   You can add image files and edit information such as Site Location, Site Information, Test Purpose, and Test Result as needed.

To load measurement file

You can load your saved screen, result, and setup from the internal memory or your external USB memory drive, **USB A** or **USB B** or **SD card.** Make sure to insert a USB memory drive to USB A or B port and insert the SD card to MicroSD port to enable the option. After insertion, you'll have access to the external storage, where you can find a sub-directory corresponding to the instrument you're using.

1 Tap the **Load** ( ) icon on the side bar.

2 Select the file to be loaded from the internal memory or from your USB drive.

   Information of your selected file appears in the File Information pane.

3 Check the file information on the right pane.

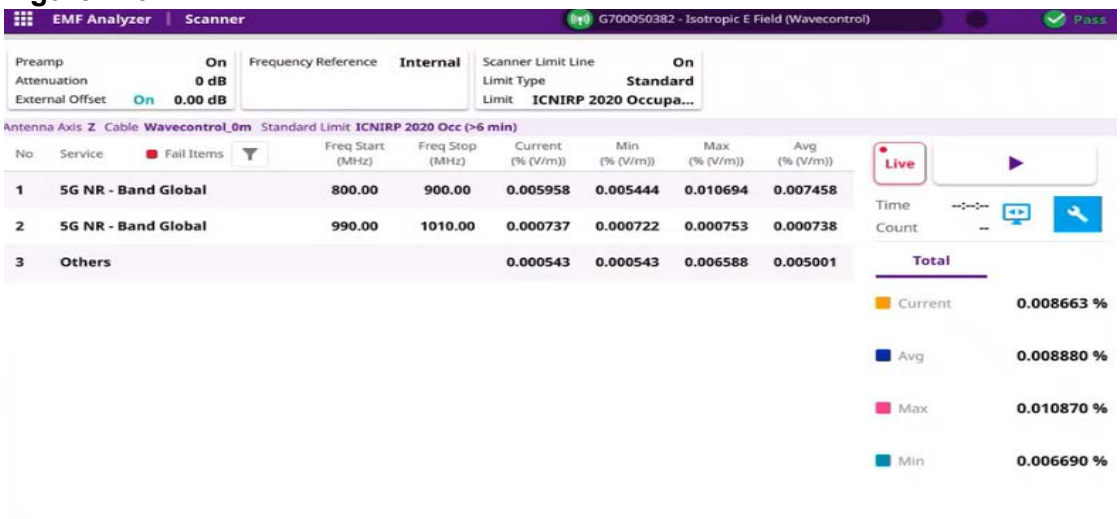
4 Tap the **Load** button to load the file.

NOTE

When you load CSV file (.csv), you can check the data that you have set up during the measurement. You can find specific information that you want using the on-screen keyboard or exit by using the Exit button.

Figure 120 shows an example of EMF scanner measurement for table view.

Figure 120 EMF scanner measurement



NOTE

If you choose the Display Mode to Table, it shows Others in the last row of the table. Others indicates the sum of EMF power for undefined bands among pre-defined bands. The Total EMF Power does not include the values for Others.

NOTE

Fail items can be seen as red based on the limit you have set as individual or standard limit. If you tap the Filter icon, you will only see the fail items.

Figure 121 shows an example of EMF scanner measurement for bar view.

Figure 121 EMF scanner measurement



NOTE

If you choose the Display Mode to Bar, it shows Others in the screen. Others indicates the sum of EMF power for undefined bands among predefined bands. The Total EMF Power does not include the values for Others.

NOTE

Fail items can be seen as a vertical red line based on the limit you have set as individual or standard limit. If you tap the Filter icon, the failure items can be seen as the first bar and others can be seen as translucent colors as shown in the above figure.

5G NR analysis

The following sections describe how to conduct 5G NR analysis.

5G NR beam analysis

5G NR beam analysis in EMF Analyzer shows the strength of RSRP for each carrier with the trend of Extrapolated Isotropic EMF Power, Extrapolated Accumulated EMF Power (Average, Maximum, and Minimum).

Setting measure setup

After configuring the spectrum measurement in “Configuring spectrum measurements” on page 25, you can set the measure setup to continue your measurement.

To set auto configuration

1 Tap the **Setup** ( ) icon on the side bar.

2 Tap **Auto Configuration**. See Figure 124.

3 Select the parameters as required in the pop-up window: Center Frequency, Case, Bandwidth, SSB Periodicity.

4 Click **SSB Auto Search** then tap the **Search** button. You can also type in SSB Frequency or GSCN manually.

5 Once SSB is obtained, Sync LED at the background turns to green.

6 *Optional.* Tap the **Search** button at the bottom to identify the TDD format. Once it's identified, it shows the values detected: Down Link Slot and Up Link Slot (Pattern1), and Slot (Pattern 2). See Figure 125.

7 *Optional.* Tap the **Run** button to start measurement when the auto detection is successful.

8 *Optional.* Tap to start the **Analysis Mode** to determine the Frame and Slot Format manually. See Figure 126 and Figure 127.

   a The pattern setup window appears.

   b Set the slot numbers from 1 to 19 as required.

   c Select a **Type** (**UpLink**, **DownLink**, or **Flexible Slot**).

   d Tap the **Apply** button to save the settings.

   e Tap the **Next** button to analyze each slot in more detail.
   - Assign the number of symbols as required.
   - Tap the **Configuration** icon to adjust the settings.
   - Tap the **Apply** button to save the settings.

NOTE

Auto Search works with Standalone 5G NR network only. You need to check the deployment mode of your 5G NR Network if Auto Search does not work even with a strong RSRP.

To set manual configuration for NR

1 Tap the **Setup** ( ) icon > **Manual Configuration (NR)** on the side bar.

2 Tap **Bandwidth/SSB SCS** then a Setting window appears.

   a If you select the operating frequency as FR1, select from the following:
   - SCS 15 kHz: 5, 10, 15, 20, 25, 30, 40, 50 MHz
   - SCS 30 kHz: 5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 MHz

3 Tap **SSB Center Frequency** and input the value using the on-screen keyboard.

4 Tap **GSCN** and input the value using the on-screen keyboard.

5 Tap **L** to set the maximum number of SS-PBCH blocks within a single SS burst set (A set of SS being transmitted in 5 ms window of SS transmission) among **4**, **8** and **64**.

6 Tap **SSB Auto Search Mode** and do the following steps:

   a Tap **Auto Preamp/Atten** and switch **SSB Auto Search** to **Start** to set preamp and attenuation automatically.

   b Tap **Manual** and switch **SSB Auto Search** to **Start** for manually setting based on your need.

7 Tap **SSB Auto Search** between **Start** and **Stop**.

   a **Start**: to search SCS, type, and the number of SSB automatically. Once Start is selected, the progress bar appears. If it fails to perform the auto search, a fail message appears and the SSB switches to Manual.

   b **Stop**: to set the SSB periodicity based on the base station.

8 Tap **SSB Periodicity** and select the options from **5 ms**, **10 ms**, **20 ms**, **40 ms**, **80 ms**, **160 ms**. The SS burst period (SSB periodicity) is defined by each base station and network configurable. 20 ms is the default for the initial cell selection.

9 Tap **Sync Raster Offset /Sync SCS Offset** and input the required value using the on-screen keyboard.

10 Tap to switch **PCI (Physical Cell ID)** to **Manual** or **Auto**.

11 Tap **PCI** and input a value from 0 to 1007 using the on-screen keyboard. The PCI switches to **Manual**.



NOTE

You can go to **Menu** > **Frequency** > **Center Frequency List** to add frequently used center frequency using the **Add** button in the Frequency List or to delete the selected frequency using the **Delete** button. You can also apply one of the default frequencies in the Frequency List by tapping the **Apply** button.

To set test configuration

1 Tap **Test Configuration**.

a Tap **Dwell Time** to specify the amount of measurement time that you want the instrument to stay for on each axis and input the value from 0.1 to 60 (second) using the on-screen keyboard.

b Tap **Measurement Mode** to switch between **Live** and **Timed**.

- Select **Live** to view the measurement results in real time as the test runs continuously.
- Select **Timed** to run the test with the time limit you set. When selected, specify the **Measurement Time**.

c Tap **Measurement Time** to specify the amount of measurement time that you want the instrument to stay for on all three axes in order to display current and accumulated EMF power and set this up to 48 hours using the on-screen keyboard.



NOTE

If you set the measurement time, the count which means the number of EMF measurements on the right panel of the measurement screen is changed corresponding to the measurement time you have set.

d Tap to switch **Axis** to **Manual** or **Auto**.

If you set it to **Manual**, Axis setting is available and if you set it to **Auto**, Axis setting is unavailable.

- **Manual**: When using isotropic EMF antenna, you can manually set x, y, and z axis. You can set Manual as a diagnosis mode whether you can receive correct signal based on each axis: X, Y, or Z.
- **Auto**: Each axis of antenna is automatically changed and measured.

e When selected as Manual, tap **Axis** and select from: **X**, **Y**, or **Z**.

f When selected as **Manual**, tap **Manual Axis Capture** to **On**.

– Select the desired **Detector**: **Both**, **Peak**, or **RMS**, to capture the current EMF power for each axis.

- **Both**: Captures and displays both Peak and RMS EMF power for each axis (X, Y, and Z).
- **Peak**: Captures and displays the Peak EMF power for each axis.
- **RMS**: Captures and displays the RMS EMF power for each axis.



NOTE

The **Live** button on the right panel of the measurement screen must be tapped to start the measurement before the captured EMF power values can be displayed.

g Tap to switch **Scaling Factor** to **On** or **Off**.

You can apply additional TDD attenuation factor by turning it on and manually input the required value.

h Tap **Move to RtSA** to view the real-time spectrum measurement mode.

2 Go back to **Setup** and **Antenna & Cable Loss**.

a *Optional.* Tap to switch **Antenna Gain** to **On** or **Off**.

b When the Antenna Gain is on, tap **Antenna Gain Value** and input the required value using the on-screen keyboard.



NOTE

You need to be cautious when using this value as the instrument applies not an antenna gain value selected from Antenna List EMF but applies this setting. This may cause measurement errors.

c Tap **Antenna List EMF** and select between **Standard** and **Custom** from the pop-up window. Based on the antenna list you selected, you need to check the Axis mode and do the following:

- When selecting G700050381 or G700050382 (Isotropic E-Field) Antenna and Axis to Auto, the Current on the measurement screen indicates as x, y, or z automatically and the Isotropic EMF Power is measured.
- When selecting Yagi antenna (Log Periodic Broadband) and Axis to Auto, the Current on the measurement screen indicates YAGI and the EMF Power is measured.
- When tapping Custom > Configuration icon, an Antenna List Editor window appears and you can customize Frequency and Antenna Factor. You can add up to 500 customized antennas.
- Once the selected antenna is successfully connected, the antenna name with a green indicator will appear at the top-right corner of the screen.



NOTE

When selecting Omni antenna (Isotropic E Field) and Axis to Manual, the Current on the measurement screen indicates as your choice (x, y, or z) and the EMF Power is measured.

The instrument supports an engineering mode as ‘Axis Mode: Manual’ to inspect G700050381 and G700050382 antenna. You must not use this mode for a general purpose to measure EMF Power. It does not guarantee the accuracy of the measurement result.

d *Optional.* Tap to Switch **Cable Loss** to **On** or **Off**.



NOTE

When the isotropic antenna is changed to a different antenna, set Cable Loss to On. In this case, the Cable List menu is disabled (grayed out), as the cable loss value is entered manually and does not require selection from the Cable List.

e When the Cable Loss is On, tap **Cable Loss Value** and input the required value using the on-screen keyboard.

The entered value is displayed in the antenna information area at the top right of the instrument.

NOTE

When you need to use an antenna that is not listed in Antenna List EMF, connect your antenna and then set the Antenna Gain and Cable Loss required for your measurement.

3 Tap **Cable List** and select between **Standard** and **Custom**.

a Tap **Standard** and select a cable from the options.

- Select **AGOS (1.6m)** as required if you use a cable provided with G700050381 (Isotropic E-Field) antenna.
- Select **WaveControl** as required if you use a cable provided with G700050382 (Isotropic E-Field) antenna.
- Select **G700050551** as required.
- Select **G700050552** as required.

b Tap **Custom** and select a registered cable if you use a cable that you registered.

c Once tapped, a Cable List Editor window pops up.

- Tap **Add** (+) button to add a new cable. This will add to a new cable list.
- Tap the **Configuration** icon to edit a cable shown in the 'Cable List'. After designating the cable name by selecting the Configuration icon, you need to input the real loss value of the cable measured between the bandwidth from 1 GHz to 2 GHz. This will automatically compensate the measurement result by calculating the input cable loss.
- Tap the **Delete** icon to delete the customized cable that you have set.

4 On the right panel of the screen, tap the **Display Mode** icon between **P vs T** and **Level Recorder**. Refer to Figure 122 and Figure 123.

Based on the selection, the measurement screen will change.

5 On the right panel of the screen, do the following steps:

a Tap the **Testing** ( ) button to start the measurement.

The instrument displays measurement results on the screen.

b Tap the **Hold** icon on the side bar to hold the display.

c Tap the **Hold** icon again to release the display.

d Tap the **Stop** ( ) button to stop the measurement.

The alert message pops up to confirm whether you want to stop now or not.

e Tap to switch to **RSRP** or **Extrapolated**.

The (Isotropic) EMF Power and Accumulated (Isotropic) EMF Power (Average/Max/Min) values are displayed respectively for RSRP or Extrapolated. The values on the right panel display based on the chart displayed on the left panel.

NOTE
If you have unsaved measurement data and start measuring by tapping the Testing button or by tapping another measurement mode, a pop-up window will appear asking whether you will restore the unsaved data or not.

To set TDD formats

1 Tap **TDD Formats** to automatically switch to the **Auto Configuration Analysis Mode** window.

   a The pattern setup window appears.

   b Set the slot numbers from 1 to 19 as required.

   c Select a **Type** (**UpLink**, **DownLink**, or **Flexible Slot**).

   d Tap the **Apply** button to save the settings.

   e Tap the **Next** button to analyze each slot in more detail.
   - Assign the number of symbols as required.
   - Tap the **Configuration** icon to adjust the settings.

2 Tap the **Apply** button to save the settings.

To set limit

1 Tap **Menu > Limit** in the side bar.

2 Tap **Reference Line**, and then enter a value that you want to set as a reference. The unit will vary depending on your selection of the unit in the Units setting in Amp/Scale.

   You can also scroll up and down the purple bar on the measurement screen.

3 Tap to switch **Reference Line Mode** to **On** or **Off**.

   If you set it to On, the reference line will appear with the purple bar on the measurement screen and set it to Off, the reference line will disappear with the purple bar on the measurement screen.

4 Tap to switch **Standard Line Mode** to **On** to display the standard line on the screen or **Off** to hide the standard line on the screen.

5 Tap **Standard Limit Line** and select from the following options:

   Standard Line is displayed on the screen based on the pre-defined standard. If you select ICNIRP Occupational or ICNIRP General Public, the Standard Line is automatically displayed with automatically calculated value defined in the ICNIRP

guideline. Make sure you change the Scale Unit to V/m in this case to follow the guideline. Other standard limit lines listed in the pop-up window indicate specific standard applied to each country.

a Select a required standard line from the list.

b Tap **ICNIRP Occupational** and **Apply** when EMF power is measured in a site where people work for long hours (occupational).

c Tap **ICNIRP General Public** and **Apply** when EMF power is measured in a public site where unspecified people come and go.

d Tap **Custom Limit** and then tap the **Configuration** icon if you want to customize setting and measure EMF power based on your need.

- A **Standard** window appears.
- Tap **Lower Frequency** and input a desired value using the on-screen keyboard.
- Tap **Upper Frequency** and input a desired value using the on-screen keyboard.
- Tap **Value for Frequency Range** and input a desired value using the on-screen keyboard. It sets coefficient of function.
- Tap **Formula** and select from the following choices: **f^n, /f^n, NA**. It defines an operator between coefficient and frequency. The operator to be defined is multiplication or division.
- Tap **Exponent Value** and input a desired value using the on-screen keyboard. It defines an exponent of the frequency.
- Tap the **Save** button if you want to save the setting.
- Optional. Tap the **Add** button to add Custom Limit.
- *Optional.* Tap the **Delete** button to delete the defined Custom Limit.



NOTE

If you set Formula to f^n or /f^n, you can define the limit line as frequency of function. If you set it to NA, you can define the limit line as a constant.

To set sweep

1 Tap **Menu > Sweep** in the side bar.

2 Tap to switch **Sweep Speed** to **Fast** or **Normal**.

a If you set it to Normal, it displays the strongest PCI’s beam with beam ID.

b If you set it to Fast, it displays multi-PCI beam.

To save measurement file

You can save your current screen, result, and setup into the internal memory or your external USB memory drive, **USB A** or **USB B** or **SD card.** Make sure to insert a USB memory drive to USB A or B port and insert the SD card to MicroSD port to enable the option. After insertion, you'll have access to the external storage, where you can find a

sub-directory corresponding to the instrument you're using. When you are using the Save feature, Hold is automatically enabled.

1 Tap the **Save** ( ) icon on the side bar.

2 Tap the **File Name** input field.

3 Enter the file name you want using the on-screen keyboard.

4 To know and how to save, see the following options:

   a Select **Screen (.png)** to save the current screen with a file type, .png.

   b Select **Report (.pdf)** to save the measurement result in a report format with comments and captured screen images with a file type, .pdf

   If you select Screen or Report in the save options, you can automatically save setup information with screenshots.

   c Select **Result (.csv)** to save the number of points displayed on the screen with a file type,.csv.

   d Select **Setup (.stav)** to save the setup and test configuration with a file type,.stav.

   e Select **Logging (.csv)** to save all measurement results with a file type, .csv.

5 *Optional.* Tap to switch the **Color Inversions** to **On** to invert the image color (only available to save as Screen or Report).

6 *Optional.* Tap **Report Setup** to create a report.

   You can add image files and edit information such as Site Location, Site Information, Test Purpose, and Test Result as needed.

To load measurement file

You can load your saved screen, result, and setup from the internal memory or your external USB memory drive, **USB A** or **USB B** or **SD card.** Make sure to insert a USB memory drive to USB A or B port and insert the SD card to MicroSD port to enable the option. After insertion, you'll have access to the external storage, where you can find a sub-directory corresponding to the instrument you're using.

1 Tap the **Load** ( ) icon on the side bar.

2 Select the file to be loaded from the internal memory or from your USB drive.

   Information of your selected file appears in the File Information pane.

3 Check the file information on the right pane.

4 Tap the **Load** button to load the file.

NOTE

When you load CSV file (.csv), you can check the data that you have set up during the measurement. You can find specific information that you want using the on-screen keyboard or exit by using the Exit button.

Figure 122 shows an example of EMF 5G NR beam analyzer measurement.

Figure 122 EMF 5G NR beam analyzer measurement (Extrapolated)

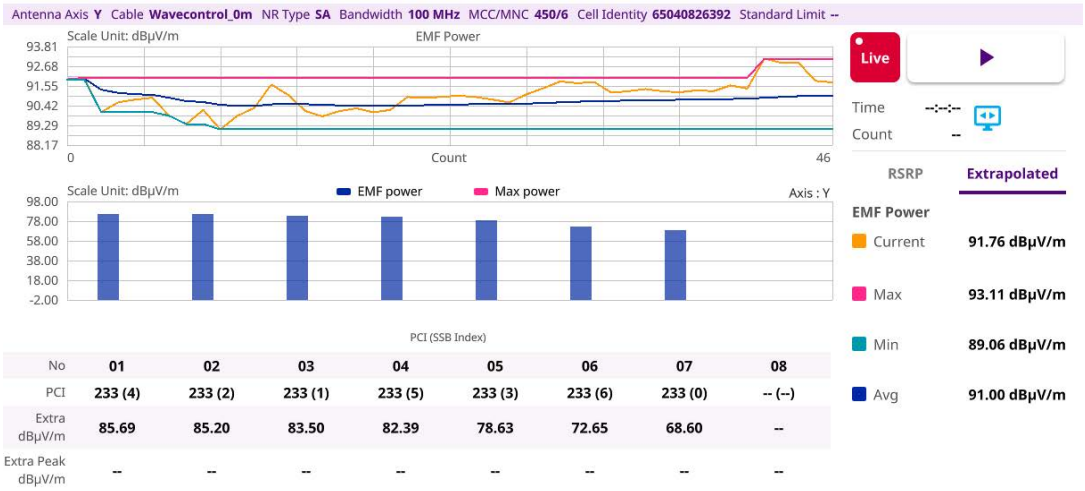
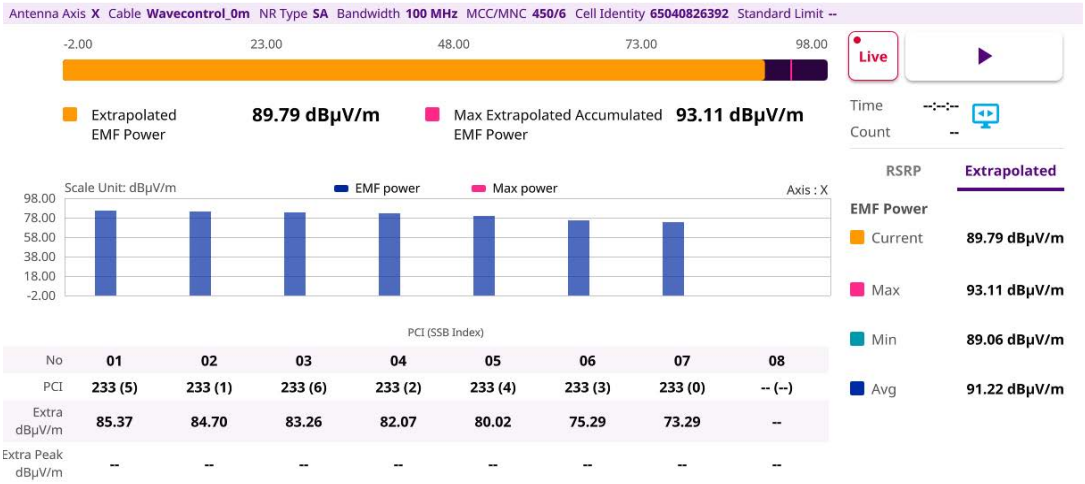


Figure 123 shows an example of EMF 5G NR beam analyzer measurement.

Figure 123 EMF 5G NR beam analyzer measurement (with level recorder)



NOTE

If you tap the Level Recorder icon in the Display Mode, you will check the Extrapolated Isotropic EMF power and Max Extrapolated Accumulated isotropic EMF Power in a form of bar chart with its corresponding colors. If you want to see the chart view, you can tap the P vs T icon in the Display Mode then you will see the trend of Isotropic EMF Power, Accumulated Isotropic EMF Power (Average/Max/Min) based on Time and Count that you have set.

5G NR traffic analysis

5G NR traffic analysis in EMF Analyzer shows the strength of user-defined RSRP for each carrier with the trend of Extrapolated Isotropic EMF Power, Extrapolated Accumulated EMF Power (Average, Maximum, and Minimum).

To set measure setup

To set auto configuration

1 Tap the **Setup** ( ) icon on the side bar.

2 Tap **Auto Configuration**.

3 Select the parameters as required in the pop-up window: Center Frequency, Case, Bandwidth, SSB Periodicity.

4 Click **SSB Auto Search** then tap the **Search** button. You can also type in SSB Frequency or GSCN manually.

5 Once SSB is obtained, Sync LED at the background turns to green.

6 *Optional.* Tap the **Search** button at the bottom to identify the TDD format. Once it's identified, it shows the values detected: Down Link Slot and Up Link Slot (Pattern1), and Slot (Pattern 2).

7 *Optional.* Tap the **Run** button to start measurement when the auto detection is successful.

8 *Optional.* Tap to start the **Analysis Mode** to determine the Frame and Slot Format manually.

a The pattern setup window appears.

b Set the slot numbers from 1 to 19 as required.

c Select a **Type** (**UpLink**, **DownLink**, or **Flexible Slot**).

d Tap the **Apply** button to save the settings.

e Tap the **Next** button to analyze each slot in more detail.

- Assign the number of symbols as required.
- Tap the **Configuration** icon to adjust the settings.
- Tap the **Apply** button to save the settings.

NOTE

Auto Search works with Standalone 5G NR network only. You need to check the deployment mode of your 5G NR Network if Auto Search does not work even with a strong RSRP.

Figure 124 displays a sample auto configuration.

Figure 124 Auto configuration window.

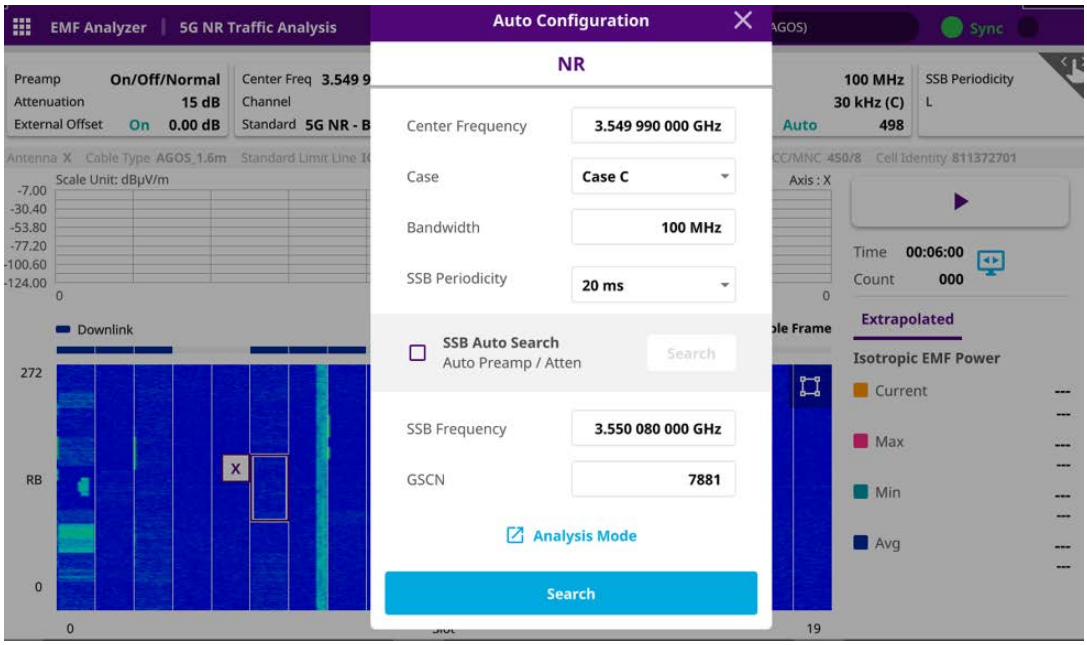


Figure 125 displays TDD pattern.

Figure 125 TDD pattern

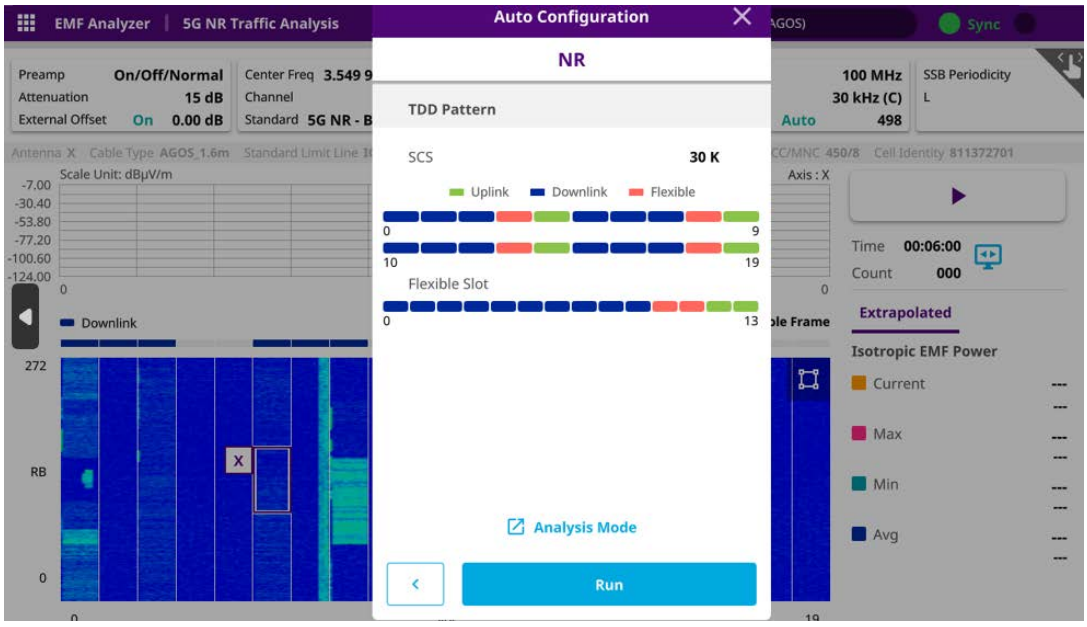


Figure 126 displays analysis mode.

Figure 126 TDD pattern setup window

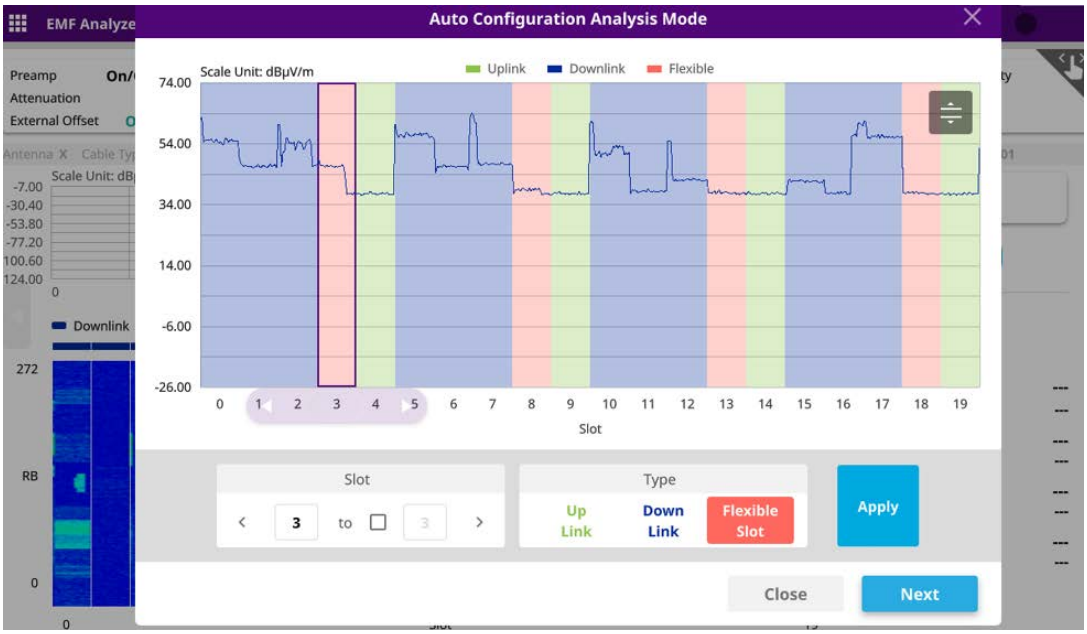
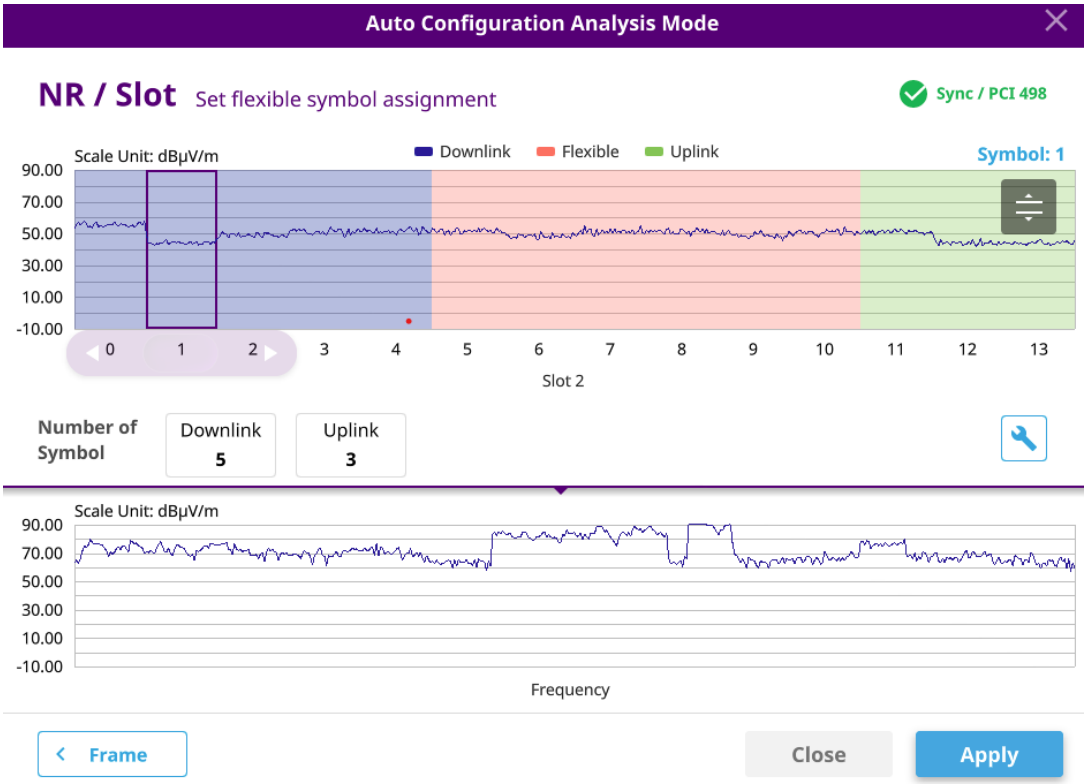


Figure 127 displays symbol assignment.

Figure 127 Symbol assignment window



To set manual configuration for NR

1 Tap the **Setup** ( ) icon > **Manual Configuration (NR)** on the side bar.

2 Tap **Bandwidth/SSB SCS** then a Setting window appears.

a If you select the operating frequency as FR1, select from the following:

- SCS 15 kHz: 5, 10, 15, 20, 25, 30, 40, 50 MHz
- SCS 30 kHz: 5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 MHz

3 Tap **SSB Center Frequency** and input the value using the on-screen keyboard.

4 Tap **GSCN** and input the value using the on-screen keyboard.

5 Tap **L** to set the maximum number of SS-PBCH blocks within a single SS burst set (A set of SS being transmitted in 5 ms window of SS transmission) among **4**, **8** and **64**.

6 Tap **SSB Auto Search Mode** and do the following steps:

a Tap **Auto Preamp/Atten** and switch **SSB Auto Search** to **Start** to set preamp and attenuation automatically.

b Tap **Manual** and switch **SSB Auto Search** to **Start** for manually setting based on your need.

7 Tap **SSB Auto Search** between **Start** and **Stop**.

a **Start**: to search SCS, type, and the number of SSB automatically. Once Start is selected, the progress bar appears. If it fails to perform the auto search, a fail message appears and the SSB switches to Manual.

b **Stop**: to set the SSB periodicity based on the base station.

8 Tap **SSB Periodicity** and select the options from **5 ms**, **10 ms**, **20 ms**, **40 ms**, **80 ms**, **160 ms**. The SS burst period (SSB periodicity) is defined by each base station and network configurable. 20 ms is the default for the initial cell selection.

9 Tap **Sync Raster Offset /Sync SCS Offset** and input the required value using the on-screen keyboard.

10 Tap to switch **PCI (Physical Cell ID)** to **Manual** or **Auto**.

11 Tap **PCI** and input a value from 0 to 1007 using the on-screen keyboard. The PCI switches to **Manual**.

To set test configuration

1 Tap **Test Configuration**.

a Tap **Dwell Time** to specify the amount of measurement time that you want the instrument to stay for on each axis and input the value from 0.1 to 60 (second) using the on-screen keyboard.

b Tap **Measurement Mode** to switch between **Live** and **Timed**.

- Select **Live** to view the measurement results in real time as the test runs continuously.
- Select **Timed** to run the test with the time limit you set. When selected, specify the **Measurement Time**.

c Tap **Measurement Time** to specify the amount of measurement time that you want the instrument to stay for on all three axes in order to display current and accumulated EMF power and set this up to 48 hours using the on-screen keyboard.



NOTE

If you set the measurement time, the count which means the number of EMF measurements on the right panel of the measurement screen is changed corresponding to the measurement time you have set.

d Tap to switch **Axis** to **Manual** or **Auto**.

If you set it to **Manual**, Axis setting is available and if you set it to **Auto**, Axis setting is unavailable.

- **Manual**: When using isotropic EMF antenna, you can manually set x, y, and z axis. You can set Manual as a diagnosis mode whether you can receive correct signal based on each axis: X, Y, or Z.
- **Auto**: Each axis of antenna is automatically changed and measured.

e When selected as Manual, tap **Axis** and select from: **X**, **Y**, or **Z**.

f When selected as **Manual**, tap **Manual Axis Capture** to **On**.

– Select the desired **Detector**: **Both**, **Peak**, or **RMS**, to capture the current EMF power for each axis.

- **Both**: Captures and displays both Peak and RMS EMF power for each axis (X, Y, and Z).
- **Peak**: Captures and displays the Peak EMF power for each axis.
- **RMS**: Captures and displays the RMS EMF power for each axis.



NOTE

The **Live** button on the right panel of the measurement screen must be tapped to start the measurement before the captured EMF power values can be displayed.

g Tap to switch **Scaling Factor** to **On** or **Off**.

You can apply additional TDD attenuation factor by turning it on and manually input the required value.

h Tap **Move to RtSA** to view the real-time spectrum measurement mode.

To capture snapshot

1 Tap the **Live** button (Live) to start the measurement.

2 Once all three axes are measured, tap the **Snapshot** icon ( ) to open the Snapshot view.

3 Select the desired Axis (X, Y, or Z) to view the power distribution measured along that axis.

4 The heatmap displays the measured power across all Resource Blocks (RB) and Slots, with color intensity representing power level according to the scale shown below the chart.

5 Tap or drag on the heatmap, or enter values directly in the Slot and RB fields, to select a specific point on the grid. Use the arrow bars on either side of the RB axis to scroll up or down and adjust the selected RB position.

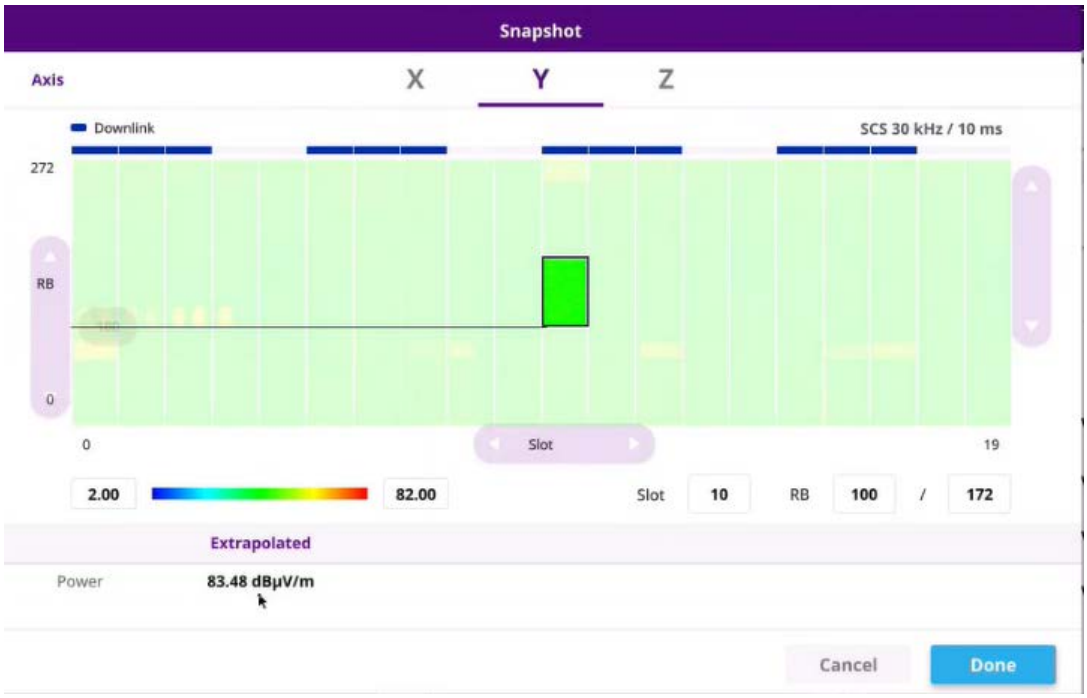
6 Use the arrow bars on either side of the RB axis to scroll and adjust the selected RB position, and the arrow bars below the Slot axis to scroll and adjust the selected Slot position.

7 The Extrapolated Power value for the selected Slot/RB position is displayed below the chart.

8 Tap **Done** to save the snapshot, or **Cancel** to exit without saving.

Figure 128 shows an example of Snapshot.

Figure 128 Snapshot



To set Antenna & Cable Loss

1 Go back to **Setup** and **Antenna & Cable Loss**.

a *Optional.* Tap to switch **Antenna Gain** to **On** or **Off**.

b When the Antenna Gain is on, tap **Antenna Gain Value** and input the required value using the on-screen keyboard.

NOTE

You need to be cautious when using this value as the instrument applies not an antenna gain value selected from Antenna List EMF but applies this setting. This may cause measurement errors.

c Tap **Antenna List EMF** and select between **Standard** and **Custom** from the pop-up window. Based on the antenna list you selected, you need to check the Axis mode and do the following:

- When selecting G700050381 or G700050382 (Isotropic E-Field) Antenna and Axis to Auto, the Current on the measurement screen indicates as x, y, or z automatically and the Isotropic EMF Power is measured.
- When selecting Yagi antenna (Log Periodic Broadband) and Axis to Auto, the Current on the measurement screen indicates YAGI and the EMF Power is measured.
- When tapping Custom > Configuration icon, an Antenna List Editor window appears and you can customize Frequency and Antenna Factor. You can add up to 500 customized antennas.

NOTE

When selecting Omni antenna (Isotropic E Field) and Axis to Manual, the Current on the measurement screen indicates as your choice (x, y, or z) and the EMF Power is measured.

The instrument supports an engineering mode as ‘Axis Mode: Manual’ to inspect G700050381 and G700050382 antenna. You must not use this mode for a general purpose to measure EMF Power. It does not guarantee the accuracy of the measurement result.

d *Optional.* Tap to Switch **Cable Loss** to **On** or **Off**.

NOTE

When the isotropic antenna is changed to a different antenna, set Cable Loss to On. In this case, the Cable List menu is disabled (grayed out), as the cable loss value is entered manually and does not require selection from the Cable List.

e When the Cable Loss is On, tap **Cable Loss Value** and input the required value using the on-screen keyboard.

The entered value is displayed in the antenna information area at the top right of the instrument.

NOTE

When you need to use an antenna that is not listed in Antenna List EMF, connect your antenna and then set the Antenna Gain and Cable Loss required for your measurement.

2 Tap **Cable List** and select between **Standard** and **Custom**.

a Tap **Standard** and select a cable from the options.

- Select **AGOS (1.6m)** as required if you use a cable provided with G700050381 (Isotropic E-Field) antenna.
- Select **WaveControl** as required if you use a cable provided with G700050382 (Isotropic E-Field) antenna.
- Select **G700050551** as required.
- Select **G700050552** as required.

b Tap **Custom** and select a registered cable if you use a cable that you registered.

c Once tapped, a Cable List Editor window pops up.

- Tap **Add** (+) button to add a new cable. This will add to a new cable list.
- Tap the **Configuration** icon to edit a cable shown in the 'Cable List'. After designating the cable name by selecting the Configuration icon, you need to input the real loss value of the cable measured between the bandwidth from 1 GHz to 2 GHz. This will automatically compensate the measurement result by calculating the input cable loss.
- Tap the **Delete** icon to delete the customized cable that you have set.

To set TDD formats

1 Tap **TDD Formats** to automatically switch to the **Auto Configuration Analysis Mode** window.

a The pattern setup window appears.

b Set the slot numbers from 1 to 19 as required.

c Select a **Type** (**UpLink**, **DownLink**, or **Flexible Slot**).

d Tap the **Apply** button to save the settings.

e Tap the **Next** button to analyze each slot in more detail.

- Assign the number of symbols as required.
- Tap the **Configuration** icon to adjust the settings.

2 Tap the **Apply** button to save the settings.

To start testing

1 On the right panel of the screen, tap the **Display Mode** icon between **Accumulated Result** and **Single Result**.
   – Accumulated Results: to view one-time measurement result
   – Single Result: to view continuous measurement result in a specific time

2 Refer to Figure 129 and Figure 130.
   Based on the selection, the measurement screen will change.

3 On the right panel of the screen, do the following steps:
   a Tap the **Testing** ( ) button to start the measurement.
   The instrument displays measurement results on the screen.
   b Tap the **Hold** icon on the side bar to hold the display.
   c Tap the **Hold** icon again to release the display.
   d Tap the **Stop** ( ) button to stop the measurement.
   The alert message pops up to confirm whether you want to stop now or not.
   e Tap to switch to **RSRP** or **Extrapolated**.

4 The (Isotropic) EMF Power and Accumulated (Isotropic) EMF Power (Average/Max/Min) values are displayed respectively for RSRP or Extrapolated. The values on the right panel display based on the chart displayed on the left panel.

NOTE
If you have unsaved measurement data and start measuring by tapping the Testing button or by tapping another measurement mode, a pop-up window will appear asking whether you will restore the unsaved data or not.

To set limit

1 Tap **Menu > Limit** in the side bar.

2 Tap **Reference Line**, and then enter a value that you want to set as a reference. The unit will vary depending on your selection of the unit in the Units setting in Amp/Scale.
   You can also scroll up and down the purple bar on the measurement screen.

3 Tap to switch **Reference Line Mode** to **On** or **Off**.
   If you set it to On, the reference line will appear with the purple bar on the measurement screen and set it to Off, the reference line will disappear with the purple bar on the measurement screen.

4 Tap to switch **Standard Line Mode** to **On** to display the standard line on the screen or **Off** to hide the standard line on the screen.

5 Tap **Standard Limit Line** and select from the following options:
   Standard Line is displayed on the screen based on the pre-defined standard. If you select ICNIRP Occupational or ICNIRP General Public, the Standard Line is automatically displayed with automatically calculated value defined in the ICNIRP

guideline. Make sure you change the Scale Unit to V/m in this case to follow the guideline. Other standard limit lines listed in the pop-up window indicate specific standard applied to each country.

a Select a required standard line from the list.

b Tap **ICNIRP Occupational** and **Apply** when EMF power is measured in a site where people work for long hours (occupational).

c Tap **ICNIRP General Public** and **Apply** when EMF power is measured in a public site where unspecified people come and go.

d Tap **Custom Limit** and then tap the **Configuration** icon if you want to customize setting and measure EMF power based on your need.

- A **Standard** window appears.
- Tap **Lower Frequency** and input a desired value using the on-screen keyboard.
- Tap **Upper Frequency** and input a desired value using the on-screen keyboard.
- Tap **Value for Frequency Range** and input a desired value using the on-screen keyboard. It sets coefficient of function.
- Tap **Formula** and select from the following choices: **f^n, /f^n, NA**. It defines an operator between coefficient and frequency. The operator to be defined is multiplication or division.
- Tap **Exponent Value** and input a desired value using the on-screen keyboard. It defines an exponent of the frequency.
- Tap the **Save** button if you want to save the setting.
- Optional. Tap the **Add** button to add Custom Limit.
- *Optional.* Tap the **Delete** button to delete the defined Custom Limit.



NOTE

If you set Formula to f^n or /f^n, you can define the limit line as frequency of function. If you set it to NA, you can define the limit line as a constant.

To set sweep

1 Tap **Menu > Sweep** in the side bar.

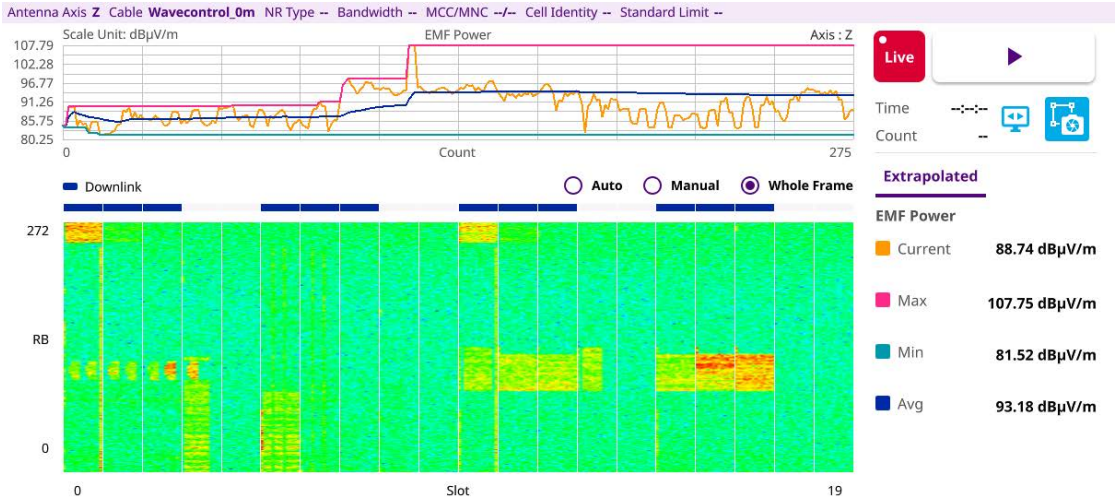
2 Tap to switch **Sweep Speed** to **Fast** or **Normal**.

a If you set it to Normal, it displays the strongest PCI's beam with beam ID.

b If you set it to Fast, it displays multi-PCI beam.

Figure 129 shows an example of EMF 5G NR traffic analyzer measurement.

Figure 129 EMF 5G NR traffic analyzer measurement (accumulated results)

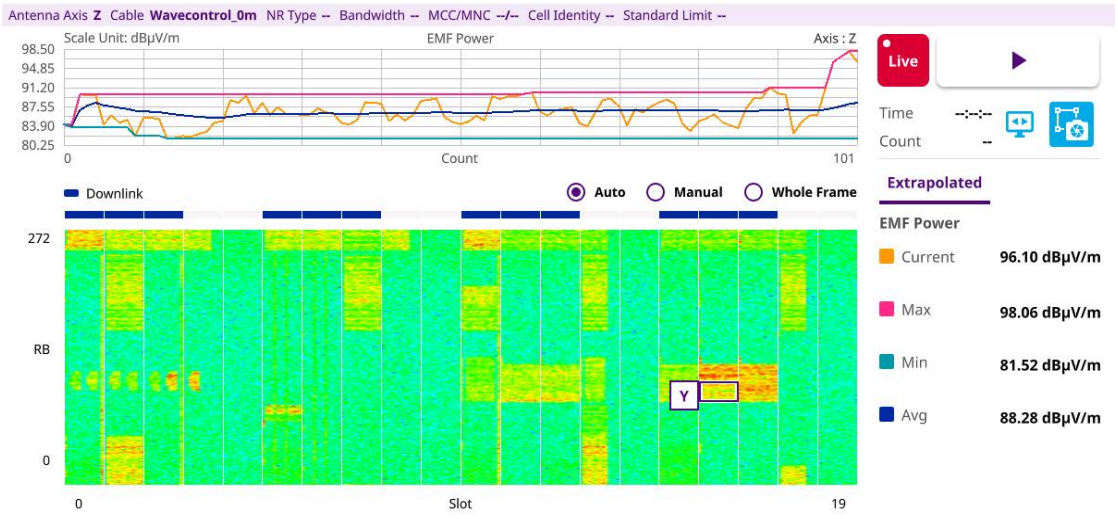


NOTE

If you tap the **Auto** icon, the instrument automatically detects the slot number and resource block with the strongest power.

Figure 130 shows an example of EMF 5G NR traffic analyzer measurement.

Figure 130 EMF 5G NR traffic analyzer measurement (single result)

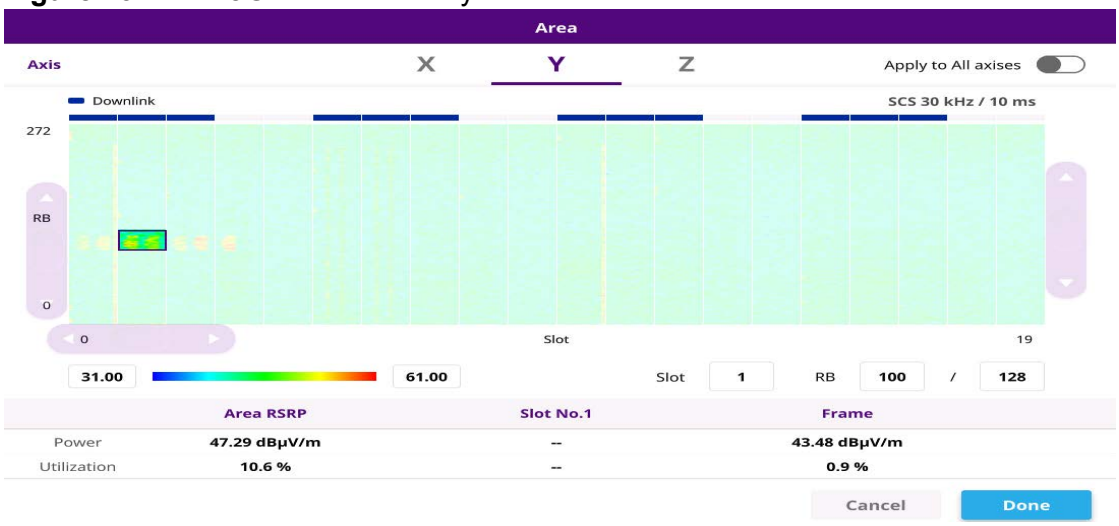


NOTE

If you tap the **Area Setting** icon on the top right of the resource block, you will check the specific area of the RSRP power and utilization for the slot and resource block that you have set based on the axis X, Y, and Z. See below figure.

Figure 131 shows an example of EMF 5G NR traffic analyzer measurement.

Figure 131 EMF 5G NR traffic analyzer measurement with Area of RSRP



NOTE

If you set the slot number and resource block for X axis, the Y and Z axis values are set automatically corresponding to the value of the X axis.

LTE analysis

The following sections describe how to conduct LTE analysis.

LTE FDD analysis

LTE analysis in EMF Analyzer shows the Isotropic EMF Power (Current, Average, Maximum, and Minimum) based on each selected index signal.

Setting measure setup

After configuring the spectrum measurement in “Configuring spectrum measurements” on page 25, you can set the measure setup to continue your measurement.

To set auto configuration

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap **Auto Configuration**.

3 Tap the **Center Frequency** box and input the required value using the on-screen keyboard.

4 Tap the **Channel Number** box and input the required value using the on-screen keyboard.

5 Tap the **Search** button.
   – Once the search is successful, Sync LED at the background turns to green.
   – Once the Frame and Slot format has been identified, it shows the values detected: Bandwidth, Pb, and Antenna.
   – Tap the **Run** button to start FDD analysis when the auto detection is successful.



NOTE

If automatic search fails, go to **Setup** and set the **MIMO** (pb) and **Boosting Factor** (Antenna) manually.

To set measure setup

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap to switch **MIB Decoding** to **On** when you do not know the number of transmitter antennas and Bandwidth or otherwise to **Off**.

3 Tap **Bandwidth** and select the value from the following choices: **1.4 MHz**, **3 MHz**, **5 MHz**, **10 MHz**, **15 MHz** or **20 MHz**.

4 Tap the **MIMO** and select **2x2** or **4x4** to select the number of antenna ports.

5 To select the Cyclic Prefix, tap **Cyclic Prefix** and select **Normal** or **Extended**.

6 Tap to switch **PCI Mode** to **Manual** or **Auto** and input a required value.
   The **PCI** switches to **Manual**.

7 Tap **Select Index** and select the index from the options as required.

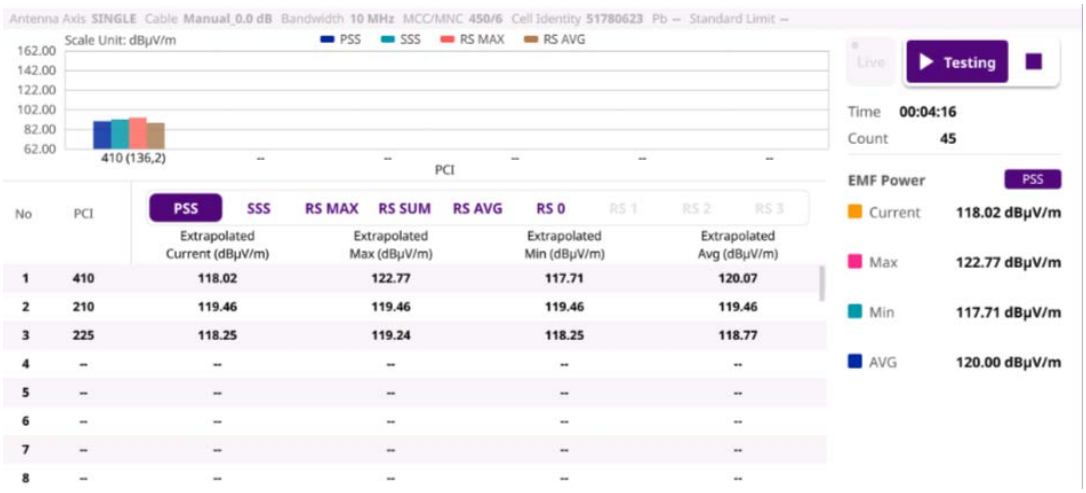
8 Tap **Boosting Factor** and input a value using the on-screen keyboard.

9 Tap **Track of PCIs** to switch it **On** or **Off**.
   – When set to On, the analyzer continuously tracks and displays measurement results for multiple PCIs simultaneously.

10 Tap **Extrapolation** to switch it **On** or **Off**.
   – When set to On, the analyzer estimates the maximum EMF power that would be radiated if the channel were fully loaded with traffic, based on the measured reference signal (pilot) power, providing a conservative estimate of the maximum expected exposure level.

Figure 132 shows an example of EMF LTE FDD measurement (Turn Track of PCIs on)

Figure 132 EMF LTE FDD measurement (Turn Track of PCIs on)



To set test configuration

1 Tap **Test Configuration**.

a Tap **Dwell Time** to specify the amount of measurement time that you want the instrument to stay for on each axis and input the value from 0.1 to 60 (second) using the on-screen keyboard.

b Tap **Measurement Mode** to switch between **Live** and **Timed**.

- Select **Live** to view the measurement results in real time as the test runs continuously.
- Select **Timed** to run the test with the time limit you set. When selected, specify the **Measurement Time**.

c Tap **Measurement Time** to specify the amount of measurement time that you want the instrument to stay for on all three axes in order to display current and accumulated EMF power and set this up to 48 hours using the on-screen keyboard.

NOTE

If you set the measurement time, the count which means the number of EMF measurements on the right panel of the measurement screen is changed corresponding to the measurement time you have set.

d Tap to switch **Axis** to **Manual** or **Auto**.

If you set it to **Manual**, Axis setting is available and if you set it to **Auto**, Axis setting is unavailable.

- **Manual**: When using isotropic EMF antenna, you can manually set x, y, and z axis. You can set Manual as a diagnosis mode whether you can receive correct signal based on each axis: X, Y, or Z.
- **Auto**: Each axis of antenna is automatically changed and measured.

e When selected as Manual, tap **Axis** and select from: **X**, **Y**, or **Z**.

f When selected as **Manual**, tap **Manual Axis Capture** to **On**.

– Select the desired **Detector**: **Both**, **Peak**, or **RMS**, to capture the current EMF power for each axis.

- **Both**: Captures and displays both Peak and RMS EMF power for each axis (X, Y, and Z).
- **Peak**: Captures and displays the Peak EMF power for each axis.
- **RMS**: Captures and displays the RMS EMF power for each axis.



NOTE

The **Live** button on the right panel of the measurement screen must be tapped to start the measurement before the captured EMF power values can be displayed.

g Tap to switch **Scaling Factor** to **On** or **Off**.

You can apply additional TDD attenuation factor by turning it on and manually input the required value.

h Tap to switch **Test Mode** to **Fast** or **Normal**.

i Tap **Move to RtSA** to view the real-time spectrum measurement mode.Go back to **Setup** and **Antenna & Cable Loss**.

j *Optional.* Tap to switch **Antenna Gain** to **On** or **Off**.

k When the Antenna Gain is on, tap **Antenna Gain Value** and input the required value using the on-screen keyboard.

NOTE

You need to be cautious when using this value as the instrument applies not an antenna gain value selected from Antenna List EMF but applies this setting. This may cause measurement errors.

l Tap **Antenna List EMF** and select between **Standard** and **Custom** from the pop-up window. Based on the antenna list you selected, you need to check the Axis mode and do the following:

- When selecting G700050381 or G700050382 (Isotropic E-Field) Antenna and Axis to Auto, the Current on the measurement screen indicates as x, y, or z automatically and the Isotropic EMF Power is measured.
- When selecting Yagi antenna (Log Periodic Broadband) and Axis to Auto, the Current on the measurement screen indicates YAGI and the EMF Power is measured.
- When tapping Custom > Configuration icon, an Antenna List Editor window appears and you can customize Frequency and Antenna Factor. You can add up to 500 customized antennas.

NOTE

When selecting Omni antenna (Isotropic E Field) and Axis to Manual, the Current on the measurement screen indicates as your choice (x, y, or z) and the EMF Power is measured.

The instrument supports an engineering mode as ‘Axis Mode: Manual’ to inspect G700050381 and G700050382 antenna. You must not use this mode for a general purpose to measure EMF Power. It does not guarantee the accuracy of the measurement result.

m *Optional.* Tap to Switch **Cable Loss** to **On** or **Off**.

NOTE

When the isotropic antenna is changed to a different antenna, set Cable Loss to On. In this case, the Cable List menu is disabled (grayed out), as the cable loss value is entered manually and does not require selection from the Cable List.

n When the Cable Loss is On, tap **Cable Loss Value** and input the required

value using the on-screen keyboard.

The entered value is displayed in the antenna information area at the top right of the instrument.

NOTE

When you need to use an antenna that is not listed in Antenna List EMF, connect your antenna and then set the Antenna Gain and Cable Loss required for your measurement.

2 Tap **Cable List** and select between **Standard** and **Custom**.

a Tap **Standard** and select a cable from the options.

- Select **AGOS (1.6m)** as required if you use a cable provided with G700050381 (Isotropic E-Field) antenna.
- Select **WaveControl** as required if you use a cable provided with G700050382 (Isotropic E-Field) antenna.
- Select **G700050551** as required.
- Select **G700050552** as required.

b Tap **Custom** and select a registered cable if you use a cable that you registered.

c Once tapped, a Cable List Editor window pops up.

- Tap **Add** (+) button to add a new cable. This will add to a new cable list.
- Tap the **Configuration** icon to edit a cable shown in the 'Cable List'. After designating the cable name by selecting the Configuration icon, you need to input the real loss value of the cable measured between the bandwidth from 1 GHz to 2 GHz. This will automatically compensate the measurement result by calculating the input cable loss.
- Tap the **Delete** icon to delete the customized cable that you have set.

To start testing

1 On the right panel of the screen, do the following steps:

a Tap the **Testing** ( ) button to start the measurement.

The instrument displays measurement results on the screen.

b Tap the **Hold** icon on the side bar to hold the display.

c Tap the **Hold** icon again to release the display.

d Tap the **Stop** ( ) button to stop the measurement.

The alert message pops up to confirm whether you want to stop now or not.

e Tap to select the index displayed in the table at the bottom.

2 The Isotropic EMF Power (Current/Average/Max/Min) values are displayed respectively for each selected index. The values on the right panel display based on the chart displayed on the left panel.



NOTE
If you have unsaved measurement data and start measuring by tapping the Testing button or by tapping another measurement mode, a pop-up window will appear asking whether you will restore the unsaved data or not.

To set limit

1 Tap **Menu > Limit** in the side bar.

2 Tap **Reference Line**, and then enter a value that you want to set as a reference. The unit will vary depending on your selection of the unit in the Units setting in Amp/Scale.

You can also scroll up and down the purple bar on the measurement screen.

3 Tap to switch **Reference Line Mode** to **On** or **Off**.

If you set it to On, the reference line will appear with the purple bar on the measurement screen and set it to Off, the reference line will disappear with the purple bar on the measurement screen.

4 Tap to switch **Standard Line Mode** to **On** to display the standard line on the screen or **Off** to hide the standard line on the screen.

5 Tap **Standard Limit Line** and select from the following options:

Standard Line is displayed on the screen based on the pre-defined standard. If you select ICNIRP Occupational or ICNIRP General Public, the Standard Line is automatically displayed with automatically calculated value defined in the ICNIRP

guideline. Make sure you change the Scale Unit to V/m in this case to follow the guideline. Other standard limit lines listed in the pop-up window indicate specific standard applied to each country.

a Select a required standard line from the list.

b Tap **ICNIRP Occupational** and **Apply** when EMF power is measured in a site where people work for long hours (occupational).

c Tap **ICNIRP General Public** and **Apply** when EMF power is measured in a public site where unspecified people come and go.

d Tap **Custom Limit** and then tap the **Configuration** icon if you want to customize setting and measure EMF power based on your need.

- A **Standard** window appears.
- Tap **Lower Frequency** and input a desired value using the on-screen keyboard.
- Tap **Upper Frequency** and input a desired value using the on-screen keyboard.
- Tap **Value for Frequency Range** and input a desired value using the on-screen keyboard. It sets coefficient of function.
- Tap **Formula** and select from the following choices: **f^n, /f^n, NA**. It defines an operator between coefficient and frequency. The operator to be defined is multiplication or division.
- Tap **Exponent Value** and input a desired value using the on-screen keyboard. It defines an exponent of the frequency.
- Tap the **Save** button if you want to save the setting.
- Optional. Tap the **Add** button to add Custom Limit.
- *Optional.* Tap the **Delete** button to delete the defined Custom Limit.



NOTE

If you set Formula to f^n or /f^n, you can define the limit line as frequency of function. If you set it to NA, you can define the limit line as a constant.

Figure 133 shows an example of EMF LTE FDD measurement.

Figure 133 EMF LTE FDD measurement



LTE TDD analysis

LTE analysis in EMF Analyzer shows the Isotropic EMF Power (Current, Average, Maximum, and Minimum) based on each selected index signal.

Setting measure setup

After configuring the spectrum measurement in “Configuring spectrum measurements” on page 25, you can set the measure setup to continue your measurement.

To set auto configuration

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap **Auto Configuration**.

3 Tap the **Center Frequency** box and input the required value using the on-screen keyboard.

4 Tap the **Channel Number** box and input the required value using the on-screen keyboard.

5 Tap the **Search** button.

- Once the search is successful, Sync LED at the background turns to green.
- Once the Frame and Slot format has been identified, it shows the values detected: Bandwidth, Uplink-Downlink Config, Pb and Antenna.
- Tap the **Run** button to start TDD analysis when the auto detection is successful.

6 Tap to start the **Analysis Mode** to determine the Frame and Slot Format manually.

7 To identify the TDD formats, select the required **Uplink-Downlink Config** and tap the **Apply** button.



NOTE

If automatic search fails, go to **Setup** and set the **MIMO** (pb) and **Boosting Factor** (Antenna) manually.

To set measure setup

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap to switch **MIB Decoding** to **On** when you do not know the number of transmitter antennas and Bandwidth or otherwise to **Off**.

3 Tap **Bandwidth** and select the value from the following choices: **1.4 MHz**, **3 MHz**, **5 MHz**, **10 MHz**, **15 MHz** or **20 MHz**.

4 Tap the **MIMO** and select **2x2** or **4x4** to select the number of antenna ports.

5 To select the Cyclic Prefix, tap **Cyclic Prefix** and select **Normal** or **Extended**.

6 Tap to switch **LTE PCI Mode** to **Manual** or **Auto** and input a required value.

The **PCI** switches to **Manual**.

7 Tap **Select Index** and select the index from the options as required.

8 Tap **Boosting Factor** and input a value using the on-screen keyboard.

9 Tap **Track of PCIs** to switch it On or Off.

– When set to On, the analyzer continuously tracks and displays measurement results for multiple PCIs simultaneously.

10 Tap **Extrapolation** to switch it **On** or **Off**.

– When set to On, the analyzer estimates the maximum EMF power that would be radiated if the channel were fully loaded with traffic, based on the measured reference signal (pilot) power, providing a conservative estimate of the maximum expected exposure level.

To set test configuration

1 Tap **Test Configuration**.

a Tap **Dwell Time** to specify the amount of measurement time that you want the instrument to stay for on each axis and input the value from 0.1 to 60 (second) using the on-screen keyboard.

b Tap **Measurement Mode** to switch between **Live** and **Timed**.

- Select **Live** to view the measurement results in real time as the test runs continuously.
- Select **Timed** to run the test with the time limit you set. When selected, specify the **Measurement Time**.

c Tap **Measurement Time** to specify the amount of measurement time that you want the instrument to stay for on all three axes in order to display current and accumulated EMF power and set this up to 48 hours using the on-screen keyboard.



NOTE

If you set the measurement time, the count which means the number of EMF measurements on the right panel of the measurement screen is changed corresponding to the measurement time you have set.

d Tap to switch **Axis** to **Manual** or **Auto**.

If you set it to **Manual**, Axis setting is available and if you set it to **Auto**, Axis setting is unavailable.

- **Manual**: When using isotropic EMF antenna, you can manually set x, y, and z axis. You can set Manual as a diagnosis mode whether you can receive correct signal based on each axis: X, Y, or Z.
- **Auto**: Each axis of antenna is automatically changed and measured.

e When selected as Manual, tap **Axis** and select from: **X**, **Y**, or **Z**.

f When selected as **Manual**, tap **Manual Axis Capture** to **On**.

– Select the desired **Detector**: **Both**, **Peak**, or **RMS**, to capture the current EMF power for each axis.

- **Both**: Captures and displays both Peak and RMS EMF power for each axis (X, Y, and Z).
- **Peak**: Captures and displays the Peak EMF power for each axis.
- **RMS**: Captures and displays the RMS EMF power for each axis.



NOTE

The **Live** button on the right panel of the measurement screen must be tapped to start the measurement before the captured EMF power values can be displayed.

g Tap to switch **Scaling Factor** to **On** or **Off**.

You can apply additional TDD attenuation factor by turning it on and manually input the required value.

h Tap to switch **Test Mode** to **Fast** or **Normal**.

i Tap **Move to RtSA** to view the real-time spectrum measurement mode.

2 Go back to **Setup** and **Antenna & Cable Loss**.

a *Optional.* Tap to switch **Antenna Gain** to **On** or **Off**.

b When the Antenna Gain is on, tap **Antenna Gain Value** and input the required value using the on-screen keyboard.



NOTE

You need to be cautious when using this value as the instrument applies not an antenna gain value selected from Antenna List EMF but applies this setting. This may cause measurement errors.

c Tap **Antenna List EMF** and select between **Standard** and **Custom** from the pop-up window. Based on the antenna list you selected, you need to check the Axis mode and do the following:

- When selecting G700050381 or G700050382 (Isotropic E-Field) Antenna and Axis to Auto, the Current on the measurement screen indicates as x, y, or z automatically and the Isotropic EMF Power is measured.
- When selecting Yagi antenna (Log Periodic Broadband) and Axis to Auto, the Current on the measurement screen indicates YAGI and the EMF Power is measured.
- When tapping Custom > Configuration icon, an Antenna List Editor window appears and you can customize Frequency and Antenna Factor. You can add up to 500 customized antennas.



NOTE

When selecting Omni antenna (Isotropic E Field) and Axis to Manual, the Current on the measurement screen indicates as your choice (x, y, or z) and the EMF Power is measured.

The instrument supports an engineering mode as ‘Axis Mode: Manual’ to inspect G700050381 and G700050382 antenna. You must not use this mode for a general purpose to measure EMF Power. It does not guarantee the accuracy of the measurement result.

d *Optional.* Tap to Switch **Cable Loss** to **On** or **Off**.



NOTE

When the isotropic antenna is changed to a different antenna, set Cable Loss to On. In this case, the Cable List menu is disabled (grayed out), as the cable loss value is entered manually and does not require selection from the Cable List.

e When the Cable Loss is On, tap **Cable Loss Value** and input the required value using the on-screen keyboard.

The entered value is displayed in the antenna information area at the top right of the instrument

NOTE

When you need to use an antenna that is not listed in Antenna List EMF, connect your antenna and then set the Antenna Gain and Cable Loss required for your measurement.

3 Tap **Cable List** and select between **Standard** and **Custom**.

a Tap **Standard** and select a cable from the options.

- Select **AGOS (1.6m)** as required if you use a cable provided with G700050381 (Isotropic E-Field) antenna.
- Select **WaveControl** as required if you use a cable provided with G700050382 (Isotropic E-Field) antenna.
- Select **G700050551** as required.
- Select **G700050552** as required.

b Tap **Custom** and select a registered cable if you use a cable that you registered.

c Once tapped, a Cable List Editor window pops up.

- Tap **Add** (+) button to add a new cable. This will add to a new cable list.
- Tap the **Configuration** icon to edit a cable shown in the 'Cable List'. After designating the cable name by selecting the Configuration icon, you need to input the real loss value of the cable measured between the bandwidth from 1 GHz to 2 GHz. This will automatically compensate the measurement result by calculating the input cable loss.
- Tap the **Delete** icon to delete the customized cable that you have set.

To start testing

1 On the right panel of the screen, do the following steps:

a Tap the **Testing** ( ) button to start the measurement.

The instrument displays measurement results on the screen.

b Tap the **Hold** icon on the side bar to hold the display.

c Tap the **Hold** icon again to release the display.

d Tap the **Stop** ( ) button to stop the measurement.

The alert message pops up to confirm whether you want to stop now or not.

e Tap to select the index displayed in the table at the bottom.

2 The Isotropic EMF Power (Current/Average/Max/Min) values are displayed respectively for each selected index. The values on the right panel display based on the chart displayed on the left panel.



NOTE
If you have unsaved measurement data and start measuring by tapping the Testing button or by tapping another measurement mode, a pop-up window will appear asking whether you will restore the unsaved data or not.

To set limit

1 Tap **Menu > Limit** in the side bar.

2 Tap **Reference Line**, and then enter a value that you want to set as a reference. The unit will vary depending on your selection of the unit in the Units setting in Amp/Scale.

You can also scroll up and down the purple bar on the measurement screen.

3 Tap to switch **Reference Line Mode** to **On** or **Off**.

If you set it to On, the reference line will appear with the purple bar on the measurement screen and set it to Off, the reference line will disappear with the purple bar on the measurement screen.

4 Tap to switch **Standard Line Mode** to **On** to display the standard line on the screen or **Off** to hide the standard line on the screen.

5 Tap **Standard Limit Line** and select from the following options:

Standard Line is displayed on the screen based on the pre-defined standard. If you select ICNIRP Occupational or ICNIRP General Public, the Standard Line is automatically displayed with automatically calculated value defined in the ICNIRP

guideline. Make sure you change the Scale Unit to V/m in this case to follow the guideline. Other standard limit lines listed in the pop-up window indicate specific standard applied to each country.

a Select a required standard line from the list.

b Tap **ICNIRP Occupational** and **Apply** when EMF power is measured in a site where people work for long hours (occupational).

c Tap **ICNIRP General Public** and **Apply** when EMF power is measured in a public site where unspecified people come and go.

d Tap **Custom Limit** and then tap the **Configuration** icon if you want to customize setting and measure EMF power based on your need.

- A **Standard** window appears.
- Tap **Lower Frequency** and input a desired value using the on-screen keyboard.
- Tap **Upper Frequency** and input a desired value using the on-screen keyboard.
- Tap **Value for Frequency Range** and input a desired value using the on-screen keyboard. It sets coefficient of function.
- Tap **Formula** and select from the following choices: **f^n, /f^n, NA**. It defines an operator between coefficient and frequency. The operator to be defined is multiplication or division.
- Tap **Exponent Value** and input a desired value using the on-screen keyboard. It defines an exponent of the frequency.
- Tap the **Save** button if you want to save the setting.
- Optional. Tap the **Add** button to add Custom Limit.
- *Optional.* Tap the **Delete** button to delete the defined Custom Limit.



NOTE

If you set Formula to f^n or /f^n, you can define the limit line as frequency of function. If you set it to NA, you can define the limit line as a constant.

Figure 134 shows an example of EMF LTE TDD measurement.

Figure 134 EMF LTE TDD measurement



Real-time analysis

The following sections describe how to perform Real-time analysis.

Spectrum

After setting test parameters as described in “Configuring spectrum measurements” on page 25, you can start your EMF measurements.

To set measure setup

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap **Test Configuration**.

a Tap **Dwell Time** to specify the amount of measurement time that you want the instrument to stay for on each axis and input the value from 0.1 to 60 (second) using the on-screen keyboard.

b Tap **Measurement Mode** to switch between **Live** and **Timed**.

- Select **Live** to view the measurement results in real time as the test runs continuously.
- Select **Timed** to run the test with the time limit you set. When selected, specify the **Measurement Time**.

c Tap **Measurement Time** to specify the amount of measurement time that you want the instrument to stay for on all three axes in order to display current and accumulated EMF power and set this up to 48 hours using the on-screen keyboard.

NOTE

If you set the measurement time, the count which means the number of EMF measurements on the right panel of the measurement screen is changed corresponding to the measurement time you have set.

3 Tap to switch **Axis** to **Manual** or **Auto**.

If you set it to **Manual**, Axis setting is available and if you set it to **Auto**, Axis setting is unavailable.

– **Manual**: When using isotropic EMF antenna, you can manually set x, y, and z axis. You can set Manual as a diagnosis mode whether you can receive correct signal based on each axis: X, Y, or Z.

– **Auto**: Each axis of antenna is automatically changed and measured.

4 When selected as **Manual**, tap **Axis** and select from: **X**, **Y**, or **Z**.

You can also select it from the right panel of the measurement screen.

5 When selected as **Manual**, tap **Manual Axis Capture** to **On**.

a Select the desired **Detector**: **Both**, **Peak**, or **RMS**, to capture the current EMF power for each axis.

- **Both**: Captures and displays both Peak and RMS EMF power for each axis (X, Y, and Z).
- **Peak**: Captures and displays the Peak EMF power for each axis.
- **RMS**: Captures and displays the RMS EMF power for each axis.

NOTE

The **Live** button on the right panel of the measurement screen must be tapped to start the measurement before the captured EMF power values can be displayed.

6 Tap **Move to RtSA** to view the real-time spectrum measurement mode.

7 Tap to switch **Moving Average** to **On** or **Off**.

When enabled, the Moving Average function averages EMF measurements over a set time duration, reducing momentary variations and improving readability of typical EMF levels.



NOTE

When Moving Average is turned On, the **Moving Average Power Max Reference** and **Moving Average Power Min Reference** settings become available under Menu > Amp/Scale, allowing you to define the upper and lower reference levels used for the moving average power trace.

8 When selected as On, Tap **Moving Average Time** and set a time duration.

9 Go back to **Setup** and tap **Antenna & Cable Loss**.

a *Optional.* Tap to switch **Antenna Gain** to **On** or **Off**.

b When the Antenna Gain is on, tap **Antenna Gain Value** and input the required value using the on-screen keyboard.



NOTE

You need to be cautious when using this value as the instrument applies not an antenna gain value selected from Antenna List but applies this setting. This may cause measurement errors.

c Tap **Antenna List EMF** and select the required antenna from the pop-up window. Based on the antenna list you selected, you need to check the Axis mode and do the following:

- When selecting G700050381 or G700050382 (Isotropic E-Field) Antenna and Axis to Auto, the Current on the measurement screen indicates as x, y, or z automatically and the Isotropic EMF Power is measured.
- When selecting Yagi antenna (Log Periodic Broadband) and Axis to Auto, the Current on the measurement screen indicates YAGI and the EMF Power is measured.
- When tapping Custom > Configuration icon, an Antenna List Editor window appears and you can customize Frequency and Antenna Factor. You can add up to 500 customized antennas.



NOTE

When selecting Omni antenna (Isotropic E Field) and Axis to Manual, the Current on the measurement screen indicates as your choice (x, y, or z) and the EMF Power is measured.

The instrument supports an engineering mode as ‘Axis Mode: Manual’ to inspect G700050381 and G700050382 antenna. You must not use this mode for a general purpose to measure EMF Power. It does not guarantee the accuracy of the measurement result.

d *Optional.* Tap to Switch **Cable Loss** to **On** or **Off**.



NOTE

When the isotropic antenna is changed to a different antenna, set Cable Loss to On. In this case, the Cable List menu is disabled (grayed out), as the cable loss value is entered manually and does not require selection from the Cable List.

e When the Cable Loss is On, tap **Cable Loss Value** and input the required value using the on-screen keyboard.

The entered value is displayed in the antenna information area at the top right of the instrument.

NOTE

When you need to use an antenna that is not listed in Antenna List EMF, connect your antenna and then set the Antenna Gain and Cable Loss required for your measurement.

10 Tap **Cable List** and select between **Standard** and **Custom**.

a Tap **Standard** and select a cable from the options.

- Select **AGOS (1.6m)** as required if you use a cable provided with G700050381 (Isotropic E-Field) antenna.
- Select **WaveControl** as required if you use a cable provided with G700050382 (Isotropic E-Field) antenna.
- Select **G700050551** as required.
- Select **G700050552** as required.

b Tap **Custom** and select a registered cable if you use a cable that you registered.

c Once tapped, a Cable List Editor window pops up.

- Tap **Add** (+) button to add a new cable. This will add to a new cable list.
- Tap the **Configuration** icon to edit a cable shown in the 'Cable List'. After designating the cable name by selecting the Configuration icon, you need to input the real loss value of the cable measured between the bandwidth from 1 GHz to 2 GHz. This will automatically compensate the measurement result by calculating the input cable loss.
- Tap the **Delete** icon to delete the customized cable that you have set.

11 Tap the **Display Mode** icon between **Spectrum** and **Level Recorder**. Refer to the Figure 117 and Figure 118.

Based on the selection, the measurement screen will change.

12 On the right panel of the screen, do the following steps:

a Tap the **Testing** ( ) button to start the measurement.

The instrument displays measurement results on the screen.

b Tap the **Hold** icon on the side bar to hold the display.

c Tap the **Hold** icon again to release the display.

d Tap the **Stop** ( ) button to stop the measurement.

The alert message pops up to confirm whether you want to stop now or not.

- The (Isotropic) EMF Power is the sum of EMF power measured with three axes for the specified dwell time for the axis, and the maximum/ minimum powers are measured based on the current measuring power.
- Spectral density displays the current signal within the integration bandwidth on the measurement screen.



NOTE
If you have unsaved measurement data and start measuring by tapping the Testing button or by tapping another measurement mode, a pop-up window will appear asking whether you will restore the unsaved data or not.

To configure Telecom Service Table

1 Tap the **Configuration** icon to set **Telecom Service Table**.

The telecom service table is a frequency/band editor that users can set and select frequency/band they want in advance.

a Tap the **Configuration** icon on the bottom left to edit the parameters: **Start Frequency**, **Stop Frequency**, **Technology**, and **Minimum BW**.

b Tap the **Channel Standard** button and select from the pop-up window.

c Tap the **Apply** button to apply the settings.

d Tap the **Save** icon to save the applied settings.

e Tap the **Load** icon to load the saved settings.



NOTE
Make sure to go to Menu > Frequency and set the proper Integrated Bandwidth based on the frequency bandwidth for technology in service to get the right measurement result.

To set trace

If you set Axis to Manual, you can see only whether T1 displays with a selected axis correctly and Current displays as a selected antenna in the Antenna List EMF. The following is the case of setting trace if you set Axis to Auto and enter into measurement mode.

1 Tap **Menu > Trace** in the side bar.

2 Tap **Select Trace** from 1 to 4.

- **T1**: Maximum Hold
- **T2**: Minimum Hold
- **T3**: Current (I: When connected to an Isotropic Antenna, E: When not connected to an Isotropic Antenna)
- **T4**: Average

3 Tap to switch **Trace View** to **On** or **Off**.

If you set the Trace from 1 to 4 to off, the trace information in Top Info will indicate it as F (false).

4 Tap **Trace Clear All** to clear Min/Max/Isotropic EMF/Spectral Density traces.



NOTE

Trace Clear All resets traces you have set and it also affects overall measurement (Max, Min, etc...) and measurement result. Therefore, you need to be cautious when using this function.

To set detector

1 Tap to switch **Detector** to **Both**, **RMS**, or **Peak** on the middle of the measurement screen.

- **a** Tap **RMS** to display 'The root mean squared average power across the spectrum'.
- **b** Tap **Peak** to display 'The highest value in each data point'.
- **c** Tap **Both** to display both **RMS** and **Peak**.

To set limit

1 Tap **Menu > Limit** in the side bar.

2 Tap **Reference Line**, and then enter a value that you want to set as a reference. The unit will vary depending on your selection of the unit in the Units setting in Amp/Scale.

You can also scroll up and down the purple bar on the measurement screen.

3 Tap to switch **Reference Line Mode** to **On** or **Off**.

If you set it to On, the reference line will appear with the purple bar on the measurement screen and set it to Off, the reference line will disappear with the purple bar on the measurement screen.

4 Tap to switch **Standard Line Mode** to **On** to display the standard line on the screen or **Off** to hide the standard line on the screen.

Make sure to set it to On and set Scale Unit to % (V/m) or %(W/m²) in Amp/Scale. Then the EMF power will be shown as % in the measurement screen.

5 Tap **Standard Limit Line** and select from the following options:

Standard Line is displayed on the screen based on the pre-defined standard. If you select ICNIRP Occupational or ICNIRP General Public, the Standard Line is automatically displayed with automatically calculated value defined in the ICNIRP

guideline. Make sure you change the Scale Unit to V/m in this case to follow the guideline. Other standard limit lines listed in the pop-up window indicate specific standard applied to each country.

a Select a required standard line from the list.

b Tap **ICNIRP Occupational** and **Apply** when EMF power is measured in a site where people work for long hours (occupational).

c Tap **ICNIRP General Public** and **Apply** when EMF power is measured in a public site where unspecified people come and go.

d Tap **Custom Limit** and then tap the **Configuration** icon if you want to customize setting and measure EMF power based on your need.

- A **Standard** window appears.
- Tap **Lower Frequency** and input a desired value using the on-screen keyboard.
- Tap **Upper Frequency** and input a desired value using the on-screen keyboard.
- Tap **Value for Frequency Range** and input a desired value using the on-screen keyboard. It sets coefficient of function.
- Tap **Formula** and select from the following choices: **f^n, /f^n, NA**. It defines an operator between coefficient and frequency. The operator to be defined is multiplication or division.
- Tap **Exponent Value** and input a desired value using the on-screen keyboard. It defines an exponent of the frequency.
- Tap the **Save** button if you want to save the setting.
- Optional. Tap the **Add** button to add Custom Limit.
- *Optional.* Tap the **Delete** button to delete the defined Custom Limit.



NOTE

If you set Formula to f^n or /f^n, you can define the limit line as frequency of function. If you set it to NA, you can define the limit line as a constant.

To save measurement file

You can save your current screen, result, and setup into the internal memory or your external USB memory drive, **USB A** or **USB B** or **SD card.** Make sure to insert a USB memory drive to USB A or B port and insert the SD card to MicroSD port to enable the option. After insertion, you'll have access to the external storage, where you can find a sub-directory corresponding to the instrument you're using. When you are using the Save feature, Hold is automatically enabled.

1 Tap the **Save** ( ) icon on the side bar.

2 Tap the **File Name** input field.

3 Enter the file name you want using the on-screen keyboard.

4 To know and how to save, see the following options:

   a Select **Screen (.png)** to save the current screen with a file type, .png.

   b Select **Report (.pdf)** to save the measurement result in a report format with comments and captured screen images with a file type, .pdf

   If you select Screen or Report in the save options, you can automatically save setup information with screenshots.

   c Select **Result (.csv)** to save the current measurement result displayed on the screen as a .csv file.

   The saved file will include the antenna factor information in Excel (.csv) format.

   d Select **Setup (.stav)** to save the setup and test configuration with a file type, .stav.

   e Select **Logging (.csv)** to save all measurement results with a file type, .csv.

5 *Optional.* Tap to switch the **Color Inversions** to **On** to invert the image color (only available to save as Screen or Report).

6 *Optional.* Tap **Report Setup** to create a report.

   You can add image files and edit information such as Site Location, Site Information, Test Purpose, and Test Result as needed.

To load measurement file

You can load your saved screen, result, and setup from the internal memory or your external USB memory drive, **USB A** or **USB B** or **SD card.** Make sure to insert a USB memory drive to USB A or B port and insert the SD card to MicroSD port to enable the option. After insertion, you'll have access to the external storage, where you can find a sub-directory corresponding to the instrument you're using.

1 Tap the **Load** ( ) icon on the side bar.

2 Select the file to be loaded from the internal memory or from your USB drive.

   Information of your selected file appears in the File Information pane.

3 Check the file information on the right pane.

4 Tap the **Load** button to load the file.

NOTE

When you load CSV file (.csv), you can check the data that you have set up during the measurement. You can search specific information that you want using the on-screen keyboard or exit by using the Exit button.

Figure 135 shows an example of EMF spectrum measurement.

Figure 135 EMF spectrum measurement (When selecting Detector to RMS)



NOTE

The selected antenna, whether it's **Standard** or **Custom** in **Antenna List EMF**, will appear on the top right panel of the screen.

Scanner

You can set frequency to be scanned. You can measure up to 100 channels with this scanner. Using existing format-based or custom parameters, you can measure the integrated EMF power for each frequency band sequentially and continuously for predefined measurement time.

To set measure setup

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap **Test Configuration**.

a Tap **Dwell Time** to specify the amount of measurement time that you want the instrument to stay for on each axis and input the value from 0.1 to 60 (second) using the on-screen keyboard.

b Tap **Measurement Mode** to switch between **Live** and **Timed**.

- Select **Live** to view the measurement results in real time as the test runs continuously.
- Select **Timed** to run the test with the time limit you set. When selected, specify the **Measurement Time**.

c Tap **Measurement Time** to specify the amount of measurement time that you want the instrument to stay for on all three axes in order to display current and accumulated EMF power and set this up to 48 hours using the on-screen keyboard.

NOTE

If you set the measurement time, the count which means the number of EMF measurements on the right panel of the measurement screen is changed corresponding to the measurement time you have set.

3 Tap to switch **Axis** to **Manual** or **Auto**.

If you set it to **Manual**, Axis setting is available and if you set it to **Auto**, Axis setting is unavailable.

– **Manual**: When using isotropic EMF antenna, you can manually set x, y, and z axis. You can set Manual as a diagnosis mode whether you can receive correct signal based on each axis: X, Y, or Z.

– **Auto**: Each axis of antenna is automatically changed and measured.

4 When selected as **Manual**, tap **Axis** and select from: **X**, **Y**, or **Z**.

You can also select it from the right panel of the measurement screen.

5 When selected as **Manual**, tap **Manual Axis Capture** to **On**.

a Select the desired **Detector**: **Both**, **Peak**, or **RMS**, to capture the current EMF power for each axis.

- **Both**: Captures and displays both Peak and RMS EMF power for each axis (X, Y, and Z).
- **Peak**: Captures and displays the Peak EMF power for each axis.
- **RMS**: Captures and displays the RMS EMF power for each axis.

NOTE

The **Live** button on the right panel of the measurement screen must be tapped to start the measurement before the captured EMF power values can be displayed.

6 Tap **Move to RtSA** to view the real-time spectrum measurement mode.

7 Go back to **Setup** and tap **Antenna & Cable Loss**.

a *Optional.* Tap to switch **Antenna Gain** to **On** or **Off**.

b When the Antenna Gain is on, tap **Antenna Gain Value** and input the required value using the on-screen keyboard.



NOTE

You need to be cautious when using this value as the instrument applies not an antenna gain value selected from Antenna List EMF but applies this setting. This may cause measurement errors.

c Tap **Antenna List EMF** and select the required antenna from the pop-up window. Based on the antenna list you selected, you need to check the Axis mode and do the following:

- When selecting G700050381 or G700050382 (Isotropic E-Field) Antenna and Axis to Auto, the Current on the measurement screen indicates as x, y, or z automatically and the Isotropic EMF Power is measured.
- When selecting Yagi antenna (Log Periodic Broadband) and Axis to Auto, the Current on the measurement screen indicates YAGI and the EMF Power is measured.
- When tapping Custom > Configuration icon, an Antenna List Editor window appears and you can customize Frequency and Antenna Factor. You can add up to 500 customized antennas.



NOTE

When selecting Omni antenna (Isotropic E Field) and Axis to Manual, the Current on the measurement screen indicates as your choice (x, y, or z) and the EMF Power is measured.

The instrument supports an engineering mode as ‘Axis Mode: Manual’ to inspect G700050381 and G700050382 antenna. You must not use this mode for a general purpose to measure EMF Power. It does not guarantee the accuracy of the measurement result.

d *Optional.* Tap to Switch **Cable Loss** to **On** or **Off**.



NOTE

When the isotropic antenna is changed to a different antenna, set Cable Loss to On. In this case, the Cable List menu is disabled (grayed out), as the cable loss value is entered manually and does not require selection from the Cable List.

e When the Cable Loss is On, tap **Cable Loss Value** and input the required value using the on-screen keyboard.

The entered value is displayed in the antenna information area at the top right of the instrument.

NOTE

When you need to use an antenna that is not listed in Antenna List EMF, connect your antenna and then set the Antenna Gain and Cable Loss required for your measurement.

8 Tap **Cable List** and select between **Standard** and **Custom**.

a Tap **Standard** and select a cable from the options.

- Select **AGOS (1.6m)** as required if you use a cable provided with G700050381 (Isotropic E-Field) antenna.
- Select **WaveControl** as required if you use a cable provided with G700050382 (Isotropic E-Field) antenna.
- Select **G700050551** as required.
- Select **G700050552** as required.

b Tap **Custom** and select a registered cable if you use a cable that you registered.

c Once tapped, a Cable List Editor window pops up.

- Tap **Add** (+) button to add a new cable. This will add to a new cable list.
- Tap the **Configuration** icon to edit a cable shown in the 'Cable List'. After designating the cable name by selecting the Configuration icon, you need to input the real loss value of the cable measured between the bandwidth from 1 GHz to 2 GHz. This will automatically compensate the measurement result by calculating the input cable loss.
- Tap the **Delete** icon to delete the customized cable that you have set.

9 On the right panel of the screen, tap the **Display Mode** icon between **Table** and **bar**.

Based on the selection, the measurement screen will change. Refer to Figure 136 and Figure 137.

10 On the right panel of the screen, do the following steps:

a Tap the **Testing** ( ) button to start the measurement.

The instrument displays measurement results on the screen.

b Tap the **Hold** icon on the side bar to hold the display.

c Tap the **Hold** icon again to release the display.

d Tap the **Stop** ( ) button to stop the measurement.

The alert message pops up to confirm whether you want to stop now or not.

- The Total indicates the quadratic sum of user-defined Average, Maximum and Minimum Integrated EMF Power and Others indicate not user-defined Integrated EMF Power taken from the counts of measurements.

NOTE
If you have unsaved measurement data and start measuring by tapping the Testing button or by tapping another measurement mode, a pop-up window will appear asking whether you will restore the unsaved data or not.

NOTE
If you go to Menu > Trace > Trace Clear All, it resets traces you have set and it also affects overall measurement (Max, Min, etc...) and measurement result. Therefore, you need to be cautious when using this function.

To configure telecom service table

1 Tap the **Configuration** icon to set **Telecom Service Table**.

The telecom service table is a frequency/band editor that users can set and select frequency/band they want in advance.

a Tap the **Add** (+) button to add a band based on the previous selection.

b Tap the **Configuration** icon on the bottom left to edit the parameters: **Start Frequency**, **Stop Frequency**, **Technology**, **Minimum BW**, and **Individual Limit** (**V/m**).

c Tap the **Channel Standard** button and select from the pop-up window.

d Tap the **Apply** button to apply the settings.

e Once all set, select the **Test Range** using the on-screen keyboard.

f Tap **Set** to use this settings.

Based on the **Display Mode** you have set, the measurement screen changes.

g Tap **Clear All** to deselect all the selected lists.

NOTE
You can save and load the telecom service table setup using the Save or Load icon at the bottom.

To set limit

1 Tap **Menu > Limit** in the side bar.

2 Tap **Reference Line**, and then enter a value that you want to set as a reference. The unit will vary depending on your selection of the unit in the Units setting in Amp/Scale.

You can also scroll up and down the purple bar on the measurement screen.

3 Tap to switch **Reference Line Mode** to **On** or **Off**.

If you set it to On, the reference line will appear with the purple bar on the measurement screen and set it to Off, the reference line will disappear with the purple bar on the measurement screen.

4 Optional. Tap to switch **Scanner Limit Mode** to **On** or **Off**. Make sure to set it to On and set Scale Unit to % (V/m) or %(W/m²) in Amp/Scale. Then the EMF power will be shown as % in the chart.

If you set it to On, the measurement screen displays the **Filter** ()icon for filtering failure items.

NOTE

Tap the Filter icon to see the filtered failure items only.

5 Tap to switch **Limit Type** to **Individual** or **Standard**.

NOTE

Based on the Individual Limit set in Telecom Service Table, the instrument judges Pass (Black) or Fail (Red).

6 Tap **Standard Limit Line** and select from the following options:

Standard Line is displayed on the screen based on the pre-defined standard. If you select ICNIRP Occupational or ICNIRP General Public, the Standard Line is automatically displayed with automatically calculated value defined in the ICNIRP

guideline. Make sure you change the Scale Unit to V/m in this case to follow the guideline. Other standard limit lines listed in the pop-up window indicate specific standard applied to each country.

a Select a required standard line from the list.

b Tap **ICNIRP Occupational** and **Apply** when EMF power is measured in a site where people work for long hours (occupational).

c Tap **ICNIRP General Public** and **Apply** when EMF power is measured in a public site where unspecified people come and go.

d Tap **Custom Limit** and then tap the **Configuration** icon if you want to customize setting and measure EMF power based on your need. You can set and add up to 10 custom limit values.

- A **Standard** window appears.
- Tap **Lower Frequency** and input a desired value using the on-screen keyboard.
- Tap **Upper Frequency** and input a desired value using the on-screen keyboard.
- Tap **Value for Frequency Range** and input a desired value using the on-screen keyboard. It sets coefficient of function.
- Tap **Formula** and select from the following choices: **f^n, /f^n, NA**. It defines an operator between coefficient and frequency. The operator to be defined is multiplication or division.
- Tap **Exponent Value** and input a desired value using the on-screen keyboard. It defines an exponent of the frequency.
- Tap the **Save** button if you want to save the setting.
- Optional. Tap the **Add** button to add Custom Limit.
- *Optional.* Tap the **Delete** button to delete the defined Custom Limit.



NOTE

If you set Formula to f^n or /f^n, you can define the limit line as frequency of function. If you set it to NA, you can define the limit line as a constant.

To save measurement file

You can save your current screen, result, and setup into the internal memory or your external USB memory drive, **USB A** or **USB B** or **SD card.** Make sure to insert a USB memory drive to USB A or B port and insert the SD card to MicroSD port to enable the option. After insertion, you'll have access to the external storage, where you can find a sub-directory corresponding to the instrument you're using. When you are using the Save feature, Hold is automatically enabled.

1 Tap the **Save** () icon on the side bar.

2 Tap the **File Name** input field.

3 Enter the file name you want using the on-screen keyboard.

4 To know and how to save, see the following options:

   a Select **Screen (.png)** to save the current screen with a file type, .png.

   b Select **Report (.pdf)** to save the measurement result in a report format with comments and captured screen images with a file type, .pdf

   If you select Screen or Report in the save options, you can automatically save setup information with screenshots.

   c Select **Result (.csv)** to save the number of points displayed on the screen with a file type, .csv.

   d Select **Setup (.stav)** to save the setup and test configuration with a file type, .stav.

   e Select **Logging (.csv)** to save all measurement results with a file type, .csv.

5 *Optional.* Tap to switch the **Color Inversions** to **On** to invert the image color (only available to save as Screen or Report).

6 *Optional.* Tap **Report Setup** to create a report.

   You can add image files and edit information such as Site Location, Site Information, Test Purpose, and Test Result as needed.

To load measurement file

You can load your saved screen, result, and setup from the internal memory or your external USB memory drive, **USB A** or **USB B** or **SD card.** Make sure to insert a USB memory drive to USB A or B port and insert the SD card to MicroSD port to enable the option. After insertion, you'll have access to the external storage, where you can find a sub-directory corresponding to the instrument you're using.

1 Tap the **Load** ( ) icon on the side bar.

2 Select the file to be loaded from the internal memory or from your USB drive.

   Information of your selected file appears in the File Information pane.

3 Check the file information on the right pane.

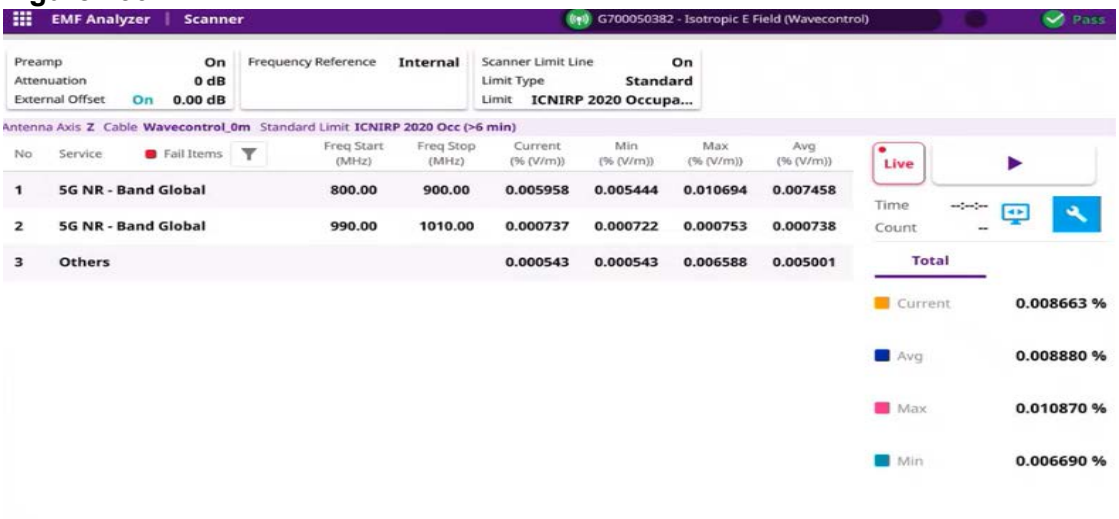
4 Tap the **Load** button to load the file.

NOTE

When you load CSV file (.csv), you can check the data that you have set up during the measurement. You can find specific information that you want using the on-screen keyboard or exit by using the Exit button.

Figure 136 shows an example of EMF scanner measurement for table view.

Figure 136 EMF scanner measurement



NOTE

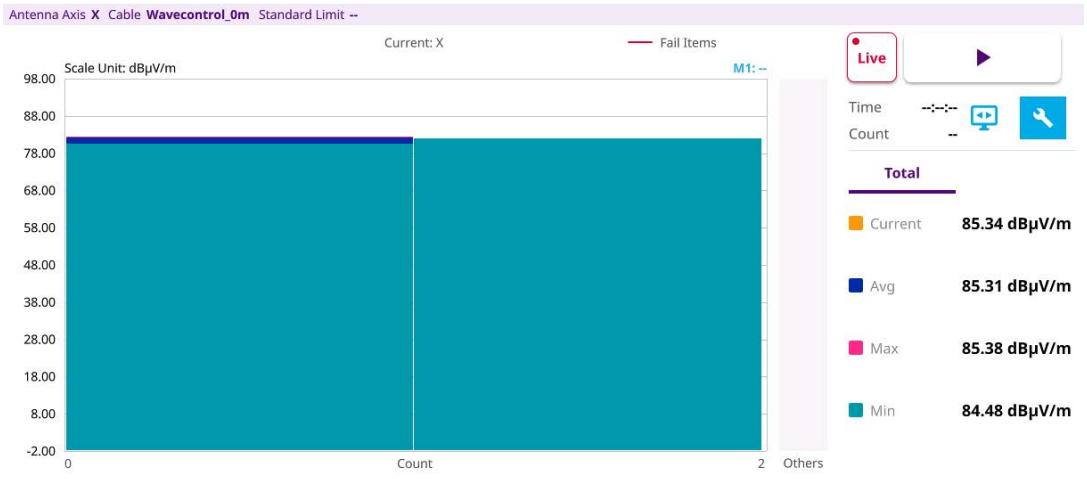
If you choose the Display Mode to Table, it shows Others in the last row of the table. Others indicates the sum of EMF power for undefined bands among pre-defined bands. The Total EMF Power does not include the values for Others.

NOTE

Fail items can be seen as red based on the limit you have set as individual or standard limit. If you tap the Filter icon, you will only see the fail items.

Figure 137 shows an example of EMF scanner measurement for bar view.

Figure 137 EMF scanner measurement



NOTE

If you choose the Display Mode to Bar, it shows Others in the screen. Others indicates the sum of EMF power for undefined bands among predefined bands. The Total EMF Power does not include the values for Others.

NOTE

Fail items can be seen as a vertical red line based on the limit you have set as individual or standard limit. If you tap the Filter icon, the failure items can be seen as the first bar and others can be seen as translucent colors as shown in the above figure.

10

Using 5G NR Signal Analyzer

This chapter describes how to use the 5G NR Signal Analyzer. Topics covered in this chapter include:

- “Introduction” on page 326
- “Selecting mode and measure” on page 327
- “RF analysis” on page 327
- “OTA analysis” on page 351
- “Signal analysis” on page 381
- “Cell phase synchronization” on page 397
- “Online route map” on page 408

Introduction

5G NR Signal Analyzer validates 3GPP 5G NR radio access. Its main 5GNR test functions are RF measurement, over-the-air measurement, and demodulation measurement. The RF measurement includes channel power, ACLR, SEM and occupied bandwidth based on triggered spectrum analysis. The over-the-air measurement includes beam analyzer, carrier scanner and route map. The demodulation measurement includes PDSCH EVM and constellation. The carrier scanner is measuring up to eight single component carriers' power as well as the strongest beam and its power level. The beam analyzer is assessing individual beam’s ID, power level and signal to noise levels, and coverage verification including real-time coverage map as well as data available for post-processing.

The 5GNR Signal Analyzer provides following measurements:

- RF Analysis
  - Trigger Spectrum
  - Channel Power
  - Occupied Bandwidth
  - Spectrum Emission Mask
  - ACLR
  - Multi-ACLR
  - Spurious Emissions
- OTA Analysis
  - Beam Analyzer
  - Carrier Scanner
  - Route Map
  - Beam Availability Index
  - Freq/Time/Power Variation
  - Multipath Profile
- Signal Analysis
  - Constellation
  - Allocation Mapper
  - Power vs Time (Slot)
  - Power vs Time (Frame)
- Cell Phase Synchronization
  - Sync Analysis
  - Sync Route Map
- Online Route Map
  - Online OTA Route Map
  - Online Sync Route Map
- PDSCH Analysis
  - PDSCH Constellation
  - EVM vs Subcarrier

Selecting mode and measure

The following procedure describes how to start measurement.

To select mode and measure

1 Tap **5G NR Signal Analyzer** on the **MODE** panel.

2 Tap any measurement mode from the following choices:

- **RF Analysis > Trigger Spectrum**, **Channel Power**, **Occupied Bandwidth**, **Spectrum Emission Mask**, **ACLR**, **Multi-ACLR**, or **Spurious Emissions**.
- **OTA Analysis > Beam Analyzer**, **Carrier Scanner**, **Route Map**, **Beam Availability Index**, **Freq/Time/Power Variation**, or **Multipath Profile**
- **Signal Analysis > Constellation**, **Allocation Mapper**, **Power vs Time (Slot)**, or **Power vs Time (Frame)**
- **Cell Phase Synchronization** > **Sync Analysis**, **Sync Route Map**
- **Online Route Map** > **Online OTA Route Map** or **Online Sync Route Map**
- **PDSCH Analysis** > **PDSCH Constellation** or **EVM vs Subcarrier**

RF analysis

The following sections describe how to perform RF analysis.



You can quickly access the Auto Gain feature by tapping the Auto Gain icon in the top right corner of the measurement screen. If you tap the Auto Gain icon, the following icon appears. + indicates the attenuation increases by 5 each time. - indicates the attenuation decreases by 5 each time. The third one is auto scale and it automatically adjusts scales.You can tap X to exit the Auto Gain feature.

Trigger spectrum

Setting measure setup

After configuring the spectrum measurement you can configure the measurements just as in Spectrum mode. For more information, see “Configuring spectrum measurements” on page 25.The measurement settings can be saved and recalled as a File Type as Setup and load the file onto the instrument using the **Save/Load** icons on the side bar.

To set measure setup

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap **Bandwidth/SSB SCS** and select the Setting in the pop-up window based on your need. SSB is an abbreviation for Synchronization Signal Block or SS Block and it refers to Synchronization PBCH block since the synchronization signal and PBCH channel are packed as a single block that always moves together. SSB should be detected first in 5G NR frame. See Table 38 for the setting criteria based on the operating frequency.

3 Tap **Sync Raster Offset** to set the sync raster resolution to 180 kHz (FR1) or to 720 kHz (FR2) for carrier frequency center using the on-screen keyboard. See Table 39 below for the sync raster offset range per SSB SCS and sync raster resolution.

4 Tap **Sync SCS Offset** to fine-tune the offset using the SCS. See Table 40 below for the sync raster offset range per SSB SCS and sync raster resolution.

5 Tap **SSB Center Frequency** and input the value using the on-screen keyboard.

6 Tap **GSCN** and input the value using the on-screen keyboard.

Based on GSCN input frequency, the SSB frequency changes automatically.

7 Tap **L** to set the maximum number of SS-PBCH blocks within a single SS burst set (A set of SS being transmitted in 5 ms window of SS transmission) among 4, 8 and 64. Refer to the selection criteria based on the table in **Step 2**.

8 Tap **SSB Auto Search Mode** and do the following steps:

a Tap **Auto Preamp/Atten** and switch **SSB Auto Search** to **Start** to set preamp and attenuation automatically.

b Tap **Manual** and switch **SSB Auto Search** to **Start** for manually setting based on your need.



NOTE

If you tap SSB Auto Search to Start, the searching progress screen appears to let you know the status of searching.

You can tap SSB Auto Search to Stop to stop searching.

9 Tap **SSB Periodicity** and select the options from **5 ms**, **10 ms**, **20 ms**, **40 ms**, **80 ms**, 1**60 ms**. The SS burst period (SSB periodicity) is defined by each base station and network configurable. 20 ms is the default for the initial cell selection.

10 Tap **Slot Formats** and input the value from 0 to 55 using the on-screen keyboard. The slot format means how to use one slot between downlink and uplink.

11 Tap to switch **Link** to **UL** or **DL**.

12 Tap to switch **PCI (Physical Cell ID)** to **Manual** or **Auto**.

13 Tap **PCI** and input a value from 0 to 1007 using the on-screen keyboard. The **PCI** switches to **Manual**.

14 Tap **Miscellaneous** > **Symbol Phase Comp** and select from the following choices: **Auto**, **Manual**, or **Off**.

Symbol Phase Compensation is used to compensate for phase differences between symbols caused by upconversion. Users do not always use the instrument based on RF frequency. In this case, you can set it to Manual or Off.

– **Auto**: Setting radio frequency to center frequency
– **Manual**: Setting radio frequency as required
– **Off**: Setting radio frequency to 0

15 Tap **Menu** > **BW/AVG** > **Average** to set the number of measurements to be averaged using the onscreen keyboard. The input value range is from 1 to 100.

Table 38 Setup per operating frequency

Operating frequency	L	Case	SCS	Slots in a burst period
< 3 GHz (FR1)	4	A {2,8} +14*n	15 kHz	5 (1 ms)
< 3 GHz (FR1)	4	B {4,8,16,20} +28*n	30 kHz	10 (0.5 ms)
< 3 GHz (FR1) For unpaired spectrum operation: < 1.88 GHz	4	C {2,8} +14*n	30 kHz	10 (0.5 ms)
3 to 6 GHz (FR1)	8	A {2,8} +14*n	15 kHz	5 (1 ms)
3 to 6 GHz (FR1)	8	B {4,8,16,20} +28*n	30 kHz	10 (0.5 ms)
3 to 6 GHz (FR1) For unpaired spectrum operation: 1.88 to 6 GHz	8	C {2,8} +14*n	30 kHz	10 (0.5 ms)
> 6 GHz (FR2)	64	D {4,8,16,20} +28*n	120 kHz	40 (0.125 ms)
> 6 GHz (FR2)	64	E {8,12,16,20,32,36,40,44} +56*n	240 kHz	80 (62.5 ms)

Table 39 Sync raster offset range per SSB SCS and sync raster resolution

SSB SCS (kHz)	Sync Raster Resolution (kHz)	Sync Raster Offset Range	SSB Frequency = Center frequency
15	180	0 to 250	125
30	180	0 to 506	253
120	720	0 to 92	46
240	720	0 to 48	24

Table 40 Sync SCS offset range per SSB SCS and sync SCS resolution

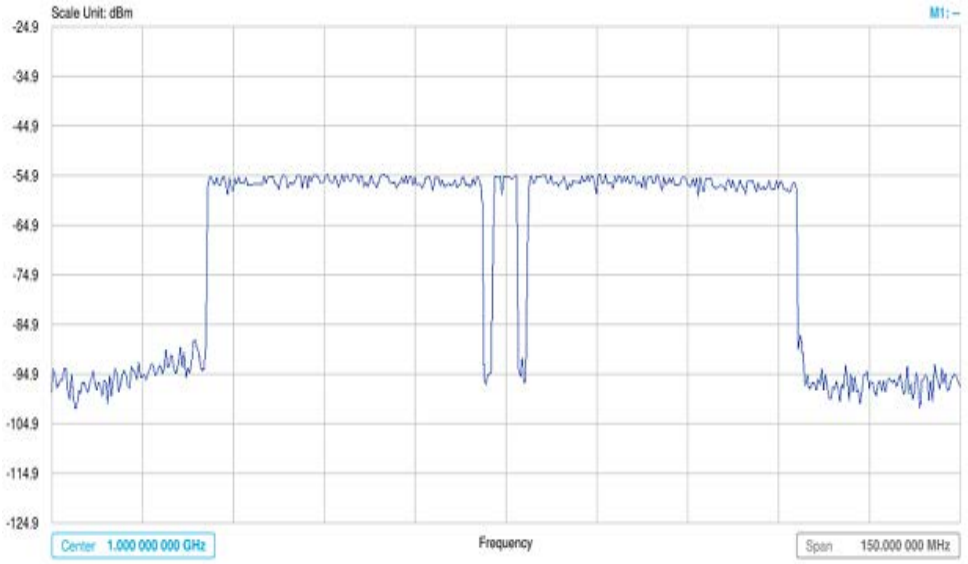
SSB SCS (kHz)	Sync Raster Resolution (kHz)	Sync Raster Offset Range	SSB Frequency = Center Frequency
15	15	0 to 11	0
30	30	0 to 5	0
120	120	0 to 5	0
240	240	0 to 2	0

NOTE

Make sure to set Frequency Reference for all measurement mode in 5G NR Signal Analyzer to sync the proper clock source.

Figure 138 shows an example of trigger spectrum measurement.

Figure 138 5G NR trigger spectrum measurement



Channel power

The Channel Power measurement is a common test used in the wireless industry to measure the total transmitted power of a radio within a defined frequency channel. It acquires a number of points representing the input signal in the time domain, transforms this information into the frequency domain using Fast Fourier Transform (FFT), and then calculates the channel power. The effective resolution bandwidth of the frequency domain trace is proportional to the number of points acquired for the FFT.

The channel power measurement identifies the total RF power, power spectral density, and Peak to Average Ratio (PAR) of the signal within the channel bandwidth.

Setting measure setup

After configuring the spectrum measurement in "Configuring spectrum measurements" on page 25, you can set the measure setup to continue your measurement. The measurement settings can be saved and recalled as a file by selecting File Type as Setup and load the file onto the instrument using the Save/Load icons on the side bar.

To set measure setup

1. Tap the **Setup** (⚙) icon in the side bar.
2. Tap **Bandwidth/SSB SCS** and select the Setting in the pop-up window based on your need. SSB is an abbreviation for Synchronization Signal Block or SS Block and it refers to Synchronization PBCH block since the synchronization signal and PBCH channel are packed as a single block that always moves together. SSB should be detected first in 5G NR frame. See Table 41 below for the setting criteria based on the operating frequency.
3. Tap **Sync Raster Offset** to set the sync raster resolution to 180 kHz (FR1) or to 720 kHz (FR2) for carrier frequency center using the on-screen keyboard. See Table 42 below for the sync raster offset range per SSB SCS and sync raster resolution.
4. Tap **Sync SCS Offset** to fine-tune the offset using the SCS. See Table 43 below for the sync raster offset range per SSB SCS and sync raster resolution.
5. Tap **SSB Center Frequency** and input the value using the on-screen keyboard.
6. Tap **GSCN** and input the value using the on-screen keyboard.

   Based on GSCN input frequency, the SSB frequency changes automatically.
7. Tap **L** to set the maximum number of SS-PBCH blocks within a single SS burst set (A set of SS being transmitted in 5 ms window of SS transmission) among 4, 8 and 64. Refer to the selection criteria based on the table in **Step 2**.

8 Tap **SSB Auto Search Mode** and do the following steps:

a Tap **Auto Preamp/Atten** and switch **SSB Auto Search** to **Start** to set preamp and attenuation automatically.

b Tap **Manual** and switch **SSB Auto Search** to **Start** for manually setting based on your need.



NOTE
If you tap SSB Auto Search to Start, the searching progress screen appears to let you know the status of searching.
You can tap SSB Auto Search to Stop to stop searching.

9 Tap **SSB Periodicity** and select the options from **5 ms**, **10 ms**, **20 ms**, **40 ms**, **80 ms**, 1**60 ms**. The SS burst period (SSB periodicity) is defined by each base station and network configurable. 20 ms is the default for the initial cell selection.

10 Tap to switch **PCI (Physical Cell ID)** to **Manual** or **Auto**.

11 Tap **PCI** and input a value from 0 to 1007 using the on-screen keyboard. The PCI switches to **Manual**.

12 Tap **Miscellaneous** > **Symbol Phase Comp** and select from the following choices: **Auto**, **Manual**, or **Off**.

Symbol Phase Compensation is used to compensate for phase differences between symbols caused by upconversion. Users do not always use the instrument based on RF frequency. In this case, you can set it to Manual or Off.

– **Auto**: Setting radio frequency to center frequency
– **Manual**: Setting radio frequency as required
– **Off**: Setting radio frequency to 0

13 Tap **EIRP Settings**.

a Select **Set Max to EIRP1** to save the currently measured maximum value to EIRP1.

b Select **Set Max to EIRP2** to save the currently measured maximum value to EIRP2.

c Select **Clear Max** to clear the currently measured maximum value.

d Select **Clear All** to reset EIRP1, EIRP2, and maximum value.

e Tap **Distance** and input the value using the on-screen keyboard.

f Tap **Antenna Gain** and input the value using the on-screen keyboard.

14 Tap **Menu** > **BW/AVG** > **Average** to set the number of measurements to be averaged using the onscreen keyboard. The input value is from 1 to 100.

NOTE

Distance and Antenna gain values are required when calculating EIRP. Effective Isotropic Radiated Power (EIRP) refers to the amount of power that a theoretical isotropic antenna (which evenly distributes power in all directions) would emit to produce the peak power density observed in the direction of maximum antenna gain. EIRP can take into account the losses in transmission line and connectors and includes the gain of the antenna. The EIRP is often stated in terms of decibels over a reference power emitted by an isotropic radiator with equivalent signal strength. The EIRP allows comparisons between different emitters regardless of type, size or form. From the EIRP, and with knowledge of a real antenna's gain, it is possible to calculate real power and field strength values.

Formula to calculate: EIRP = Tx RF Power (dBm)+GA (dB) - FL (dB)

Tx RF Power refers to RF power measured at RF connector of the unit

GA refers to Gain Antenna

FL refers to Feeder loss (cable loss of any other loss incurred)

You can tap to switch to Channel Power or EIRP under the chart in the table, and it will show the automatically calculated value.

Table 41 Setup per operating frequency

Operating frequency	L	Case	SCS	Slots in a burst period
< 3 GHz (FR1)	4	A {2,8} +14*n	15 kHz	5 (1 ms)
< 3 GHz (FR1)	4	B {4,8,16,20} +28*n	30 kHz	10 (0.5 ms)
< 3 GHz (FR1) For unpaired spectrum operation: < 1.88 GHz	4	C {2,8} +14*n	30 kHz	10 (0.5 ms)
3 to 6 GHz (FR1)	8	A {2,8} +14*n	15 kHz	5 (1 ms)
3 to 6 GHz (FR1)	8	B {4,8,16,20} +28*n	30 kHz	10 (0.5 ms)

Table 41 Setup per operating frequency

Operating frequency	L	Case	SCS	Slots in a burst period
3 to 6 GHz (FR1) For unpaired spectrum operation: 1.88 to 6 GHz	8	C {2,8} +14*n	30 kHz	10 (0.5 ms)
> 6 GHz (FR2)	64	D {4,8,16,20} +28*n	120 kHz	40 (0.125 ms)
> 6 GHz (FR2)	64	E {8,12,16,20,32,36,40,44} +56*n	240 kHz	80 (62.5 ms)

Table 42 Sync raster offset range per SSB SCS and sync raster resolution

SSB SCS (kHz)	Sync Raster Resolution (kHz)	Sync Raster Offset Range	SSB Frequency = Center frequency
15	180	0 to 250	125
30	180	0 to 506	253
120	720	0 to 92	46
240	720	0 to 48	24

Table 43 Sync SCS offset range per SSB SCS and sync SCS resolution

SSB SCS (kHz)	Sync Raster Resolution (kHz)	Sync Raster Offset Range	SSB Frequency = Center Frequency
15	15	0 to 11	0
30	30	0 to 5	0
120	120	0 to 5	0
240	240	0 to 2	0

To set the limit

1 Tap **Menu > Limit**.

2 Tap to switch the **Test Limits** to **On** or **Off** to enable or disable Pass/Fail indication. The result table color for Pass is green, and the result table color for Fail is red.

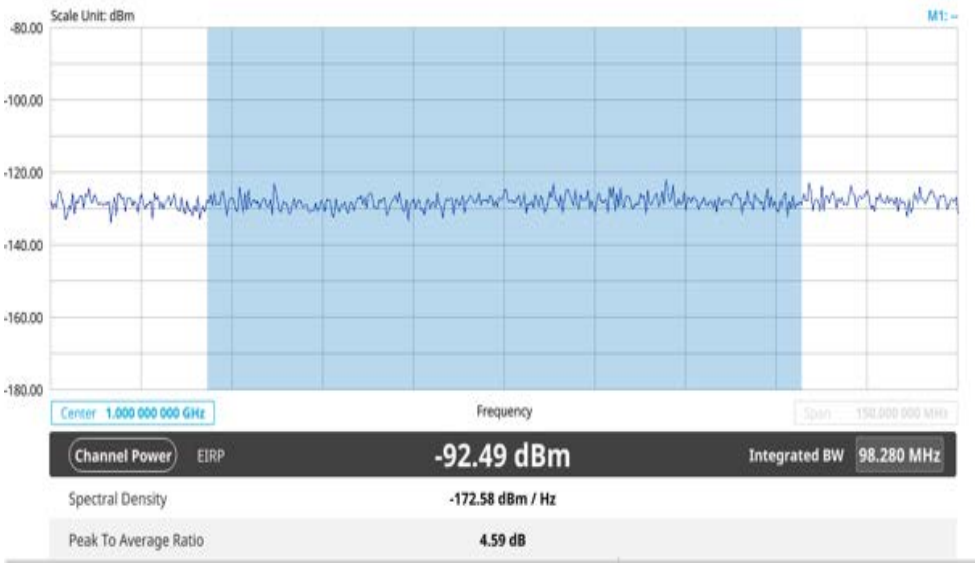
3 Tap **High Limit** to set the upper threshold using the on-screen keyboard.

4 Tap **Low Limit** to set the lower threshold using the on-screen keyboard.

5 *Optional.* Tap the **Save** hot key on the side bar and select the save option from the choices available for your measurement mode.

Figure 139 shows an example of channel power measurement.

Figure 139 5G NR channel power measurement



Channel power measurement result shows channel power and spectrum density in a user specified channel bandwidth. The peak to average ratio (PAR) is shown at the bottom of the screen as well. The shaded area on the display indicates the channel bandwidth.

Occupied bandwidth

The Occupied Bandwidth measures the percentage of the transmitted power within a specified bandwidth. The percentage is typically 99%.

Setting measure setup

After configuring the spectrum measurement in “Configuring spectrum measurements” on page 25, you can set the measure setup to continue your measurement. The measurement settings can be saved and recalled as a file by selecting File Type as Setup and load the file onto the instrument using the Save/Load icons on the side bar.

To set measure setup

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap **Bandwidth/SSB SCS** and select the Setting in the pop-up window based on your need. SSB is an abbreviation for Synchronization Signal Block or SS Block and it refers to Synchronization PBCH block since the synchronization signal and PBCH channel are packed as a single block that always moves together. SSB should be detected first in 5G NR frame. See Table 44 below for the setting criteria based on the operating frequency.

3 Tap **Sync Raster Offset** to set the sync raster resolution to 180 kHz (FR1) or to 720 kHz (FR2) for carrier frequency center using the on-screen keyboard. See Table 45 below for the sync raster offset range per SSB SCS and sync raster resolution.

4 Tap **Sync SCS Offset** to fine-tune the offset using the SCS. See Table 46 below for the sync raster offset range per SSB SCS and sync raster resolution.

5 Tap **SSB Center Frequency** and input the value using the on-screen keyboard.

6 Tap **GSCN** and input the value using the on-screen keyboard.

Based on GSCN input frequency, the SSB frequency changes automatically.

7 Tap **L** to set the maximum number of SS-PBCH blocks within a single SS burst set (A set of SS being transmitted in 5 ms window of SS transmission) among 4, 8 and 64. Refer to the selection criteria based on the table in **Step 2**.

8 Tap **SSB Auto Search Mode** and do the following steps:

a Tap **Auto Preamp/Atten** and switch **SSB Auto Search** to **Start** to set preamp and attenuation automatically.

b Tap **Manual** and switch **SSB Auto Search** to **Start** for manually setting based on your need.



NOTE
If you tap SSB Auto Search to Start, the searching progress screen appears to let you know the status of searching.
You can tap SSB Auto Search to Stop to stop searching.

9 Tap **SSB Periodicity** and select the options from **5 ms**, **10 ms**, **20 ms**, **40 ms**, **80 ms**, 1**60 ms**. The SS burst period (SSB periodicity) is defined by each base station and network configurable. 20 ms is the default for the initial cell selection.

10 Tap to switch **PCI (Physical Cell ID)** to **Manual** or **Auto**.

11 Tap **PCI** and input a value from 0 to 1007 using the on-screen keyboard. The PCI switches to **Manual**.

12 Tap **Miscellaneous** > **Symbol Phase Comp** and select from the following choices: **Auto**, **Manual**, or **Off**.

Symbol Phase Compensation is used to compensate for phase differences between symbols caused by upconversion. Users do not always use the instrument based on RF frequency. In this case, you can set it to Manual or Off.

– **Auto**: Setting radio frequency to center frequency
– **Manual**: Setting radio frequency as required
– **Off**: Setting radio frequency to 0

13 Tap **Menu** > **BW/AVG** > **Average** to set the number of measurements to be averaged using the onscreen keyboard. The input value is from 1 to 100.

Table 44 Setup per operating frequency

Operating frequency	L	Case	SCS	Slots in a burst period
< 3 GHz (FR1)	4	A {2,8} +14*n	15 kHz	5 (1 ms)
< 3 GHz (FR1)	4	B {4,8,16,20} +28*n	30 kHz	10 (0.5 ms)
< 3 GHz (FR1) For unpaired spectrum operation: < 1.88 GHz	4	C {2,8} +14*n	30 kHz	10 (0.5 ms)
3 to 6 GHz (FR1)	8	A {2,8} +14*n	15 kHz	5 (1 ms)
3 to 6 GHz (FR1)	8	B {4,8,16,20} +28*n	30 kHz	10 (0.5 ms)
3 to 6 GHz (FR1) For unpaired spectrum operation: 1.88 to 6 GHz	8	C {2,8} +14*n	30 kHz	10 (0.5 ms)
> 6 GHz (FR2)	64	D {4,8,16,20} +28*n	120 kHz	40 (0.125 ms)
> 6 GHz (FR2)	64	E {8,12,16,20,32,36,40,44} +56*n	240 kHz	80 (62.5 ms)

Table 45 Sync raster offset range per SSB SCS and sync raster resolution

SSB SCS (kHz)	Sync Raster Resolution (kHz)	Sync Raster Offset Range	SSB Frequency = Center frequency
15	180	0 to 250	125
30	180	0 to 506	253

Table 45 Sync raster offset range per SSB SCS and sync raster resolution

SSB SCS (kHz)	Sync Raster Resolution (kHz)	Sync Raster Offset Range	SSB Frequency = Center frequency
120	720	0 to 92	46
240	720	0 to 48	24

Table 46 Sync SCS offset range per SSB SCS and sync SCS resolution

SSB SCS (kHz)	Sync Raster Resolution (kHz)	Sync Raster Offset Range	SSB Frequency = Center Frequency
15	15	0 to 11	0
30	30	0 to 5	0
120	120	0 to 5	0
240	240	0 to 2	0

To set the limit

1 Tap **Menu > Limit**.

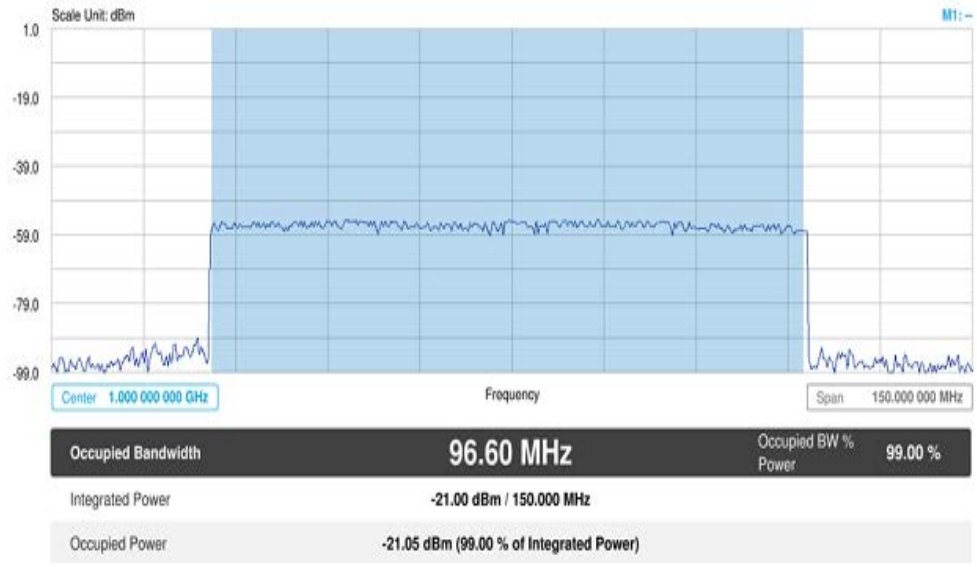
2 Tap to switch the **Test Limits** to **On** or **Off** to enable or disable Pass/Fail indication. The result table color for Pass is green, and the result table color for Fail is red.

3 Tap **High Limit** to set the upper threshold using the on-screen keyboard.

4 *Optional.* Tap the **Save** hot key on the side bar and select the save option from the choices available for your measurement mode.

Figure 140 shows an example of occupied bandwidth measurement.

Figure 140 5G NR occupied bandwidth measurement



The Occupied Bandwidth measurement shows both power across the band and power bandwidth in a user specified percentage to determine the amount of spectrum used by a modulated signal. Occupied bandwidth is typically calculated as the bandwidth containing 99% of the transmitted power.

Spectrum emission mask

The Spectrum Emission Mask (SEM) measurement is to identify and determine the power level of out-of-band spurious emission outside the necessary channel bandwidth and modulated signal. It measures the power ratio between in-band and adjacent channels. The instrument indicates either Pass or Fail based on the specified limit of the signal.

Setting measure setup

After configuring the spectrum measurement in “Configuring spectrum measurements” on page 25, you can set the measure setup to continue your measurement. The measurement settings can be saved and recalled as a file by selecting File Type as Setup and load the file onto the instrument using the Save/Load icons on the side bar.

To set measure setup

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap **Bandwidth/SSB SCS** and select the Setting in the pop-up window based on your need. SSB is an abbreviation for Synchronization Signal Block or SS Block and it refers to Synchronization PBCH block since the synchronization signal and PBCH channel are packed as a single block that always moves together. SSB should be detected first in 5G NR frame. See Table 47 below for the setting criteria based on the operating frequency.

3 Tap **Sync Raster Offset** to set the sync raster resolution to 180 kHz (FR1) or to 720 kHz (FR2) for carrier frequency center using the on-screen keyboard. See Table 48 below for the sync raster offset range per SSB SCS and sync raster resolution.

4 Tap **Sync SCS Offset** to fine-tune the offset using the SCS. See Table 49 below for the sync raster offset range per SSB SCS and sync raster resolution.

5 Tap **SSB Center Frequency** and input the value using the on-screen keyboard.

6 Tap **GSCN** and input the value using the on-screen keyboard.

Based on GSCN input frequency, the SSB frequency changes automatically.

7 Tap **L** to set the maximum number of SS-PBCH blocks within a single SS burst set (A set of SS being transmitted in 5 ms window of SS transmission) among 4, 8 and 64. Refer to the selection criteria based on the table in **Step 2**.

8 Tap **SSB Auto Search Mode** and do the following steps:

a Tap **Auto Preamp/Atten** and switch **SSB Auto Search** to **Start** to set preamp and attenuation automatically.

b Tap **Manual** and switch **SSB Auto Search** to **Start** for manually setting based on your need.



NOTE
If you tap SSB Auto Search to Start, the searching progress screen appears to let you know the status of searching.
You can tap SSB Auto Search to Stop to stop searching.

9 Tap **SSB Periodicity** and select the options from **5 ms**, **10 ms**, **20 ms**, **40 ms**, **80 ms**, 1**60 ms**. The SS burst period (SSB periodicity) is defined by each base station and network configurable. 20 ms is the default for the initial cell selection.

10 Tap to switch **PCI (Physical Cell ID)** to **Manual** or **Auto**.

11 Tap **PCI** and input a value from 0 to 1007 using the on-screen keyboard. The PCI switches to **Manual**.

12 Tap **Miscellaneous** > **Symbol Phase Comp** and select from the following choices: **Auto**, **Manual**, or **Off**.

Symbol Phase Compensation is used to compensate for phase differences between symbols caused by upconversion. Users do not always use the instrument based on RF frequency. In this case, you can set it to Manual or Off.

– **Auto**: Setting radio frequency to center frequency
– **Manual**: Setting radio frequency as required
– **Off**: Setting radio frequency to 0

13 Tap **SEM Config** to configure the following items:

a Tap **BS Type** and select the option from **1-C/1-H**, **1-O**, or **2-O**.

Set 1-C (Conducted)/1-H (Hybrid) for multi-band operation with mapping of transceivers to one or more antenna connectors (1-C) or TAB (transceiver array boundary) connectors for 1-H. Set 1-O when BS operates at FR1 and 2-O when BS operates at FR2.

b Tap **Category** and select the option from **Wide Area BS A**, **Wide Area BS B**, **Medium Range BS**, or **Local Area BS**.

The category is defined with base station type. Set Wide Area BS A/B for macro cell, Medium Range BS for micro cell, and Local Area Base Station for pico cell.

c Tap **Mask Type** and select the option from **KCA** or **3GPP**.

You can select the KCA to follow Korea Communications Agency standard (Korea-specific) or select 3GPP to follow international standard.

14 Tap **Menu** > **BW/AVG** > **Average** to set the number of measurements to be averaged using the onscreen keyboard. The input value is from 1 to 100.

Table 47 Setup per operating frequency

Operating frequency	L	Case	SCS	Slots in a burst period
< 3 GHz (FR1)	4	A {2,8} +14*n	15 kHz	5 (1 ms)
< 3 GHz (FR1)	4	B {4,8,16,20} +28*n	30 kHz	10 (0.5 ms)
< 3 GHz (FR1) For unpaired spectrum operation: < 1.88 GHz	4	C {2,8} +14*n	30 kHz	10 (0.5 ms)
3 to 6 GHz (FR1)	8	A {2,8} +14*n	15 kHz	5 (1 ms)
3 to 6 GHz (FR1)	8	B {4,8,16,20} +28*n	30 kHz	10 (0.5 ms)
3 to 6 GHz (FR1) For unpaired spectrum operation: 1.88 to 6 GHz	8	C {2,8} +14*n	30 kHz	10 (0.5 ms)
> 6 GHz (FR2)	64	D {4,8,16,20} +28*n	120 kHz	40 (0.125 ms)

Table 47 Setup per operating frequency

Operating frequency	L	Case	SCS	Slots in a burst period
> 6 GHz (FR2)	64	E {8,12,16,20,32,36,40,44} +56*n	240 kHz	80 (62.5 ms)

Table 48 Sync raster offset range per SSB SCS and sync raster resolution

SSB SCS (kHz)	Sync Raster Resolution (kHz)	Sync Raster Offset Range	SSB Frequency = Center frequency
15	180	0 to 250	125
30	180	0 to 506	253
120	720	0 to 92	46
240	720	0 to 48	24

Table 49 Sync SCS offset range per SSB SCS and sync SCS resolution

SSB SCS (kHz)	Sync Raster Resolution (kHz)	Sync Raster Offset Range	SSB Frequency = Center Frequency
15	15	0 to 11	0
30	30	0 to 5	0
120	120	0 to 5	0
240	240	0 to 2	0

To set the limit

1 Tap **Menu > Limit**.

2 Tap to switch the **Test Limits** to **On** or **Off** to enable or disable Pass/Fail indication. The result table color for Pass is green, and the result table color for Fail is red.

3 *Optional.* Tap the **Save** hot key on the side bar and select the save option from the choices available for your measurement mode.

Figure 141 shows an example of spectrum emission mask measurement.

Figure 141 5G NR spectrum emission mask measurement



If Lower Peak or Upper Peak indicate Fail, the mask line becomes red.

ACLR

The Adjacent Channel Power Ratio (ACPR) designated by the 3GPP WCDMA specifications as the Adjacent Channel Leakage Power Ratio (ACLR), is the power contained in a specified frequency channel bandwidth relative to the total carrier power. It may also be expressed as a ratio of power spectral densities between the carrier and the specified offset frequency band.

Setting measure setup

After configuring the spectrum measurement in “Configuring spectrum measurements” on page 25, you can set the measure setup to continue your measurement. The measurement settings can be saved and recalled as a file by selecting File Type as Setup and load the file onto the instrument using the Save/Load icons on the side bar.

To set measure setup

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap **Bandwidth/SSB SCS** and select the Setting in the pop-up window based on your need. SSB is an abbreviation for Synchronization Signal Block or SS Block and it refers to Synchronization PBCH block since the synchronization signal and PBCH channel are packed as a single block that always moves together. SSB should be detected first in 5G NR frame. See Table 49 below for the setting criteria based on the operating frequency.

3 Tap **Sync Raster Offset** to set the sync raster resolution to 180 kHz (FR1) or to 720 kHz (FR2) for carrier frequency center using the on-screen keyboard. See Table 50 below for the sync raster offset range per SSB SCS and sync raster resolution.

4 Tap **Sync SCS Offset** to fine-tune the offset using the SCS. See Table 51 below for the sync raster offset range per SSB SCS and sync raster resolution.

5 Tap **SSB Center Frequency** and input the value using the on-screen keyboard.

6 Tap **GSCN** and input the value using the on-screen keyboard.

Based on GSCN input frequency, the SSB frequency changes automatically.

7 Tap **L** to set the maximum number of SS-PBCH blocks within a single SS burst set (A set of SS being transmitted in 5 ms window of SS transmission) among 4, 8 and 64. Refer to the selection criteria based on the table in **Step 2**.

8 Tap **SSB Auto Search Mode** and do the following steps:

a Tap **Auto Preamp/Atten** and switch **SSB Auto Search** to **Start** to set preamp and attenuation automatically.

b Tap **Manual** and switch **SSB Auto Search** to **Start** for manually setting based on your need.



NOTE
If you tap SSB Auto Search to Start, the searching progress screen appears to let you know the status of searching.
You can tap SSB Auto Search to Stop to stop searching.

9 Tap **SSB Periodicity** and select the options from **5 ms**, **10 ms**, **20 ms**, **40 ms**, **80 ms**, 1**60 ms**. The SS burst period (SSB periodicity) is defined by each base station and network configurable. 20 ms is the default for the initial cell selection.

10 Tap to switch **PCI (Physical Cell ID)** to **Manual** or **Auto**.

11 Tap **PCI** and input a value from 0 to 1007 using the on-screen keyboard. The PCI switches to **Manual**.

12 Tap **Miscellaneous** > **Symbol Phase Comp** and select from the following choices: **Auto**, **Manual**, or **Off**.

Symbol Phase Compensation is used to compensate for phase differences between symbols caused by upconversion. Users do not always use the instrument based on RF frequency. In this case, you can set it to Manual or Off.

– **Auto**: Setting radio frequency to center frequency
– **Manual**: Setting radio frequency as required
– **Off**: Setting radio frequency to 0

13 Tap **BS Type** and select the option from **1-C/1-H**, **1-O**, or **2-O**.

Set 1-C (Conducted)/1-H (Hybrid) for multi-band operation with mapping of transceivers to one or more antenna connectors (1-C) or TAB (transceiver array boundary) connectors for 1-H. Set 1-O when BS operates at FR1 and 2-O when BS operates at FR2.

14 Tap **Category** and select the option from **Wide Area BS A**, **Wide Area BS B**, **Medium Range BS**, or **Local Area BS**.

The category is defined with base station type. Set Wide Area BS A/B for macro cell, Medium Range BS for micro cell, and Local Area Base Station for pico cell.

15 Tap **Menu** > **Trigger** and tap to switch **Burst Spectrum** to **On** or **Off**, which takes time for FPGA change.

- **On**: Functions as Threshold RMS Spectrum. Automatically sets UI Update Rate 100 ms, Average 100, RBW 100kHz, VBW 100kHz
- **Off**: Functions as PSS Correlation Spectrum. Automatically sets UI Update Rate 600 ms, Average 1, RBW 100kHz,VBW 100kHz

16 Tap **Menu** > **Trigger** and tap to switch **Triggered Spectrum** to **On** or **Off**, which takes time for FPGA change.

Table 50 Setup per operating frequency

Operating frequency	L	Case	SCS	Slots in a burst period
< 3 GHz (FR1)	4	A {2,8} +14*n	15 kHz	5 (1 ms)
< 3 GHz (FR1)	4	B {4,8,16,20} +28*n	30 kHz	10 (0.5 ms)
< 3 GHz (FR1) For un-paired spectrum operation: < 1.88 GHz	4	C {2,8} +14*n	30 kHz	10 (0.5 ms)
3 to 6 GHz (FR1)	8	A {2,8} +14*n	15 kHz	5 (1 ms)
3 to 6 GHz (FR1)	8	B {4,8,16,20} +28*n	30 kHz	10 (0.5 ms)
3 to 6 GHz (FR1) For un-paired spectrum operation: 1.88 to 6 GHz	8	C {2,8} +14*n	30 kHz	10 (0.5 ms)
> 6 GHz (FR2)	64	D {4,8,16,20} +28*n	120 kHz	40 (0.125 ms)
> 6 GHz (FR2)	64	E {8,12,16,20,32,36,40,44} +56*n	240 kHz	80 (62.5 ms)

Table 51 Sync raster offset range per SSB SCS and sync raster resolution

SSB SCS (kHz)	Sync Raster Resolution (kHz)	Sync Raster Offset Range	SSB Frequency = Center frequency
15	180	0 to 250	125
30	180	0 to 506	253
120	720	0 to 92	46
240	720	0 to 48	24

Table 52 Sync SCS offset range per SSB SCS and sync SCS resolution

SSB SCS (kHz)	Sync Raster Resolution (kHz)	Sync Raster Offset Range	SSB Frequency = Center Frequency
15	15	0 to 11	0
30	30	0 to 5	0
120	120	0 to 5	0
240	240	0 to 2	0

To set the limit

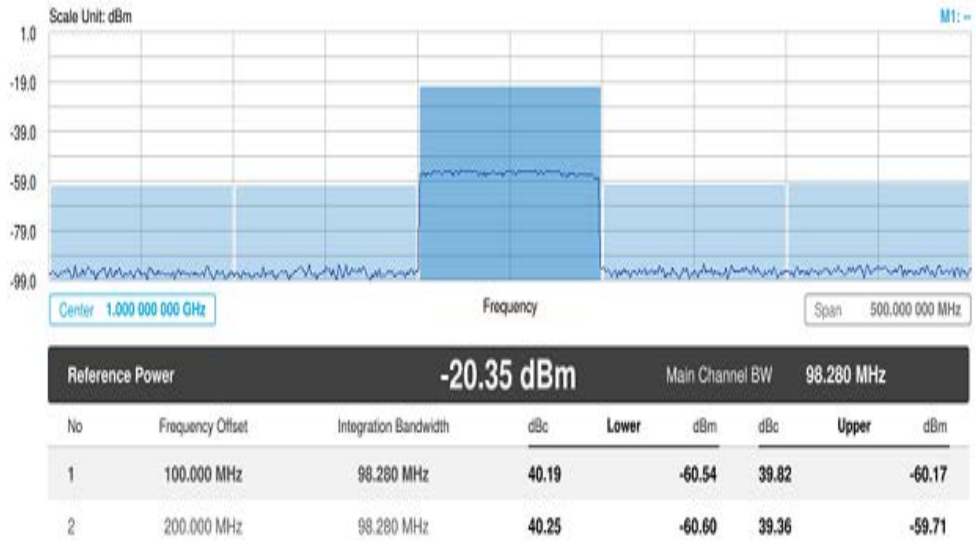
1 Tap **Menu > Limit**.

2 Tap to switch the **Test Limits** to **On** or **Off** to enable or disable Pass/Fail indication. The result table color for Pass is green, and the result table color for Fail is red.

3 *Optional.* Tap the **Save** hot key on the side bar and select the save option from the choices available for your measurement mode.

Figure 142 shows an example of 5G NR ACLR measurement.

Figure 142 5G NR ACLR measurement



Multi-ACLR

The Multi-ACLR measurement is used to perform multi-channel ACLR measurements with as many channels as possible. It helps you to measure ACLR in multi-channel transmitting Base Station environment.

Setting measure setup

After configuring the spectrum measurement in “Configuring spectrum measurements” on page 25, you can set the measure setup to continue your measurement. The measurement settings can be saved and recalled as a file by selecting File Type as Setup and load the file onto the instrument using the Save/Load icons on the side bar.

To set measure setup

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap **Bandwidth/SSB SCS** and select the Setting in the pop-up window based on your need. SSB is an abbreviation for Synchronization Signal Block or SS Block and it refers to Synchronization PBCH block since the synchronization signal and PBCH channel are packed as a single block that always moves together. SSB should be detected first in 5G NR frame. See Table 53 for the setting criteria based on the operating frequency.

3 Tap **BS Type** and select the option from **1-C/1-H**, **1-O**, or **2-O**.

Set 1-C (Conducted)/1-H (Hybrid) for multi-band operation with mapping of transceivers to one or more antenna connectors (1-C) or TAB (transceiver array boundary) connectors for 1-H. Set 1-O when BS operates at FR1 and 2-O when BS operates at FR2.

Table 53 Setup per operating frequency

Operating frequency	L	Case	SCS	Slots in a burst period
< 3 GHz (FR1)	4	A {2,8} +14*n	15 kHz	5 (1 ms)
< 3 GHz (FR1)	4	B {4,8,16,20} +28*n	30 kHz	10 (0.5 ms)
< 3 GHz (FR1) For unpaired spectrum operation: < 1.88 GHz	4	C {2,8} +14*n	30 kHz	10 (0.5 ms)
3 to 6 GHz (FR1)	8	A {2,8} +14*n	15 kHz	5 (1 ms)
3 to 6 GHz (FR1)	8	B {4,8,16,20} +28*n	30 kHz	10 (0.5 ms)
3 to 6 GHz (FR1) For unpaired spectrum operation: 1.88 to 6 GHz	8	C {2,8} +14*n	30 kHz	10 (0.5 ms)
> 6 GHz (FR2)	64	D {4,8,16,20} +28*n	120 kHz	40 (0.125 ms)
> 6 GHz (FR2)	64	E {8,12,16,20,32,36,40,44} +56*n	240 kHz	80 (62.5 ms)

To set the limit

1 Tap **Menu > Limit**.

2 Tap to switch the **Test Limits** to **On** or **Off** to enable or disable Pass/Fail indication. The result table color for Pass is green, and the result table color for Fail is red.

3 *Optional.* Tap the **Save** hot key on the side bar and select the save option from the choices available for your measurement mode.

Figure 143 shows an example of 5G NR Multi-ACLR measurement.

Figure 143 5G NR Multi-ACLR measurement



NOTE
You can set the Lowest Ref. Frequency and Highest Ref. Frequency by tapping the rectangle with value using the on-screen keyboard.

Spurious emissions

The Spurious Emissions measurement is to identify or determine the power level of in-band or out-of-band spurious emissions within the necessary channel bandwidth and modulated signal. The instrument indicates either Pass or Fail based on the specified limit of the signal.

Setting measure setup

After configuring the spectrum measurement in “Configuring spectrum measurements” on page 25, you can set the measure setup to continue your measurement. The measurement settings can be saved and recalled as a file by selecting File Type as Setup and load the file onto the instrument using the Save/Load icons on the side bar.

To set measure setup

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap **BS Type** and select the option from **1-C/1-H**, **1-O**, or **2-O**.

Set 1-C (Conducted)/1-H (Hybrid) for multi-band operation with mapping of transceivers to one or more antenna connectors (1-C) or TAB (transceiver array boundary) connectors for 1-H. Set 1-O when BS operates at FR1 and 2-O when BS operates at FR2.

3 Tap **Measure Type** and select the option from **Transmitted** or **Receiver**.

4 Tap to switch **Setting** to **User** if you want user defined setting and tap **Configuration** or the **Configuration** icon.

   a Tap **Range** under the chart screen and switch to **On** to display or **Off** to hide the selected range in the result table.

   You can select the range number between **1** and **20** to add as a new or change the existing settings.

   b Tap **Start Frequency/Stop Frequency** and enter the value for the selected range using the on-screen keyboard.

   c Tap **Start Limit/Stop Limit** and enter the lower limit/upper limit for Pass/Fail indication.

   d Tap **Attenuation/RBW/VBW** and specify or select the value.

5 Tap to switch **Setting** to **3GPP** if you want 3GPP standard defined setting and tap **Configuration** or **Configuration**.

   a Tap **Range** under the chart screen and switch to **On** to display or **Off** to hide the selected range in the result table.

   You can select the range number between **1** and **20** to add as a new or change the existing settings.

   b Tap **Attenuation** and specify or select the value.

6 Tap **Measurement Type** between **Full** and **Examine**.

   The **Examine** mode displays only the selected range while the **Full** mode lets the instrument automatically change the selected range from one another.

7 Tap **Average** on the box of upper screen and enter the value between **1** and **100** to set the number of measurements to be averaged.

   You can also access this menu through **Menu > Average** on the side bar.

To set the limit

1 Tap **Menu > Limit**.

2 Tap to switch the **Test Limits** to **On** or **Off** to enable or disable Pass/Fail indication. The result table color for Pass is green, and the result table color for Fail is red.

3 *Optional.* Tap the **Save** hot key on the side bar and select the save option from the choices available for your measurement mode.

Figure 144 shows an example of 5G NR spurious emissions measurement.

Figure 144 5G NR spurious emissions measurement



NOTE
You can only set the frequency range and attenuation by tapping the Configuration icon if your setting is 3GPP. If you select the first icon next to the Range table above, it only shows the selected range and if you select the second icon next to the Range table, it keeps moving from the first selected range to the final selected range.

OTA analysis

The following sections describe how to perform OTA analysis.

Beam analyzer

5G NR provides the beamforming profile of each transmission carrier, including the eight strongest beams and the corresponding power levels during its transmission period, and includes:

- **S-SS RSRP (Secondary Synchronization Signal – Reference Signal Received Power)** — linear average over the power contributions (in Watts) of the resource elements which carry secondary synchronization signals
- **P-SS RSRP (Primary Synchronization Signal – Reference Signal Received Power)** — average power measurement through all the primary sync signals
- **S-SS SINR (Secondary Synchronization Signal – Signal to Interference Plus Noise Ratio)** — linear average over the power contribution (in Watts) of the resource elements carrying secondary synchronization signals divided by the linear average of the noise and interference power contribution (in Watts) over the resource elements carrying secondary synchronization signals within the same frequency bandwidth

- **S-SS RSRQ (Secondary Synchronization Signal – Reference Signal Received Quality)** — ratio of N x SS-RSRP/NR carrier RSSI. Here N refers to number of resource blocks in NR carrier RSSI measurement Bandwidth

Setting measure setup

Before starting the Beam Analyzer, you need to set Spectrum measurements displayed on the quick access and display tab. See “Configuring spectrum measurements” on page 25 for more details.

To set measure setup

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap **Bandwidth/SSB SCS** and select the Setting in the pop-up window based on your need. SSB is an abbreviation for Synchronization Signal Block or SS Block and it refers to Synchronization PBCH block since the synchronization signal and PBCH channel are packed as a single block that always moves together. SSB should be detected first in 5G NR frame. See Table 54 below for the setting criteria based on the operating frequency.

3 Tap **Sync Raster Offset** to set the sync raster resolution to 180 kHz (FR1) or to 720 kHz (FR2) for carrier frequency center using the on-screen keyboard. See Table 55 below for the sync raster offset range per SSB SCS and sync raster resolution.

4 Tap **Sync SCS Offset** to fine-tune the offset using the SCS. See Table 56 below for the sync raster offset range per SSB SCS and sync raster resolution.

5 Tap **SSB Center Frequency** and input the value using the on-screen keyboard.

6 Tap **GSCN** and input the value using the on-screen keyboard.

Based on GSCN input frequency, the SSB frequency changes automatically.

7 Tap **L** to set the maximum number of SS-PBCH blocks within a single SS burst set (A set of SS being transmitted in 5 ms window of SS transmission) among 4, 8 and 64. Refer to the selection criteria based on the table in **Step 2**.

8 Tap **SSB Auto Search Mode** and do the following steps:

a Tap **Auto Preamp/Atten** and switch **SSB Auto Search** to **Start** to set preamp and attenuation automatically.

b Tap **Manual** and switch **SSB Auto Search** to **Start** for manually setting based on your need.

NOTE
If you tap SSB Auto Search to Start, the searching progress screen appears to let you know the status of searching.
You can tap SSB Auto Search to Stop to stop searching.

9 Tap **SSB Periodicity** and select the options from **5 ms**, **10 ms**, **20 ms**, **40 ms**, **80 ms**, 1**60 ms**. The SS burst period (SSB periodicity) is defined by each base station and network configurable. 20 ms is the default for the initial cell selection.

10 Tap to switch **PCI (Physical Cell ID)** to **Manual** or **Auto**.

11 Tap **PCI** and input a value from 0 to 1007 using the on-screen keyboard. The PCI switches to **Manual**.

12 Tap **Time Error Window** and select from the choices: **SSB Periodicity**, **Frame**, or **Half Frame**.

If you select Frame, the range is -5 ms to +5 ms based on 10 ms specified by 3GPP and if you select Half Frame, the range is -2.5 ms to +2.5 ms based on 5 ms specified by 3GPP.

13 Tap **Miscellaneous** and do the following steps:

a Tap **Symbol Phase Comp** and select from the following choices: **Auto**, **Manual**, or **Off**.

Symbol Phase Compensation is used to compensate for phase differences between symbols caused by upconversion. Users do not always use the instrument based on RF frequency. In this case, you can set it to Manual or Off.

- **Auto**: Setting radio frequency to center frequency
- **Manual**: Setting radio frequency as required
- **Off**: Setting radio frequency to 0

b Tap to switch **Compensation** to **On** or **Off**.

When the Compensation is set to On, Multi-PCIs changes to Single PCI and it applies the compensation for distance for Single PCI to Time Error.

c Tap **Distance** and input the required value using the on-screen keyboard.

This will be applied when you are measuring the time error.

14 Tap to switch **Sorting Type** to **PCI** or **RSRP**.

When both Multi PCI and Multi Beam are present, selecting PCI groups the results by PCI, while selecting RSRP reorders the results based on RSRP values.

15 Tap to switch **NCI/ BW Decoding** to **On** of **Off**.

When **NCI/ BW Decoding** is set to On, if SIB1 is present, the measurement screen displays Stand Alone (SA). If the SIB1 information includes bandwidth details, the detected bandwidth is also displayed at the top left of the table.

16 *Optional.* Tap **Limit** > **PCI Dominance**. Once tapped On, you can set the value using the on-screen keyboard.

If the PCI dominance is on, you can judge pass (green) or fail (red) with colors based on the limit you have set. For example, if it becomes smaller than the threshold, the fail indicator (red) can be identified in the PCI column of the result table and the top right corner of the instrument at the same time.



NOTE

You can go to **Menu** > **Frequency** > **Center Frequency List** to add frequently used center frequency using the **Add** button in the Frequency List or to delete the selected frequency using the **Delete** button. You can also apply one of the default frequencies in the Frequency List by tapping the **Apply** button.

Table 54 Setup per operating frequency

Operating frequency	L	Case	SCS	Slots in a burst period
< 3 GHz (FR1)	4	A {2,8} +14*n	15 kHz	5 (1 ms)
< 3 GHz (FR1)	4	B {4,8,16,20} +28*n	30 kHz	10 (0.5 ms)
< 3 GHz (FR1) For un-paired spectrum operation: < 1.88 GHz	4	C {2,8} +14*n	30 kHz	10 (0.5 ms)
3 to 6 GHz (FR1)	8	A {2,8} +14*n	15 kHz	5 (1 ms)
3 to 6 GHz (FR1)	8	B {4,8,16,20} +28*n	30 kHz	10 (0.5 ms)
3 to 6 GHz (FR1) For un-paired spectrum operation: 1.88 to 6 GHz	8	C {2,8} +14*n	30 kHz	10 (0.5 ms)
> 6 GHz (FR2)	64	D {4,8,16,20} +28*n	120 kHz	40 (0.125 ms)
> 6 GHz (FR2)	64	E {8,12,16,20,32,36,40,44} +56*n	240 kHz	80 (62.5 ms)

Table 55 Sync raster offset range per SSB SCS and sync raster resolution

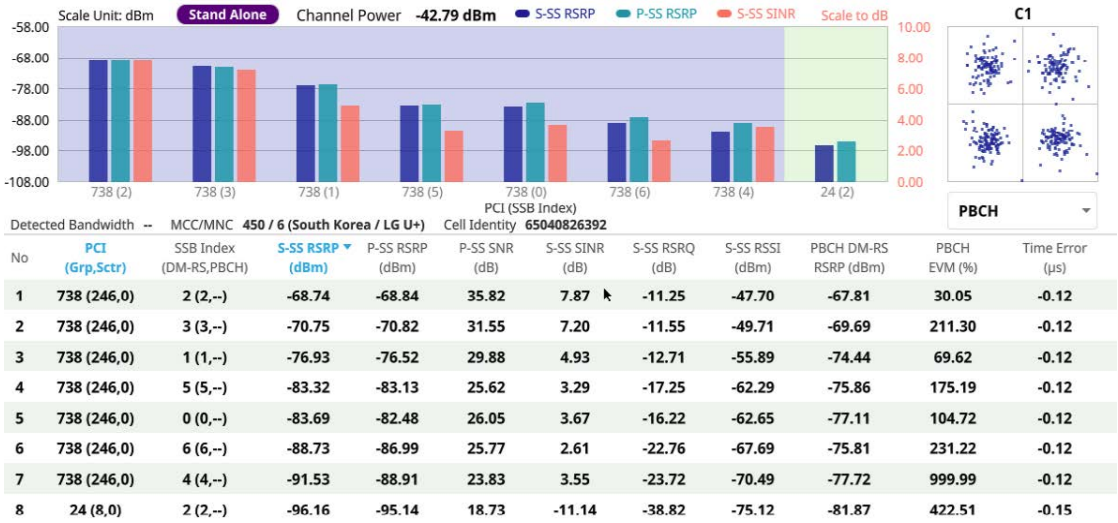
SSB SCS (kHz)	Sync Raster Resolution (kHz)	Sync Raster Offset Range	SSB Frequency = Center frequency
15	180	0 to 250	125
30	180	0 to 506	253
120	720	0 to 92	46
240	720	0 to 48	24

Table 56 Sync SCS offset range per SSB SCS and sync SCS resolution

SSB SCS (kHz)	Sync Raster Resolution (kHz)	Sync Raster Offset Range	SSB Frequency = Center Frequency
15	15	0 to 11	0
30	30	0 to 5	0
120	120	0 to 5	0
240	240	0 to 2	0

Figure 145 shows an example of beam analyzer measurement.

Figure 145 5G NR beam analyzer measurement



No	PCI (Grp,Sctr)	SSB Index (DM-RS,PBCH)	S-SS RSRP (dBm)	P-SS RSRP (dBm)	P-SS SNR (dB)	S-SS SINR (dB)	S-SS RSRQ (dB)	S-SS RSSI (dBm)	PBCH DM-RS RSRP (dBm)	PBCH EVM (%)	Time Error (µs)
1	738 (246,0)	2 (2,--)	-68.74	-68.84	35.82	7.87	-11.25	-47.70	-67.81	30.05	-0.12
2	738 (246,0)	3 (3,--)	-70.75	-70.82	31.55	7.20	-11.55	-49.71	-69.69	211.30	-0.12
3	738 (246,0)	1 (1,--)	-76.93	-76.52	29.88	4.93	-12.71	-55.89	-74.44	69.62	-0.12
4	738 (246,0)	5 (5,--)	-83.32	-83.13	25.62	3.29	-17.25	-62.29	-75.86	175.19	-0.12
5	738 (246,0)	0 (0,--)	-83.69	-82.48	26.05	3.67	-16.22	-62.65	-77.11	104.72	-0.12
6	738 (246,0)	6 (6,--)	-88.73	-86.99	25.77	2.61	-22.76	-67.69	-75.81	231.22	-0.12
7	738 (246,0)	4 (4,--)	-91.53	-88.91	23.83	3.55	-23.72	-70.49	-77.72	999.99	-0.12
8	24 (8,0)	2 (2,--)	-96.16	-95.14	18.73	-11.14	-38.82	-75.12	-81.87	422.51	-0.15

NOTE

The undetected values in the Detected ID List table will be indicated as "--".

NOTE

The constellation shows a beam with the highest signal received as indicated in No.1 in the Detected ID List table and there is an option to show the constellation for PBCH and PBCH DM-RS.

Carrier scanner

5G Carrier Scanner provides an easy and fast response power measurements of up to eight single component carriers of 100 MHz. The power measurement for each carrier includes:

- **S-SS RSRP (Secondary Synchronization Signal – Reference Signal Received Power)** — linear average over the power contributions (in Watts) of the resource elements which carry secondary synchronization signals

- **Channel Power** — integrated power of the entire channel bandwidth (100 MHz) during an entire transmission frame (10 ms)

Carrier Scanner supports N type and K type port selection automatically using top right panel () icon. You will need to connect the RF input port correctly on your instrument based on the frequency range (9 kHz to 18 GHz/9 kHz to 44 GHz).

Setting measure setup

Before starting the Beam Analyzer, you need to set Spectrum measurements displayed on the quick access and display tab. See “Configuring spectrum measurements” on page 25 for more details.

To set measure setup

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap **Configuration** or the **Configuration** icon in the Carrier Scanner table.

a Tap **No** and select the carrier from 1 to 8.

b Tap **Center Frequency** and input the required center frequency using the on-screen keyboard.

- If you apply **Center Frequency**, **Channel No**, and **Bandwidth, SSB Frequency, SCS, GSCN, and Periodicity** all at once, tap the **Center Frequency List** ( ) icon and do the following:

i Tap the **Add (+)** icon and input Center Frequency, Channel No, and Bandwidth as required using the on-screen keyboard.

ii Tap the **Apply** button to apply the changes. The screen moves to the Center Frequency List table.

iii Highlight the one of the added lists and tap the **Configuration** icon that appears in gray to change the applied values.

iv Tap the **Delete** icon to delete the selected list(s).

v Tap the **Toothed Wheel** ( ) icon to load the applied parameters based on the center frequency input values. You need to input the required center frequency in the Setting table in advance.

NOTE
You will be able to multi-select the added items and apply them all at once only if the carrier number is On. If the carrier 1 and 3 are On and you highlight No. 0,3, and 4, the first two highlighted lists, 0 and 3 are applied to each carrier 1 and 3.

c Tap **Channel Standard** and select the required channel standard from the pop-up window.

d Tap **Channel Number** and input the required channel number using the on-screen keyboard.

3 Tap **Bandwidth/SCS** and select the required setting from the pop-up window.

   a If you go with FR1, select the following:
   - SCS 15 kHz: 5, 10, 15, 20, 25, 30, 40, 50 MHz
   - SCS 30 kHz: 5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 MHz

   b If you go with FR2, select the following:
   - SCS 120 kHz: 50, 100 MHz
   - SCS 240 kHz: 100MHz

4 Tap **SSB Auto Search Mode** and do the following steps:

   a Tap **Auto Preamp/Atten** and switch **SSB Auto Search** to **Start** to set preamp and attenuation automatically.

   b Tap **Manual** and switch **SSB Auto Search** to **Start** for manually setting based on your need.

5 Tap **SSB Auto Search** between **Start** and **Stop**.

   a **Start**: to search SCS, type, and the number of SSB automatically. Once Start is selected, the progress bar appears. If it fails to perform the auto search, a fail message appears and the SSB switches to Manual.

   b **Stop**: to set the SSB periodicity based on the base station.

6 Tap **L** to set the maximum number of SS-PBCH blocks within a single SS burst set (A set of SS being transmitted in 5 ms window of SS transmission) among 4, 8 and 64.

7 Tap **SSB Periodicity** and select the options from **5 ms**, **10 ms**, **20 ms**, **40 ms**, **80 ms**, 1**60 ms**. The SS burst period (SSB periodicity) is defined by each base station and network configurable. 20 ms is the default for the initial cell selection.

8 Tap to switch **PCI Mode** to **Manual** or **Auto**.

9 Tap **PCI** and input a value from 0 to 1007 using the on-screen keyboard. The PCI switches to **Manual**.

10 Tap **SSB Center Frequency** and input the value using the on-screen keyboard.

11 Tap **GSCN** and input the value using the on-screen keyboard.

12 Tap **Sync Raster Offset** and input the value using the on-screen keyboard.

13 Tap **Sync SCS Offset** and input the required value using the on-screen keyboard.

14 Tap **Distance** and input the required value using the on-screen keyboard.

   This will be applied when you are measuring the frequency and time error.

15 Tap **Time Error Window** and select from the choices: **SSB Periodicity**, **Frame**, or **Half Frame**.

   If you select Frame, the range is -5 ms to +5 ms based on 10 ms specified by 3GPP and if you select Half Frame, the range is -2.5 ms to +2.5 ms based on 5 ms specified by 3GPP.

16 Tap **Miscellaneous** > **Symbol Phase Comp** and select from the following choices: **Auto**, **Manual**, or **Off**.

Symbol Phase Compensation is used to compensate for phase differences between symbols caused by upconversion. Users do not always use the instrument based on RF frequency. In this case, you can set it to Manual or Off.

- **Auto**: Setting radio frequency to center frequency
- **Manual**: Setting radio frequency as required
- **Off**: Setting radio frequency to 0

17 *Optional.* Tap the **Column** icon to set the parameters's order using the up and down arrows.

Setting beam analyzer mode

To set up

1 Tap the **Beam Analysis** icon of the selected carrier in the carrier scanner table to set the limit. This enables you to check the beam information without changing the measurement mode to Beam Analyzer. The beam information pops up for the selected carrier.

a Select the **Auto Scale** ( ) icon to set **S-SS RSRP Line** and **S-SS SINR Line** to **On** or **Off**. When selecting on, set the limit using the on-screen keyboard.

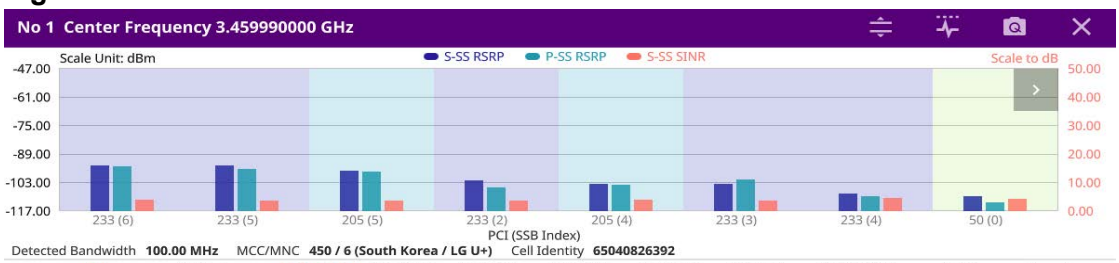
b Select the **Limit** ( ) icon to set **S-SS RSRP Line** and **S-SS SINR Line** to **On** or **Off**. When selecting on, set the limit using the on-screen keyboard. You can also set limits moving the SS-RSRP Line Limit (default: blue) bar on the left edge and SS-SINR Line Limit (default: orange) bar on the right edge. If the setting value is smaller than the limit, the line bar color and the result text color of the table become red.

c Select the **Quick Save** ( ) icon to capture the current screen.

d Select the **Close** ( ) icon to close the Beam Information window.

Figure 146 shows an example of a beam information screen.

Figure 146 Beam information



No	PCI (Grp,Sctr)	SSB Index (DM-RS,PBCH)	S-SS RSRP (dBm)	P-SS RSRP (dBm)	P-SS SNR (dB)	S-SS SINR (dB)	S-SS RSRQ (dB)	S-SS RSSI (dBm)	PBCH DM-RS RSRP (dBm)	PBCH EVM (%)	Time Error (µs)
1	233 (77,2)	6 (6,--)	-94.61	-94.80	19.75	3.87	-12.91	-73.57	-92.64	100.00	1.77
2	233 (77,2)	5 (5,--)	-94.75	-96.36	21.82	3.51	-14.15	-73.71	-91.43	224.03	1.77
3	205 (68,1)	5 (5,--)	-96.98	-97.76	21.81	3.50	-16.38	-75.94	-91.43	290.13	1.75
4	233 (77,2)	2 (2,--)	-101.85	-105.14	16.58	3.56	-16.34	-80.81	-96.43	228.64	1.77
5	205 (68,1)	4 (4,--)	-103.51	-103.99	15.24	3.82	-18.12	-82.47	-95.94	334.48	1.75
6	233 (77,2)	3 (3,--)	-103.79	-101.46	17.35	3.58	-16.67	-82.75	-97.20	183.98	1.77
7	233 (77,2)	4 (4,--)	-108.58	-109.75	15.20	4.52	-23.18	-87.55	-95.98	170.95	1.77
8	50 (16,2)	0 (0,--)	-109.68	-112.64	15.59	4.03	-23.18	-88.64	-97.35	272.74	2.04

Setting sweep speed

To set up

1 Tap **Menu** > **Sweep**.

2 Tap **Sweep Speed** between **Fast** and **Normal**.

3 *Optional.* Tap **Sweep Once** to get a new measurement.

Setting limit

To set up

1 Tap **Menu** > **Limit**.

2 Tap **PBCH EVM Limit** between **On** and **Off**.

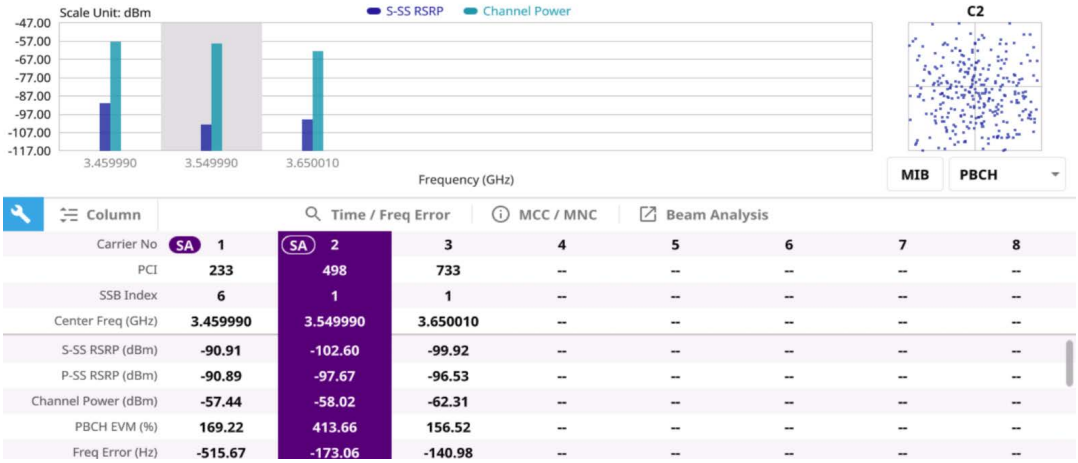
Once on, you can set the PBCH EVM Limit value using the on-screen keyboard.

3 Tap **PBCH DM-RS EVM Limit** between **On** and **Off**.

Once on, you can set the PBCH DM-RS EVM Limit value using the on-screen keyboard.

Figure 147 shows an example of carrier scanner measurement.

Figure 147 5G NR carrier scanner measurement



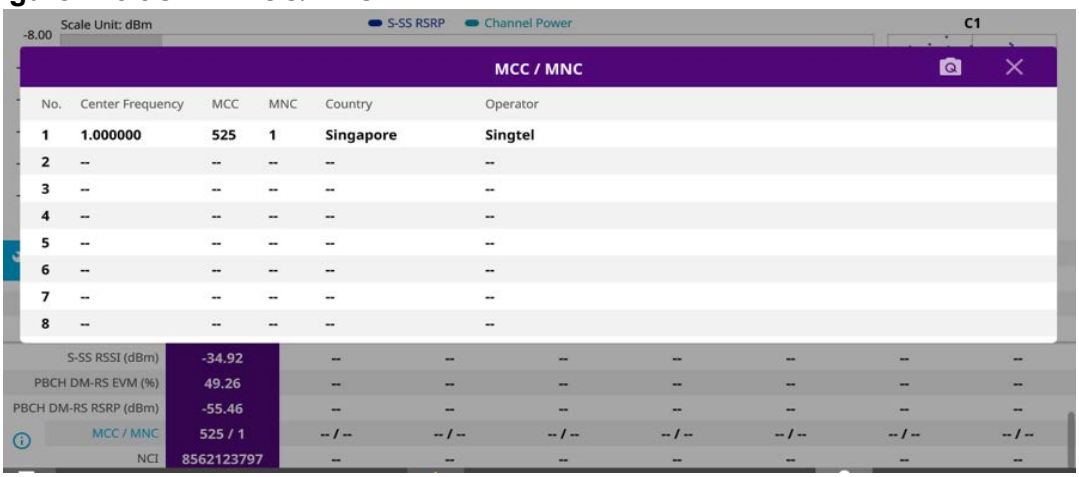
NOTE

Based on the Limit you have set from Menu > Limit, the table indicates PBCH EVM or PBCH DM-RS EVM value with pass (green) or fail (red).

NOTE

If MCC/MNC information is detected from SSB detection, it means System Information Block 1 (SIB1) exists. Therefore the carrier detected is considered Stand-alone(SA) as seen in the measurement screen.

Figure 148 5G NR MCC/MNC information



NOTE

Tap the **MCC/MNC** icon in the carrier scanner table. Once tapped, the Mobile Country Codes (MCC) and Mobile Network Codes (MNC) are displayed, which enable you to identify the country a mobile subscriber belongs to and to identify a mobile subscriber's network.

Figure 149 5G NR carrier scanner measurement with frequency error

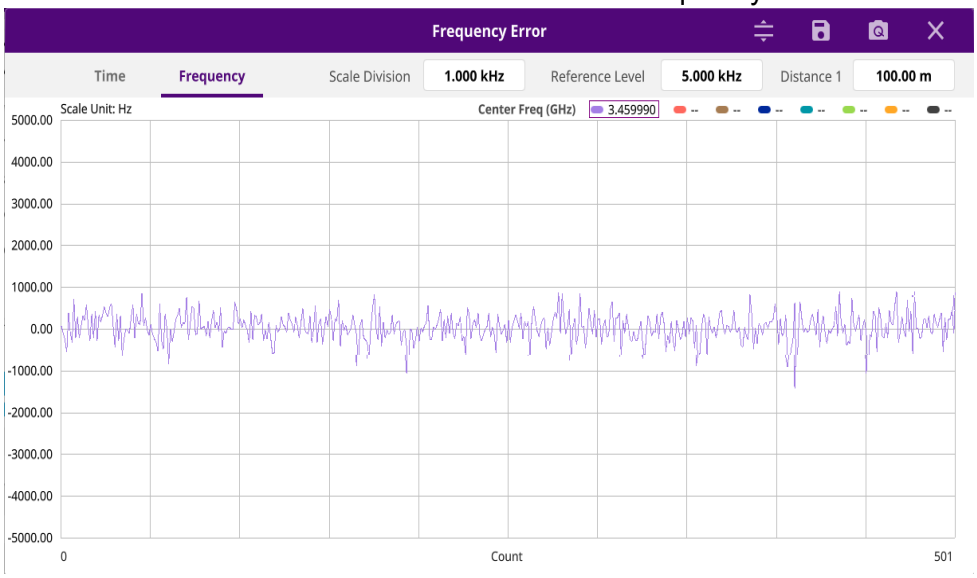
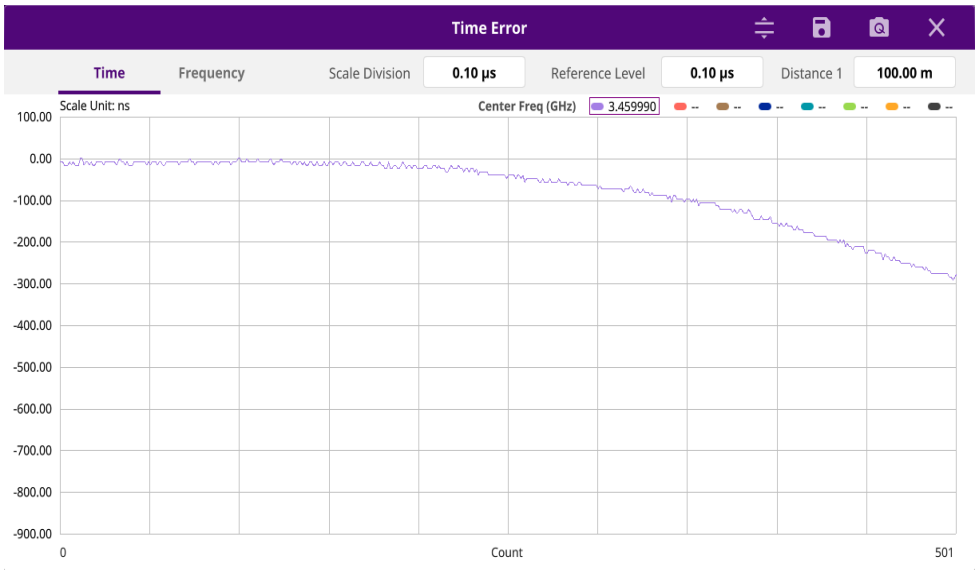


Figure 150 5G NR carrier scanner measurement with time error



Using icons

You can tap the **Magnifier** icon to check the frequency or time error. You can also perform the following operation using the icons.

Icon	Description
	**Auto Scale**: You can set the scale automatically.
	**Save as CSV**: You can assign file name using the on-screen keyboard and apply the changes. This will let you save your measurement file internally.
	**Quick Save**: You can save current measurement screen as it is.
	**Close**: You can close the screen you are seeing now.

Route map

5G route map traces the power level of the strongest beam corresponding to a particular time and geographical position and presents it in a geographical map as a measurement point. All the collected measurements can be exported for post-processing purposes, including data of the eight strongest beams for each measurement point, including its measurement time and geographical location.

Figure 151 shows an example of 5G NR OTA route map measurement.

Figure 151 OTA route map with 5G NR Signal Analyzer



Loading a map

To use any features related to maps, you need to download and install the maps on the instrument. The **VIAVI JDMapCreator** will help you to download maps. Ensure the JDMapCreator application on your computer is connected to the instrument via LAN. You can send a map file with a single layer to the instrument directly by using the **Send to EQP** menu in JDMapCreator. For information about how to use the JDMapCreator, see the *JDMapCreator 2.0 User Guide*.

To load a map

1 Plug in your USB flash drive that has a map file in .mcfv file type created in JDMapCreator.

2 Tap the **Load** ( ) icon on the side bar.

3 Navigate to the map file that you want to open.

The **File Information** pane displays the file properties, including its name, size, type, and date modified.

4 Tap the **Load** button on the screen.

Once you have loaded the map, you can also control the map using the following icons on the map.

Table 57 Map control icons

Icon	Description
	Tap to go to your current location on the map. Once tapped, the purple icon appears on the map, indicating your current location.
	Tap to switch to the full screen map view.

Table 57 Map control icons

Icon	Description
	Tap to zoom in the map.
	Tap to zoom out the map.
	Tap and select the area where you want to expand.

The left-most cell-site icon is activated when you import the cell-site information file.

To set measurement setup

Before starting the Route Map measurement, you need to set Spectrum measurements displayed on the quick access and display tab. See “Configuring spectrum measurements” on page 25 for more information.

1 If required, connect a GNSS receiver to your instrument for outdoor mapping. Indoor mapping does not necessarily need a GNSS antenna.

2 Tap the **Setup** ( ) icon on the side bar.

3 Tap **Map Config** to configure the map setting.

   a Tap to switch the **Plot Point** to **GNSS**, **Position**, or **Time**.
   - To collect data/plot points automatically as you move around in a vehicle or outside, select **GNSS**.
   - To collect data/plot points manually in an indoor layout without a GNSS antenna, select **Position**.
   - To collect data/plot points based on time, select **Time**.

   b Tap to switch **Plot Item** to **P-SS RSRP**, **S-SS RSRP**, **S-SS RSRQ**, **S-SS SINR** or **PCI Dominance**.

   c Tap to switch the **Screen Mode** between **Map** and **Full**.
   - With the **Map** setting, you can view only the collected points that can be seen within the boundary of the loaded map.
   - With the **Full** setting, you can view all the collected points of the route without the loaded map

4 Tap **Bandwidth/SSB SCS** and select the Setting in the pop-up window based on your need. SSB is an abbreviation for Synchronization Signal Block or SS Block and it refers to Synchronization PBCH block since the synchronization signal and

PBCH channel are packed as a single block that always moves together. SSB should be detected first in 5G NR frame. See Table 58 below for the setting criteria based on the operating frequency.

5 Tap **Sync Raster Offset** to set the sync raster resolution to 180 kHz (FR1) or to 720 kHz (FR2) for carrier frequency center using the on-screen keyboard. See Table 59 below for the sync raster offset range per SSB SCS and sync raster resolution.

6 Tap **Sync SCS Offset** to fine-tune the offset using the SCS. See Table 60 below for the sync raster offset range per SSB SCS and sync raster resolution.

7 Tap **L** to set the maximum number of SS-PBCH blocks within a single SS burst set (A set of SS being transmitted in 5 ms window of SS transmission) among 4, 8 and 64. Refer to the selection criteria based on the table in **Step 4**.

8 Tap **SSB Auto Search Mode** and do the following steps:

- **a** Tap **Auto Preamp/Atten** and switch **SSB Auto Search** to **Start** to set preamp and attenuation automatically.
- **b** Tap **Manual** and switch **SSB Auto Search** to **Start** for manually setting based on your need.

9 Tap **SSB Auto Search** between **Start** and **Stop**.

- **a** **Start**: to search SCS, type, and the number of SSB automatically. Once Start is selected, the progress bar appears. If it fails to perform the auto search, a fail message appears and the SSB switches to Manual.
- **b** **Stop**: to set the SSB periodicity based on the base station.

10 Tap **SSB Periodicity** and select the options from **5 ms**, **10 ms**, **20 ms**, **40 ms**, **80 ms**, 1**60 ms**. The SS burst period (SSB periodicity) is defined by each base station and network configurable. 20 ms is the default for the initial cell selection.

11 Tap **SSB Center Frequency** and input the value using the on-screen keyboard.

12 Tap **GSCN** and input the value using the on-screen keyboard.

13 Tap to switch **PCI (Physical Cell ID)** to **Manual** or **Auto**.

14 Tap **PCI** and input a value from 0 to 1007 using the on-screen keyboard. The PCI switches to **Manual**.

15 Tap **Time Error Window** and select from the choices: **SSB Periodicity**, **Frame**, or **Half Frame**.

If you select Frame, the range is -5 ms to +5 ms based on 10 ms specified by 3GPP and if you select Half Frame, the range is -2.5 ms to +2.5 ms based on 5 ms specified by 3GPP.

16 Tap **Miscellaneous** > **Symbol Phase Comp** and select from the following choices: **Auto**, **Manual**, or **Off**.

Symbol Phase Compensation is used to compensate for phase differences between symbols caused by upconversion. Users do not always use the instrument based on RF frequency. In this case, you can set it to Manual or Off.

– **Auto**: Setting radio frequency to center frequency
– **Manual**: Setting radio frequency as required
– **Off**: Setting radio frequency to 0

Table 58 Setup per operating frequency

Operating frequency	L	Case	SCS	Slots in a burst period
< 3 GHz (FR1)	4	A {2,8} +14*n	15 kHz	5 (1 ms)
< 3 GHz (FR1)	4	B {4,8,16,20} +28*n	30 kHz	10 (0.5 ms)
< 3 GHz (FR1) For unpaired spectrum operation: < 1.88 GHz	4	C {2,8} +14*n	30 kHz	10 (0.5 ms)
3 to 6 GHz (FR1)	8	A {2,8} +14*n	15 kHz	5 (1 ms)
3 to 6 GHz (FR1)	8	B {4,8,16,20} +28*n	30 kHz	10 (0.5 ms)
3 to 6 GHz (FR1) For unpaired spectrum operation: 1.88 to 6 GHz	8	C {2,8} +14*n	30 kHz	10 (0.5 ms)
> 6 GHz (FR2)	64	D {4,8,16,20} +28*n	120 kHz	40 (0.125 ms)
> 6 GHz (FR2)	64	E {8,12,16,20,32,36,40,44} +56*n	240 kHz	80 (62.5 ms)

Table 59 Sync raster offset range per SSB SCS and sync raster resolution

SSB SCS (kHz)	Sync Raster Resolution (kHz)	Sync Raster Offset Range	SSB Frequency = Center frequency
15	180	0 to 250	125
30	180	0 to 506	253
120	720	0 to 92	46
240	720	0 to 48	24

Table 60 Sync SCS offset range per SSB SCS and sync SCS resolution

SSB SCS (kHz)	Sync Raster Resolution (kHz)	Sync Raster Offset Range	SSB Frequency = Center Frequency
15	15	0 to 11	0
30	30	0 to 5	0
120	120	0 to 5	0
240	240	0 to 2	0

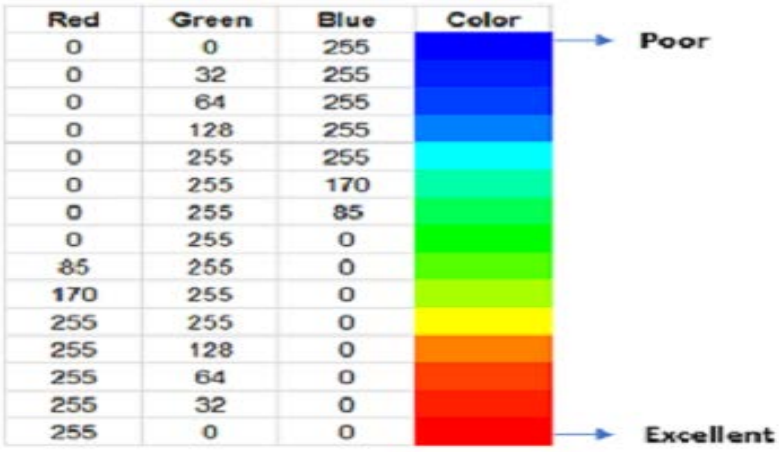
To set limit

You can set the thresholds for the two different color indicators, red and blue. The maximum value is the Limit for **Excellent**, and the minimum value is the Limit for **Poor**. See below to check the plot point color based on the Legend Color Table.

1. Tap the rectangle with value before color legend bar on the right panel.
2. Set a value for **Poor** (minimum value) using the on-screen keyboard.
3. Tap the rectangle with value after color legend bar on the right panel.
4. Set a value for **Excellent** (maximum value) using the on-screen keyboard.

Figure 152 shows a legend color table.

Figure 152 Legend color table



Logging data

To use any features related to maps, you need to download and install the maps on the instrument. The VIAVI JDMapCreator will help you download maps. Make sure the JDMapCreator application on your computer is connected to the instrument via LAN. You can send a map file with a single layer to the instrument directly by using the Send to EQP menu in JDMapCreator. For more information on how to use the JDMapCreator, see the *JDMapCreator 2.0 User Guide*.

To log data

1 Follow **steps 1 to 3** in Setting measure setup.

2 Tap the **Testing** button on the right panel of the map to start plotting on the map. When you select a point on the map, a marker appears and an Information window appears on the right panel.

If you select the Plot Item to PCI Dominance, you will see the plotting circled dot and its edge with PCI legend color based on its received power and PCI Dominance color based on the threshold you have set respectively. If PCI Dominance is lower than the value you have set, it judges fail showing red in the edge. Otherwise, it judges pass showing green in the edge.

3 Tap the **Stop** (■) button to stop plotting.

4 Tap the **Pause** button (❚❚) to pause plotting, then the GNSS point cannot be plotted.

5 If you start test and select **Setup** > **Map Config** > **Plot Point** > **Position**, you can undo by tapping the **Testing** button.

6 If you select the **Stop** button, the Plot Stop pop-up window appears, then tap **Yes**.

7 Tap **Yes** when the Save pop-up window appears and save the logging file to your USB.

If you go to **Limit** > **PCI Dominance** and set it, you can judge pass (green) or fail (red) with colors based on the limit you have set. For example, if it becomes smaller than the threshold, the fail indicator (red) can be identified in the PCI column of the Information window and the top right corner of the instrument at the same time.

Viewing the logging data

To view the logging data

1 Load the saved logging file using the **Load** () icon on the side bar. Make sure the file extension is .gomv.

2 If the **PCI** is set to **Auto**, the point on the map appears with a color representing the largest **S-SS-RSRP** value. When you select a point on the map, a marker appears and the Information window appears on the right panel.

3 Set the **PCI** to **Manual** and tap the **Select** button.

The Select PCI window appears.

4 Select PCI on the left and then the corresponding Beam Index appeared on the right.

5 Tap the **Apply** button.

The point color of the map changes to the corresponding SS-RSRP value, and if there is no detected Beam Index, the point will be hidden.

NOTE
When you load the result file, a pop-up message asking whether you want to load data only or data with map appears. If the current screen does not display all the loaded data, the screen mode will be automatically changed to Full.

Importing cellsite DB

You can import the site DB by creating the 5G site information form.

To import cellsite DB

1 Create the 5G site information with an excel file as below.

2 Input the two mandatory fields: **Lat (DecDeg)** and **Long (DecDeg)**.

3 Input the **Azimuth** field if you want to check the direction of antenna.

4 Make sure to save the file as (Comma delimited) (*.csv).

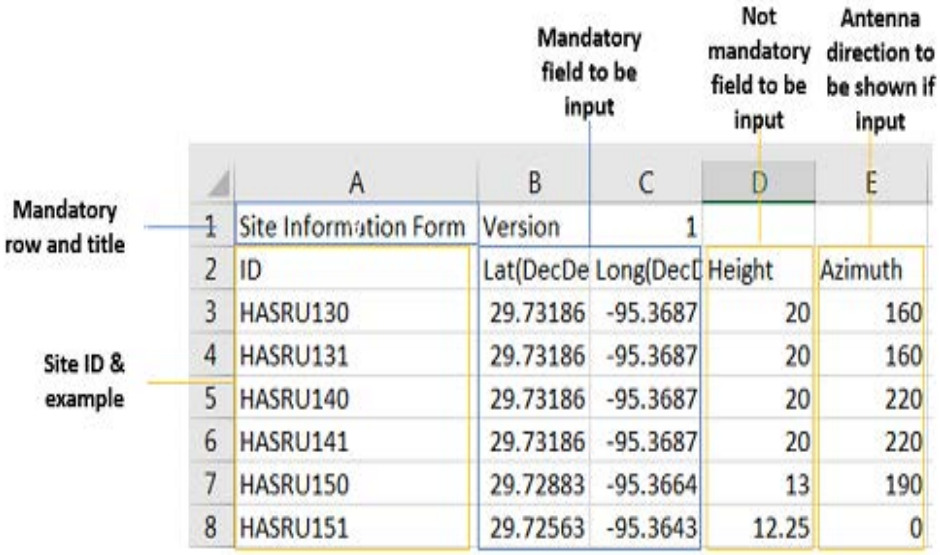
5 Copy the file to the USB memory stick and insert it to the **USB A** or **USB B** port of the instrument.

6 Tap the **Load** ( ) icon on the side bar.

7 Import the saved file.
Once the file is loaded, the following cellsite information appears with an icon.

Figure 153 shows an example of an importing cellsite DB.

Figure 153 Importing Cellsite DB



	A	B	C	D	E
1	Site Information Form	Version	1		
2	ID	Lat(DecDe	Long(DecD	Height	Azimuth
3	HASRU130	29.73186	-95.3687	20	160
4	HASRU131	29.73186	-95.3687	20	160
5	HASRU140	29.73186	-95.3687	20	220
6	HASRU141	29.73186	-95.3687	20	220
7	HASRU150	29.72883	-95.3664	13	190
8	HASRU151	29.72563	-95.3643	12.25	0

Figure 154 Route map measurement with site information screen

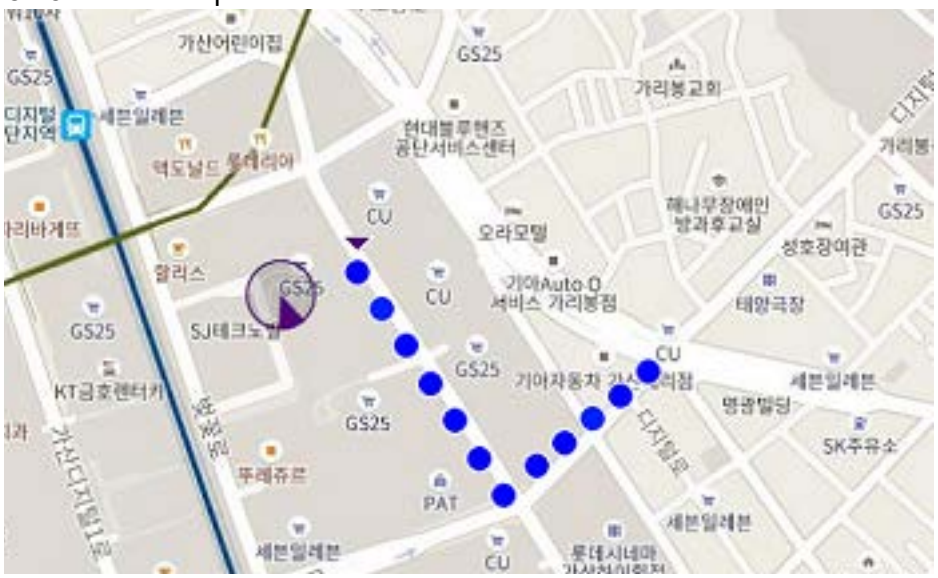
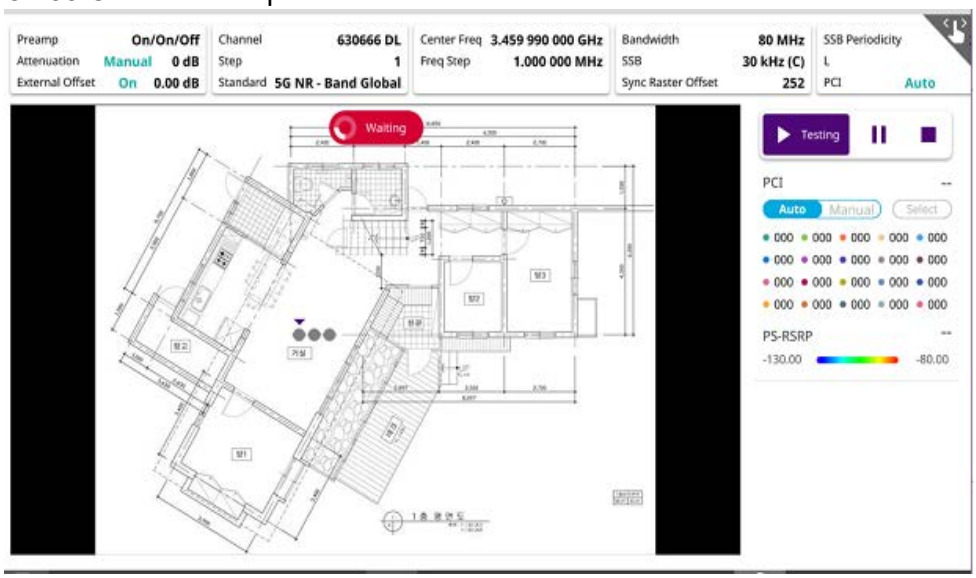


Figure 155 shows an example of OTA route map measurement with Plot Point to Time.

Figure 155 OTA route map measurement with Plot Point to Time



NOTE

When you setup Plot Point to Time and tap the start/testing button, you can't touch the screen to active. After the waiting indicator(Waiting) stops, the active indicator(00 Data) shows up.

Beam availability Index

The Beam availability index measurement enables showing the maximum beam resource blocks with its power for each detected PCI. Normally recognized beam color is blue and unrecognized one is gray.

Setting measure setup

After configuring the spectrum measurement in “Configuring spectrum measurements” on page 25, you can set the measure setup to continue your measurement. The measurement settings can be saved and recalled as a file by selecting File Type as Setup and load the file onto the instrument using the **Save/Load** icons on the side bar.

To set measure setup

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap **Bandwidth/SSB SCS** and select the Setting in the pop-up window based on your need. SSB is an abbreviation for Synchronization Signal Block or SS Block and it refers to Synchronization PBCH block since the synchronization signal and PBCH channel are packed as a single block that always moves together. SSB should be detected first in 5G NR frame. See Table 61 below for the setting criteria based on the operating frequency.

3 Tap **Sync Raster Offset** to set the sync raster resolution to 180 kHz (FR1) or to 720 kHz (FR2) for carrier frequency center using the on-screen keyboard. See Table 62 below for the sync raster offset range per SSB SCS and sync raster resolution.

4 Tap **Sync SCS Offset** to fine-tune the offset using the SCS. See Table 63 below for the sync raster offset range per SSB SCS and sync raster resolution.

5 Tap **SSB Center Frequency** and input the value using the on-screen keyboard.

6 Tap **GSCN** and input the value using the on-screen keyboard.

7 Tap **L** to set the maximum number of SS-PBCH blocks within a single SS burst set (A set of SS being transmitted in 5 ms window of SS transmission) among 4, 8 and 64. Refer to the selection criteria based on the table in **Step 2**.

8 Tap **SSB Auto Search Mode** and do the following steps:

   a Tap **Auto Preamp/Atten** and switch **SSB Auto Search** to **Start** to set preamp and attenuation automatically.

   b Tap **Manual** and switch **SSB Auto Search** to **Start** for manually setting based on your need.

9 Tap **SSB Auto Search** between **Start** and **Stop**.

   a **Start**: to search SCS, type, and the number of SSB automatically. Once Start is selected, the progress bar appears. If it fails to perform the auto search, a fail message appears and the SSB switches to Manual.

   b **Stop**: to set the SSB periodicity based on the base station.

10 Tap **SSB Periodicity** and select the options from **5 ms**, **10 ms**, **20 ms**, **40 ms**, **80 ms**, 1**60 ms**. The SS burst period (SSB periodicity) is defined by each base station and network configurable. 20 ms is the default for the initial cell selection.

11 Tap to switch **PCI (Physical Cell ID)** to **Manual** or **Auto**.

12 Tap **PCI** and input a value from 0 to 1007 using the on-screen keyboard. The PCI switches to **Manual**.

13 Tap **Distance** and input a value using the on-screen keyboard.

14 Tap **Antenna Gain** and input a value using the on-screen keyboard.

NOTE

Distance and Antenna gain values are required when calculating EIRP. Effective Isotropic Radiated Power (EIRP) refers to the amount of power that a theoretical isotropic antenna (which evenly distributes power in all directions) would emit to produce the peak power density observed in the direction of maximum antenna gain. EIRP can take into account the losses in transmission line and connectors and includes the gain of the antenna. The EIRP is often stated in terms of decibels over a reference power emitted by an isotropic radiator with equivalent signal strength. The EIRP allows comparisons between different emitters regardless of type, size or form. From the EIRP, and with knowledge of a real antenna's gain, it is possible to calculate real power and field strength values.

Formula to calculate: EIRP = Tx RF Power (dBm)+GA (dB) - FL (dB)

Tx RF Power refers to RF power measured at RF connector of the unit

GA refers to Gain Antenna

FL refers to Feeder loss (cable loss of any other loss incurred)

You can tap to switch to Channel Power or EIRP under the chart in the table, and it will show the automatically calculated value.

Table 61 Setup per operating frequency

Operating frequency	L	Case	SCS	Slots in a burst period
< 3 GHz (FR1)	4	A {2,8} +14*n	15 kHz	5 (1 ms)
< 3 GHz (FR1)	4	B {4,8,16,20} +28*n	30 kHz	10 (0.5 ms)
< 3 GHz (FR1) For unpaired spectrum operation: < 1.88 GHz	4	C {2,8} +14*n	30 kHz	10 (0.5 ms)
3 to 6 GHz (FR1)	8	A {2,8} +14*n	15 kHz	5 (1 ms)
3 to 6 GHz (FR1)	8	B {4,8,16,20} +28*n	30 kHz	10 (0.5 ms)

Table 61 Setup per operating frequency

Operating frequency	L	Case	SCS	Slots in a burst period
3 to 6 GHz (FR1) For un-paired spectrum operation: 1.88 to 6 GHz	8	C {2,8} +14*n	30 kHz	10 (0.5 ms)
> 6 GHz (FR2)	64	D {4,8,16,20} +28*n	120 kHz	40 (0.125 ms)
> 6 GHz (FR2)	64	E {8,12,16,20,32,36,40,44} +56*n	240 kHz	80 (62.5 ms)

Table 62 Sync raster offset range per SSB SCS and sync raster resolution

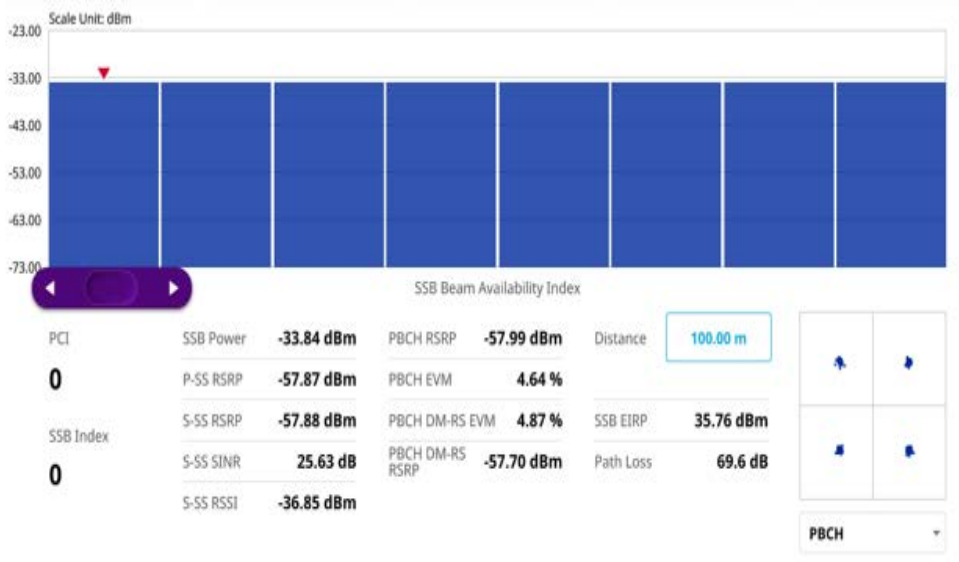
SSB SCS (kHz)	Sync Raster Resolution (kHz)	Sync Raster Offset Range	SSB Frequency = Center frequency
15	180	0 to 250	125
30	180	0 to 506	253
120	720	0 to 92	46
240	720	0 to 48	24

Table 63 Sync SCS offset range per SSB SCS and sync SCS resolution

SSB SCS (kHz)	Sync Raster Resolution (kHz)	Sync Raster Offset Range	SSB Frequency = Center Frequency
15	15	0 to 11	0
30	30	0 to 5	0
120	120	0 to 5	0
240	240	0 to 2	0

Figure 156 shows an example of 5G NR beam availability index.

Figure 156 5G NR beam availability index



NOTE
You can adjust SSB frequency using the purple scroll bar on the chart. You can see the constellation information by selecting either PBCH or PBCH DM-RS.

Freq/Time/Power variation

The frequency, time, and power variation shows the frequency, time, and power error trend based on the time elapsed.

After configuring the spectrum measurement in “Configuring spectrum measurements” on page 25, you can set the measure setup to continue your measurement. The measurement settings can be saved and recalled as a file by selecting File Type as Setup and load the file onto the instrument using the **Save/Load** icons on the side bar.

Setting measure setup

To set measure setup

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap **Bandwidth/SSB SCS** and select the Setting in the pop-up window based on your need. SSB is an abbreviation for Synchronization Signal Block or SS Block and it refers to Synchronization PBCH block since the synchronization signal and PBCH channel are packed as a single block that always moves together. SSB should be detected first in 5G NR frame. See Table 64 below for the setting criteria based on the operating frequency.

3 Tap **Sync Raster Offset** to set the sync raster resolution to 180 kHz (FR1) or to 720 kHz (FR2) for carrier frequency center using the on-screen keyboard. See Table 65 below for the sync raster offset range per SSB SCS and sync raster resolution.

4 Tap **Sync SCS Offset** to fine-tune the offset using the SCS. See Table 66 below for the sync raster offset range per SSB SCS and sync raster resolution.

5 Tap **SSB Center Frequency** and input the value using the on-screen keyboard.

6 Tap **GSCN** and input the value using the on-screen keyboard.

7 Tap **L** to set the maximum number of SS-PBCH blocks within a single SS burst set (A set of SS being transmitted in 5 ms window of SS transmission) among 4, 8 and 64. Refer to the selection criteria based on the table in **Step 2**.

8 Tap **SSB Auto Search Mode** and do the following steps:

   a Tap **Auto Preamp/Atten** and switch **SSB Auto Search** to **Start** to set preamp and attenuation automatically.

   b Tap **Manual** and switch **SSB Auto Search** to **Start** for manually setting based on your need.

9 Tap **SSB Auto Search** between **Start** and **Stop**.

   a **Start**: to search SCS, type, and the number of SSB automatically. Once Start is selected, the progress bar appears. If it fails to perform the auto search, a fail message appears and the SSB switches to Manual.

   b **Stop**: to set the SSB periodicity based on the base station.

10 Tap **SSB Periodicity** and select the options from **5 ms**, **10 ms**, **20 ms**, **40 ms**, **80 ms**, 1**60 ms**. The SS burst period (SSB periodicity) is defined by each base station and network configurable. 20 ms is the default for the initial cell selection.

11 Tap to switch **PCI (Physical Cell ID)** to **Manual** or **Auto**.

12 Tap **PCI** and input a value from 0 to 1007 using the on-screen keyboard. The PCI switches to **Manual**

13 Tap **Time Error Window** and select from the choices: **SSB Periodicity**, **Frame**, or **Half Frame**.

   If you select Frame, the range is -5 ms to +5 ms based on 10 ms specified by 3GPP and if you select Half Frame, the range is -2.5 ms to +2.5 ms based on 5 ms specified by 3GPP.

14 Tap **Miscellaneous** > **Symbol Phase Comp** and select from the following choices: **Auto**, **Manual**, or **Off**.

   Symbol Phase Compensation is used to compensate for phase differences between symbols caused by upconversion. Users do not always use the instrument based on RF frequency. In this case, you can set it to Manual or Off.

   – **Auto**: Setting radio frequency to center frequency
   – **Manual**: Setting radio frequency as required
   – **Off**: Setting radio frequency to 0

Table 64 Setup per operating frequency

Operating frequency	L	Case	SCS	Slots in a burst period
< 3 GHz (FR1)	4	A {2,8} +14*n	15 kHz	5 (1 ms)
< 3 GHz (FR1)	4	B {4,8,16,20} +28*n	30 kHz	10 (0.5 ms)
< 3 GHz (FR1) For un-paired spectrum operation: < 1.88 GHz	4	C {2,8} +14*n	30 kHz	10 (0.5 ms)
3 to 6 GHz (FR1)	8	A {2,8} +14*n	15 kHz	5 (1 ms)
3 to 6 GHz (FR1)	8	B {4,8,16,20} +28*n	30 kHz	10 (0.5 ms)
3 to 6 GHz (FR1) For un-paired spectrum operation: 1.88 to 6 GHz	8	C {2,8} +14*n	30 kHz	10 (0.5 ms)
> 6 GHz (FR2)	64	D {4,8,16,20} +28*n	120 kHz	40 (0.125 ms)
> 6 GHz (FR2)	64	E {8,12,16,20,32,36,40,44} +56*n	240 kHz	80 (62.5 ms)

Table 65 Sync raster offset range per SSB SCS and sync raster resolution

SSB SCS (kHz)	Sync Raster Resolution (kHz)	Sync Raster Offset Range	SSB Frequency = Center frequency
15	180	0 to 250	125
30	180	0 to 506	253
120	720	0 to 92	46

Table 65 Sync raster offset range per SSB SCS and sync raster resolution

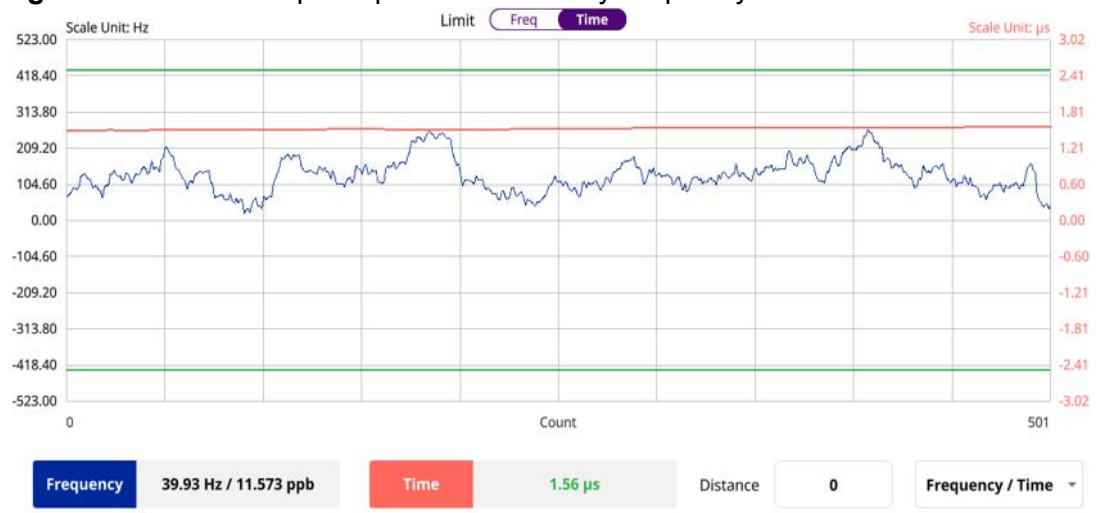
SSB SCS (kHz)	Sync Raster Resolution (kHz)	Sync Raster Offset Range	SSB Frequency = Center frequency
240	720	0 to 48	24

Table 66 Sync SCS offset range per SSB SCS and sync SCS resolution

SSB SCS (kHz)	Sync Raster Resolution (kHz)	Sync Raster Offset Range	SSB Frequency = Center Frequency
15	15	0 to 11	0
30	30	0 to 5	0
120	120	0 to 5	0
240	240	0 to 2	0

Figure 157 shows an example of 5G NR freq/time/power variation by frequency/time.

Figure 157 5G NR freq/time/power variation by frequency/time



NOTE

You can tap the Distance box and input the value that you want to compensate for distance. When distance is entered, the time will show the value with distance correction. Make sure the default value for Distance is 0.

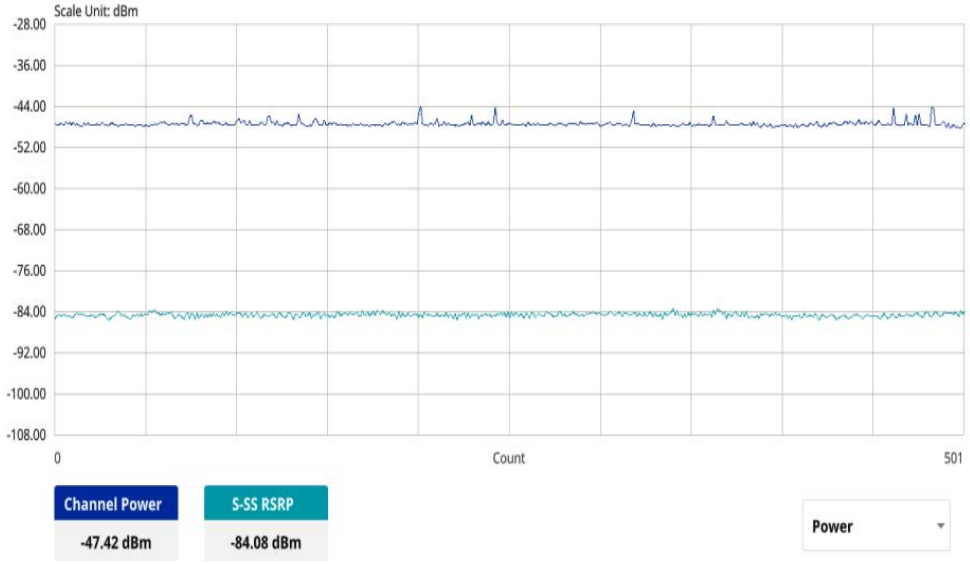
You can see the selected trace being plotted on the chart based on the selection from drop-down menu: Frequency, Time, Frequency/Time, or Power.

NOTE

When you select the Frequency/Time trace to be plotted, the Limit toggle icon will appear in the middle of the measurement screen. Once the Limit menu is turned on, the limit line will be displayed based on your selection of either Frequency or Time.

Figure 158 shows an example of 5G NR freq/time/power variation by power.

Figure 158 5G NR freq/time/power variation by power



Multipath profile

The Multipath Profile enables you to determine RF environmental conditions of testing area. It indicates the amount of power of the dominant pilot signal that is dispersed outside the main correlation peak due to multipath echoes that are expressed in dB. This value should be very small ideally.

The multipath profile is the result of portions of the original broadcast signal arriving at the receiving antenna out of phase. This can be caused by the signal being reflected off objects such as buildings or being refracted through the atmosphere differently from the main signal.

Setting measure setup

After configuring the spectrum measurement in “Configuring spectrum measurements” on page 25, you can set the measure setup to continue your measurement. The measurement settings can be saved and recalled as a file by selecting File Type as Setup and load the file onto the instrument using the **Save/Load** icons on the side bar.

To set measure setup

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap **Bandwidth/SSB SCS** and select the Setting in the pop-up window based on your need. SSB is an abbreviation for Synchronization Signal Block or SS Block and it refers to Synchronization PBCH block since the synchronization signal and PBCH channel are packed as a single block that always moves together. SSB should be detected first in 5G NR frame. See Table 67 below for the setting criteria based on the operating frequency.

3 Tap **Sync Raster Offset** to set the sync raster resolution to 180 kHz (FR1) or to 720 kHz (FR2) for carrier frequency center using the on-screen keyboard. See Table 68 below for the sync raster offset range per SSB SCS and sync raster resolution.

4 Tap **Sync SCS Offset** to fine-tune the offset using the SCS. See Table 69 below for the sync raster offset range per SSB SCS and sync raster resolution.

5 Tap **SSB Center Frequency** and input the value using the on-screen keyboard.

6 Tap **GSCN** and input the value using the on-screen keyboard.

7 Tap **L** to set the maximum number of SS-PBCH blocks within a single SS burst set (A set of SS being transmitted in 5 ms window of SS transmission) among 4, 8 and 64. Refer to the selection criteria based on the table in **Step 2**.

8 Tap **SSB Auto Search Mode** and do the following steps:

   a Tap **Auto Preamp/Atten** and switch **SSB Auto Search** to **Start** to set preamp and attenuation automatically.

   b Tap **Manual** and switch **SSB Auto Search** to **Start** for manually setting based on your need.

9 Tap **SSB Auto Search** and select between **Start** and **Stop**.

   a **Start**: to search SCS, type, and the number of SSB automatically. Once Start is selected, the progress bar appears. If it fails to perform the auto search, a fail message appears and the SSB switches to Manual.

   b **Stop**: to set the SSB periodicity based on the base station.

10 Tap **SSB Periodicity** and select the options from **5 ms**, **10 ms**, **20 ms**, **40 ms**, **80 ms**, 1**60 ms**. The SS burst period (SSB periodicity) is defined by each base station and network configurable. 20 ms is the default for the initial cell selection.

11 Tap to switch **PCI (Physical Cell ID)** to **Manual** or **Auto**.

12 Tap **PCI** and input a value from 0 to 1007 using the on-screen keyboard. The PCI switches to **Manual**.

13 Tap **Sync Window** and select between **Default** and **Symmetrical**.

   If you select **Symmetrical**, it will show the symmetrical view for the measurement screen.

14 Tap **Miscellaneous** > **Symbol Phase Comp** and select from the following choices: **Auto**, **Manual**, or **Off**.

Symbol Phase Compensation is used to compensate for phase differences between symbols caused by upconversion. Users do not always use the instrument based on RF frequency. In this case, you can set it to Manual or Off.

– **Auto**: Setting radio frequency to center frequency
– **Manual**: Setting radio frequency as required
– **Off**: Setting radio frequency to 0

Table 67 Setup per operating frequency

Operating frequency	L	Case	SCS	Slots in a burst period
< 3 GHz (FR1)	4	A {2,8} +14*n	15 kHz	5 (1 ms)
< 3 GHz (FR1)	4	B {4,8,16,20} +28*n	30 kHz	10 (0.5 ms)
< 3 GHz (FR1) For unpaired spectrum operation: < 1.88 GHz	4	C {2,8} +14*n	30 kHz	10 (0.5 ms)
3 to 6 GHz (FR1)	8	A {2,8} +14*n	15 kHz	5 (1 ms)
3 to 6 GHz (FR1)	8	B {4,8,16,20} +28*n	30 kHz	10 (0.5 ms)
3 to 6 GHz (FR1) For unpaired spectrum operation: 1.88 to 6 GHz	8	C {2,8} +14*n	30 kHz	10 (0.5 ms)
> 6 GHz (FR2)	64	D {4,8,16,20} +28*n	120 kHz	40 (0.125 ms)
> 6 GHz (FR2)	64	E {8,12,16,20,32,36,40,44} +56*n	240 kHz	80 (62.5 ms)

Table 68 Sync raster offset range per SSB SCS and sync raster resolution

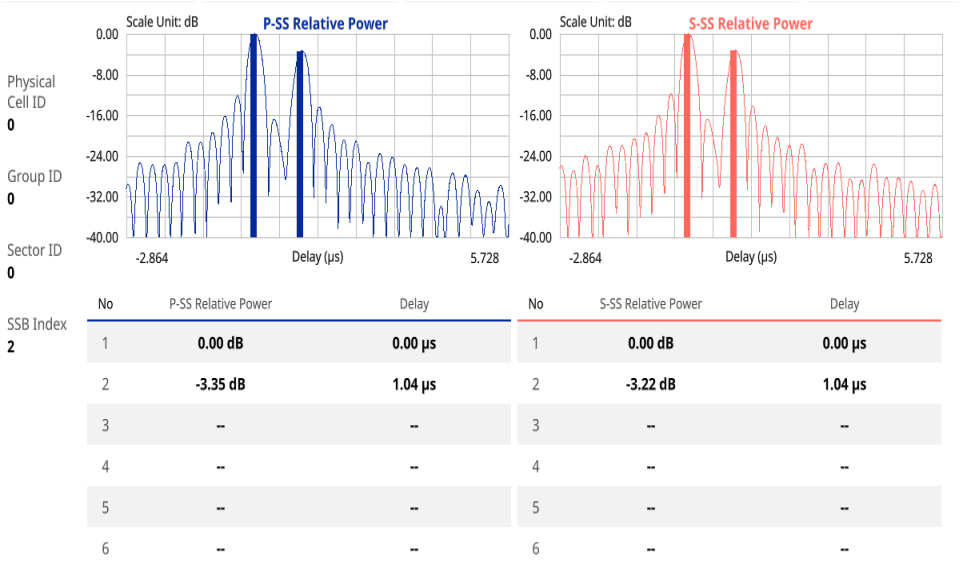
SSB SCS (kHz)	Sync Raster Resolution (kHz)	Sync Raster Offset Range	SSB Frequency = Center frequency
15	180	0 to 250	125
30	180	0 to 506	253
120	720	0 to 92	46
240	720	0 to 48	24

Table 69 Sync SCS offset range per SSB SCS and sync SCS resolution

SSB SCS (kHz)	Sync Raster Resolution (kHz)	Sync Raster Offset Range	SSB Frequency = Center Frequency
15	15	0 to 11	0
30	30	0 to 5	0
120	120	0 to 5	0
240	240	0 to 2	0

Figure 159 shows an example of 5G NR multipath profile.

Figure 159 5G NR multipath profile



Signal analysis

The following sections describe how to perform signal analysis.

Constellation

The constellation is used to observe some aspects of modulation accuracy and can reveal certain fault mechanisms such as I/Q amplitude imbalance or quadrature imbalance. It displays constellation diagram by modulation types.

Setting measure setup

After configuring the spectrum measurement in "Configuring spectrum measurements" on page 25, you can set the measure setup to continue your measurement. The measurement settings can be saved and recalled as a file by selecting File Type as Setup and load the file onto the instrument using the **Save/Load** icons on the side bar.

To set measure setup

1. Tap the **Setup** ( ) icon in the side bar.
2. Tap **Bandwidth/SSB SCS** and select the Setting in the pop-up window based on your need. SSB is an abbreviation for Synchronization Signal Block or SS Block and it refers to Synchronization PBCH block since the synchronization signal and PBCH channel are packed as a single block that always moves together. SSB should be detected first in 5G NR frame. See Table 70 below for the setting criteria based on the operating frequency.
3. Tap **Sync Raster Offset** to set the sync raster resolution to 180 kHz (FR1) or to 720 kHz (FR2) for carrier frequency center using the on-screen keyboard. See Table 71 below for the sync raster offset range per SSB SCS and sync raster resolution.
4. Tap **Sync SCS Offset** to fine-tune the offset using the SCS. See Table 72 below for the sync raster offset range per SSB SCS and sync raster resolution.
5. Tap **SSB Center Frequency** and input the value using the on-screen keyboard.
6. Tap **GSCN** and input the value using the on-screen keyboard.
7. Tap **L** to set the maximum number of SS-PBCH blocks within a single SS burst set (A set of SS being transmitted in 5 ms window of SS transmission) among 4, 8 and 64. Refer to the selection criteria based on the table in **Step 2**.
8. Tap **SSB Auto Search Mode** and do the following steps:
   a. Tap **Auto Preamp/Atten** and switch **SSB Auto Search** to **Start** to set preamp and attenuation automatically.
   b. Tap **Manual** and switch **SSB Auto Search** to **Start** for manually setting based on your need.
9. Tap **SSB Auto Search** between **Start** and **Stop**.
   a. **Start**: to search SCS, type, and the number of SSB automatically. Once Start is selected, the progress bar appears. If it fails to perform the auto search, a fail message appears and the SSB switches to Manual.
   b. **Stop**: to set the SSB periodicity based on the base station.

10 Tap **SSB Periodicity** and select the options from **5 ms**, **10 ms**, **20 ms**, **40 ms**, **80 ms**, 1**60 ms**. The SS burst period (SSB periodicity) is defined by each base station and network configurable. 20 ms is the default for the initial cell selection.

11 Tap to switch **PCI (Physical Cell ID)** to **Manual** or **Auto**.

12 Tap **PCI** and input a value from 0 to 1007 using the on-screen keyboard. The PCI switches to **Manual**.

13 Tap **Time Error Window** and select from the choices: **SSB Periodicity**, **Frame**, or **Half Frame**.

If you select Frame, the range is -5 ms to +5 ms based on 10 ms specified by 3GPP and if you select Half Frame, the range is -2.5 ms to +2.5 ms based on 5 ms specified by 3GPP.

14 Tap **Miscellaneous** > **Symbol Phase Comp** and select from the following choices: **Auto**, **Manual**, or **Off**.

Symbol Phase Compensation is used to compensate for phase differences between symbols caused by upconversion. Users do not always use the instrument based on RF frequency. In this case, you can set it to Manual or Off.

– **Auto**: Setting radio frequency to center frequency
– **Manual**: Setting radio frequency as required
– **Off**: Setting radio frequency to 0

Table 70 Setup per operating frequency

Operating frequency	L	Case	SCS	Slots in a burst period
< 3 GHz (FR1)	4	A {2,8} +14*n	15 kHz	5 (1 ms)
< 3 GHz (FR1)	4	B {4,8,16,20} +28*n	30 kHz	10 (0.5 ms)
< 3 GHz (FR1) For unpaired spectrum operation: < 1.88 GHz	4	C {2,8} +14*n	30 kHz	10 (0.5 ms)
3 to 6 GHz (FR1)	8	A {2,8} +14*n	15 kHz	5 (1 ms)
3 to 6 GHz (FR1)	8	B {4,8,16,20} +28*n	30 kHz	10 (0.5 ms)

Table 70 Setup per operating frequency

Operating frequency	L	Case	SCS	Slots in a burst period
3 to 6 GHz (FR1) For un-paired spectrum operation: 1.88 to 6 GHz	8	C {2,8} +14*n	30 kHz	10 (0.5 ms)
> 6 GHz (FR2)	64	D {4,8,16,20} +28*n	120 kHz	40 (0.125 ms)
> 6 GHz (FR2)	64	E {8,12,16,20,32,36,40,44} +56*n	240 kHz	80 (62.5 ms)

Table 71 Sync raster offset range per SSB SCS and sync raster resolution

SSB SCS (kHz)	Sync Raster Resolution (kHz)	Sync Raster Offset Range	SSB Frequency = Center frequency
15	180	0 to 250	125
30	180	0 to 506	253
120	720	0 to 92	46
240	720	0 to 48	24

Table 72 Sync SCS offset range per SSB SCS and sync SCS resolution

SSB SCS (kHz)	Sync Raster Resolution (kHz)	Sync Raster Offset Range	SSB Frequency = Center Frequency
15	15	0 to 11	0
30	30	0 to 5	0
120	120	0 to 5	0
240	240	0 to 2	0

To set limit

1 Tap **Menu > Limit**.

2 Tap the test items and set the limits depending on your selected measurement mode:

To set the limit for	Select and set
Frequency Error	Test limits On/Off, High/Low Limit
Time Error	Test limits On/Off, High/Low Limit
SS-RSRP Power	Test limits On/Off, High/Low Limit
PDSCH EVM	Test limits On/Off, High Limit for QPSK/16 QAM/64 QAM/ 256 QAM
Data EVM RMS	Test limits On/Off, High Limit
Data EVM Peak	Test limits On/Off, High Limit

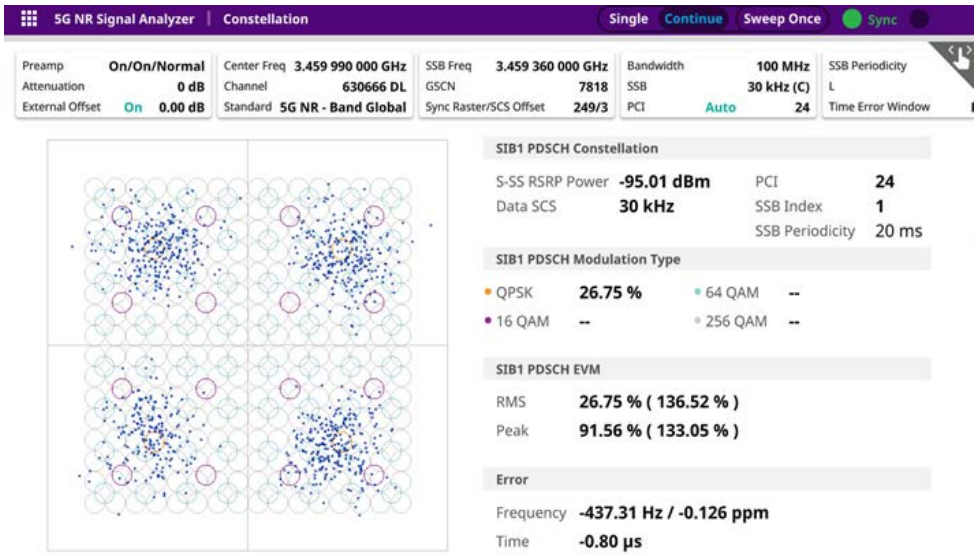
3 *Optional*: Tap the **Save** hot key on the side bar and select the save option from the choices available for your measurement.



NOTE
The instrument currently measures the PDSCH EVM values based on SIB1 contained PDSCH RB. The instrument performs the 3GPP recommended call protocol connection to get SIB1 PDSCH RB which should have the following pieces of information required for proper measuring support:
- Pdcch-configSIB1 of MIB (Master Information Block) determines the common search space of type-0 PDCCH
- DCI (Downlink Control information) format 1_0 is used to get the information of SIB1 PDSCH RB location
- SIB1 (System Information Block type

Figure 160 shows an example of 5G NR constellation measurement.

Figure 160 5G NR constellation measurement



NOTE
Once you tap the Time Offset button at the right bottom of the screen, the histogram graph appears.

Allocation mapper

The 5G NR Allocation Mapper displays power for X axis (time) and Y axis (frequency) of 1 frame with resources being measured for current PCI.

Setting measure setup

After configuring the spectrum measurement in “Configuring spectrum measurements” on page 25, you can set the measure setup to continue your measurement. The measurement settings can be saved and recalled as a file by selecting File Type as Setup and load the file onto the instrument using the **Save/Load** icons on the side bar.

To set measure setup

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap **Bandwidth/SSB SCS** and select the Setting in the pop-up window based on your need. SSB is an abbreviation for Synchronization Signal Block or SS Block and it refers to Synchronization PBCH block since the synchronization signal and PBCH channel are packed as a single block that always moves together. SSB should be detected first in 5G NR frame. See Table 73 below for the setting criteria based on the operating frequency.

3 Tap **Sync Raster Offset** to set the sync raster resolution to 180 kHz (FR1) or to 720 kHz (FR2) for carrier frequency center using the on-screen keyboard. See Table 74 below for the sync raster offset range per SSB SCS and sync raster resolution.

4 Tap **Sync SCS Offset** to fine-tune the offset using the SCS. See Table 75 below for the sync raster offset range per SSB SCS and sync raster resolution.

5 Tap **SSB Center Frequency** and input the value using the on-screen keyboard.

6 Tap **GSCN** and input the value using the on-screen keyboard.

7 Tap **L** to set the maximum number of SS-PBCH blocks within a single SS burst set (A set of SS being transmitted in 5 ms window of SS transmission) among 4, 8 and 64. Refer to the selection criteria based on the table in **Step 2**.

8 Tap **SSB Auto Search Mode** and do the following steps:

   a Tap **Auto Preamp/Atten** and switch **SSB Auto Search** to **Start** to set preamp and attenuation automatically.

   b Tap **Manual** and switch **SSB Auto Search** to **Start** for manually setting based on your need.

9 Tap **SSB Auto Search** between **Start** and **Stop**.

   a **Start**: to search SCS, type, and the number of SSB automatically. Once Start is selected, the progress bar appears. If it fails to perform the auto search, a fail message appears and the SSB switches to Manual.

   b **Stop**: to set the SSB periodicity based on the base station.

10 Tap **SSB Periodicity** and select the options from **5 ms**, **10 ms**, **20 ms**, **40 ms**, **80 ms**, **160 ms**. The SS burst period (SSB periodicity) is defined by each base station and network configurable. 20 ms is the default for the initial cell selection.

11 Tap to switch **PCI (Physical Cell ID)** to **Manual** or **Auto**.

12 Tap **PCI** and input a value from 0 to 1007 using the on-screen keyboard. The PCI switches to **Manual**.

13 Tap **Miscellaneous** > **Symbol Phase Comp** and select from the following choices: **Auto**, **Manual**, or **Off**.

   Symbol Phase Compensation is used to compensate for phase differences between symbols caused by upconversion. Users do not always use the instrument based on RF frequency. In this case, you can set it to Manual or Off.

   – **Auto**: Setting radio frequency to center frequency
   – **Manual**: Setting radio frequency as required
   – **Off**: Setting radio frequency to 0

To set limit

1 Tap the rectangle with value before color legend bar on the measurement screen.

a Set a value for **Minimum** using the on-screen keyboard.

b Set a value for **Maximum** using the on-screen keyboard.

Table 73 Setup per operating frequency

Operating frequency	L	Case	SCS	Slots in a burst period
< 3 GHz (FR1)	4	A {2,8} +14*n	15 kHz	5 (1 ms)
< 3 GHz (FR1)	4	B {4,8,16,20} +28*n	30 kHz	10 (0.5 ms)
< 3 GHz (FR1) For un-paired spectrum operation: < 1.88 GHz	4	C {2,8} +14*n	30 kHz	10 (0.5 ms)
3 to 6 GHz (FR1)	8	A {2,8} +14*n	15 kHz	5 (1 ms)
3 to 6 GHz (FR1)	8	B {4,8,16,20} +28*n	30 kHz	10 (0.5 ms)
3 to 6 GHz (FR1) For un-paired spectrum operation: 1.88 to 6 GHz	8	C {2,8} +14*n	30 kHz	10 (0.5 ms)
> 6 GHz (FR2)	64	D {4,8,16,20} +28*n	120 kHz	40 (0.125 ms)
> 6 GHz (FR2)	64	E {8,12,16,20,32,36,40,44} +56*n	240 kHz	80 (62.5 ms)

Table 74 Sync raster offset range per SSB SCS and sync raster resolution

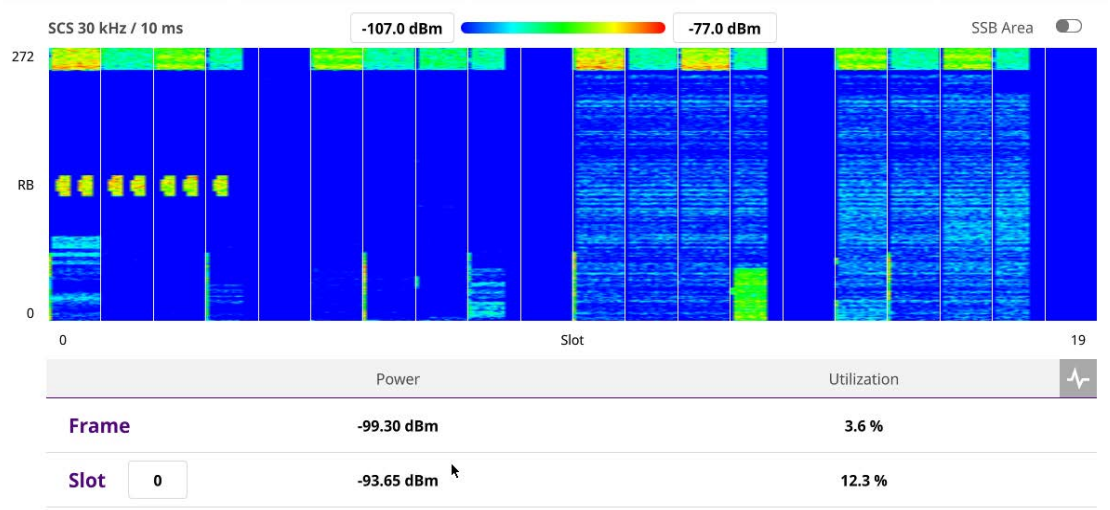
SSB SCS (kHz)	Sync Raster Resolution (kHz)	Sync Raster Offset Range	SSB Frequency = Center frequency
15	180	0 to 250	125
30	180	0 to 506	253
120	720	0 to 92	46
240	720	0 to 48	24

Table 75 Sync SCS offset range per SSB SCS and sync SCS resolution

SSB SCS (kHz)	Sync Raster Resolution (kHz)	Sync Raster Offset Range	SSB Frequency = Center Frequency
15	15	0 to 11	0
30	30	0 to 5	0
120	120	0 to 5	0
240	240	0 to 2	0

Figure 161 shows an example of 5G NR allocation mapper measurement.

Figure 161 5G NR allocation mapper measurement



NOTE
If the SSB Area is set to On, it shows the expected resource location of SSB in the currently set 5G NR.

- Frame Power: the average RE power of the whole frames (dB, full bandwidth)
- Frame Utilization: RE% of “PBCH-DMRS RSRP(dB) - 6dB” or more in whole frame RE
- Slot Power: the average RE power of the corresponding whole slot (dB, fullbandwidth)
- Slot Utilization: RE% of “PBCH-DMRS RSRP(dB) - 6dB” or more in the corresponding whole slot
- Chart View icon: You can tap the Chart View icon on the top right of the table to view the utilization counter graph

Power vs Time (Slot)

The Power vs. Time (Slot) measurement measures the transmit power profile of a 5G NR slot over time and verifies that the power ramp-up and ramp-down at the slot edges fit within the defined mask. It also lets you view the transition (on/off) periods and the useful (average) power portion of the slot.

This measurement provides limit settings for parameters such as Symbol/Frame Average Power, Off Power, Transition Period, I-Q Origin Offset, Time Error, and Slot Power. The 0 dB reference is determined by measuring the average transmitted power during the useful part of the slot.

Setting measure setup

After configuring the spectrum measurement in “Configuring spectrum measurements” on page 25, you can set the measure setup to continue your measurement. The measurement settings can be saved and recalled as a file by selecting File Type as Setup and load the file onto the instrument using the **Save/Load** icons on the side bar.

To set measure setup

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap **Bandwidth/SSB SCS** and select the Setting in the pop-up window based on your need. SSB is an abbreviation for Synchronization Signal Block or SS Block and it refers to Synchronization PBCH block since the synchronization signal and PBCH channel are packed as a single block that always moves together. SSB should be detected first in 5G NR frame. See Table 76 below for the setting criteria based on the operating frequency.

3 Tap **Sync Raster Offset** to set the sync raster resolution to 180 kHz (FR1) or to 720 kHz (FR2) for carrier frequency center using the on-screen keyboard. See Table 77 below for the sync raster offset range per SSB SCS and sync raster resolution.

4 Tap **Sync SCS Offset** to fine-tune the offset using the SCS. See Table 78 below for the sync raster offset range per SSB SCS and sync raster resolution.

5 Tap **SSB Center Frequency** and input the value using the on-screen keyboard.

6 Tap **GSCN** and input the value using the on-screen keyboard.

7 Tap **L** to set the maximum number of SS-PBCH blocks within a single SS burst set (A set of SS being transmitted in 5 ms window of SS transmission) among 4, 8 and 64. Refer to the selection criteria based on the table in **Step 2**.

8 Tap **SSB Auto Search Mode** and do the following steps:

   a Tap **Auto Preamp/Atten** and switch **SSB Auto Search** to **Start** to set preamp and attenuation automatically.

   b Tap **Manual** and switch **SSB Auto Search** to **Start** for manually setting based on your need.

9 Tap **SSB Auto Search** between **Start** and **Stop**.

   a **Start**: to search SCS, type, and the number of SSB automatically. Once Start is selected, the progress bar appears. If it fails to perform the auto search, a fail message appears and the SSB switches to Manual.

   b **Stop**: to set the SSB periodicity based on the base station.

10 Tap **SSB Periodicity** and select the options from **5 ms**, **10 ms**, **20 ms**, **40 ms**, **80 ms**, 1**60 ms**. The SS burst period (SSB periodicity) is defined by each base station and network configurable. 20 ms is the default for the initial cell selection.

11 Tap to switch **PCI (Physical Cell ID)** to **Manual** or **Auto**.

12 Tap **PCI** and input a value from 0 to 1007 using the on-screen keyboard. The PCI switches to **Manual**.

13 Tap **Slot Formats** and input the value from 0 to 55 using the on-screen keyboard.

   The slot format means how to divide one slot between downlink and uplink

14 Tap **Miscellaneous** > **Symbol Phase Comp** and select from the following choices: **Auto**, **Manual**, or **Off**.

Symbol Phase Compensation is used to compensate for phase differences between symbols caused by upconversion. Users do not always use the instrument based on RF frequency. In this case, you can set it to Manual or Off.

– **Auto**: Setting radio frequency to center frequency
– **Manual**: Setting radio frequency as required
– **Off**: Setting radio frequency to 0

Table 76 Setup per operating frequency

Operating frequency	L	Case	SCS	Slots in a burst period
< 3 GHz (FR1)	4	A {2,8} +14*n	15 kHz	5 (1 ms)
< 3 GHz (FR1)	4	B {4,8,16,20} +28*n	30 kHz	10 (0.5 ms)
< 3 GHz (FR1) For unpaired spectrum operation: < 1.88 GHz	4	C {2,8} +14*n	30 kHz	10 (0.5 ms)
3 to 6 GHz (FR1)	8	A {2,8} +14*n	15 kHz	5 (1 ms)
3 to 6 GHz (FR1)	8	B {4,8,16,20} +28*n	30 kHz	10 (0.5 ms)
3 to 6 GHz (FR1) For unpaired spectrum operation: 1.88 to 6 GHz	8	C {2,8} +14*n	30 kHz	10 (0.5 ms)
> 6 GHz (FR2)	64	D {4,8,16,20} +28*n	120 kHz	40 (0.125 ms)
> 6 GHz (FR2)	64	E {8,12,16,20,32,36,40,44} +56*n	240 kHz	80 (62.5 ms)

Table 77 Sync raster offset range per SSB SCS and sync raster resolution

SSB SCS (kHz)	Sync Raster Resolution (kHz)	Sync Raster Offset Range	SSB Frequency = Center frequency
15	180	0 to 250	125
30	180	0 to 506	253
120	720	0 to 92	46
240	720	0 to 48	24

Table 78 Sync SCS offset range per SSB SCS and sync SCS resolution

SSB SCS (kHz)	Sync Raster Resolution (kHz)	Sync Raster Offset Range	SSB Frequency = Center Frequency
15	15	0 to 11	0
30	30	0 to 5	0
120	120	0 to 5	0
240	240	0 to 2	0

Figure 162 shows an example of 5G NR power vs time (slot) measurement.

Figure 162 5G NR power vs time (slot) measurement



NOTE
You can set the Slot No. from 0 to 19 in the Symbol Average Power table.

Power vs Time (Frame)

The Power vs. Time (Frame) measures the modulation envelope in the time domain, showing the power of each time slot in a NR signal.

Setting measure setup

After configuring the spectrum measurement in "Configuring spectrum measurements" on page 25, you can set the measure setup to continue your measurement. The measurement settings can be saved and recalled as a file by selecting File Type as Setup and load the file onto the instrument using the **Save/Load** icons on the side bar.

To set measure setup

1. Tap the **Setup** (⚙) icon in the side bar.
2. Tap **Bandwidth/SSB SCS** and select the Setting in the pop-up window based on your need. SSB is an abbreviation for Synchronization Signal Block or SS Block and it refers to Synchronization PBCH block since the synchronization signal and PBCH channel are packed as a single block that always moves together. SSB should be detected first in 5G NR frame. See Table 79 below for the setting criteria based on the operating frequency.
3. Tap **Sync Raster Offset** to set the sync raster resolution to 180 kHz (FR1) or to 720 kHz (FR2) for carrier frequency center using the on-screen keyboard. See Table 80 below for the sync raster offset range per SSB SCS and sync raster resolution.
4. Tap **Sync SCS Offset** to fine-tune the offset using the SCS. See Table 81 below for the sync raster offset range per SSB SCS and sync raster resolution.
5. Tap **SSB Center Frequency** and input the value using the on-screen keyboard.
6. Tap **GSCN** and input the value using the on-screen keyboard.
7. Tap **L** to set the maximum number of SS-PBCH blocks within a single SS burst set (A set of SS being transmitted in 5 ms window of SS transmission) among 4, 8 and 64. Refer to the selection criteria based on the table in **Step 2**.
8. Tap **SSB Auto Search Mode** and do the following steps:
   a. Tap **Auto Preamp/Atten** and switch **SSB Auto Search** to **Start** to set preamp and attenuation automatically.
   b. Tap **Manual** and switch **SSB Auto Search** to **Start** for manually setting based on your need.
9. Tap **SSB Auto Search** between **Start** and **Stop**.
   a. **Start**: to search SCS, type, and the number of SSB automatically. Once Start is selected, the progress bar appears. If it fails to perform the auto search, a fail message appears and the SSB switches to Manual.
   b. **Stop**: to set the SSB periodicity based on the base station.

10 Tap **SSB Periodicity** and select the options from **5 ms**, **10 ms**, **20 ms**, **40 ms**, **80 ms**, 1**60 ms**. The SS burst period (SSB periodicity) is defined by each base station and network configurable. 20 ms is the default for the initial cell selection.

11 Tap to switch **PCI (Physical Cell ID)** to **Manual** or **Auto**.

12 Tap **PCI** and input a value from 0 to 1007 using the on-screen keyboard. The PCI switches to **Manual**.

13 Tap **Time Error Window** and select from the choices: **SSB Periodicity**, **Frame**, or **Half Frame**.

If you select Frame, the range is -5 ms to +5 ms based on 10 ms specified by 3GPP and if you select Half Frame, the range is -2.5 ms to +2.5 ms based on 5 ms specified by 3GPP.

14 Tap **Miscellaneous** > **Symbol Phase Comp** and select from the following choices: **Auto**, **Manual**, or **Off**.

Symbol Phase Compensation is used to compensate for phase differences between symbols caused by upconversion. Users do not always use the instrument based on RF frequency. In this case, you can set it to Manual or Off.

– **Auto**: Setting radio frequency to center frequency
– **Manual**: Setting radio frequency as required
– **Off**: Setting radio frequency to 0

Table 79 Setup per operating frequency

Operating frequency	L	Case	SCS	Slots in a burst period
< 3 GHz (FR1)	4	A {2,8} +14*n	15 kHz	5 (1 ms)
< 3 GHz (FR1)	4	B {4,8,16,20} +28*n	30 kHz	10 (0.5 ms)
< 3 GHz (FR1) For unpaired spectrum operation: < 1.88 GHz	4	C {2,8} +14*n	30 kHz	10 (0.5 ms)
3 to 6 GHz (FR1)	8	A {2,8} +14*n	15 kHz	5 (1 ms)
3 to 6 GHz (FR1)	8	B {4,8,16,20} +28*n	30 kHz	10 (0.5 ms)

Table 79 Setup per operating frequency

Operating frequency	L	Case	SCS	Slots in a burst period
3 to 6 GHz (FR1) For un-paired spectrum operation: 1.88 to 6 GHz	8	C {2,8} +14*n	30 kHz	10 (0.5 ms)
> 6 GHz (FR2)	64	D {4,8,16,20} +28*n	120 kHz	40 (0.125 ms)
> 6 GHz (FR2)	64	E {8,12,16,20,32,36,40,44} +56*n	240 kHz	80 (62.5 ms)

Table 80 Sync raster offset range per SSB SCS and sync raster resolution

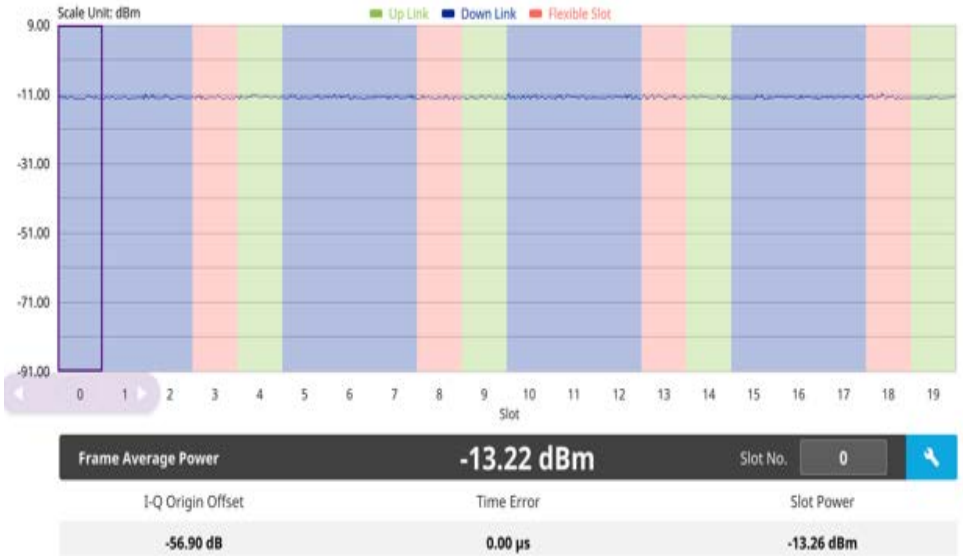
SSB SCS (kHz)	Sync Raster Resolution (kHz)	Sync Raster Offset Range	SSB Frequency = Center frequency
15	180	0 to 250	125
30	180	0 to 506	253
120	720	0 to 92	46
240	720	0 to 48	24

Table 81 Sync SCS offset range per SSB SCS and sync SCS resolution

SSB SCS (kHz)	Sync Raster Resolution (kHz)	Sync Raster Offset Range	SSB Frequency = Center Frequency
15	15	0 to 11	0
30	30	0 to 5	0
120	120	0 to 5	0
240	240	0 to 2	0

Figure 163 shows an example of 5G NR power vs time (frame) measurement.

Figure 163 5G NR power vs time (frame) measurement



NOTE
You can set the Slot No. from 0 to 19 or move the purple scroll bar to set and highlight the slot number you want to see. Once highlighted, you can tap the Search button to see the selected slot number information (zoomed in 3 slots). If you set slot number 4, you will see slot number 3, 4, and 5 with chart displaying uplink, downlink, and flexible slot.
You can also set slot type (Uplink/Downlink/Flexible Slot) and number by tapping the Configuration icon.

Cell phase synchronization

The following sections describe how to perform cell phase synchronization.

Sync Analysis

Sync Analysis measures time difference between every signal (PCI). Sync Error is defined as the difference between the Primary PCI and target PCIs for Time Error. Once it exceeds a specific limit set by the user, the alarm will beep and the screen displays the interference signal as red.

Setting measure setup

After configuring the spectrum measurement in “Configuring spectrum measurements” on page 25, you can set the measure setup to continue your measurement. The measurement settings can be saved and recalled as a file by selecting File Type as Setup and load the file onto the instrument using the **Save/Load** icons on the side bar.

To set measure setup

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap **SSB Auto Search Mode** and do the following steps:

   a Tap **Auto Preamp/Atten** and switch **SSB Auto Search** to **Start** to set preamp and attenuation automatically.

   b Tap **Manual** and switch **SSB Auto Search** to **Start** for manually setting based on your need.

3 Tap **SSB Auto Search** between **Start** and **Stop**.

   a **Start**: to search SCS, type, and the number of SSB automatically. Once Start is selected, the progress bar appears. If it fails to perform the auto search, a fail message appears and the SSB switches to Manual.

   b **Stop**: to set the SSB periodicity based on the base station.

NOTE

You can go ahead with SSB Auto Search first to make your measurement/setting easier and faster. If the auto search is not successful, you can follow the procedure below for manual search.

4 Tap **Bandwidth/SSB SCS** and select the Setting in the pop-up window based on your need. SSB is an abbreviation for Synchronization Signal Block or SS Block and it refers to Synchronization PBCH block since the synchronization signal and PBCH channel are packed as a single block that always moves together. SSB should be detected first in 5G NR frame. See Table 82 below for the setting criteria based on the operating frequency.

5 Tap **Sync Raster Offset** to set the sync raster resolution to 180 kHz (FR1) or to 720 kHz (FR2) for carrier frequency center using the on-screen keyboard. See Table 83 below for the sync raster offset range per SSB SCS and sync raster resolution.

6 Tap **Sync SCS Offset** to fine-tune the offset using the SCS. See Table 84 below for the sync raster offset range per SSB SCS and sync raster resolution.

7 Tap **SSB Center Frequency** and input the value using the on-screen keyboard.

8 Tap **GSCN** and input the value using the on-screen keyboard.

9 Tap **L** to set the maximum number of SS-PBCH blocks within a single SS burst set (A set of SS being transmitted in 5 ms window of SS transmission) among 4, 8 and 64. Refer to the selection criteria based on the table in **Step 4**.

10 Tap **SSB Periodicity** and select the options from **5 ms**, **10 ms**, **20 ms**, **40 ms**, **80 ms**, **160 ms**. The SS burst period (SSB periodicity) is defined by each base station and network configurable. 20 ms is the default for the initial cell selection.

11 Tap to switch **PCI (Physical Cell ID)** to **Manual** or **Auto**.

12 Tap **PCI** and input a value from 0 to 1007 using the on-screen keyboard. The PCI switches to **Manual**.

13 Tap **Time Error Window** and select from the choices: **SSB Periodicity**, **Frame**, or **Half Frame**.

If you select Frame, the range is -5 ms to +5 ms based on 10 ms specified by 3GPP and if you select Half Frame, the range is -2.5 ms to +2.5 ms based on 5 ms specified by 3GPP.

14 Tap **Miscellaneous** > **Symbol Phase Comp** and select from the following choices: **Auto**, **Manual**, or **Off**.

Symbol Phase Compensation is used to compensate for phase differences between symbols caused by upconversion. Users do not always use the instrument based on RF frequency. In this case, you can set it to Manual or Off.

– **Auto**: Setting radio frequency to center frequency
– **Manual**: Setting radio frequency as required
– **Off**: Setting radio frequency to 0

To set limit

You will be able to judge any interfering signal is coming by setting the test limits to On.

1 Tap **Menu** > **Limit**.

2 Tap **Sync Error**.

a Tap to switch **Test Limits** to **On** or **Off**.

b Tap **Limit** and input the value using the on-screen keyboard. The default value is 3 µs.

3 Tap **Time Error**.

a Tap to switch **Test Limits** to **On** or **Off**.

b Tap **High Limit** or **Low Limit** and input the value using the on-screen keyboard.



NOTE

If you set the Time Error in Limit menu, you will check the Time Error values that you have set with green (pass) or fail (red) on the measurement screen. Refer to the below measurement screen.

Table 82 Setup per operating frequency

Operating frequency	L	Case	SCS	Slots in a burst period
< 3 GHz (FR1)	4	A {2,8} +14*n	15 kHz	5 (1 ms)
< 3 GHz (FR1)	4	B {4,8,16,20} +28*n	30 kHz	10 (0.5 ms)

Table 82 Setup per operating frequency

Operating frequency	L	Case	SCS	Slots in a burst period
< 3 GHz (FR1) For unpaired spectrum operation: < 1.88 GHz	4	C {2,8} +14*n	30 kHz	10 (0.5 ms)
3 to 6 GHz (FR1)	8	A {2,8} +14*n	15 kHz	5 (1 ms)
3 to 6 GHz (FR1)	8	B {4,8,16,20} +28*n	30 kHz	10 (0.5 ms)
3 to 6 GHz (FR1) For unpaired spectrum operation: 1.88 to 6 GHz	8	C {2,8} +14*n	30 kHz	10 (0.5 ms)
> 6 GHz (FR2)	64	D {4,8,16,20} +28*n	120 kHz	40 (0.125 ms)
> 6 GHz (FR2)	64	E {8,12,16,20,32,36,40,44} +56*n	240 kHz	80 (62.5 ms)

Table 83 Sync raster offset range per SSB SCS and sync raster resolution

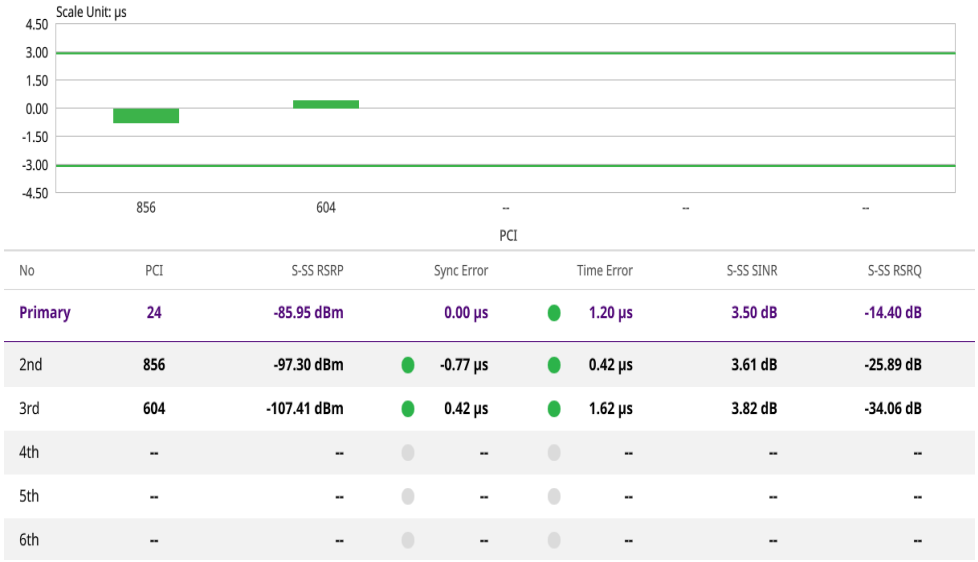
SSB SCS (kHz)	Sync Raster Resolution (kHz)	Sync Raster Offset Range	SSB Frequency = Center frequency
15	180	0 to 250	125
30	180	0 to 506	253
120	720	0 to 92	46
240	720	0 to 48	24

Table 84 Sync SCS offset range per SSB SCS and sync SCS resolution

SSB SCS (kHz)	Sync Raster Resolution (kHz)	Sync Raster Offset Range	SSB Frequency = Center Frequency
15	15	0 to 11	0
30	30	0 to 5	0
120	120	0 to 5	0
240	240	0 to 2	0

Figure 164 shows an example of Sync Analysis measurement.

Figure 164 5G NR Sync Analysis measurement



No	PCI	S-SS RSRP	Sync Error	Time Error	S-SS SINR	S-SS RSRQ
Primary	24	-85.95 dBm	0.00 µs	1.20 µs	3.50 dB	-14.40 dB
2nd	856	-97.30 dBm	-0.77 µs	0.42 µs	3.61 dB	-25.89 dB
3rd	604	-107.41 dBm	0.42 µs	1.62 µs	3.82 dB	-34.06 dB
4th	--	--	--	--	--	--
5th	--	--	--	--	--	--
6th	--	--	--	--	--	--

- S-SS RSRP represents the average power of every symbol delivering S-SS.
- Sync Error represents the time offset of each PCI on the reference of Primary PCI.
- Time Error represents the time offset between Trigger Source and 5G NR frame start.

NOTE

You can go to Menu > Amp/Scale > Ref Time Error Offset to adjust scale on the chart.

Sync route map

5G sync route map traces the power level of the NR signal's beam and sync and time error corresponding to a particular time and geographical position and presents it in a geographical map as a measurement point. All the collected measurements can be exported for post-processing purposes.

Figure 165 shows an example of 5G NR sync route map measurement.

Figure 165 Sync route map with 5G NR Signal Analyzer



Loading a map

To use any features related to maps, you need to download and install the maps on the instrument. The **VIAVI JDMapCreator** will help you to download maps. Ensure the JDMapCreator application on your computer is connected to the instrument via LAN. You can send a map file with a single layer to the instrument directly by using the **Send to EQP** menu in JDMapCreator. For information about how to use the JDMapCreator, see the *JDMapCreator 2.0 User Guide*.

To load a map

1 Plug in your USB flash drive that has a map file in .mcfv file type created in JDMapCreator.

2 Tap the **Load** ( ) icon on the side bar.

3 Navigate to the map file that you want to open.

The **File Information** pane displays the file properties, including its name, size, type, and date modified.

4 Tap the **Load** button on the screen.

Once you have loaded the map, you can also control the map using the following icons on the map.

Table 85 Map control icons

Icon	Description
	Tap to go to your current location on the map. Once tapped, the purple icon appears on the map, indicating your current location.
	Tap to switch to the full screen map view.

Table 85 Map control icons

Icon	Description
	Tap to zoom in the map.
	Tap to zoom out the map.
	Tap and select the area where you want to expand.

The left-most cell-site icon is activated when you import the cell-site information file.

To set measurement setup

Before starting the Route Map measurement, you need to set Spectrum measurements displayed on the quick access and display tab. See “Configuring spectrum measurements” on page 25 for more information.

1 If required, connect a GNSS receiver to your instrument for outdoor mapping. Indoor mapping does not necessarily need a GNSS antenna.

2 Tap the Setup ( ) icon on the side bar.

3 Tap **Map Config** to configure the map setting.

   a Tap to switch the **Screen Mode** between **Map** and **Full**.

   - With the **Map** setting, you can view only the collected points that can be seen within the boundary of the loaded map.
   - With the **Full** setting, you can view all the collected points of the route without the loaded map

4 Tap **Bandwidth/SSB SCS** and select the Setting in the pop-up window based on your need. SSB is an abbreviation for Synchronization Signal Block or SS Block and it refers to Synchronization PBCH block since the synchronization signal and PBCH channel are packed as a single block that always moves together. SSB should be detected first in 5G NR frame. See Table 86 below for the setting criteria based on the operating frequency.

5 Tap **Sync Raster Offset** to set the sync raster resolution to 180 kHz (FR1) or to 720 kHz (FR2) for carrier frequency center using the on-screen keyboard. See Table 87 below for the sync raster offset range per SSB SCS and sync raster resolution.

6 Tap **Sync SCS Offset** to fine-tune the offset using the SCS. See Table 88 below for the sync raster offset range per SSB SCS and sync raster resolution.

7 Tap **L** to set the maximum number of SS-PBCH blocks within a single SS burst set (A set of SS being transmitted in 5 ms window of SS transmission) among 4, 8 and 64. Refer to the selection criteria based on the table in **Step 4**.

8 Tap **SSB Auto Search Mode** and do the following steps:

a Tap **Auto Preamp/Atten** and switch **SSB Auto Search** to **Start** to set preamp and attenuation automatically.

b Tap **Manual** and switch **SSB Auto Search** to **Start** for manually setting based on your need.

9 Tap **SSB Auto Search** between **Start** and **Stop**.

a **Start**: to search SCS, type, and the number of SSB automatically. Once Start is selected, the progress bar appears. If it fails to perform the auto search, a fail message appears and the SSB switches to Manual.

b **Stop**: to set the SSB periodicity based on the base station.

10 Tap **SSB Periodicity** and select the options from **5 ms**, **10 ms**, **20 ms**, **40 ms**, **80 ms**, 1**60 ms**. The SS burst period (SSB periodicity) is defined by each base station and network configurable. 20 ms is the default for the initial cell selection.

11 Tap **SSB Center Frequency** and input the value using the on-screen keyboard.

12 Tap **GSCN** and input the value using the on-screen keyboard.

13 Tap to switch **PCI (Physical Cell ID)** to **Manual** or **Auto**.

14 Tap **PCI** and input a value from 0 to 1007 using the on-screen keyboard. The PCI switches to **Manual**.

15 Tap **Time Error Window** and select from the choices: **SSB Periodicity**, **Frame**, or **Half Frame**.

If you select Frame, the range is -5 ms to +5 ms based on 10 ms specified by 3GPP and if you select Half Frame, the range is -2.5 ms to +2.5 ms based on 5 ms specified by 3GPP.

16 Tap **Miscellaneous** > **Symbol Phase Comp** and select from the following choices: **Auto**, **Manual**, or **Off**.

Symbol Phase Compensation is used to compensate for phase differences between symbols caused by upconversion. Users do not always use the instrument based on RF frequency. In this case, you can set it to Manual or Off.

– **Auto**: Setting radio frequency to center frequency
– **Manual**: Setting radio frequency as required
– **Off**: Setting radio frequency to 0.

Table 86 Setup per operating frequency

Operating frequency	L	Case	SCS	Slots in a burst period
< 3 GHz (FR1)	4	A {2,8} +14*n	15 kHz	5 (1 ms)

Table 86 Setup per operating frequency

Operating frequency	L	Case	SCS	Slots in a burst period
< 3 GHz (FR1)	4	B {4,8,16,20} +28*n	30 kHz	10 (0.5 ms)
< 3 GHz (FR1) For un-paired spectrum operation: < 1.88 GHz	4	C {2,8} +14*n	30 kHz	10 (0.5 ms)
3 to 6 GHz (FR1)	8	A {2,8} +14*n	15 kHz	5 (1 ms)
3 to 6 GHz (FR1)	8	B {4,8,16,20} +28*n	30 kHz	10 (0.5 ms)
3 to 6 GHz (FR1) For un-paired spectrum operation: 1.88 to 6 GHz	8	C {2,8} +14*n	30 kHz	10 (0.5 ms)
> 6 GHz (FR2)	64	D {4,8,16,20} +28*n	120 kHz	40 (0.125 ms)
> 6 GHz (FR2)	64	E {8,12,16,20,32,36,40,44} +56*n	240 kHz	80 (62.5 ms)

Table 87 Sync raster offset range per SSB SCS and sync raster resolution

SSB SCS (kHz)	Sync Raster Resolution (kHz)	Sync Raster Offset Range	SSB Frequency = Center frequency
15	180	0 to 250	125
30	180	0 to 506	253
120	720	0 to 92	46
240	720	0 to 48	24

Table 88 Sync SCS offset range per SSB SCS and sync SCS resolution

SSB SCS (kHz)	Sync Raster Resolution (kHz)	Sync Raster Offset Range	SSB Frequency = Center Frequency
15	15	0 to 11	0
30	30	0 to 5	0
120	120	0 to 5	0
240	240	0 to 2	0

To set limit

You can set the thresholds for the two different color indicators, red and green. When there is no interference signal, the color is displayed as green (pass). Otherwise, it is displayed as red (fail).

1 Tap **Menu** > **Limit**.

2 Tap **Sync Error**.

   a Tap to switch **Test Limits** to **On** or **Off**.

   b Tap **Limit** and input the value using the on-screen keyboard. The default value is 3 µs.

3 Tap **Time Error**.

   a Tap to switch **Test Limits** to **On** or **Off**.

   b Tap **High Limit** or **Low Limit** and input the value using the on-screen keyboard.

NOTE
If you set the Time Error in Limit menu, you will check the Time Error values that you have set with green (pass) or fail (red) on the measurement screen.

Logging data

To use any features related to maps, you need to download and install the maps on the instrument. The VIAVI JDMapCreator will help you download maps. Make sure the JDMapCreator application on your computer is connected to the instrument via LAN. You can send a map file with a single layer to the instrument directly by using the Send to EQP menu in JDMapCreator. For more information on how to use the JDMapCreator, see the *JDMapCreator 2.0 User Guide*.

To log data

1 Follow **steps 1 to 3** in Setting measure setup.

2 Tap the **Testing** button on the right panel of the map to start plotting on the map. Sync status is plotted on the map with color index. Green for sync pass and red for sync fail.

3 Tap the **Stop** (■) button to stop plotting.

4 Tap the **Pause** button (❚❚) to pause plotting, then the GNSS point cannot be plotted.

5 If you select the **Stop** button, the Plot Stop pop-up window appears, then tap **Yes**.

6 Tap **Yes** when the Save pop-up window appears and save the logging file to your USB.

Viewing the logging data

To view the logging data

1 Load the saved logging file using the **Load** () icon on the side bar. Make sure the file extension is .gomv.

2 Based on the judgement between pass or fail for 2nd sync error, the green (pass) or red (fail) color applies.

3 When you select a point on the map, a marker appears and the Information window appears on the right panel.



NOTE
When you load the result file, a pop-up message asking whether you want to load data only or data with map appears. If the current screen does not display all the loaded data, the screen mode will be automatically changed to Full.

Importing cellsite DB

You can import the site DB by creating the 5G site information form.

To import cellsite DB

1 Create the 5G site information with an excel file as below.

2 Input the two mandatory fields: **Lat (DecDeg)** and **Long (DecDeg)**.

3 Input the **Azimuth** field if you want to check the direction of antenna.

4 Make sure to save the file as (Comma delimited) (*.csv).

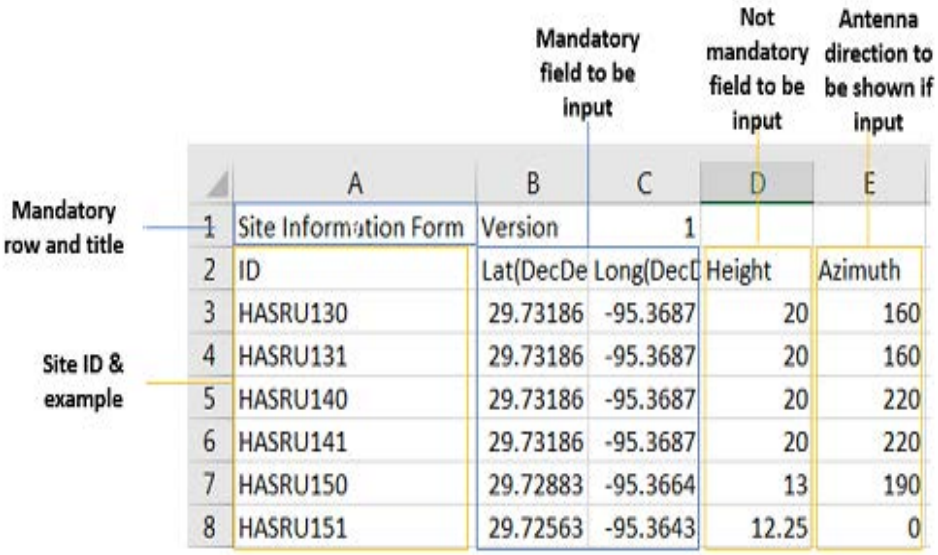
5 Copy the file to the USB memory stick and insert it to the **USB A** or **USB B** port of the instrument.

6 Tap the **Load** () icon on the side bar.

7 Import the saved file.
Once the file is loaded, the following cellsite information appears with an icon.

Figure 166 shows an example of an importing cellsite DB.

Figure 166 Importing Cellsite DB



Online route map

The following sections describe how to perform online route map.

Online OTA route map

Online OTA route map enables you to download a map automatically when connected to the network then you can continue route map measurement using the downloaded map whether you are online or offline. It traces the power level of the NR signal's beam and sync and time error corresponding to a particular time and geographical position and presents it in a geographical map as a measurement point. All the collected measurements can be exported for post-processing purposes.

Figure 167 shows an example of 5G NR Online OTA route map measurement.

Figure 167 Online OTA route map with 5G NR Signal Analyzer



Controlling a map

To control a map

See the following table to control a map.

Table 89 Map control icons

Icon	Description
	Tap to go to your current location on the map. Once tapped, the purple icon appears on the map, indicating your current location.
	Tap to zoom in the map.
	Tap to zoom out the map.

The left-most cell-site icon is activated when you import the cell-site information file.

To set measurement setup

Before starting the Online OTA Route Map measurement, you need to set Spectrum measurements displayed on the quick access and display tab. See “Configuring spectrum measurements” on page 25 for more information.

1. Connect a GNSS receiver to your instrument for outdoor mapping.
2. Tap the **Setup** ( ) icon on the side bar.
3. Tap to switch **Plot Item** to **P-SS RSRP**, **S-SS RSRP**, **S-SS RSRQ**, **S-SS SINR**, or **PCI Dominance**.
4. Tap **Bandwidth/SSB SCS** and select the Setting in the pop-up window based on your need. SSB is an abbreviation for Synchronization Signal Block or SS Block and it refers to Synchronization PBCH block since the synchronization signal and PBCH channel are packed as a single block that always moves together. SSB should be detected first in 5G NR frame. See Table 90 below for the setting criteria based on the operating frequency.
5. Tap **Sync Raster Offset** to set the sync raster resolution to 180 kHz (FR1) or to 720 kHz (FR2) for carrier frequency center using the on-screen keyboard. See Table 91 below for the sync raster offset range per SSB SCS and sync raster resolution.
6. Tap **Sync SCS Offset** to fine-tune the offset using the SCS. See Table 92 below for the sync raster offset range per SSB SCS and sync raster resolution.

7 Tap **L** to set the maximum number of SS-PBCH blocks within a single SS burst set (A set of SS being transmitted in 5 ms window of SS transmission) among 4, 8 and 64. Refer to the selection criteria based on the table in **Step 4**.

8 Tap **SSB Auto Search Mode** and do the following steps:

a Tap **Auto Preamp/Atten** and switch **SSB Auto Search** to **Start** to set preamp and attenuation automatically.

b Tap **Manual** and switch **SSB Auto Search** to **Start** for manually setting based on your need.

9 Tap **SSB Auto Search** between **Start** and **Stop**.

a **Start**: to search SCS, type, and the number of SSB automatically. Once Start is selected, the progress bar appears. If it fails to perform the auto search, a fail message appears and the SSB switches to Manual.

b **Stop**: to set the SSB periodicity based on the base station.

10 Tap **SSB Periodicity** and select the options from **5 ms**, **10 ms**, **20 ms**, **40 ms**, **80 ms**, 1**60 ms**. The SS burst period (SSB periodicity) is defined by each base station and network configurable. 20 ms is the default for the initial cell selection.

11 Tap **SSB Center Frequency** and input the value using the on-screen keyboard.

12 Tap **GSCN** and input the value using the on-screen keyboard.

13 Tap to switch **PCI (Physical Cell ID)** to **Manual** or **Auto**.

14 Tap **PCI** and input a value from 0 to 1007 using the on-screen keyboard. The PCI switches to **Manual**.

15 Tap **Time Error Window** and select from the choices: **SSB Periodicity**, **Frame**, or **Half Frame**.

If you select Frame, the range is -5 ms to +5 ms based on 10 ms specified by 3GPP and if you select Half Frame, the range is -2.5 ms to +2.5 ms based on 5 ms specified by 3GPP

16 Tap **Miscellaneous** > **Symbol Phase Comp** and select from the following choices: **Auto**, **Manual**, or **Off**.

Symbol Phase Compensation is used to compensate for phase differences between symbols caused by upconversion. Users do not always use the instrument based on RF frequency. In this case, you can set it to Manual or Off.

– **Auto**: Setting radio frequency to center frequency
– **Manual**: Setting radio frequency as required
– **Off**: Setting radio frequency to 0

Table 90 Setup per operating frequency

Operating frequency	L	Case	SCS	Slots in a burst period
< 3 GHz (FR1)	4	A {2,8} +14*n	15 kHz	5 (1 ms)

Table 90 Setup per operating frequency

Operating frequency	L	Case	SCS	Slots in a burst period
< 3 GHz (FR1)	4	B {4,8,16,20} +28*n	30 kHz	10 (0.5 ms)
< 3 GHz (FR1) For un-paired spectrum operation: < 1.88 GHz	4	C {2,8} +14*n	30 kHz	10 (0.5 ms)
3 to 6 GHz (FR1)	8	A {2,8} +14*n	15 kHz	5 (1 ms)
3 to 6 GHz (FR1)	8	B {4,8,16,20} +28*n	30 kHz	10 (0.5 ms)
3 to 6 GHz (FR1) For un-paired spectrum operation: 1.88 to 6 GHz	8	C {2,8} +14*n	30 kHz	10 (0.5 ms)
> 6 GHz (FR2)	64	D {4,8,16,20} +28*n	120 kHz	40 (0.125 ms)
> 6 GHz (FR2)	64	E {8,12,16,20,32,36,40,44} +56*n	240 kHz	80 (62.5 ms)

Table 91 Sync raster offset range per SSB SCS and sync raster resolution

SSB SCS (kHz)	Sync Raster Resolution (kHz)	Sync Raster Offset Range	SSB Frequency = Center frequency
15	180	0 to 250	125
30	180	0 to 506	253
120	720	0 to 92	46
240	720	0 to 48	24

Table 92 Sync SCS offset range per SSB SCS and sync SCS resolution

SSB SCS (kHz)	Sync Raster Resolution (kHz)	Sync Raster Offset Range	SSB Frequency = Center Frequency
15	15	0 to 11	0
30	30	0 to 5	0
120	120	0 to 5	0
240	240	0 to 2	0

To set limit

You can set the thresholds for the two different color indicators, red and blue. The maximum value is the Limit for **Excellent**, and the minimum value is the Limit for **Poor**. See below to check the plot point color based on the Legend Color Table.

1 Tap the rectangle with value before color legend bar on the right panel.

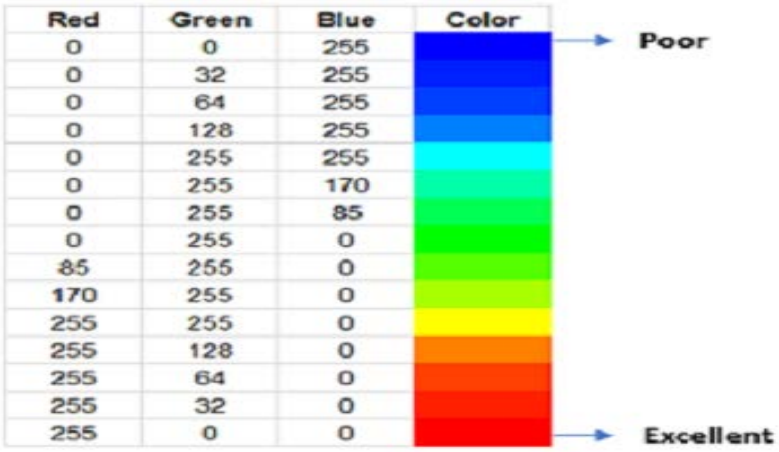
2 Set a value for **Poor** (minimum value) using the on-screen keyboard.

3 Tap the rectangle with value after color legend bar on the right panel.

4 Set a value for **Excellent** (maximum value) using the on-screen keyboard.

Figure 168 shows a legend color table.

Figure 168 Legend color table



Logging data

To log data

1 Follow **steps 1 to 3** in Setting measure setup.

2 Tap the **Testing** button on the right panel of the map to start plotting on the map. When you select a point on the map, a marker appears and the Information window appears on the right panel.

If you select the Plot Item to PCI Dominance, you will see the plotting circled dot and its edge with PCI legend color based on its received power and PCI Dominance color based on the threshold you have set respectively. If PCI Dominance is lower than the value you have set, it judges fail showing red in the edge. Otherwise, it judges pass showing green in the edge.

3 Tap the **Stop** (■) button to stop plotting.

4 Tap the **Pause** button (❚❚) to pause plotting, then the GNSS point cannot be plotted.

5 If you select the **Stop** button, the Plot Stop pop-up window appears, then tap **Yes**.

6 Tap **Yes** when the Save pop-up window appears and save the logging file to your USB.

If you go to **Limit** > **PCI Dominance** and set it, you can judge pass (green) or fail (red) with colors based on the limit you have set. For example, if it becomes smaller than the threshold, the fail indicator (red) can be identified in the PCI column of the Information window and the top right corner of the instrument at the same time.

Viewing the logging data

To view the logging data

1 Load the saved logging file using the **Load** ( ) icon on the side bar. Make sure the file extension is .orr.

2 If the **PCI** is set to **Auto**, the point on the map appears with a color representing the largest **S-SS-RSRP** value. When you select a point on the map, a marker appears and the Information window appears on the right panel.

3 Set the **PCI** to **Manual** and tap the **Select** button.

The Select PCI window appears.

4 Select PCI on the left and then the corresponding Beam Index appeared on the right.

5 Tap the **Apply** button.

The point color of the map changes to the corresponding SS-RSRP value, and if there is no detected Beam Index, the point will be hidden.

Importing cellsite DB

You can import the site DB by creating the 5G site information form.

To import cellsite DB

1 Create the 5G site information with an excel file as below.

2 Input the two mandatory fields: **Lat (DecDeg)** and **Long (DecDeg)**.

3 Input the **Azimuth** field if you want to check the direction of antenna.

4 Make sure to save the file as (Comma delimited) (*.csv).

5 Copy the file to the USB memory stick and insert it to the **USB A** or **USB B** port of the instrument.

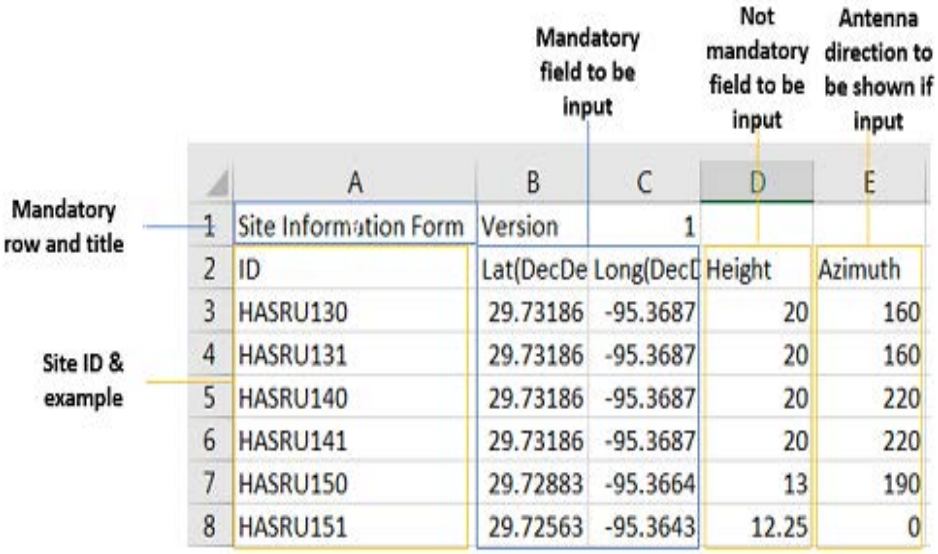
6 Tap the **Load** ( ) icon on the side bar.

7 Import the saved file.

Once the file is loaded, the following cellsite information appears with an icon.

Figure 169 shows an example of an importing cellsite DB.

Figure 169 Importing Cellsite DB



NOTE
If you have unsaved measurement data (map) and start measuring by tapping the Testing button or by tapping another measurement mode, a pop-up window will appear asking whether you will restore the unsaved data or not.

Creating a map

You can create a map online and continue conducting a route map analysis using the created map even when there is no Ethernet connection.

1 Tap the **Map Creator** button on the right panel at the bottom.

2 Tap the **Search** box and input the location using the on-screen keyboard and select one of the options as required.

3 Tap the **Zoom Level** box to capture the map with corresponding zoom level.

4 Tap the **Capture** button to start capturing the map.

Once the map is captured, the capturing completed pop-up will appear.

5 Select between the two options: Save in the system or Save as file.

6 Tap the **Done** button.

NOTE
If you have unsaved measurement data (map) and start measuring by tapping the Testing button or by tapping another measurement mode, a pop-up window will appear asking whether you will restore the unsaved data or not.

Online sync route map

Online sync route map enables you to download a map automatically when connected to the network then you can continue route map measurement using the downloaded map whether you are online or offline. It traces the power level of the NR signal's beam and sync and time error corresponding to a particular time and geographical position and presents it in a geographical map as a measurement point. All the collected measurements can be exported for post-processing purposes.

Figure 170 shows an example of 5G NR online sync route map measurement.

Figure 170 Online sync route map with 5G NR Signal Analyzer



Controlling a map

To control a map

See the following table to control a map.

Table 93 Map control icons

Icon	Description
	Tap to go to your current location on the map. Once tapped, the purple icon appears on the map, indicating your current location.
	Tap to zoom in the map.
	Tap to zoom out the map.

The left-most cell-site icon is activated when you import the cell-site information file.

To set measurement setup

Before starting the Online OTA Route Map measurement, you need to set Spectrum measurements displayed on the quick access and display tab. See “Configuring spectrum measurements” on page 25 for more information.

1. Connect a GNSS receiver to your instrument for outdoor mapping.
2. Tap the **Setup** ( ) icon on the side bar.
3. Tap to switch **Plot Item** to **P-SS RSRP**, **S-SS RSRP**, **S-SS RSRQ** or **S-SS SINR**.
4. Tap **Bandwidth/SSB SCS** and select the Setting in the pop-up window based on your need. SSB is an abbreviation for Synchronization Signal Block or SS Block and it refers to Synchronization PBCH block since the synchronization signal and PBCH channel are packed as a single block that always moves together. SSB should be detected first in 5G NR frame. See Table 94 below for the setting criteria based on the operating frequency.
5. Tap **Sync Raster Offset** to set the sync raster resolution to 180 kHz (FR1) or to 720 kHz (FR2) for carrier frequency center using the on-screen keyboard. See Table 95 below for the sync raster offset range per SSB SCS and sync raster resolution.
6. Tap **Sync SCS Offset** to fine-tune the offset using the SCS. See Table 96 below for the sync raster offset range per SSB SCS and sync raster resolution.

7 Tap **L** to set the maximum number of SS-PBCH blocks within a single SS burst set (A set of SS being transmitted in 5 ms window of SS transmission) among 4, 8 and 64. Refer to the selection criteria based on the table in **Step 4**.

8 Tap **SSB Auto Search Mode** and do the following steps:

a Tap **Auto Preamp/Atten** and switch **SSB Auto Search** to **Start** to set preamp and attenuation automatically.

b Tap **Manual** and switch **SSB Auto Search** to **Start** for manually setting based on your need.

9 Tap **SSB Auto Search** between **Start** and **Stop**.

a **Start**: to search SCS, type, and the number of SSB automatically. Once Start is selected, the progress bar appears. If it fails to perform the auto search, a fail message appears and the SSB switches to Manual.

b **Stop**: to set the SSB periodicity based on the base station.

10 Tap **SSB Periodicity** and select the options from **5 ms**, **10 ms**, **20 ms**, **40 ms**, **80 ms**, 1**60 ms**. The SS burst period (SSB periodicity) is defined by each base station and network configurable. 20 ms is the default for the initial cell selection.

11 Tap **SSB Center Frequency** and input the value using the on-screen keyboard.

12 Tap **GSCN** and input the value using the on-screen keyboard.

13 Tap to switch **PCI (Physical Cell ID)** to **Manual** or **Auto**.

14 Tap **PCI** and input a value from 0 to 1007 using the on-screen keyboard. The PCI switches to **Manual**.

15 Tap **Time Error Window** and select from the choices: **SSB Periodicity**, **Frame**, or **Half Frame**.

If you select Frame, the range is -5 ms to +5 ms based on 10 ms specified by 3GPP and if you select Half Frame, the range is -2.5 ms to +2.5 ms based on 5 ms specified by 3GPP

16 Tap **Miscellaneous** > **Symbol Phase Comp** and select from the following choices: **Auto**, **Manual**, or **Off**.

Symbol Phase Compensation is used to compensate for phase differences between symbols caused by upconversion. Users do not always use the instrument based on RF frequency. In this case, you can set it to Manual or Off.

– **Auto**: Setting radio frequency to center frequency
– **Manual**: Setting radio frequency as required
– **Off**: Setting radio frequency to 0

Table 94 Setup per operating frequency

Operating frequency	L	Case	SCS	Slots in a burst period
< 3 GHz (FR1)	4	A {2,8} +14*n	15 kHz	5 (1 ms)

Table 94 Setup per operating frequency

Operating frequency	L	Case	SCS	Slots in a burst period
< 3 GHz (FR1)	4	B {4,8,16,20} +28*n	30 kHz	10 (0.5 ms)
< 3 GHz (FR1) For un-paired spectrum operation: < 1.88 GHz	4	C {2,8} +14*n	30 kHz	10 (0.5 ms)
3 to 6 GHz (FR1)	8	A {2,8} +14*n	15 kHz	5 (1 ms)
3 to 6 GHz (FR1)	8	B {4,8,16,20} +28*n	30 kHz	10 (0.5 ms)
3 to 6 GHz (FR1) For un-paired spectrum operation: 1.88 to 6 GHz	8	C {2,8} +14*n	30 kHz	10 (0.5 ms)
> 6 GHz (FR2)	64	D {4,8,16,20} +28*n	120 kHz	40 (0.125 ms)
> 6 GHz (FR2)	64	E {8,12,16,20,32,36,40,44} +56*n	240 kHz	80 (62.5 ms)

Table 95 Sync raster offset range per SSB SCS and sync raster resolution

SSB SCS (kHz)	Sync Raster Resolution (kHz)	Sync Raster Offset Range	SSB Frequency = Center frequency
15	180	0 to 250	125
30	180	0 to 506	253
120	720	0 to 92	46
240	720	0 to 48	24

Table 96 Sync SCS offset range per SSB SCS and sync SCS resolution

SSB SCS (kHz)	Sync Raster Resolution (kHz)	Sync Raster Offset Range	SSB Frequency = Center Frequency
15	15	0 to 11	0
30	30	0 to 5	0
120	120	0 to 5	0
240	240	0 to 2	0

To set limit

You can set the thresholds for the two different color indicators, red and green. When there is no interference signal, the color is displayed as green (pass). Otherwise, it is displayed as red (fail).

1 Tap **Menu** > **Limit**.

2 Tap **Sync Error**.

   a Tap to switch **Test Limits** to **On** or **Off**.

   b Tap **Limit** and input the value using the on-screen keyboard. The default value is 3 µs.

3 Tap **Time Error**.

   a Tap to switch **Test Limits** to **On** or **Off**.

   b Tap **High Limit** or **Low Limit** and input the value using the on-screen keyboard.

NOTE
If you set the Time Error in Limit menu, you will check the Time Error values that you have set with green (pass) or fail (red) on the measurement screen.

Logging data

To log data

1 Follow **steps 1 to 3** in Setting measure setup.

2 Tap the **Testing** button on the right panel of the map to start plotting on the map. When you select a point on the map, a marker appears and the Information window appears on the right panel.

3 Tap the **Stop** (■) button to stop plotting.

4 Tap the **Pause** button (❚❚) to pause plotting, then the GNSS point cannot be plotted.

5 If you select the **Stop** button, the Plot Stop pop-up window appears, then tap **Yes**.

6 Tap **Yes** when the Save pop-up window appears and save the logging file to your USB.

Viewing the logging data

To view the logging data

1 Load the saved logging file using the **Load** ( ) icon on the side bar. Make sure the file extension is .orr.

2 If the **PCI** is set to **Auto**, the point on the map appears with a color representing the largest **S-SS-RSRP** value. When you select a point on the map, a marker appears and the Information window appears on the right panel.

3 Set the **PCI** to **Manual** and tap the **Select** button.

The Select PCI window appears.

4 Select PCI on the left and then the corresponding Beam Index appeared on the right.

5 Tap the **Apply** button.

The point color of the map changes to the corresponding SS-RSRP value, and if there is no detected Beam Index, the point will be hidden.

Importing cellsite DB

You can import the site DB by creating the 5G site information form.

To import cellsite DB

1 Create the 5G site information with an excel file as below.

2 Input the two mandatory fields: **Lat (DecDeg)** and **Long (DecDeg)**.

3 Input the **Azimuth** field if you want to check the direction of antenna.

4 Make sure to save the file as (Comma delimited) (*.csv).

5 Copy the file to the USB memory stick and insert it to the **USB A** or **USB B** port of the instrument.

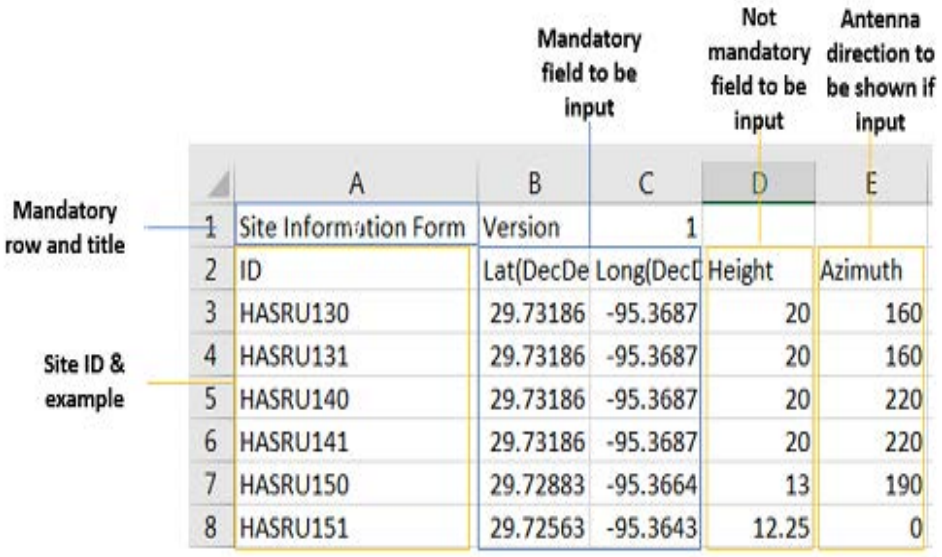
6 Tap the **Load** ( ) icon on the side bar.

7 Import the saved file.

Once the file is loaded, the following cellsite information appears with an icon.

Figure 171 shows an example of an importing cellsite DB.

Figure 171 Importing Cellsite DB



Creating a map

You can create a map online and continue conducting a route map analysis using the created map even when there is no Ethernet connection.

1 Tap the **Map Creator** button on the right panel at the bottom.

2 Tap the **Search** box and input the location using the on-screen keyboard and select one of the options as required.

3 Tap the **Zoom Level** box to capture the map with corresponding zoom level.

4 Tap the **Capture** button to start capturing the map.

Once the map is captured, the capturing completed pop-up will appear.

5 Select between the two options: Save in the system or Save as file.

6 Tap the **Done** button.

NOTE
If you have unsaved measurement data (map) and start measuring by tapping the Testing button or by tapping another measurement mode, a pop-up window will appear asking whether you will restore the unsaved data or not.

PDSCH analysis

The following sections describe how to perform PDSCH measurements.

PDSCH constellation

In 5G NR, PDSCH is defined as the physical downlink channel that carries user data. DM-RS and PT-RS are the reference signals associated with PDSCH. These signals are generated within the PDSCH allocation. DM-RS is used for channel estimation as part of coherent demodulation of PDSCH. ONA-800 enables PDSCH EVM setting and shows its demodulated data as constellation.

Setting measure setup

After configuring the spectrum measurement in "Configuring spectrum measurements" on page 25, you can set the measure setup to continue your measurement. The measurement settings can be saved and recalled as a file by selecting File Type as Setup and load the file onto the instrument using the **Save/Load** icons on the side bar.

To set measure setup

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap **SSB Auto Search Mode** and do the following steps:

- **a** Tap **Auto Preamp/Atten** and switch **SSB Auto Search** to **Start** to set preamp and attenuation automatically.
- **b** Tap **Manual** and switch **SSB Auto Search** to **Start** for manually setting based on your need.

3 Tap **SSB Auto Search** between **Start** and **Stop**.

- **a** **Start**: to search SCS, type, and the number of SSB automatically. Once Start is selected, the progress bar appears. If it fails to perform the auto search, a fail message appears and the SSB switches to Manual.
- **b** **Stop**: to set the SSB periodicity based on the base station.

NOTE

You can go ahead with SSB Auto Search first to make your measurement/setting easier and faster. If the auto search is not successful, you can follow the procedure below for manual search.

4 Tap **Bandwidth/SSB SCS** and select the Setting in the pop-up window based on your need. SSB is an abbreviation for Synchronization Signal Block or SS Block and it refers to Synchronization PBCH block since the synchronization signal and PBCH channel are packed as a single block that always moves together. SSB should be detected first in 5G NR frame. See Table 82 below for the setting criteria based on the operating frequency.

5 Tap **Sync Raster Offset** to set the sync raster resolution to 180 kHz (FR1) or to 720 kHz (FR2) for carrier frequency center using the on-screen keyboard. See Table 83 below for the sync raster offset range per SSB SCS and sync raster resolution.

6 Tap **Sync SCS Offset** to fine-tune the offset using the SCS. See Table 84 below for the sync raster offset range per SSB SCS and sync raster resolution.

7 Tap **SSB Center Frequency** and input the value using the on-screen keyboard.

8 Tap **GSCN** and input the value using the on-screen keyboard.

9 Tap **L** to set the maximum number of SS-PBCH blocks within a single SS burst set (A set of SS being transmitted in 5 ms window of SS transmission) among 4, 8 and 64. Refer to the selection criteria based on the table in **Step 4**.

10 Tap **SSB Periodicity** and select the options from **5 ms**, **10 ms**, **20 ms**, **40 ms**, **80 ms**, **160 ms**. The SS burst period (SSB periodicity) is defined by each base station and network configurable. 20 ms is the default for the initial cell selection.

11 Tap to switch **PCI (Physical Cell ID)** to **Manual** or **Auto**.

12 Tap **PCI** and input a value from 0 to 1007 using the on-screen keyboard. The PCI switches to **Manual**.

13 Tap **PDSCH Configuration** or the **Configuration** icon on the screen to set PDSCH EVM in the PDSCH VEM Setting window appeared.

a Tap **Data** and select **Data Subcarrier Spacing** from the following options: **15 kHz**, **30 kHz**, **60 kHz**, or **120 kHz**.

- **Start Symbol** and **Number of RBs** are automatically changed based on the Data Subcarrier Spacing selection.

b Tap **Grid** to set the resource grid that BWP to be assigned per each numerology (SSB SCS and Data SCS).

- In the formula, a wider numerology between SSB SCS and Data SCS represents μ0 and narrower numerology represents μ.
- Based on the input numerology and bandwidth you have set, input **Start Grid** and **Size Grid** using the on-screen keyboard.

c Tap **Bandwidth Part** to set the range that to be assigned BWP for the input Data SCS.

- In the formula, input Start BWP and Size BWP value using the on-screen keyboard.

d Back to **Data**, do the following steps:

- Select **Slot Number** for analyzing PDSCH EVM from 1 to 19 using the on-screen keyboard.
- Tap **Offset RB** and **Number of RBs** to set resource blocks within the range of BWP using the on-screen keyboard.



NOTE

You need to input values for Offset RB and Number of RBs considering the range that actual data should be allocated. As the input values need to be within the range of BWP, if you assign data from BWP start RB, the Offset RB should be 0.

- Tap **Start Symbol** and **Number of Symbols** set from 10 to 13 using the on-screen keyboard.
- Tap **Modulation type** and select the options from: **QPSK**, **16 QAM**, **64 QAM**, or **256QAM**

e Tap **PDSCH DM-RS** and do the following steps:

PDSCH DMRS is a special type of physical layer signal which functions as a reference signal for decoding PDSCH in 5G NR.

- Select NSCID between **0** or **1**. The quantity NSCID ϵ {0,1} is given by the DM-RS sequence initialization field, if DCI is associated with the PDSCH transmission, 1 is selected and, otherwise 0 is used.
- Select Sequence Generation between **Scrambling ID** and **PCI**. Set Scrambling ID for configuring with the higher-layer parameter data-scrambling identity or PCI from the physical cell ID and input the required value using the on-screen keyboard.
- Select between **Mapping Type A** and **B**. Set Mapping Type A to start only at symbol 2 or 3 within a slot, meaning that SLIV (Start and Length Indicator for the time domain allocation for PDSCH) that starts from symbol 4 or higher cannot use this type of DMRS and Mapping Type B to start always at the first symbols of scheduled SLIV.
- Select between **Configuration Type 1** and **2**. In Configuration type 1, the minimum resource element group in frequency domain is one RE. In Configuration type 2, the minimum resource element group in frequency domain is two consecutive REs.
- Select **DM-RS Type A Position** between **pos2** and **pos3** to set the PDSCH DM-RS position for mapping type A.
- Select **DM-RS Additional Position** to set the Position for additional DM-RS in DL.
- Select **DM-RS Duration** between **Single** and **Double**. Set Single when single-symbol DM-RS is used or Double when double (two) symbols are used.
- Set **Antenna Port** to be used as reference for initial synchronization for DM-RS. Usable antenna port is determined by Configuration Type and DM-RS Duration.
- Set **Power Boosting** in dB (relative) of the DMRS associated with the PDSCH physical channel relative to PDSCH power.



NOTE
You need to make sure PDSCH DM-RS setting is accurately done to get the right analysis data. For more details on setting, you can find it in the following location and check the latest 38.211 documentation:

https://portal.3gpp.org/desktopmodules/Specifications/SpecificationDetails.aspx?specificationId=3213.

f Tap to switch **PT-RS** to **On** or **Off** and when On, do the following steps:

- Select KPT-RS to set the PTRS period in subcarrier in the frequency domain between **2** and **4**.
- Select LPT-RS to set the start PTRS symbol in time domain from the options: **1**, **2**, and **4**.
- Select **Resource Element Offset** to set PT-RS resource element offset from **Offset00**, **Offset01**, **Offset10**, and **Offset11**.
- Select NRNTI to set the physical channel.

g Tap **Summary** to check all the parameters are accurately set. Do the

following steps:

- **PDSCH Preview** displays resources that are assigned PDSCH within BWP (X axis: symbol, Y axis: subcarrier).

h Tap the **Done** button if you finish all settings.

14 Tap **Miscellaneous** > **Symbol Phase Comp** and select from the following choices: **Auto**, **Manual**, or **Off**.

Symbol Phase Compensation is used to compensate for phase differences between symbols caused by upconversion. Users do not always use the instrument based on RF frequency. In this case, you can set it to Manual or Off.

– **Auto**: Setting radio frequency to center frequency

– **Manual**: Setting radio frequency as required

– **Off**: Setting radio frequency to 0

To set limit

1 Tap **Menu > Limit**.

2 Tap the test items and set the limits depending on your selected measurement mode:

To set the limit for	Select and set
Frequency Error	Test limits On/Off, High/Low Limit
Time Error	Test limits On/Off, High/Low Limit
Channel Power	Test limits On/Off, High/Low Limit
PDSCH EVM	Test limits On/Off, High Limit for QPSK/16 QAM/64 QAM/ 256 QAM
Data EVM RMS	Test limits On/Off, High Limit
Data EVM Peak	Test limits On/Off, High Limit

3 *Optional*: Tap the **Save** icon on the side bar and select the save option from the choices available for your measurement.

Table 97 Setup per operating frequency

Operating frequency	L	Case	SCS	Slots in a burst period
< 3 GHz (FR1)	4	A {2,8} +14*n	15 kHz	5 (1 ms)
< 3 GHz (FR1)	4	B {4,8,16,20} +28*n	30 kHz	10 (0.5 ms)

Table 97 Setup per operating frequency

Operating frequency	L	Case	SCS	Slots in a burst period
< 3 GHz (FR1) For un-paired spectrum operation: < 1.88 GHz	4	C {2,8} +14*n	30 kHz	10 (0.5 ms)
3 to 6 GHz (FR1)	8	A {2,8} +14*n	15 kHz	5 (1 ms)
3 to 6 GHz (FR1)	8	B {4,8,16,20} +28*n	30 kHz	10 (0.5 ms)
3 to 6 GHz (FR1) For un-paired spectrum operation: 1.88 to 6 GHz	8	C {2,8} +14*n	30 kHz	10 (0.5 ms)
> 6 GHz (FR2)	64	D {4,8,16,20} +28*n	120 kHz	40 (0.125 ms)
> 6 GHz (FR2)	64	E {8,12,16,20,32,36,40,44} +56*n	240 kHz	80 (62.5 ms)

Table 98 Sync raster offset range per SSB SCS and sync raster resolution

SSB SCS (kHz)	Sync Raster Resolution (kHz)	Sync Raster Offset Range	SSB Frequency = Center frequency
15	180	0 to 250	125
30	180	0 to 506	253
120	720	0 to 92	46
240	720	0 to 48	24

Table 99 Sync SCS offset range per SSB SCS and sync SCS resolution

SSB SCS (kHz)	Sync Raster Resolution (kHz)	Sync Raster Offset Range	SSB Frequency = Center Frequency
15	15	0 to 11	0
30	30	0 to 5	0
120	120	0 to 5	0
240	240	0 to 2	0

Figure 172 shows an example of PDSCH Constellation measurement.

Figure 172 5G NR PDSCH Constellation measurement

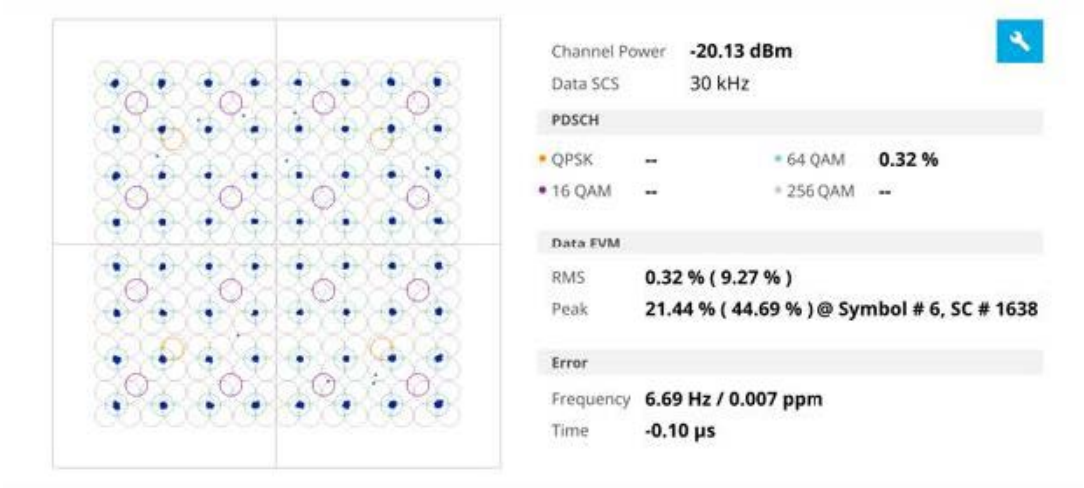


Figure 173 shows an example of PDSCH EVM setting summary.

Figure 173 5G NR PDSCH EVM setting summary



NOTE

You can tap the **Enlarge** icon on the top right side of the screen to zoom in the PDSCH Preview screen.

EVM vs subcarrier

5G NR EVM vs Subcarrier provides bar chart consisting of the average for resource elements with assigned PDSCH in each RB (12 subcarriers x 14 symbols).

Setting measure setup

After configuring the spectrum measurement in “Configuring spectrum measurements” on page 25, you can set the measure setup to continue your measurement. The measurement settings can be saved and recalled as a file by selecting File Type as Setup and load the file onto the instrument using the **Save/Load** icons on the side bar.

To set measure setup

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap **SSB Auto Search Mode** and do the following steps:

- **a** Tap **Auto Preamp/Atten** and switch **SSB Auto Search** to **Start** to set preamp and attenuation automatically.
- **b** Tap **Manual** and switch **SSB Auto Search** to **Start** for manually setting based on your need.

3 Tap **SSB Auto Search** between **Start** and **Stop**.

- **a** **Start**: to search SCS, type, and the number of SSB automatically. Once Start is selected, the progress bar appears. If it fails to perform the auto search, a fail message appears and the SSB switches to Manual.
- **b** **Stop**: to set the SSB periodicity based on the base station.

NOTE

You can go ahead with SSB Auto Search first to make your measurement/setting easier and faster. If the auto search is not successful, you can follow the procedure below for manual search.

4 Tap **Bandwidth/SSB SCS** and select the Setting in the pop-up window based on your need. SSB is an abbreviation for Synchronization Signal Block or SS Block and it refers to Synchronization PBCH block since the synchronization signal and PBCH channel are packed as a single block that always moves together. SSB should be detected first in 5G NR frame. See Table 82 below for the setting criteria based on the operating frequency.

5 Tap **Sync Raster Offset** to set the sync raster resolution to 180 kHz (FR1) or to 720 kHz (FR2) for carrier frequency center using the on-screen keyboard. See Table 83 below for the sync raster offset range per SSB SCS and sync raster resolution.

6 Tap **Sync SCS Offset** to fine-tune the offset using the SCS. See Table 84 below for the sync raster offset range per SSB SCS and sync raster resolution.

7 Tap **SSB Center Frequency** and input the value using the on-screen keyboard.

8 Tap **GSCN** and input the value using the on-screen keyboard.

9 Tap **L** to set the maximum number of SS-PBCH blocks within a single SS burst set (A set of SS being transmitted in 5 ms window of SS transmission) among 4, 8 and 64. Refer to the selection criteria based on the table in **Step 4**.

10 Tap **SSB Periodicity** and select the options from **5 ms**, **10 ms**, **20 ms**, **40 ms**, **80 ms**, **160 ms**. The SS burst period (SSB periodicity) is defined by each base station and network configurable. 20 ms is the default for the initial cell selection.

11 Tap to switch **PCI (Physical Cell ID)** to **Manual** or **Auto**.

12 Tap **PCI** and input a value from 0 to 1007 using the on-screen keyboard. The PCI switches to **Manual**.

13 Tap **PDSCH Configuration** or the **Configuration** icon on the screen to set PDSCH EVM in the PDSCH VEM Setting window appeared.

a Tap **Data** and select **Data Subcarrier Spacing** from the following options: **15 kHz**, **30 kHz**, **60 kHz**, or **120 kHz**.

- **Start Symbol** and **Number of RBs** are automatically changed based on the Data Subcarrier Spacing selection.

b Tap **Grid** to set the resource grid that BWP to be assigned per each numerology (SSB SCS and Data SCS).

- In the formula, a wider numerology between SSB SCS and Data SCS represents μ0 and narrower numerology represents μ.
- Based on the input numerology and bandwidth you have set, input **Start Grid** and **Size Grid** using the on-screen keyboard.

c Tap **Bandwidth Part** to set the range that to be assigned BWP for the input Data SCS.

- In the formula, input Start BWP and Size BWP value using the on-screen keyboard.

d Back to **Data**, do the following steps:

- Select **Slot Number** for analyzing PDSCH EVM from 1 to 19 using the on-screen keyboard.
- Tap **Offset RB** and **Number of RBs** to set resource blocks within the range of BWP using the on-screen keyboard.



NOTE

You need to input values for Offset RB and Number of RBs considering the range that actual data should be allocated. As the input values need to be within the range of BWP, if you assign data from BWP start RB, the Offset RB should be 0.

- Tap **Start Symbol** and **Number of Symbols** set from 10 to 13 using the on-screen keyboard.
- Tap **Modulation type** and select the options from: **QPSK**, **16 QAM**, **64 QAM**, or **256QAM**

e Tap **PDSCH DM-RS** and do the following steps:

PDSCH DMRS is a special type of physical layer signal which functions as a reference signal for decoding PDSCH in 5G NR.

- Select NSCID between **0** or **1**. The quantity NSCID ϵ {0,1} is given by the DM-RS sequence initialization field, if DCI is associated with the PDSCH transmission, 1 is selected and, otherwise 0 is used.
- Select Sequence Generation between **Scrambling ID** and **PCI**. Set Scrambling ID for configuring with the higher-layer parameter data-scrambling identity or PCI from the physical cell ID and input the required value using the on-screen keyboard.
- Select between **Mapping Type A** and **B**. Set Mapping Type A to start only at symbol 2 or 3 within a slot, meaning that SLIV (Start and Length Indicator for the time domain allocation for PDSCH) that starts from symbol 4 or higher cannot use this type of DMRS and Mapping Type B to start always at the first symbols of scheduled SLIV.
- Select between **Configuration Type 1** and **2**. In Configuration type 1, the minimum resource element group in frequency domain is one RE. In Configuration type 2, the minimum resource element group in frequency domain is two consecutive REs.
- Select **DM-RS Type A Position** between **pos2** and **pos3** to set the PDSCH DM-RS position for mapping type A.
- Select **DM-RS Additional Position** to set the Position for additional DM-RS in DL.
- Select **DM-RS Duration** between **Single** and **Double**. Set Single when single-symbol DM-RS is used or Double when double (two) symbols are used.
- Set **Antenna Port** to be used as reference for initial synchronization for DM-RS. Usable antenna port is determined by Configuration Type and DM-RS Duration.
- Set **Power Boosting** in dB (relative) of the DMRS associated with the PDSCH physical channel relative to PDSCH power.

NOTE
You need to make sure PDSCH DM-RS setting is accurately done to get the right analysis data. For more details on setting, you can find it in the following location and check the latest 38.211 documentation:

https://portal.3gpp.org/desktopmodules/Specifications/SpecificationDetails.aspx?specificationId=3213.

f Tap to switch **PT-RS** to **On** or **Off** and when On, do the following steps:

- Select KPT-RS to set the PTRS period in subcarrier in the frequency domain between **2** and **4**.
- Select LPT-RS to set the start PTRS symbol in time domain from the options: **1**, **2**, and **4**.
- Select **Resource Element Offset** to set PT-RS resource element offset from **Offset00**, **Offset01**, **Offset10**, and **Offset11**.
- Select NRNTI to set the physical channel.

g Tap **Summary** to check all the parameters are accurately set. Do the

following steps:

- **PDSCH Preview** displays resources that are assigned PDSCH within BWP (X axis: symbol, Y axis: subcarrier).

h Tap the **Done** button if you finish all settings.

14 Tap **Miscellaneous** > **Symbol Phase Comp** and select from the following choices: **Auto**, **Manual**, or **Off**.

Symbol Phase Compensation is used to compensate for phase differences between symbols caused by upconversion. Users do not always use the instrument based on RF frequency. In this case, you can set it to Manual or Off.

– **Auto**: Setting radio frequency to center frequency

– **Manual**: Setting radio frequency as required

– **Off**: Setting radio frequency to 0

Table 100 Setup per operating frequency

Operating frequency	L	Case	SCS	Slots in a burst period
< 3 GHz (FR1)	4	A {2,8} +14*n	15 kHz	5 (1 ms)
< 3 GHz (FR1)	4	B {4,8,16,20} +28*n	30 kHz	10 (0.5 ms)
< 3 GHz (FR1) For unpaired spectrum operation: < 1.88 GHz	4	C {2,8} +14*n	30 kHz	10 (0.5 ms)
3 to 6 GHz (FR1)	8	A {2,8} +14*n	15 kHz	5 (1 ms)
3 to 6 GHz (FR1)	8	B {4,8,16,20} +28*n	30 kHz	10 (0.5 ms)
3 to 6 GHz (FR1) For unpaired spectrum operation: 1.88 to 6 GHz	8	C {2,8} +14*n	30 kHz	10 (0.5 ms)
> 6 GHz (FR2)	64	D {4,8,16,20} +28*n	120 kHz	40 (0.125 ms)

Table 100 Setup per operating frequency

Operating frequency	L	Case	SCS	Slots in a burst period
> 6 GHz (FR2)	64	E {8,12,16,20,32,36,40,44} +56*n	240 kHz	80 (62.5 ms)

Table 101 Sync raster offset range per SSB SCS and sync raster resolution

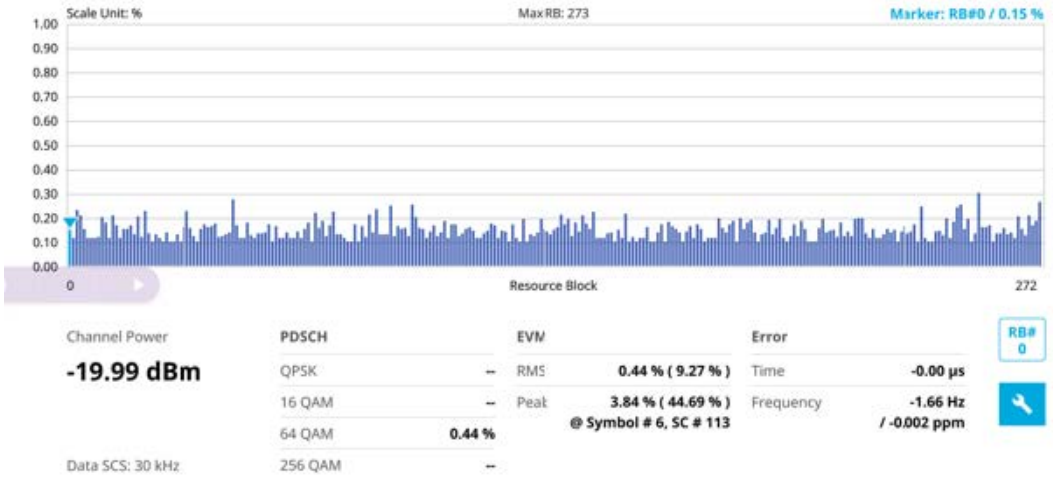
SSB SCS (kHz)	Sync Raster Resolution (kHz)	Sync Raster Offset Range	SSB Frequency = Center frequency
15	180	0 to 250	125
30	180	0 to 506	253
120	720	0 to 92	46
240	720	0 to 48	24

Table 102 Sync SCS offset range per SSB SCS and sync SCS resolution

SSB SCS (kHz)	Sync Raster Resolution (kHz)	Sync Raster Offset Range	SSB Frequency = Center Frequency
15	15	0 to 11	0
30	30	0 to 5	0
120	120	0 to 5	0
240	240	0 to 2	0

Figure 174 shows an example of EVM vs Subcarrier measurement.

Figure 174 5G NR EVM vs Subcarrier measurement

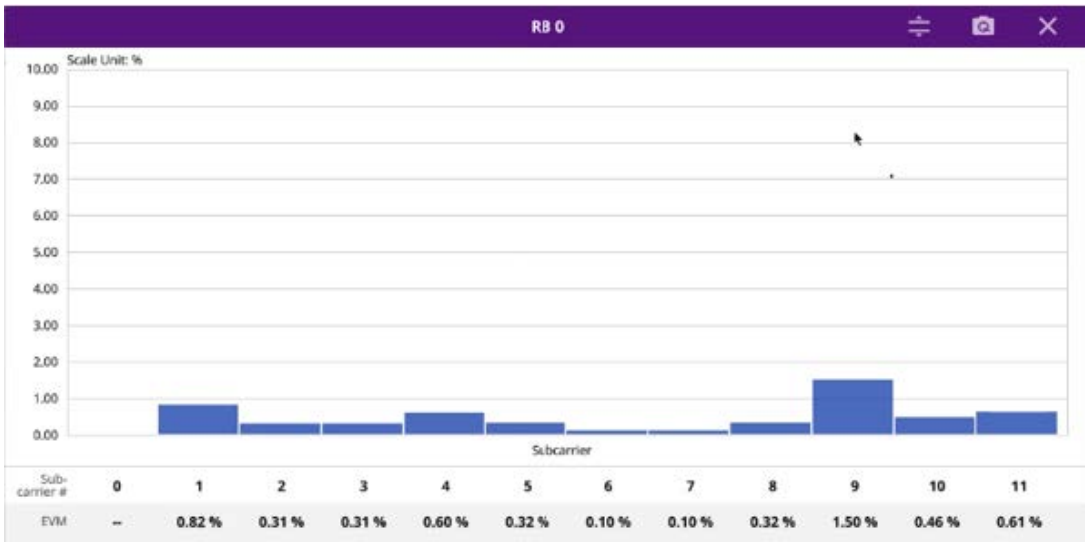


NOTE

EVM vs Subcarrier does not display subcarriers with PT-RS and if there is any of this case, it shows as "–" in value.

Figure 175 shows an example of Selected RB's EVM vs Subcarrier measurement.

Figure 175 5G NR Selected RB's EVM vs Subcarrier



NOTE

You can move purple scroll bar right and left once tapped (activated) to set the specific RB number. If you tap the **Magnifier** icon, you can check the selected RB's EVM and subcarrier information and the mean for resource elements with assigned PDSCH in each RB (12 subcarriers x 14 symbols).

Icon	Description
	**Auto Scale**: You can set the scale automatically.
	**Quick Save**: You can save current measurement screen as it is.
	**Close**: You can close the screen you are seeing now.

11

Using 5G TM Signal Analyzer

This chapter describes how to use the 5G TM Signal Analyzer. Topics covered in this chapter include:

- “Introduction” on page 438
- “Selecting mode and measure” on page 438
- “Conducting conformance test” on page 438

Introduction

5G TM Analyzer focuses on the following measurements based on each Test Models supported for 5G NR FR1 and FR2 band. Note that SPA06MA-O do not support 5G TM Analysis yet.

The 5G TM Analyzer provides following measurements:

- Conformance Test
  - BS Output Power
  - Occupied Bandwidth
  - ACLR
  - Multi-ACLR
  - Operating Band Unwanted Emissions
  - Transmitter Spurious Emissions
  - Transmitter ON/OFF Power
  - Modulation Quality
  - MIMO Time Alignment Error
  - CA Time Alignment Error

Selecting mode and measure

The following procedure describes how to start measurement.

To select mode and measure

1. Tap 5G TM Signal Analyzer on the MODE panel.
2. Tap any measurement mode from the following choices:
   - **Conformance Test > BS Output Power**, **Occupied Bandwidth**, **ACLR**, **Multi-ACLR**, **Operating Band Unwanted Emissions**, **Transmitter Spurious Emissions**, **Transmitter ON/OFF Power**, **Modulation Quality**, **MIMO Time Alignment Error**, or **CA Time Alignment Error**

Conducting conformance test

The following sections describe how to conduct conformance tests.

BS output power

Output power of the base station is the mean power of one carrier delivered to a load with resistance equal to the nominal load impedance of the transmitter.

To set measure setup

You can configure the measurements just as in Spectrum mode. For more information, see “Configuring spectrum measurements” on page 25.

1 Tap the **Setup** ( ) icon on the side bar.

2 Tap **TM Configuration** and select **3GPP** first and then **Radio**, and **Test Model** from a pop-up window.

3 Select **3GPP version** from the choices.

NOTE

Based on the activation of software license (ONA-SP-5GNR-TM2), the 3GPP version that you can select varies. If the software license ONA-SP-5GNR-TM2 is disabled, you can only select TS 38.141 v 15.2.0 (2019-06). If it is enabled, the selection options are TS 38.141 v 15.2.0 (2019-06), TS 38.141 v 15.4.0 (2019-12), TS 38.141 v 16.4.0 (2020-06), and TS 38.141 v 16.5.0 and after (2020-09).

4 Tap **Radio** and select **Frequency Range**, **Bandwidth**, **Subcarrier Spacing** and **Duplex Type**.

a If you select the operating frequency as **FR1**, select from the following:

– SCS 15 kHz: 5, 10, 15, 20, 25, 30, 40, 50 MHz

– SCS 30 kHz: 5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 MHz

– SCS 60 kHz: 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 MHz

– Select **Duplex Type** between **FDD** and **TDD** as required.

- When selecting FDD, both uplink and downlink can transmit at the same time at different spectrum frequencies.
- When selecting TDD, both uplink and downlink use the same spectrum frequencies but at different times.

b If you select the operating frequency as **FR2**, select from the following:

– SCS 15 kHz: 5, 10, 15, 20, 25, 30, 40, 50 MHz

– SCS 30 kHz: 5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 MHz

5 Based on the above setting, tap **Test Model FR1** and select the options from the following choices: FR1-TM1.1, FR1-TM1.2, FR1-TM3.1, FR1-TM3.1a, FR1-TM3.2, FR1-TM3.

6 Based on the above setting, tap **Test Model FR2** and select the options from the following choices: FR2-TM1.1, FR2-TM2, FR2-TM3.1.

NOTE

When you choose TS 38.141 v 16.4.0 (2020-06) or TS 38.141 v 16.5.0 and after (2020-09), the Test Model for FR2 varies. You can select FR2-TM1.1, FR2-TM2, FR2-TM2a, FR2-TM3.1, or FR2-TM3.1a. The Modulation Type is already set for FR1 test models of each 3GPP version, but some test models in FR2, you can select from the options displayed in Modulation Type column as required.

7 Tap **EIRP Settings** and do the following:

a Select **Set Max to EIRP1** to save the currently measured maximum value to EIRP1.

b Select **Set Max to EIRP2** to save the currently measured maximum value to EIRP2.

c Select **Clear Max** to clear the currently measured maximum value.

d Select **Clear All** to reset EIRP1, EIRP2, and maximum value.

e Select **Distance** and input the value using the on-screen keyboard.

f Select **Antenna Gain** and input the value using the on-screen keyboard.

NOTE

Distance and Antenna gain values are required when calculating EIRP. Effective Isotropic Radiated Power (EIRP) refers to the amount of power that a theoretical isotropic antenna (which evenly distributes power in all directions) would emit to produce the peak power density observed in the direction of maximum antenna gain . EIRP can take into account the losses in transmission line and connectors and includes the gain of the antenna. The EIRP is often stated in terms of decibels over a reference power emitted by an isotropic radiator with equivalent signal strength. The EIRP allows comparisons between different emitters regardless of type, size or form. From the EIRP, and with knowledge of a real antenna's gain, it is possible to calculate real power and field strength values.

Formula to calculate: EIRP = Tx RF Power (dBm)+GA (dB) - FL (dB)

Tx RF Power refers to RF power measured at RF connector of the unit

GA refers to Gain Antenna

FL refers to Feeder loss (cable loss of any other loss occurred)

You can tap to switch to **BS Output Power** or **EIRP** under the chart in the table, and it will show the automatically calculated value.

To set limit

1 Tap the **Menu** > **Limit** on the side bar.

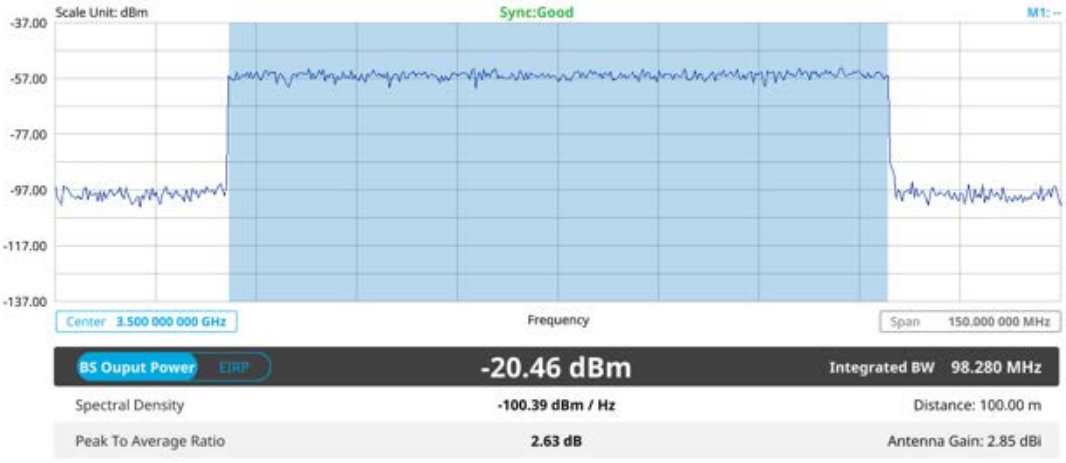
2 Tap to switch the **Test Limits** to **On** or **Off** to enable or disable Pass/Fail indication.
The result table color for Pass is green, and the result table color for Fail is red.

3 Tap **High Limit** to set the upper threshold using the on-screen keyboard.

4 Tap **Low Limit** to set the lower threshold using the on-screen keyboard.

5 Optional. Tap the **Save** icon on the side bar and select the save option from the choices.

Figure 176 BS output power measurement with 5G TM



Occupied bandwidth

The Occupied Bandwidth measures the percentage of the transmitted power within a specified bandwidth. The percentage is typically 99%.

Setting measure setup

After configuring the spectrum measurement in “Configuring spectrum measurements” on page 25, you can set the measure setup to continue your measurement.

To set measure setup

1 Tap the **Setup** ( ) icon on the side bar.

2 Tap **TM Configuration** and select **3GPP** first and then **Radio**, and **Test Model** from a pop-up window.

3 Select **3GPP version** from the choices.



NOTE

Based on the activation of software license (ONA-SP-5GNR-TM2), the 3GPP version that you can select varies. If the software license ONA-SP-5GNR-TM2 is disabled, you can only select TS 38.141 v 15.2.0 (2019-06). If it is enabled, the selection options are TS 38.141 v 15.2.0 (2019-06), TS 38.141 v 15.4.0 (2019-12), TS 38.141 v 16.4.0 (2020-06), and TS 38.141 v 16.5.0 and after (2020-09).

4 Tap **Radio** and select **Frequency Range**, **Bandwidth**, **Subcarrier Spacing** and **Duplex Type**.

a If you select the operating frequency as **FR1**, select from the following:

– SCS 15 kHz: 5, 10, 15, 20, 25, 30, 40, 50 MHz

– SCS 30 kHz: 5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 MHz

– SCS 60 kHz: 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 MHz

– Select **Duplex Type** between **FDD** and **TDD** as required.

- When selecting FDD, both uplink and downlink can transmit at the same time at different spectrum frequencies.
- When selecting TDD, both uplink and downlink use the same spectrum frequencies but at different times.

b If you select the operating frequency as **FR2**, select from the following:

– SCS 15 kHz: 5, 10, 15, 20, 25, 30, 40, 50 MHz

– SCS 30 kHz: 5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 MHz

5 Based on the above setting, tap **Test Model FR1** and select the options from the following choices: FR1-TM1.1, FR1-TM1.2, FR1-TM3.1, FR1-TM3.1a, FR1-TM3.2, FR1-TM3.

6 Based on the above setting, tap **Test Model FR2** and select the options from the following choices: FR2-TM1.1, FR2-TM2, FR2-TM3.1.



NOTE

When you choose TS 38.141 v 16.4.0 (2020-06) or TS 38.141 v 16.5.0 and after (2020-09), the Test Model for FR2 varies. You can select FR2-TM1.1, FR2-TM2, FR2-TM2a, FR2-TM3.1, or FR2-TM3.1a. The Modulation Type is already set for FR1 test models of each 3GPP version, but some test models in FR2, you can select from the options displayed in Modulation Type column as required.

To set limit

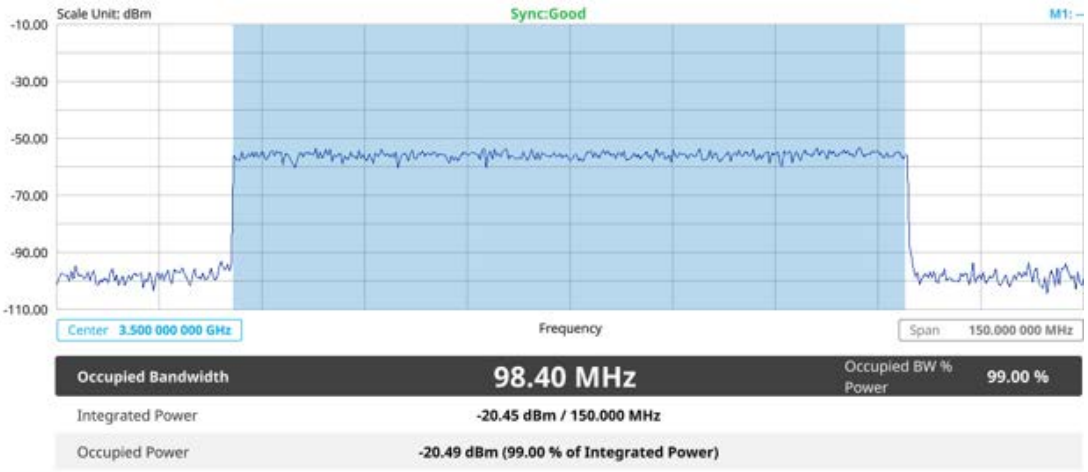
1 Tap the **Menu** > **Limit** on the side bar.

2 Tap to switch the **Test Limits** to **On** or **Off** to enable or disable Pass/Fail indication.
The result table color for Pass is green, and the result table color for Fail is red.

3 Tap **High Limit** to set the upper threshold using the on-screen keyboard.

4 *Optional.* Tap the **Save** icon on the side bar and select the save option from the choices.

Figure 177 Occupied bandwidth measurement with 5G TM



ACLR

The Adjacent Channel Power Ratio (ACPR), designated by the 3GPP WCDMA specifications as the Adjacent Channel Leakage power Ratio (ACLR), is the power contained in a specified frequency channel bandwidth relative to the total carrier power. It may also be expressed as a ratio of power spectral densities between the carrier and the specified offset frequency band.

To set measure setup

After configuring the spectrum measurement in “Configuring spectrum measurements” on page 25, you can set the measure setup to continue your measurement.

1 Tap the **Setup** (⚙) icon on the side bar.

2 Tap **TM Configuration** and select **3GPP** first and then **Radio**, and **Test Model** from a pop-up window.

3 Select **3GPP version** from the choices.

NOTE

Based on the activation of software license (ONA-SP-5GNR-TM2), the 3GPP version that you can select varies. If the software license ONA-SP-5GNR-TM2 is disabled, you can only select TS 38.141 v 15.2.0 (2019-06). If it is enabled, the selection options are TS 38.141 v 15.2.0 (2019-06), TS 38.141 v 15.4.0 (2019-12), TS 38.141 v 16.4.0 (2020-06), and TS 38.141 v 16.5.0 and after (2020-09).

4 Tap **Radio** and select **Frequency Range**, **Bandwidth**, **Subcarrier Spacing** and **Duplex Type**.

a If you select the operating frequency as **FR1**, select from the following:

– SCS 15 kHz: 5, 10, 15, 20, 25, 30, 40, 50 MHz

– SCS 30 kHz: 5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 MHz

– SCS 60 kHz: 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 MHz

– Select **Duplex Type** between **FDD** and **TDD** as required.

- When selecting FDD, both uplink and downlink can transmit at the same time at different spectrum frequencies.
- When selecting TDD, both uplink and downlink use the same spectrum frequencies but at different times.

b If you select the operating frequency as **FR2**, select from the following:

– SCS 15 kHz: 5, 10, 15, 20, 25, 30, 40, 50 MHz

– SCS 30 kHz: 5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 MHz

5 Based on the above setting, tap **Test Model FR1** and select the options from the following choices: FR1-TM1.1, FR1-TM1.2, FR1-TM3.1, FR1-TM3.1a, FR1-TM3.2, FR1-TM3.

6 Based on the above setting, tap **Test Model FR2** and select the options from the following choices: FR2-TM1.1, FR2-TM2, FR2-TM3.1.

NOTE

When you choose TS 38.141 v 16.4.0 (2020-06) or TS 38.141 v 16.5.0 and after (2020-09), the Test Model for FR2 varies. You can select FR2-TM1.1, FR2-TM2, FR2-TM2a, FR2-TM3.1, or FR2-TM3.1a. The Modulation Type is already set for FR1 test models of each 3GPP version, but some test models in FR2, you can select from the options displayed in Modulation Type column as required.

7 Tap **BS Type** and select the option from **1-C/1-H**, **1-O**, or **2-O**.

– Set 1-C (Conducted)/1-H (Hybrid) for multi-band operation with mapping of transceivers to one or more antenna connectors (1-C) or TAB (transceiver array boundary) connectors for 1-H.

– Set 1-O when BS operates at FR1 and 2-O when BS operates at FR2.

8 Tap **Category** and select the option from **Wide Area BS A**, **Wide Area BS B**, **Medium Range BS**, or **Local Area BS**.
The category is defined with base station type.

– Wide Area BS A/B for macro cell

– Medium Range BS for micro cell

– Local Area Base Station for pico cell

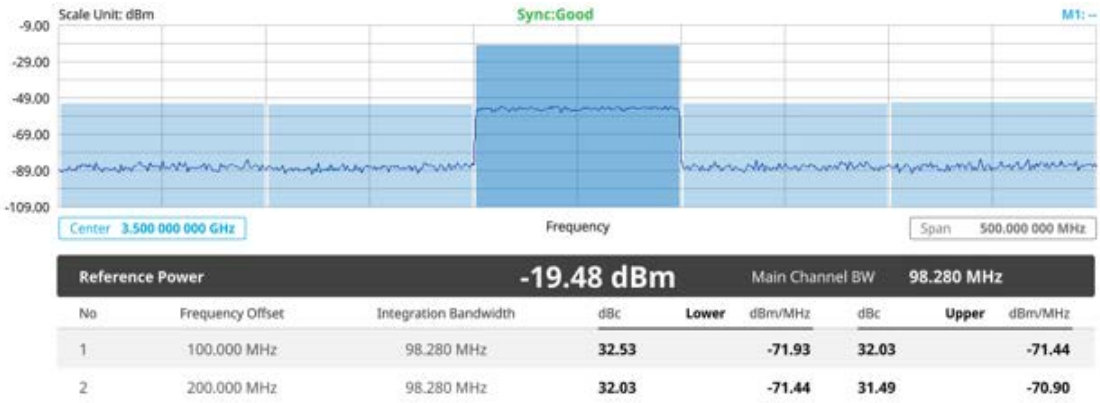
To set limit

1 Tap the **Menu** > **Limit** on the side bar.

2 Tap to switch the **Test Limits** to **On** or **Off** to enable or disable Pass/Fail indication.
The result table color for Pass is green, and the result table color for Fail is red.

3 Optional. Tap the **Save** icon on the side bar and select the save option from the choices.

Figure 178 ACLR with 5G TM



Multi-ACLR

The Multi-ACLR measurement is used to perform multi-channel ACLR measurements with as many channels as possible. It helps you to measure ACLR in multi-channel transmitting Base Station environment.

To set measure setup

After configuring the spectrum measurement in “Configuring spectrum measurements” on page 25, you can set the measure setup to continue your measurement.

1 Tap the **Setup** ( ) icon on the side bar.

2 Tap **TM Configuration** and select **3GPP** first and then **Radio**, and **Test Model** from a pop-up window.

3 Select **3GPP version** from the choices.

NOTE

Based on the activation of software license (ONA-SP-5GNR-TM2), the 3GPP version that you can select varies. If the software license ONA-SP-5GNR-TM2 is disabled, you can only select TS 38.141 v 15.2.0 (2019-06). If it is enabled, the selection options are TS 38.141 v 15.2.0 (2019-06), TS 38.141 v 15.4.0 (2019-12), TS 38.141 v 16.4.0 (2020-06), and TS 38.141 v 16.5.0 and after (2020-09).

4 Tap **Radio** and select **Frequency Range**, **Bandwidth**, **Subcarrier Spacing** and **Duplex Type**.

a If you select the operating frequency as **FR1**, select from the following:

– SCS 15 kHz: 5, 10, 15, 20, 25, 30, 40, 50 MHz

– SCS 30 kHz: 5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 MHz

– SCS 60 kHz: 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 MHz

– Select **Duplex Type** between **FDD** and **TDD** as required.

- When selecting FDD, both uplink and downlink can transmit at the same time at different spectrum frequencies.
- When selecting TDD, both uplink and downlink use the same spectrum frequencies but at different times.

b If you select the operating frequency as **FR2**, select from the following:

– SCS 15 kHz: 5, 10, 15, 20, 25, 30, 40, 50 MHz

– SCS 30 kHz: 5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 MHz

5 Based on the above setting, tap **Test Model FR1** and select the options from the following choices: FR1-TM1.1, FR1-TM1.2, FR1-TM3.1, FR1-TM3.1a, FR1-TM3.2, FR1-TM3.

6 Based on the above setting, tap **Test Model FR2** and select the options from the following choices: FR2-TM1.1, FR2-TM2, FR2-TM3.1.

NOTE

When you choose TS 38.141 v 16.4.0 (2020-06) or TS 38.141 v 16.5.0 and after (2020-09), the Test Model for FR2 varies. You can select FR2-TM1.1, FR2-TM2, FR2-TM2a, FR2-TM3.1, or FR2-TM3.1a. The Modulation Type is already set for FR1 test models of each 3GPP version, but some test models in FR2, you can select from the options displayed in Modulation Type column as required.

7 Tap **BS Type** and select the option from **1-C/1-H**, **1-O**, or **2-O**.

– Set 1-C (Conducted)/1-H (Hybrid) for multi-band operation with mapping of transceivers to one or more antenna connectors (1-C) or TAB (transceiver array boundary) connectors for 1-H.

– Set 1-O when BS operates at FR1

– Set 2-O when BS operates at FR2.

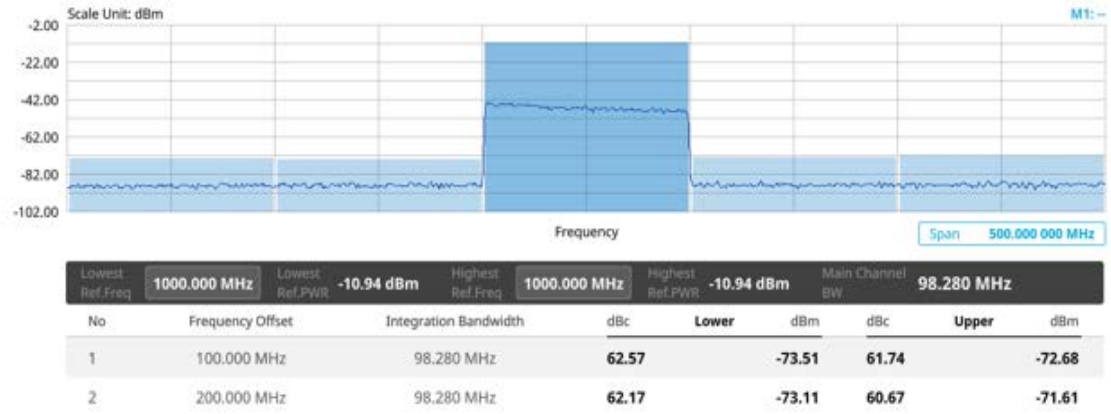
To set limit

1 Tap the **Menu** > **Limit** on the side bar.

2 Tap to switch the **Test Limits** to **On** or **Off** to enable or disable Pass/Fail indication.
The result table color for Pass is green, and the result table color for Fail is red.

3 Optional. Tap the **Save** icon on the side bar and select the save option from the choices.

Figure 179 Multi-ACLR with 5G TM



NOTE

You can set the Lowest Ref. Frequency and Highest Ref. Frequency by tapping the rectangle with value using the on-screen keyboard.

Operating band unwanted emission

The operating band unwanted emissions define all unwanted emissions in the downlink operating band plus the frequency ranges 10 MHz above and 10 MHz below the band. Unwanted emissions outside of this frequency range are limited by a spurious emissions requirement.

For a BS supporting multi-carrier or intra-band contiguous CA, the unwanted emissions requirements apply to channel bandwidths of the outermost carrier larger than or equal to 5 MHz.

To set measure setup

After configuring the spectrum measurement in “Configuring spectrum measurements” on page 25, you can set the measure setup to continue your measurement.

1 Tap the **Setup** ( ) icon on the side bar.

2 Tap **TM Configuration** and select **3GPP** first and then **Radio**, and **Test Model** from a pop-up window.

3 Select **3GPP version** from the choices.

NOTE

Based on the activation of software license (ONA-SP-5GNR-TM2), the 3GPP version that you can select varies. If the software license ONA-SP-5GNR-TM2 is disabled, you can only select TS 38.141 v 15.2.0 (2019-06). If it is enabled, the selection options are TS 38.141 v 15.2.0 (2019-06), TS 38.141 v 15.4.0 (2019-12), TS 38.141 v 16.4.0 (2020-06), and TS 38.141 v 16.5.0 and after (2020-09).

4 Tap **Radio** and select **Frequency Range**, **Bandwidth**, **Subcarrier Spacing** and **Duplex Type**.

a If you select the operating frequency as **FR1**, select from the following:

– SCS 15 kHz: 5, 10, 15, 20, 25, 30, 40, 50 MHz

– SCS 30 kHz: 5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 MHz

– SCS 60 kHz: 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 MHz

– Select **Duplex Type** between **FDD** and **TDD** as required.

- When selecting FDD, both uplink and downlink can transmit at the same time at different spectrum frequencies.
- When selecting TDD, both uplink and downlink use the same spectrum frequencies but at different times.

b If you select the operating frequency as **FR2**, select from the following:

– SCS 15 kHz: 5, 10, 15, 20, 25, 30, 40, 50 MHz

– SCS 30 kHz: 5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 MHz

5 Based on the above setting, tap **Test Model FR1** and select the options from the following choices: FR1-TM1.1, FR1-TM1.2, FR1-TM3.1, FR1-TM3.1a, FR1-TM3.2, FR1-TM3.

6 Based on the above setting, tap **Test Model FR2** and select the options from the following choices: FR2-TM1.1, FR2-TM2, FR2-TM3.1.

NOTE

When you choose TS 38.141 v 16.4.0 (2020-06) or TS 38.141 v 16.5.0 and after (2020-09), the Test Model for FR2 varies. You can select FR2-TM1.1, FR2-TM2, FR2-TM2a, FR2-TM3.1, or FR2-TM3.1a. The Modulation Type is already set for FR1 test models of each 3GPP version, but some test models in FR2, you can select from the options displayed in Modulation Type column as required.

7 Tap **SEM Config** to configure the following items:

a Tap **BS Type** and select the option from **1-C/1-H**, **1-O**, or **2-O**.

- Set 1-C (Conducted)/1-H (Hybrid) for multi-band operation with mapping of transceivers to one or more antenna connectors (1-C) or TAB (transceiver array boundary) connectors for 1-H.
- Set 1-O when BS operates at FR1
- Set 2-O when BS operates at FR2.

b Tap **Category** and select the option from **Wide Area BS A**, **Wide Area BS B**, **Medium Range BS**, or **Local Area BS**.
The category is defined with base station type.

- Wide Area BS A/B for macro cell
- Medium Range BS for micro cell
- Local Area Base Station for pico cell

c Tap **Mask Type** and select from **KCA** or **3GPP**.

- Select the KCA to follow Korea Communications Agency standard (Korea-specific).
- Select 3GPP to follow international standard.

d Tap **Menu** > **BW/AVG** > **Average** to set the number of measurements to be averaged using the on screen keyboard.

The input value range is from 1 to 100.

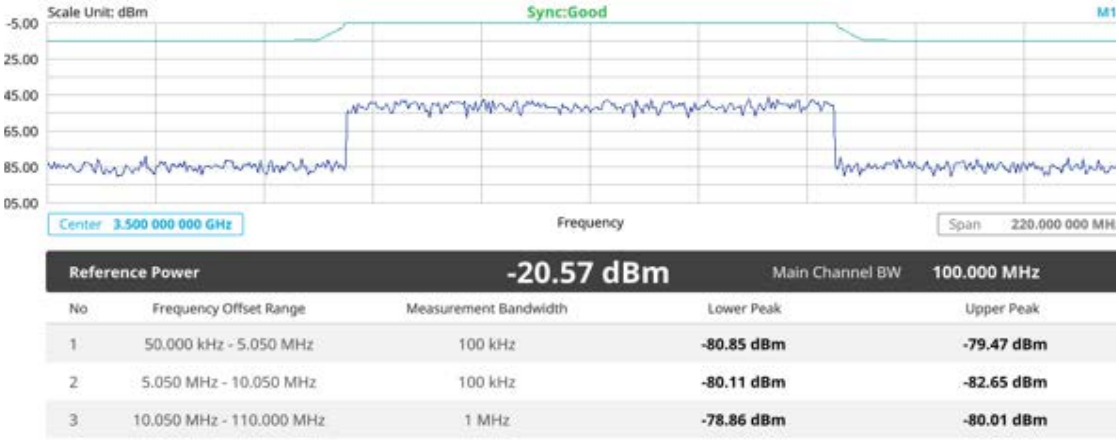
To set limit

1 Tap the **Menu** > **Limit** on the side bar.

2 Tap to switch the **Test Limits** to **On** or **Off** to enable or disable Pass/Fail indication.
The result table color for Pass is green, and the result table color for Fail is red.

3 Optional. Tap the **Save** icon on the side bar and select the save option from the choices.

Figure 180 Operating band unwanted emission with 5G TM



NOTE

You can set the Lowest Ref. Frequency and Highest Ref. Frequency by tapping the rectangle with value using the on-screen keyboard.

Transmitter spurious emissions

The transmitter spurious emission limits apply from 9 kHz to 12.75 GHz, excluding the frequency range from 10 MHz below the lowest frequency of the downlink operating band up to 10 MHz above the highest frequency of the downlink operating band.

To set measure setup

After configuring the spectrum measurement in “Configuring spectrum measurements” on page 25, you can set the measure setup to continue your measurement.

1 Tap the **Setup** ( ) icon on the side bar.

2 Tap **TM Configuration** and select **3GPP** first and then **Radio**, and **Test Model** from a pop-up window.

3 Select **3GPP version** from the choices.

NOTE

Based on the activation of software license (ONA-SP-5GNR-TM2), the 3GPP version that you can select varies. If the software license ONA-SP-5GNR-TM2 is disabled, you can only select TS 38.141 v 15.2.0 (2019-06). If it is enabled, the selection options are TS 38.141 v 15.2.0 (2019-06), TS 38.141 v 15.4.0 (2019-12), TS 38.141 v 16.4.0 (2020-06), and TS 38.141 v 16.5.0 and after (2020-09).

4 Tap **Radio** and select **Frequency Range**, **Bandwidth**, **Subcarrier Spacing** and **Duplex Type**.

a If you select the operating frequency as **FR1**, select from the following:

– SCS 15 kHz: 5, 10, 15, 20, 25, 30, 40, 50 MHz

– SCS 30 kHz: 5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 MHz

– SCS 60 kHz: 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 MHz

– Select **Duplex Type** between **FDD** and **TDD** as required.

- When selecting FDD, both uplink and downlink can transmit at the same time at different spectrum frequencies.
- When selecting TDD, both uplink and downlink use the same spectrum frequencies but at different times.

b If you select the operating frequency as **FR2**, select from the following:

– SCS 15 kHz: 5, 10, 15, 20, 25, 30, 40, 50 MHz

– SCS 30 kHz: 5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 MHz

5 Based on the above setting, tap **Test Model FR1** and select the options from the following choices: FR1-TM1.1, FR1-TM1.2, FR1-TM3.1, FR1-TM3.1a, FR1-TM3.2, FR1-TM3.

6 Based on the above setting, tap **Test Model FR2** and select the options from the following choices: FR2-TM1.1, FR2-TM2, FR2-TM3.1.



NOTE

When you choose TS 38.141 v 16.4.0 (2020-06) or TS 38.141 v 16.5.0 and after (2020-09), the Test Model for FR2 varies. You can select FR2-TM1.1, FR2-TM2, FR2-TM2a, FR2-TM3.1, or FR2-TM3.1a. The Modulation Type is already set for FR1 test models of each 3GPP version, but some test models in FR2, you can select from the options displayed in Modulation Type column as required.

7 Tap to switch **Setting** to **User** to set user-defined setting or **3GPP** to set 3GPP defined setting.

8 When selecting 3GPP, do the following:

a Tap **BS Type** and select the option from **1-C/1-H**, **1-O**, or **2-O**.

- Set 1-C (Conducted)/1-H (Hybrid) for multi-band operation with mapping of transceivers to one or more antenna connectors (1-C) or TAB (transceiver array boundary) connectors for 1-H.
- Set 1-O when BS operates at FR1
- Set 2-O when BS operates at FR2.

b Tap **Measure Type** and select between **Transmitted** and **Receiver**.

Based on the measure type you have selected, the frequency range changes in accordance with each standard.

c Tap **Category** and select the option from **Wide Area BS A**, **Wide Area BS B**, **Medium Range BS**, or **Local Area BS**.
The category is defined with base station type.

- Wide Area BS A/B for macro cell
- Medium Range BS for micro cell
- Local Area Base Station for pico cell

d Tap **Menu** > **BW/AVG** > **Average** to set the number of measurements to be averaged using the on screen keyboard.

The input value range is from 1 to 100.

To set limit

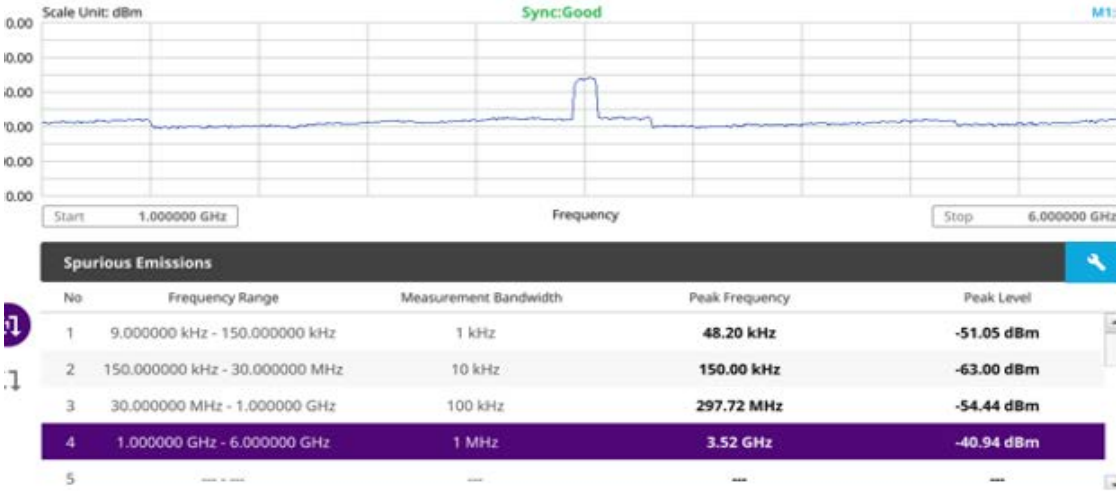
1 Tap the **Menu** > **Limit** on the side bar.

2 Tap to switch the **Test Limits** to **On** or **Off** to enable or disable Pass/Fail indication.
The result table color for Pass is green, and the result table color for Fail is red.

3 *Optional.* Tap the **Save** icon on the side bar and select the save option from the choices.

Figure 181 shows an example of Transmitter Spurious Emissions.

Figure 181 Transmitter spurious emissions with 5G TM



Transmit on/off power

Transmitter OFF power is referred to as the mean power measured over 70 us filtered with a square filter of bandwidth equal to the transmission bandwidth configuration of the BS centred on the assigned channel frequency during the transmitter OFF period. Transmit OFF power requirements apply only to TDD operation of the BS.

To set measure setup

After configuring the spectrum measurement in "Configuring spectrum measurements" on page 25, you can set the measure setup to continue your measurement.

1 Tap the **Setup** ( ) icon on the side bar.

2 Tap **TM Configuration** and select **3GPP** first and then **Radio**, and **Test Model** from a pop-up window.

3 Select **3GPP version** from the choices.

NOTE

Based on the activation of software license (ONA-SP-5GNR-TM2), the 3GPP version that you can select varies. If the software license ONA-SP-5GNR-TM2 is disabled, you can only select TS 38.141 v 15.2.0 (2019-06). If it is enabled, the selection options are TS 38.141 v 15.2.0 (2019-06), TS 38.141 v 15.4.0 (2019-12), TS 38.141 v 16.4.0 (2020-06), and TS 38.141 v 16.5.0 and after (2020-09).

4 Tap **Radio** and select **Frequency Range**, **Bandwidth**, **Subcarrier Spacing** and **Duplex Type**.

a If you select the operating frequency as **FR1**, select from the following:

– SCS 15 kHz: 5, 10, 15, 20, 25, 30, 40, 50 MHz

– SCS 30 kHz: 5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 MHz

– SCS 60 kHz: 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 MHz

– Select **Duplex Type** between **FDD** and **TDD** as required.

- When selecting FDD, both uplink and downlink can transmit at the same time at different spectrum frequencies.
- When selecting TDD, both uplink and downlink use the same spectrum frequencies but at different times.

b If you select the operating frequency as **FR2**, select from the following:

– SCS 15 kHz: 5, 10, 15, 20, 25, 30, 40, 50 MHz

– SCS 30 kHz: 5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 MHz

5 Based on the above setting, tap **Test Model FR1** and select the options from the following choices: FR1-TM1.1, FR1-TM1.2, FR1-TM3.1, FR1-TM3.1a, FR1-TM3.2, FR1-TM3.

6 Based on the above setting, tap **Test Model FR2** and select the options from the following choices: FR2-TM1.1, FR2-TM2, FR2-TM3.1.

NOTE

When you choose TS 38.141 v 16.4.0 (2020-06) or TS 38.141 v 16.5.0 and after (2020-09), the Test Model for FR2 varies. You can select FR2-TM1.1, FR2-TM2, FR2-TM2a, FR2-TM3.1, or FR2-TM3.1a. The Modulation Type is already set for FR1 test models of each 3GPP version, but some test models in FR2, you can select from the options displayed in Modulation Type column as required.

7 Tap to switch **Phase Correction** to **On** or **Off**.

Phase Correction is a way of optimizing EVM performance. When you switch it On, it will decrease inter-symbol interference and compensate distortion caused by a filter applying to each OFDM symbol.

8 Tap **Symbol Phase Comp** and select from the following choices: **Auto**, **Manual**, or **Off**.

Symbol Phase Compensation is used to compensate for phase differences between symbols caused by upconversion. Users do not always use the instrument based on RF frequency. In this case, you can set it to Manual or Off.

- **Auto**: Setting radio frequency to center frequency.
- **Manual**: Setting radio frequency as required.
- **Off**: Setting radio frequency to 0.

NOTE

When calculating Symbol Phase Compensation, you can use the following formula. It complies with 3GPP standard and used to calculate conversion of 5G NR signal to RF signal.

$$\mathrm{Re}\left\{ s_l^{(p,\mu)}(t) \cdot e^{j2\pi f_0 \left(t - t_{\mathrm{start},l}^{\mu} - N_{\mathrm{CP},l}^{\mu} T_c\right)} \right\}$$

9 Tap **Slot No**. and input the slot number from 0 to 19 using the on-screen keyboard.

To set limit

1 Tap the **Menu** > **Limit** on the side bar.

2 Tap the test items and set the limits depending on your selected measurement mode.

The result table color for Pass is green and Fail is red.

To set the limit for	Select and set
Symbol Average Power	Test limits On/Off, High/Low Limit
Off Power	Test limits On/Off, High Limit
Transition Period	Test limits On/Off, High Limit

Figure 182 Transmitter off to on power with 5G TM

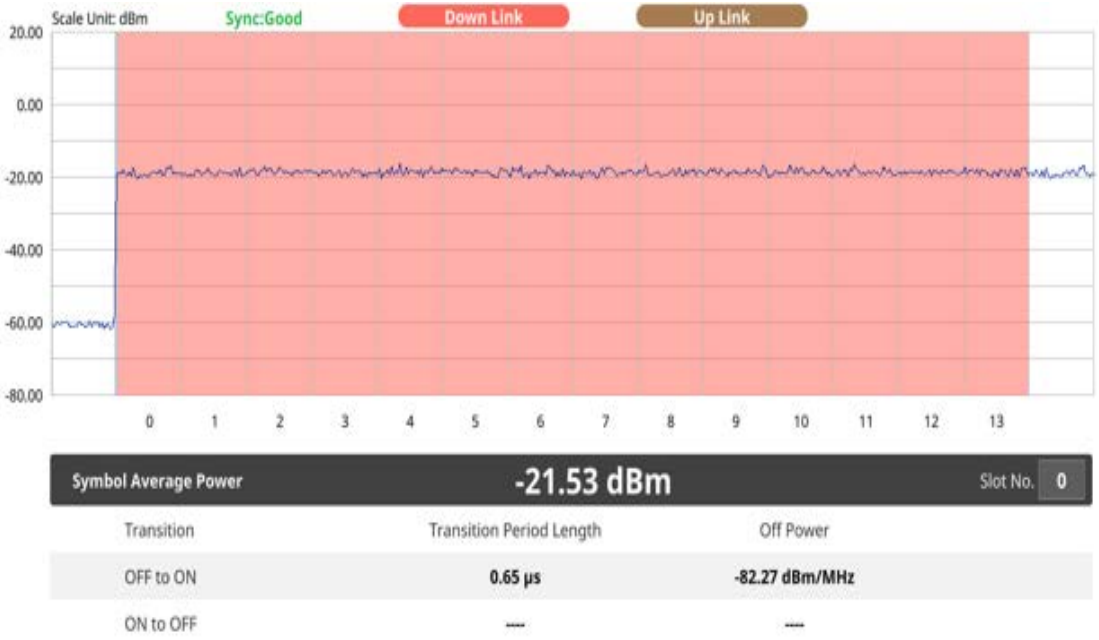


Figure 183 Transmitter on to off power with 5G TM



Modulation quality

Modulation quality is defined by the difference between the measured carrier signal and an ideal signal. Modulation quality can be expressed as Error Vector Magnitude (EVM). The Error Vector Magnitude is a measure of the difference between the ideal

symbols and the measured symbols after the equalization. This difference is called the error vector. OTA modulation quality requirement is defined as a directional requirement at the RIB and shall be met within the OTA coverage range.

To set measure setup

After configuring the spectrum measurement in "Configuring spectrum measurements" on page 25, you can set the measure setup to continue your measurement.

1 Tap the **Setup** ( ) icon on the side bar.

2 Tap **TM Configuration** and select **3GPP** first and then **Radio**, and **Test Model** from a pop-up window.

3 Select **3GPP version** from the choices.



NOTE

Based on the activation of software license (ONA-SP-5GNR-TM2), the 3GPP version that you can select varies. If the software license ONA-SP-5GNR-TM2 is disabled, you can only select TS 38.141 v 15.2.0 (2019-06). If it is enabled, the selection options are TS 38.141 v 15.2.0 (2019-06), TS 38.141 v 15.4.0 (2019-12), TS 38.141 v 16.4.0 (2020-06), and TS 38.141 v 16.5.0 and after (2020-09).

4 Tap **Radio** and select **Frequency Range**, **Bandwidth**, **Subcarrier Spacing** and **Duplex Type**.

a If you select the operating frequency as **FR1**, select from the following:

– SCS 15 kHz: 5, 10, 15, 20, 25, 30, 40, 50 MHz

– SCS 30 kHz: 5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 MHz

– SCS 60 kHz: 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 MHz

– Select **Duplex Type** between **FDD** and **TDD** as required.

- When selecting FDD, both uplink and downlink can transmit at the same time at different spectrum frequencies.
- When selecting TDD, both uplink and downlink use the same spectrum frequencies but at different times.

b If you select the operating frequency as **FR2**, select from the following:

– SCS 15 kHz: 5, 10, 15, 20, 25, 30, 40, 50 MHz

– SCS 30 kHz: 5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 MHz

5 Based on the above setting, tap **Test Model FR1** and select the options from the following choices: FR1-TM1.1, FR1-TM1.2, FR1-TM3.1, FR1-TM3.1a, FR1-TM3.2, FR1-TM3.

6 Based on the above setting, tap **Test Model FR2** and select the options from the following choices: FR2-TM1.1, FR2-TM2, FR2-TM3.1.

NOTE

When you choose TS 38.141 v 16.4.0 (2020-06) or TS 38.141 v 16.5.0 and after (2020-09), the Test Model for FR2 varies. You can select FR2-TM1.1, FR2-TM2, FR2-TM2a, FR2-TM3.1, or FR2-TM3.1a. The Modulation Type is already set for FR1 test models of each 3GPP version, but some test models in FR2, you can select from the options displayed in Modulation Type column as required.

7 Tap to switch **Phase Correction** to **On** or **Off**.

Phase Correction is a way of optimizing EVM performance. When you switch it On, it will decrease inter-symbol interference and compensate distortion caused by a filter applying to each OFDM symbol.

8 Tap **Symbol Phase Comp** and select from the following choices: **Auto**, **Manual**, or **Off**.

Symbol Phase Compensation is used to compensate for phase differences between symbols caused by upconversion. Users do not always use the instrument based on RF frequency. In this case, you can set it to Manual or Off.

- **Auto**: Setting radio frequency to center frequency.
- **Manual**: Setting radio frequency as required.
- **Off**: Setting radio frequency to 0.

NOTE

When calculating Symbol Phase Compensation, you can use the following formula. It complies with 3GPP standard and used to calculate conversion of 5G NR signal to RF signal.

$$\mathrm{Re}\left\{ s_l^{(p,\mu)}(t) \cdot e^{j2\pi f_0 \left(t - t_{\mathrm{start},l}^{\mu} - N_{\mathrm{CP},l}^{\mu} T_c\right)} \right\}$$

9 Tap to switch **Select Mode** to **Frame** or **Slot**.

If Slot is selected, tap the Slot No. from 0 to 19 using the on-screen keyboard.

To set limit

1 Tap the **Menu** > **Limit** on the side bar.

2 Tap the test items and set the limits depending on your selected measurement mode.

The result table color for Pass is green and Fail is red.

To set the limit for	Select and set
Symbol Average Power	Test limits On/Off, High/Low Limit
Off Power	Test limits On/Off, High Limit
Transition Period	Test limits On/Off, High Limit

Figure 184 Transmitter on to off power with 5G TM



NOTE

You can easily set the number slot number by tapping the Slot No. Once you select any slot number from 1 to 19, the selected slot number is indicated as yellow (active data signal). The valid signal data is indicated as green, therefore you must set the right slot number not to select the invalid data signal indicated as gray.

MIMO time alignment error

In eNode-B supporting Tx Diversity transmission, signals are transmitted from two or more antennas. These signals shall be aligned. The time alignment error in Tx diversity is specified as the delay between the signals from two antennas at the antenna ports.

To set measure setup

After configuring the spectrum measurement in “Configuring spectrum measurements” on page 25, you can set the measure setup to continue your measurement.

1 Tap the **Setup** ( ) icon on the side bar.

2 Tap **TM Configuration** and select **3GPP** first and then **Radio**, and **Test Model** from a pop-up window.

3 Select **3GPP version** from the choices.



NOTE

Based on the activation of software license (ONA-SP-5GNR-TM2), the 3GPP version that you can select varies. If the software license ONA-SP-5GNR-TM2 is disabled, you can only select TS 38.141 v 15.2.0 (2019-06). If it is enabled, the selection options are TS 38.141 v 15.2.0 (2019-06), TS 38.141 v 15.4.0 (2019-12), TS 38.141 v 16.4.0 (2020-06), and TS 38.141 v 16.5.0 and after (2020-09).

4 Tap **Radio** and select **Frequency Range**, **Bandwidth**, **Subcarrier Spacing** and **Duplex Type**.

a If you select the operating frequency as **FR1**, select from the following:

– SCS 15 kHz: 5, 10, 15, 20, 25, 30, 40, 50 MHz

– SCS 30 kHz: 5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 MHz

– SCS 60 kHz: 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 MHz

– Select **Duplex Type** between **FDD** and **TDD** as required.

- When selecting FDD, both uplink and downlink can transmit at the same time at different spectrum frequencies.
- When selecting TDD, both uplink and downlink use the same spectrum frequencies but at different times.

b If you select the operating frequency as **FR2**, select from the following:

– SCS 15 kHz: 5, 10, 15, 20, 25, 30, 40, 50 MHz

– SCS 30 kHz: 5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 MHz

5 Based on the above setting, tap **Test Model FR1** and select the options from the following choices: FR1-TM1.1, FR1-TM1.2, FR1-TM3.1, FR1-TM3.1a, FR1-TM3.2, FR1-TM3.

6 Based on the above setting, tap **Test Model FR2** and select the options from the following choices: FR2-TM1.1, FR2-TM2, FR2-TM3.1.



NOTE

When you choose TS 38.141 v 16.4.0 (2020-06) or TS 38.141 v 16.5.0 and after (2020-09), the Test Model for FR2 varies. You can select FR2-TM1.1, FR2-TM2, FR2-TM2a, FR2-TM3.1, or FR2-TM3.1a. The Modulation Type is already set for FR1 test models of each 3GPP version, but some test models in FR2, you can select from the options displayed in Modulation Type column as required.

7 Tap to switch **Phase Correction** to **On** or **Off**.

Phase Correction is a way of optimizing EVM performance. When you switch it On, it will decrease inter-symbol interference and compensate distortion caused by a filter applying to each OFDM symbol.

8 Tap **Symbol Phase Comp** and select from the following choices: **Auto**, **Manual**, or **Off**.

Symbol Phase Compensation is used to compensate for phase differences between symbols caused by upconversion. Users do not always use the instrument based on RF frequency. In this case, you can set it to Manual or Off.

- **Auto**: Setting radio frequency to center frequency.
- **Manual**: Setting radio frequency as required.
- **Off**: Setting radio frequency to 0.

NOTE

When calculating Symbol Phase Compensation, you can use the following formula. It complies with 3GPP standard and used to calculate conversion of 5G NR signal to RF signal.

$$\mathrm{Re}\left\{ s_l^{(p,\mu)}(t) \cdot e^{j2\pi f_0 \left(t - t_{\mathrm{start},l}^{\mu} - N_{\mathrm{CP},l}^{\mu} T_c\right)} \right\}$$

To set limit

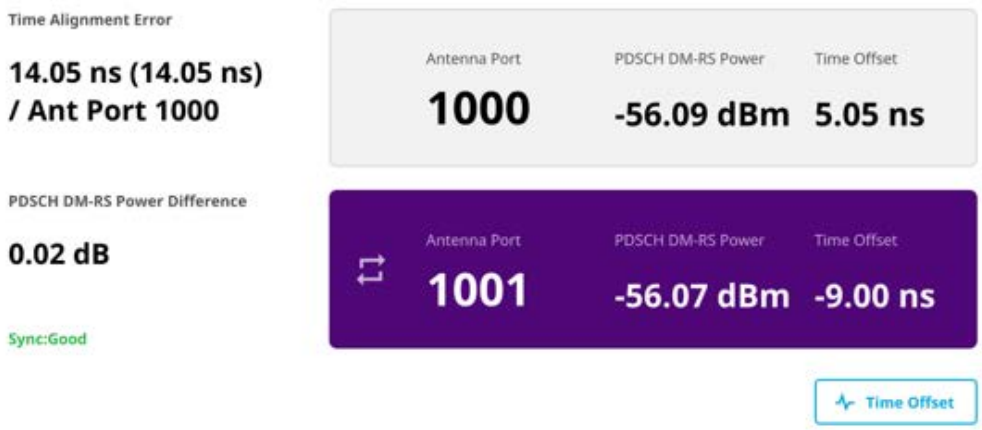
1 Tap the **Menu** > **Limit** on the side bar.

2 Tap to switch the **Test Limits** to **On** or **Off** to enable or disable Pass/Fail indication.
The result table color for Pass is green, and the result table color for Fail is red.

3 Tap **High Limit** to set the upper threshold using the on-screen keyboard.

4 *Optional.* Tap the **Save** icon on the side bar and select the save option from the choices available for your measurement mode.

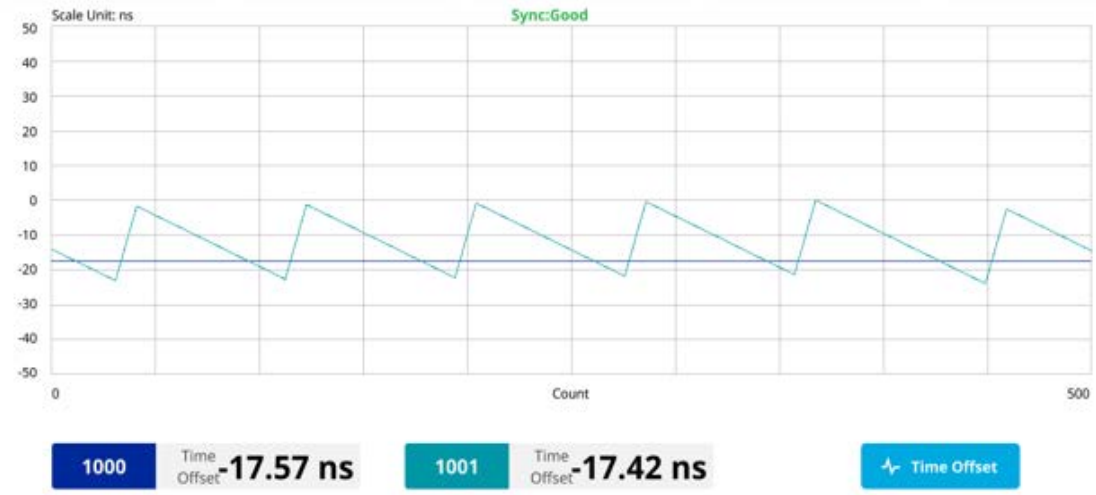
Figure 185 MIMO time alignment error with 5G TM (3GPP version:2019-06)



NOTE

In case you choose 3GPP version for 2019-06, you can tap to switch Antenna Port 1000 or 1001 to receive correct source for each antenna port. But if you choose the other three options, you can not choose antenna port but it shows the correct signal source for each antenna port.

Figure 186 MIMO time alignment error with Time offset chart with 5G TM



CA time alignment error

Carrier Aggregation time alignment error measures time error of each signal that has different carrier frequency and show difference between measured time errors.

To set measure setup

After configuring the spectrum measurement in “Configuring spectrum measurements” on page 25, you can set the measure setup to continue your measurement.

1 Tap the **Setup** ( ) icon on the side bar.

2 Tap **CA Configuration**.

a Tap the number to switch the carrier on or off. You can select up to 8 carriers.

b Tap **Center Frequency** and input the value using the on-screen keyboard.

3 Tap **TM Configuration** and select **3GPP** first then **Radio**, and **Test Model** from a pop-up window.

4 Select **3GPP version** from the choices.

NOTE

Based on the activation of software license (ONA-SP-5GNR-TM2), the 3GPP version that you can select varies. If the software license ONA-SP-5GNR-TM2 is disabled, you can only select TS 38.141 v 15.2.0 (2019-06). If it is enabled, the selection options are TS 38.141 v 15.2.0 (2019-06), TS 38.141 v 15.4.0 (2019-12), TS 38.141 v 16.4.0 (2020-06), and TS 38.141 v 16.5.0 and after (2020-09).

5 Tap **Radio** and select **Frequency Range**, **Bandwidth**, **Subcarrier Spacing** and **Duplex Type**.

a If you select the operating frequency as **FR1**, select from the following:

– SCS 15 kHz: 5, 10, 15, 20, 25, 30, 40, 50 MHz

– SCS 30 kHz: 5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 MHz

– SCS 60 kHz: 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 MHz

– Select **Duplex Type** between **FDD** and **TDD** as required.

- When selecting FDD, both uplink and downlink can transmit at the same time at different spectrum frequencies.
- When selecting TDD, both uplink and downlink use the same spectrum frequencies but at different times.

b If you select the operating frequency as **FR2**, select from the following:

– SCS 15 kHz: 5, 10, 15, 20, 25, 30, 40, 50 MHz

– SCS 30 kHz: 5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 MHz

6 Based on the above setting, tap **Test Model FR1** and select the options from the following choices: FR1-TM1.1, FR1-TM1.2, FR1-TM3.1, FR1-TM3.1a, FR1-TM3.2, FR1-TM3.

7 Based on the above setting, tap **Test Model FR2** and select the options from the following choices: FR2-TM1.1, FR2-TM2, FR2-TM3.1.

NOTE

When you choose TS 38.141 v 16.4.0 (2020-06) or TS 38.141 v 16.5.0 and after (2020-09), the Test Model for FR2 varies. You can select FR2-TM1.1, FR2-TM2, FR2-TM2a, FR2-TM3.1, or FR2-TM3.1a. The Modulation Type is already set for FR1 test models of each 3GPP version, but some test models in FR2, you can select from the options displayed in Modulation Type column as required.

8 Tap to switch **Phase Correction** to **On** or **Off**.

Phase Correction is a way of optimizing EVM performance. When you switch it On, it will decrease inter-symbol interference and compensate distortion caused by a filter applying to each OFDM symbol.

9 Tap **Symbol Phase Comp** and select from the following choices: **Auto**, **Manual**, or **Off**.

Symbol Phase Compensation is used to compensate for phase differences between symbols caused by upconversion. Users do not always use the instrument based on RF frequency. In this case, you can set it to Manual or Off.

- **Auto**: Setting radio frequency to center frequency.
- **Manual**: Setting radio frequency as required.
- **Off**: Setting radio frequency to 0.



NOTE

When calculating Symbol Phase Compensation, you can use the following formula. It complies with 3GPP standard and used to calculate conversion of 5G NR signal to RF signal.

$$\mathrm{Re}\left\{ s_l^{(p,\mu)}(t) \cdot e^{j2\pi f_0 \left(t - t_{\mathrm{start},l}^{\mu} - N_{\mathrm{CP},l}^{\mu} T_c\right)} \right\}$$

To set limit

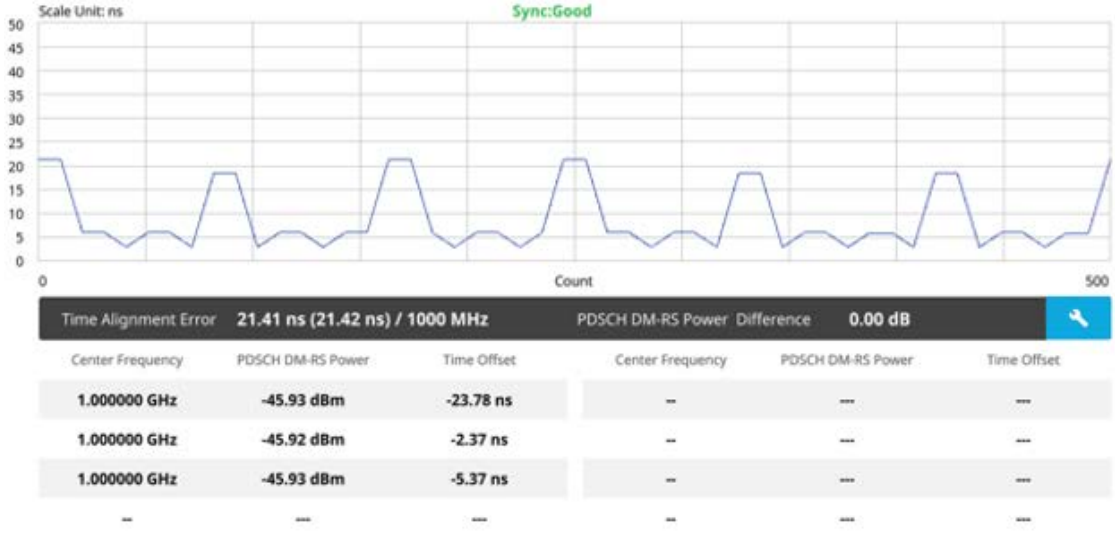
1 Tap the **Menu** > **Limit** on the side bar.

2 Tap to switch the **Test Limits** to **On** or **Off** to enable or disable Pass/Fail indication.
The result table color for Pass is green, and the result table color for Fail is red.

3 Tap **High Limit** to set the upper threshold using the on-screen keyboard.

4 *Optional.* Tap the **Save** icon on the side bar and select the save option from the choices available for your measurement mode.

Figure 187 CA time alignment error with 5G TM



12

Using RAN Analyzer

This chapter describes how to use the RAN Analyzer. Topics covered in this chapter include:

- “Introduction” on page 466
- “Selecting mode and measure” on page 466
- “ 5G NR signal analysis” on page 467
- “Real-time spectrum analysis” on page 488
- “TDD auto gated spectrum analysis” on page 495
- “RF Viewer analysis” on page 515
- “Cell phase synchronization” on page 519
- “Online route map” on page 530

Introduction

RAN Analyzer allows you to perform essential turn up tests for 5G NR Radio, by purchasing only RAN Analyzer license option without purchasing all required licenses, users can perform the required tests in a cost-effective way.

RAN supports the following measurements:

- 5G NR Signal Analysis
  - Beam Analyzer
  - Freq/Time/Power Variation
  - Allocation Mapper
  - Route Map
- Real-time Spectrum Analysis
  - RtSA Persistent Spectrum
  - RtSA Persistent Spectrogram
  - RtSA Spectrum Replayer
- TDD Auto Gated Spectrum
  - TAGS Spectrum
  - TAGS Spectrogram
  - TAGS Persistent Spectrum
  - TAGS Persistent Spectrogram
  - TAGS Spectrum Replayer
- RF Viewer Analysis (Only available with the license, ONA-SP-RFVIEWER)
  - Directional Antenna
- Cell Phase Synchronization
  - Sync Analysis
  - Sync Route Map
- Online Route Map
  - Online OTA Route Map
  - Online Sync Route Map

Selecting mode and measure

The following procedure describes how to select the mode and measure.

To select mode and measure

1 Tap **RAN Analyzer** on the **Mode** panel.

2 Tap any measurement mode from the following choices:

- **5G NR Signal Analysis > Beam Analyzer**, **Freq/Time/Power Variation Allocation Mapper**, or **Route Map**
- **Real-time Spectrum Analysis** > **RtSA Persistent Spectrum**, **RtSA Persistent Spectrogram**, or **RtSA Spectrum Replayer**
- **TDD Auto Gated Spectrum** > **TAGS Spectrum**, **TAGS Spectrogram**, **TAGS Persistent Spectrum**, **TAGS Persistent Spectrogram**, or **TAGS Spectrum Replayer**
- **RF Viewer Analysis** > **Directional Antenna**
- **Cell Phase Synchronization > Sync Analysis** or **Sync Route Map**
- **Online Route Map > Online OTA Route Map** or **Online Sync Route Map**



NOTE

If you have a CAA module with CAA-RFS license (enabled), the RF Source menu will be activated. Go to **Setup** > **RF Source** > **CAA RF Power**. And tap to switch **CAA RF Power** to **On**. Then you can tap to switch **RF Source** to **On** and set **Frequency**/**Power Level** as required. Note that if you have a CAA module with catalog number (CAA06MB with Bias Voltage option), you can tap to switch **Bias Voltage** to **On** and set the required **Bias Voltage**.

With this Bias Voltage, you can enhance the sensitivity while performing interference analysis on feeder of old BTS (Base Transceiver Station) without RRH.

5G NR signal analysis

Beam analyzer

5G NR provides the beamforming profile of each transmission carrier, including the eight strongest beams and the corresponding power levels during its transmission period, and includes:

- **S-SS RSRP (Secondary Synchronization Signal – Reference Signal Received Power)** — linear average over the power contributions (in Watts) of the resource elements which carry secondary synchronization signals
- **P-SS RSRP (Primary Synchronization Signal – Reference Signal Received Power)** — average power measurement through all the primary sync signals
- **S-SS SINR (Secondary Synchronization Signal – Signal to Interference Plus Noise Ratio)** — linear average over the power contribution (in Watts) of the resource elements carrying secondary synchronization signals divided by the linear average of the noise and interference power contribution (in Watts) over the resource elements carrying secondary synchronization signals within the same frequency bandwidth

- **S-SS RSRQ (Secondary Synchronization Signal – Reference Signal Received Quality)** — ratio of N x SS-RSRP/NR carrier RSSI. Here N refers to number of resource blocks in NR carrier RSSI measurement Bandwidth

Setting measure setup

Before starting the Beam Analyzer, you need to set Spectrum measurements displayed on the quick access and display tab. See “Configuring spectrum measurements” on page 25 for more details.

To set measure setup

1 Tap the **Setup** (⚙) icon in the side bar.

2 Tap **Bandwidth/SSB SCS** and select the Setting in the pop-up window based on your need. SSB is an abbreviation for Synchronization Signal Block or SS Block and it refers to Synchronization PBCH block since the synchronization signal and PBCH channel are packed as a single block that always moves together. SSB should be detected first in 5G NR frame. See Table 103 below for the setting criteria based on the operating frequency.

3 Tap **Sync Raster Offset** to set the sync raster resolution to 180 kHz (FR1) or to 720 kHz (FR2) for carrier frequency center using the on-screen keyboard. See Table 104 below for the sync raster offset range per SSB SCS and sync raster resolution.

4 Tap **Sync SCS Offset** to fine-tune the offset using the SCS. See Table 105 below for the sync raster offset range per SSB SCS and sync raster resolution.

5 Tap **SSB Center Frequency** and input the value using the on-screen keyboard.

6 Tap **GSCN** and input the value using the on-screen keyboard.

Based on GSCN input frequency, the SSB frequency changes automatically.

7 Tap **L** to set the maximum number of SS-PBCH blocks within a single SS burst set (A set of SS being transmitted in 5 ms window of SS transmission) among 4, 8 and 64. Refer to the selection criteria based on the table in **Step 2**.

8 Tap **SSB Auto Search Mode** and do the following steps:

a Tap **Auto Preamp/Atten** and switch **SSB Auto Search** to **Start** to set preamp and attenuation automatically.

b Tap **Manual** and switch **SSB Auto Search** to **Start** for manually setting based on your need.



NOTE
If you tap SSB Auto Search to Start, the searching progress screen appears to let you know the status of searching.
You can tap SSB Auto Search to Stop to stop searching.

9 Tap **SSB Periodicity** and select the options from **5 ms**, **10 ms**, **20 ms**, **40 ms**, **80 ms**, 1**60 ms**. The SS burst period (SSB periodicity) is defined by each base station and network configurable. 20 ms is the default for the initial cell selection.

10 Tap to switch **PCI (Physical Cell ID)** to **Manual** or **Auto**.

11 Tap **PCI** and input a value from 0 to 1007 using the on-screen keyboard. The PCI switches to **Manual**.

12 Tap **Time Error Window** and select from the choices: **SSB Periodicity**, **Frame**, or **Half Frame**.

If you select Frame, the range is -5 ms to +5 ms based on 10 ms specified by 3GPP and if you select Half Frame, the range is -2.5 ms to +2.5 ms based on 5 ms specified by 3GPP

13 Tap **Miscellaneous** and do the following steps:

a Tap **Symbol Phase Comp** and select from the following choices: **Auto**, **Manual**, or **Off**.

Symbol Phase Compensation is used to compensate for phase differences between symbols caused by upconversion. Users do not always use the instrument based on RF frequency. In this case, you can set it to Manual or Off.

- **Auto**: Setting radio frequency to center frequency
- **Manual**: Setting radio frequency as required
- **Off**: Setting radio frequency to 0

b Tap to switch **Compensation** to **On** or **Off**.

When the Compensation is set to On, Multi-PCIs changes to Single PCI and it applies the compensation for distance for Single PCI to Time Error.

c Tap **Distance** and input the required value using the on-screen keyboard.

This will be applied when you are measuring the time error.

14 Tap to switch **Sorting Type** to **PCI** or **RSRP**.

When both Multi PCI and Multi Beam are present, selecting PCI groups the results by PCI, while selecting RSRP reorders the results based on RSRP values.

15 Tap to switch **Decoding Bandwidth** to **On** of **Off**.

When Decoding Bandwidth is set to On, if SIB1 is present, the measurement screen displays Stand Alone (SA). If the SIB1 information includes bandwidth details, the detected bandwidth is also displayed at the top left of the table.

16 *Optional.* Tap **Limit** > **PCI Dominance**. Once tapped On, you can set the value using the on-screen keyboard.

If the PCI dominance is on, you can judge pass (green) or fail (red) with colors based on the limit you have set. For example, if it becomes smaller than the threshold, the fail indicator (red) can be identified in the PCI column of the result table and the top right corner of the instrument at the same time.



NOTE

You can go to **Menu** > **Frequency** > **Center Frequency List** to add frequently used center frequency using the **Add** button in the Frequency List or to delete the selected frequency using the **Delete** button. You can also apply one of the default frequencies in the Frequency List by tapping the **Apply** button.

Table 103 Setup per operating frequency

Operating frequency	L	Case	SCS	Slots in a burst period
< 3 GHz (FR1)	4	A {2,8} +14*n	15 kHz	5 (1 ms)
< 3 GHz (FR1)	4	B {4,8,16,20} +28*n	30 kHz	10 (0.5 ms)
< 3 GHz (FR1) For un-paired spectrum operation: < 1.88 GHz	4	C {2,8} +14*n	30 kHz	10 (0.5 ms)
3 to 6 GHz (FR1)	8	A {2,8} +14*n	15 kHz	5 (1 ms)
3 to 6 GHz (FR1)	8	B {4,8,16,20} +28*n	30 kHz	10 (0.5 ms)
3 to 6 GHz (FR1) For un-paired spectrum operation: 1.88 to 6 GHz	8	C {2,8} +14*n	30 kHz	10 (0.5 ms)
> 6 GHz (FR2)	64	D {4,8,16,20} +28*n	120 kHz	40 (0.125 ms)
> 6 GHz (FR2)	64	E {8,12,16,20,32,36,40,44} +56*n	240 kHz	80 (62.5 ms)

Table 104 Sync raster offset range per SSB SCS and sync raster resolution

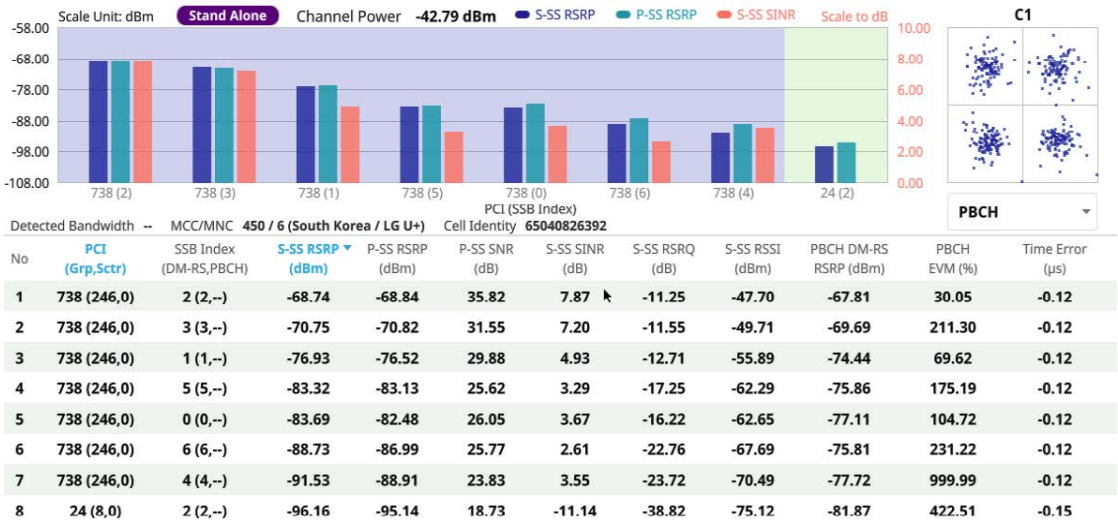
SSB SCS (kHz)	Sync Raster Resolution (kHz)	Sync Raster Offset Range	SSB Frequency = Center frequency
15	180	0 to 250	125
30	180	0 to 506	253
120	720	0 to 92	46
240	720	0 to 48	24

Table 105 Sync SCS offset range per SSB SCS and sync SCS resolution

SSB SCS (kHz)	Sync Raster Resolution (kHz)	Sync Raster Offset Range	SSB Frequency = Center Frequency
15	15	0 to 11	0
30	30	0 to 5	0
120	120	0 to 5	0
240	240	0 to 2	0

Figure 188 shows an example of beam analyzer measurement.

Figure 188 5G NR beam analyzer measurement



No	PCI (Grp,Sctr)	SSB Index (DM-RS,PBCH)	S-SS RSRP (dBm)	P-SS RSRP (dBm)	P-SS SNR (dB)	S-SS SINR (dB)	S-SS RSRQ (dB)	S-SS RSSI (dBm)	PBCH DM-RS RSRP (dBm)	PBCH EVM (%)	Time Error (µs)
1	738 (246,0)	2 (2,--)	-68.74	-68.84	35.82	7.87	-11.25	-47.70	-67.81	30.05	-0.12
2	738 (246,0)	3 (3,--)	-70.75	-70.82	31.55	7.20	-11.55	-49.71	-69.69	211.30	-0.12
3	738 (246,0)	1 (1,--)	-76.93	-76.52	29.88	4.93	-12.71	-55.89	-74.44	69.62	-0.12
4	738 (246,0)	5 (5,--)	-83.32	-83.13	25.62	3.29	-17.25	-62.29	-75.86	175.19	-0.12
5	738 (246,0)	0 (0,--)	-83.69	-82.48	26.05	3.67	-16.22	-62.65	-77.11	104.72	-0.12
6	738 (246,0)	6 (6,--)	-88.73	-86.99	25.77	2.61	-22.76	-67.69	-75.81	231.22	-0.12
7	738 (246,0)	4 (4,--)	-91.53	-88.91	23.83	3.55	-23.72	-70.49	-77.72	999.99	-0.12
8	24 (8,0)	2 (2,--)	-96.16	-95.14	18.73	-11.14	-38.82	-75.12	-81.87	422.51	-0.15

NOTE

The undetected values in the Detected ID List table will be indicated as "--".

NOTE

The constellation shows a beam with the highest signal received as indicated in No.1 in the Detected ID List table and there is an option to show the constellation for PBCH and PBCH DM-RS.

Freq/Time/Power variation

The frequency, time, and power variation shows the frequency, time, and power error trend based on the time elapsed.

After configuring the spectrum measurement in “Configuring spectrum measurements” on page 25, you can set the measure setup to continue your measurement. The measurement settings can be saved and recalled as a file by selecting File Type as Setup and load the file onto the instrument using the **Save/Load** icons on the side bar.

Setting measure setup

To set measure setup

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap **Bandwidth/SSB SCS** and select the Setting in the pop-up window based on your need. SSB is an abbreviation for Synchronization Signal Block or SS Block and it refers to Synchronization PBCH block since the synchronization signal and PBCH channel are packed as a single block that always moves together. SSB should be detected first in 5G NR frame. See Table 106 below for the setting criteria based on the operating frequency.

3 Tap **Sync Raster Offset** to set the sync raster resolution to 180 kHz (FR1) or to 720 kHz (FR2) for carrier frequency center using the on-screen keyboard. See Table 107 below for the sync raster offset range per SSB SCS and sync raster resolution.

4 Tap **Sync SCS Offset** to fine-tune the offset using the SCS. See Table 108 below for the sync raster offset range per SSB SCS and sync raster resolution.

5 Tap **SSB Center Frequency** and input the value using the on-screen keyboard.

6 Tap **GSCN** and input the value using the on-screen keyboard.

7 Tap **L** to set the maximum number of SS-PBCH blocks within a single SS burst set (A set of SS being transmitted in 5 ms window of SS transmission) among 4, 8 and 64. Refer to the selection criteria based on the table in **Step 2**.

8 Tap **SSB Auto Search Mode** and do the following steps:

   a Tap **Auto Preamp/Atten** and switch **SSB Auto Search** to **Start** to set preamp and attenuation automatically.

   b Tap **Manual** and switch **SSB Auto Search** to **Start** for manually setting based on your need.

9 Tap **SSB Auto Search** between **Start** and **Stop**.

   a **Start**: to search SCS, type, and the number of SSB automatically. Once Start is selected, the progress bar appears. If it fails to perform the auto search, a fail message appears and the SSB switches to Manual.

   b **Stop**: to set the SSB periodicity based on the base station.

10 Tap **SSB Periodicity** and select the options from **5 ms**, **10 ms**, **20 ms**, **40 ms**, **80 ms**, 1**60 ms**. The SS burst period (SSB periodicity) is defined by each base station and network configurable. 20 ms is the default for the initial cell selection.

11 Tap to switch **PCI (Physical Cell ID)** to **Manual** or **Auto**.

12 Tap **PCI** and input a value from 0 to 1007 using the on-screen keyboard. The PCI switches to **Manual**

13 Tap **Time Error Window** and select from the choices: **SSB Periodicity**, **Frame**, or **Half Frame**.

   If you select Frame, the range is -5 ms to +5 ms based on 10 ms specified by 3GPP and if you select Half Frame, the range is -2.5 ms to +2.5 ms based on 5 ms specified by 3GPP

14 Tap **Miscellaneous** > **Symbol Phase Comp** and select from the following choices: **Auto**, **Manual**, or **Off**.

Symbol Phase Compensation is used to compensate for phase differences between symbols caused by upconversion. Users do not always use the instrument based on RF frequency. In this case, you can set it to Manual or Off.

– **Auto**: Setting radio frequency to center frequency
– **Manual**: Setting radio frequency as required
– **Off**: Setting radio frequency to 0

Table 106 Setup per operating frequency

Operating frequency	L	Case	SCS	Slots in a burst period
< 3 GHz (FR1)	4	A {2,8} +14*n	15 kHz	5 (1 ms)
< 3 GHz (FR1)	4	B {4,8,16,20} +28*n	30 kHz	10 (0.5 ms)
< 3 GHz (FR1) For unpaired spectrum operation: < 1.88 GHz	4	C {2,8} +14*n	30 kHz	10 (0.5 ms)
3 to 6 GHz (FR1)	8	A {2,8} +14*n	15 kHz	5 (1 ms)
3 to 6 GHz (FR1)	8	B {4,8,16,20} +28*n	30 kHz	10 (0.5 ms)
3 to 6 GHz (FR1) For unpaired spectrum operation: 1.88 to 6 GHz	8	C {2,8} +14*n	30 kHz	10 (0.5 ms)
> 6 GHz (FR2)	64	D {4,8,16,20} +28*n	120 kHz	40 (0.125 ms)
> 6 GHz (FR2)	64	E {8,12,16,20,32,36,40,44} +56*n	240 kHz	80 (62.5 ms)

Table 107 Sync raster offset range per SSB SCS and sync raster resolution

SSB SCS (kHz)	Sync Raster Resolution (kHz)	Sync Raster Offset Range	SSB Frequency = Center frequency
15	180	0 to 250	125
30	180	0 to 506	253
120	720	0 to 92	46
240	720	0 to 48	24

Table 108 Sync SCS offset range per SSB SCS and sync SCS resolution

SSB SCS (kHz)	Sync Raster Resolution (kHz)	Sync Raster Offset Range	SSB Frequency = Center Frequency
15	15	0 to 11	0
30	30	0 to 5	0
120	120	0 to 5	0
240	240	0 to 2	0

Figure 189 shows an example of 5G NR freq/time/power variation by frequency/time.

Figure 189 5G NR freq/time/power variation by frequency/time



NOTE

You can tap the Distance box and input the value that you want to compensate for distance. When distance is entered, the time will show the value with distance correction. Make sure the default value for Distance is 0.

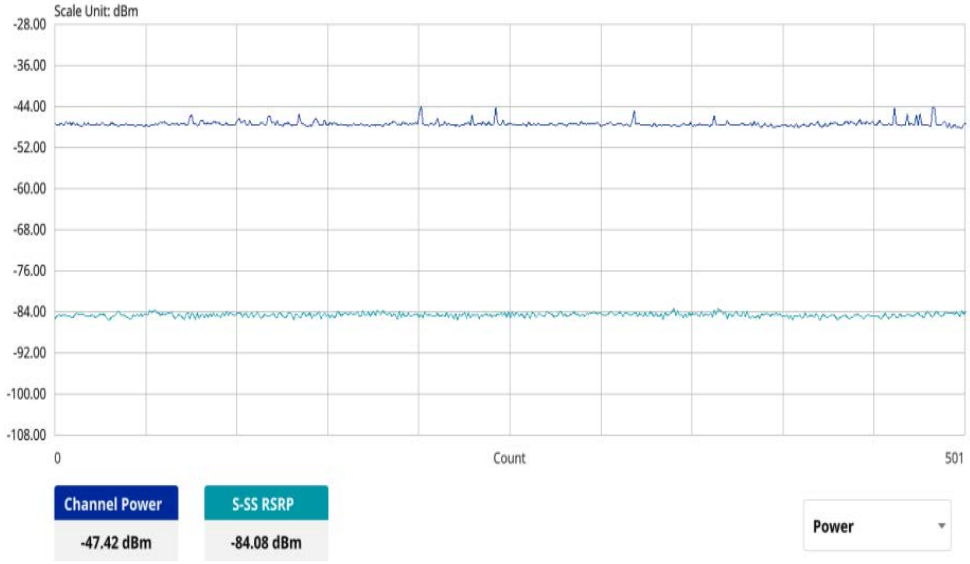
You can see the selected trace being plotted on the chart based on the selection from drop-down menu: Frequency, Time, Frequency/Time, or Power.

NOTE

When you select the Frequency/Time trace to be plotted, the Limit toggle icon will appear in the middle of the measurement screen. Once the Limit menu is turned on, the limit line will be displayed based on your selection of either Frequency or Time.

Figure 190 shows an example of 5G NR freq/time/power variation by power.

Figure 190 5G NR freq/time/power variation by power



Allocation mapper

The 5G NR Allocation Mapper displays power for X axis (time) and Y axis (frequency) of 1 frame with resources being measuring for current PDSCH EVM.

Setting measure setup

After configuring the spectrum measurement in “Configuring spectrum measurements” on page 25, you can set the measure setup to continue your measurement. The measurement settings can be saved and recalled as a file by selecting File Type as Setup and load the file onto the instrument using the **Save/Load** icons on the side bar.

To set measure setup

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap **Bandwidth/SSB SCS** and select the Setting in the pop-up window based on your need. SSB is an abbreviation for Synchronization Signal Block or SS Block and it refers to Synchronization PBCH block since the synchronization signal and PBCH channel are packed as a single block that always moves together. SSB should be detected first in 5G NR frame. See Table 109 below for the setting criteria based on the operating frequency.

3 Tap **Sync Raster Offset** to set the sync raster resolution to 180 kHz (FR1) or to 720 kHz (FR2) for carrier frequency center using the on-screen keyboard. See Table 110 below for the sync raster offset range per SSB SCS and sync raster resolution.

4 Tap **Sync SCS Offset** to fine-tune the offset using the SCS. See Table 111 below for the sync raster offset range per SSB SCS and sync raster resolution.

5 Tap **SSB Center Frequency** and input the value using the on-screen keyboard.

6 Tap **GSCN** and input the value using the on-screen keyboard.

7 Tap **L** to set the maximum number of SS-PBCH blocks within a single SS burst set (A set of SS being transmitted in 5 ms window of SS transmission) among 4, 8 and 64. Refer to the selection criteria based on the table in **Step 2**.

8 Tap **SSB Auto Search Mode** and do the following steps:

   a Tap **Auto Preamp/Atten** and switch **SSB Auto Search** to **Start** to set preamp and attenuation automatically.

   b Tap **Manual** and switch **SSB Auto Search** to **Start** for manually setting based on your need.

9 Tap **SSB Auto Search** between **Start** and **Stop**.

   a **Start**: to search SCS, type, and the number of SSB automatically. Once Start is selected, the progress bar appears. If it fails to perform the auto search, a fail message appears and the SSB switches to Manual.

   b **Stop**: to set the SSB periodicity based on the base station.

10 Tap **SSB Periodicity** and select the options from **5 ms**, **10 ms**, **20 ms**, **40 ms**, **80 ms**, **160 ms**. The SS burst period (SSB periodicity) is defined by each base station and network configurable. 20 ms is the default for the initial cell selection.

11 Tap to switch **PCI (Physical Cell ID)** to **Manual** or **Auto**.

12 Tap **PCI** and input a value from 0 to 1007 using the on-screen keyboard. The PCI switches to **Manual**.

13 Tap **Miscellaneous** > **Symbol Phase Comp** and select from the following choices: **Auto**, **Manual**, or **Off**.

   Symbol Phase Compensation is used to compensate for phase differences between symbols caused by upconversion. Users do not always use the instrument based on RF frequency. In this case, you can set it to Manual or Off.

   – **Auto**: Setting radio frequency to center frequency
   – **Manual**: Setting radio frequency as required
   – **Off**: Setting radio frequency to 0

To set limit

1 Tap the rectangle with value before color legend bar on the measurement screen.

a Set a value for **Minimum** using the on-screen keyboard.

b Set a value for **Maximum** using the on-screen keyboard.

Table 109 Setup per operating frequency

Operating frequency	L	Case	SCS	Slots in a burst period
< 3 GHz (FR1)	4	A {2,8} +14*n	15 kHz	5 (1 ms)
< 3 GHz (FR1)	4	B {4,8,16,20} +28*n	30 kHz	10 (0.5 ms)
< 3 GHz (FR1) For un-paired spectrum operation: < 1.88 GHz	4	C {2,8} +14*n	30 kHz	10 (0.5 ms)
3 to 6 GHz (FR1)	8	A {2,8} +14*n	15 kHz	5 (1 ms)
3 to 6 GHz (FR1)	8	B {4,8,16,20} +28*n	30 kHz	10 (0.5 ms)
3 to 6 GHz (FR1) For un-paired spectrum operation: 1.88 to 6 GHz	8	C {2,8} +14*n	30 kHz	10 (0.5 ms)
> 6 GHz (FR2)	64	D {4,8,16,20} +28*n	120 kHz	40 (0.125 ms)
> 6 GHz (FR2)	64	E {8,12,16,20,32,36,40,44} +56*n	240 kHz	80 (62.5 ms)

Table 110 Sync raster offset range per SSB SCS and sync raster resolution

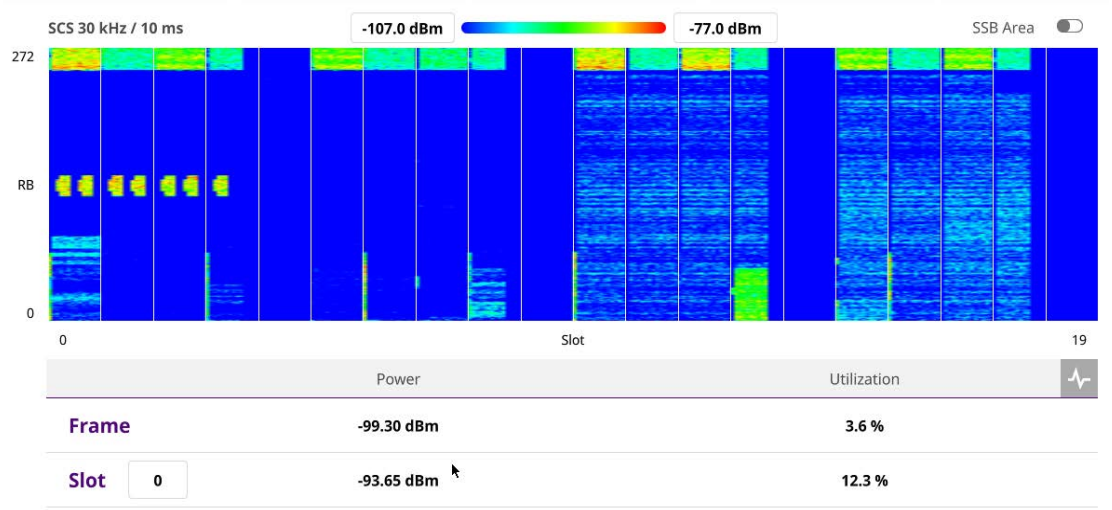
SSB SCS (kHz)	Sync Raster Resolution (kHz)	Sync Raster Offset Range	SSB Frequency = Center frequency
15	180	0 to 250	125
30	180	0 to 506	253
120	720	0 to 92	46
240	720	0 to 48	24

Table 111 Sync SCS offset range per SSB SCS and sync SCS resolution

SSB SCS (kHz)	Sync Raster Resolution (kHz)	Sync Raster Offset Range	SSB Frequency = Center Frequency
15	15	0 to 11	0
30	30	0 to 5	0
120	120	0 to 5	0
240	240	0 to 2	0

Figure 191 shows an example of 5G NR allocation mapper measurement.

Figure 191 5G NR allocation mapper measurement



NOTE
If the SSB Area is set to On, it shows the expected resource location of SSB in the currently set 5G NR.

- Frame Power: the average RE power of the whole frames (dB, full bandwidth)
- Frame Utilization: RE% of “PBCH-DMRS RSRP(dB) - 6dB” or more in whole frame RE
- Slot Power: the average RE power of the corresponding whole slot (dB, fullbandwidth)
- Slot Utilization: RE% of “PBCH-DMRS RSRP(dB) - 6dB” or more in the corresponding whole slot
- Chart View icon: You can tap the Chart View icon on the top right of the table to view the utilization counter graph

Route map

5G route map traces the power level of the strongest beam corresponding to a particular time and geographical position and presents it in a geographical map as a measurement point. All the collected measurements can be exported for post-processing purposes, including data of the eight strongest beams for each measurement point, including its measurement time and geographical location.

Figure 192 shows an example of RAN route map measurement.

Figure 192 Route map with RAN Analyzer



Loading a map

To use any features related to maps, you need to download and install the maps on the instrument. The **VIAVI JDMapCreator** will help you to download maps. Ensure the JDMapCreator application on your computer is connected to the instrument via LAN. You can send a map file with a single layer to the instrument directly by using the **Send to EQP** menu in JDMapCreator. For information about how to use the JDMapCreator, see the *JDMapCreator 2.0 User Guide*.

To load a map

1 Plug in your USB flash drive that has a map file in .mcfv file type created in JDMapCreator.

2 Tap the **Load** ( ) icon on the side bar.

3 Navigate to the map file that you want to open.

The **File Information** pane displays the file properties, including its name, size, type, and date modified.

4 Tap the **Load** button on the screen.

Once you have loaded the map, you can also control the map using the following icons on the map.

Table 112 Map control icons

Icon	Description
	Tap to go to your current location on the map. Once tapped, the purple icon appears on the map, indicating your current location.
	Tap to switch to the full screen map view.

Table 112 Map control icons

Icon	Description
	Tap to zoom in the map.
	Tap to zoom out the map.
	Tap and select the area where you want to expand.

The left-most cell-site icon is activated when you import the cell-site information file.

To set measurement setup

Before starting the Route Map measurement, you need to set Spectrum measurements displayed on the quick access and display tab. See “Configuring spectrum measurements” on page 25 for more information.

1 If required, connect a GNSS receiver to your instrument for outdoor mapping. Indoor mapping does not necessarily need a GNSS antenna.

2 Tap the **Setup** ( ) icon on the side bar.

3 Tap **Map Config** to configure the map setting.

   a Tap to switch the **Plot Point** to **GNSS**, **Position**, or **Time**.
   - To collect data/plot points automatically as you move around in a vehicle or outside, select **GNSS**.
   - To collect data/plot points manually in an indoor layout without a GNSS antenna, select **Position**.
   - To collect data/plot points based on time, select **Time**.

   b Tap to switch **Plot Item** to **P-SS RSRP**, **S-SS RSRP**, **S-SS RSRQ**, **S-SS SINR** or **PCI Dominance**.

   c Tap to switch the **Screen Mode** between **Map** and **Full**.
   - With the **Map** setting, you can view only the collected points that can be seen within the boundary of the loaded map.
   - With the **Full** setting, you can view all the collected points of the route without the loaded map

4 Tap **Bandwidth/SSB SCS** and select the Setting in the pop-up window based on your need. SSB is an abbreviation for Synchronization Signal Block or SS Block and it refers to Synchronization PBCH block since the synchronization signal and

PBCH channel are packed as a single block that always moves together. SSB should be detected first in 5G NR frame. See Table 113 below for the setting criteria based on the operating frequency.

5 Tap **Sync Raster Offset** to set the sync raster resolution to 180 kHz (FR1) or to 720 kHz (FR2) for carrier frequency center using the on-screen keyboard. See Table 114 below for the sync raster offset range per SSB SCS and sync raster resolution.

6 Tap **Sync SCS Offset** to fine-tune the offset using the SCS. See Table 115 below for the sync raster offset range per SSB SCS and sync raster resolution.

7 Tap **L** to set the maximum number of SS-PBCH blocks within a single SS burst set (A set of SS being transmitted in 5 ms window of SS transmission) among 4, 8 and 64. Refer to the selection criteria based on the table in **Step 4**.

8 Tap **SSB Auto Search Mode** and do the following steps:

- **a** Tap **Auto Preamp/Atten** and switch **SSB Auto Search** to **Start** to set preamp and attenuation automatically.
- **b** Tap **Manual** and switch **SSB Auto Search** to **Start** for manually setting based on your need.

9 Tap **SSB Auto Search** between **Start** and **Stop**.

- **a** **Start**: to search SCS, type, and the number of SSB automatically. Once Start is selected, the progress bar appears. If it fails to perform the auto search, a fail message appears and the SSB switches to Manual.
- **b** **Stop**: to set the SSB periodicity based on the base station.

10 Tap **SSB Periodicity** and select the options from **5 ms**, **10 ms**, **20 ms**, **40 ms**, **80 ms**, 1**60 ms**. The SS burst period (SSB periodicity) is defined by each base station and network configurable. 20 ms is the default for the initial cell selection.

11 Tap **SSB Center Frequency** and input the value using the on-screen keyboard.

12 Tap **GSCN** and input the value using the on-screen keyboard.

13 Tap to switch **PCI (Physical Cell ID)** to **Manual** or **Auto**.

14 Tap **PCI** and input a value from 0 to 1007 using the on-screen keyboard. The PCI switches to **Manual**.

15 Tap **Time Error Window** and select from the choices: **SSB Periodicity**, **Frame**, or **Half Frame**.

If you select Frame, the range is -5 ms to +5 ms based on 10 ms specified by 3GPP and if you select Half Frame, the range is -2.5 ms to +2.5 ms based on 5 ms specified by 3GPP

16 Tap **Miscellaneous** > **Symbol Phase Comp** and select from the following choices: **Auto**, **Manual**, or **Off**.

Symbol Phase Compensation is used to compensate for phase differences between symbols caused by upconversion. Users do not always use the instrument based on RF frequency. In this case, you can set it to Manual or Off.

– **Auto**: Setting radio frequency to center frequency
– **Manual**: Setting radio frequency as required
– **Off**: Setting radio frequency to 0

Table 113 Setup per operating frequency

Operating frequency	L	Case	SCS	Slots in a burst period
< 3 GHz (FR1)	4	A {2,8} +14*n	15 kHz	5 (1 ms)
< 3 GHz (FR1)	4	B {4,8,16,20} +28*n	30 kHz	10 (0.5 ms)
< 3 GHz (FR1) For unpaired spectrum operation: < 1.88 GHz	4	C {2,8} +14*n	30 kHz	10 (0.5 ms)
3 to 6 GHz (FR1)	8	A {2,8} +14*n	15 kHz	5 (1 ms)
3 to 6 GHz (FR1)	8	B {4,8,16,20} +28*n	30 kHz	10 (0.5 ms)
3 to 6 GHz (FR1) For unpaired spectrum operation: 1.88 to 6 GHz	8	C {2,8} +14*n	30 kHz	10 (0.5 ms)
> 6 GHz (FR2)	64	D {4,8,16,20} +28*n	120 kHz	40 (0.125 ms)
> 6 GHz (FR2)	64	E {8,12,16,20,32,36,40,44} +56*n	240 kHz	80 (62.5 ms)

Table 114 Sync raster offset range per SSB SCS and sync raster resolution

SSB SCS (kHz)	Sync Raster Resolution (kHz)	Sync Raster Offset Range	SSB Frequency = Center frequency
15	180	0 to 250	125
30	180	0 to 506	253
120	720	0 to 92	46
240	720	0 to 48	24

Table 115 Sync SCS offset range per SSB SCS and sync SCS resolution

SSB SCS (kHz)	Sync Raster Resolution (kHz)	Sync Raster Offset Range	SSB Frequency = Center Frequency
15	15	0 to 11	0
30	30	0 to 5	0
120	120	0 to 5	0
240	240	0 to 2	0

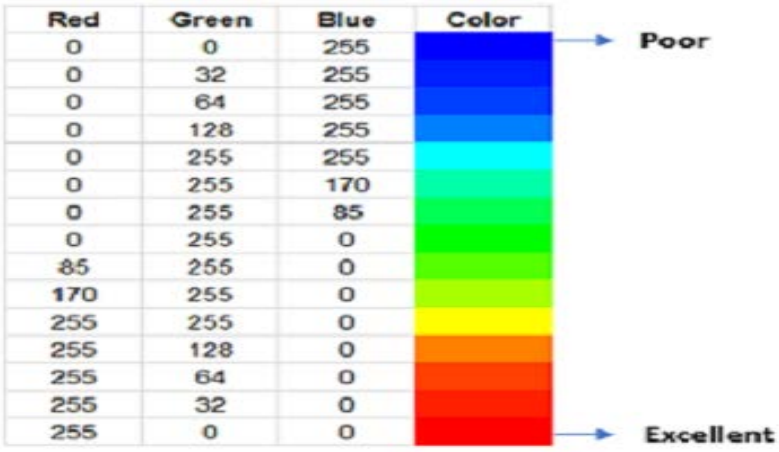
To set limit

You can set the thresholds for the two different color indicators, red and blue. The maximum value is the Limit for **Excellent**, and the minimum value is the Limit for **Poor**. See below to check the plot point color based on the Legend Color Table.

1. Tap the rectangle with value before color legend bar on the right panel.
2. Set a value for **Poor** (minimum value) using the on-screen keyboard.
3. Tap the rectangle with value after color legend bar on the right panel.
4. Set a value for **Excellent** (maximum value) using the on-screen keyboard.

Figure 193 shows a legend color table.

Figure 193 Legend color table



Logging data

To use any features related to maps, you need to download and install the maps on the instrument. The VIAVI JDMapCreator will help you download maps. Make sure the JDMapCreator application on your computer is connected to the instrument via LAN. You can send a map file with a single layer to the instrument directly by using the Send to EQP menu in JDMapCreator. For more information on how to use the JDMapCreator, see the *JDMapCreator 2.0 User Guide*.

To log data

1 Follow **steps 1 to 3** in Setting measure setup.

2 Tap the **Testing** button on the right panel of the map to start plotting on the map. When you select a point on the map, a marker appears and an Information window appears on the right panel.

If you select the Plot Item to PCI Dominance, you will see the plotting circled dot and its edge with PCI legend color based on its received power and PCI Dominance color based on the threshold you have set respectively. If PCI Dominance is lower than the value you have set, it judges fail showing red in the edge. Otherwise, it judges pass showing green in the edge.

3 Tap the **Stop** (■) button to stop plotting.

4 Tap the **Pause** button (❚❚) to pause plotting, then the GNSS point cannot be plotted.

5 If you start test and select **Setup** > **Map Config** > **Plot Point** > **Position**, you can undo by tapping the **Testing** button.

6 If you select the **Stop** button, the Plot Stop pop-up window appears, then tap **Yes**.

7 Tap **Yes** when the Save pop-up window appears and save the logging file to your USB.

If you go to **Limit** > **PCI Dominance** and set it, you can judge pass (green) or fail (red) with colors based on the limit you have set. For example, if it becomes smaller than the threshold, the fail indicator (red) can be identified in the PCI column of the Information window and the top right corner of the instrument at the same time.

Viewing the logging data

To view the logging data

1 Load the saved logging file using the **Load** () icon on the side bar. Make sure the file extension is .gomv.

2 If the **PCI** is set to **Auto**, the point on the map appears with a color representing the largest **S-SS-RSRP** value. When you select a point on the map, a marker appears and the Information window appears on the right panel.

3 Set the **PCI** to **Manual** and tap the **Select** button.

The Select PCI window appears.

4 Select PCI on the left and then the corresponding Beam Index appeared on the right.

5 Tap the **Apply** button.

The point color of the map changes to the corresponding SS-RSRP value, and if there is no detected Beam Index, the point will be hidden.

NOTE
When you load the result file, a pop-up message asking whether you want to load data only or data with map appears. If the current screen does not display all the loaded data, the screen mode will be automatically changed to Full.

Importing cellsite DB

You can import the site DB by creating the 5G site information form.

To import cellsite DB

1 Create the 5G site information with an excel file as below.

2 Input the two mandatory fields: **Lat (DecDeg)** and **Long (DecDeg)**.

3 Input the **Azimuth** field if you want to check the direction of antenna.

4 Make sure to save the file as (Comma delimited) (*.csv).

5 Copy the file to the USB memory stick and insert it to the **USB A** or **USB B** port of the instrument.

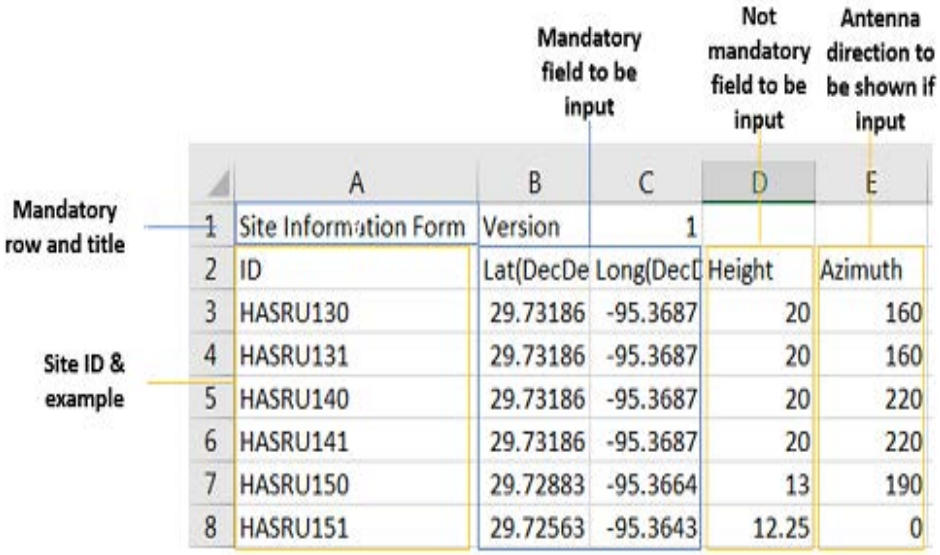
6 Tap the **Load** ( ) icon on the side bar.

7 Import the saved file.

Once the file is loaded, the following cellsite information appears with an icon.

Figure 194 shows an example of an importing cellsite DB.

Figure 194 Importing Cellsite DB



	A	B	C	D	E
1	Site Information Form	Version	1		
2	ID	Lat(DecDe	Long(DecD	Height	Azimuth
3	HASRU130	29.73186	-95.3687	20	160
4	HASRU131	29.73186	-95.3687	20	160
5	HASRU140	29.73186	-95.3687	20	220
6	HASRU141	29.73186	-95.3687	20	220
7	HASRU150	29.72883	-95.3664	13	190
8	HASRU151	29.72563	-95.3643	12.25	0

Figure 195 Route map measurement with site information screen

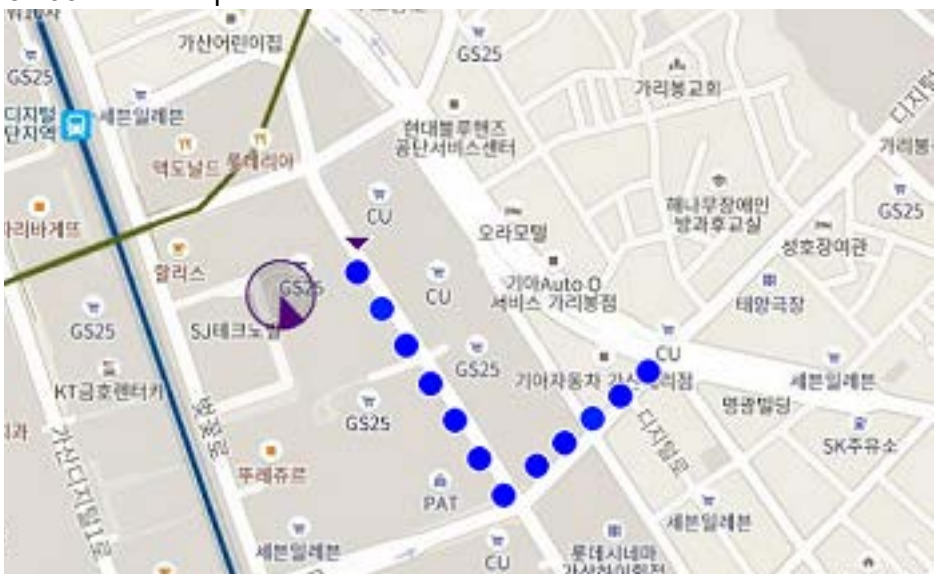
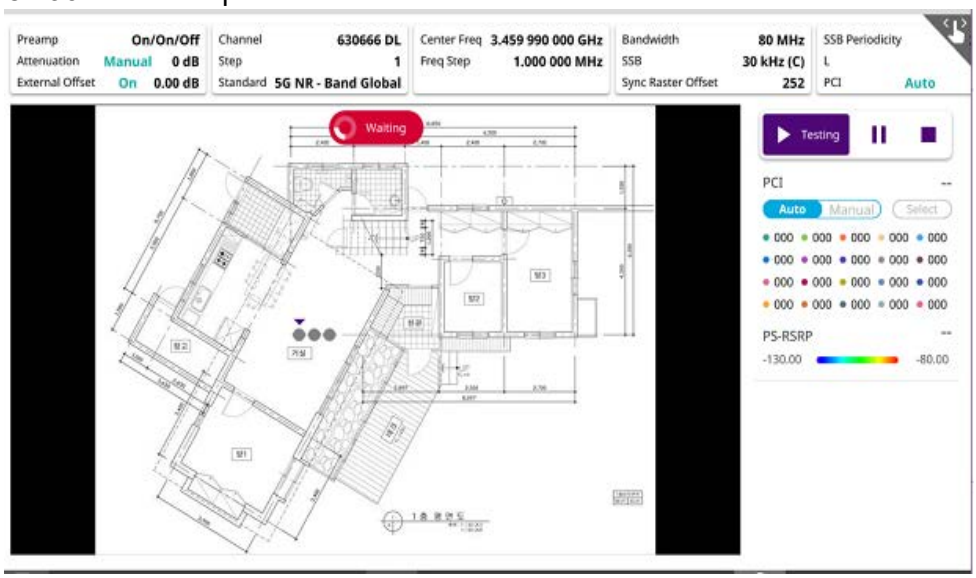


Figure 196 shows an example of route map measurement with Plot Point to Time.

Figure 196 Route map measurement with Plot Point to Time



NOTE

When you setup Plot Point to Time and tap the start/testing button, you can't touch the screen to active. After the waiting indicator(Waiting) stops, the active indicator(00 Data) shows up.

Real-time spectrum analysis

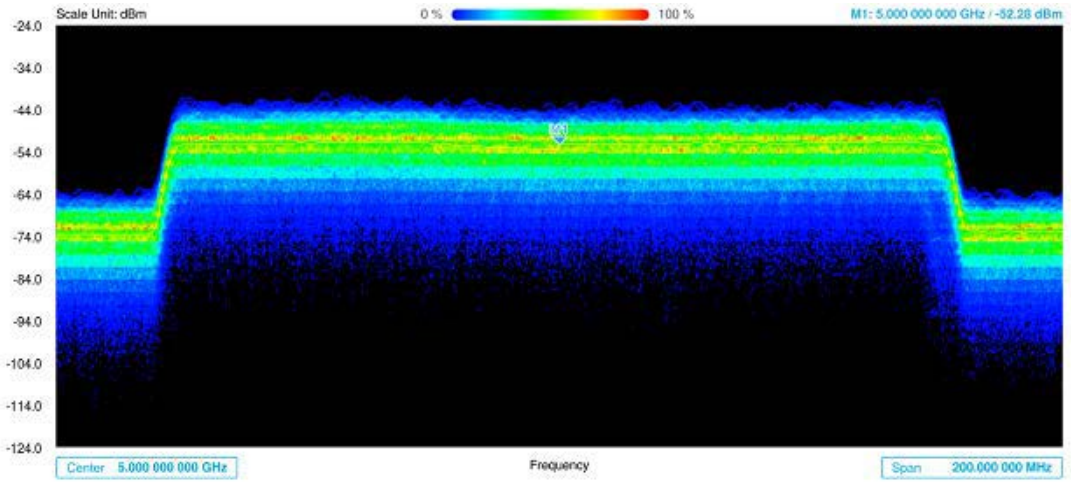
The following sections describe how to conduct interference measurements.

RtSA persistent spectrum

The persistent spectrum of a signal is a time-frequency view that shows the percentage of the time that a given frequency is present in a signal. It is a histogram in power-frequency space. The longer a particular frequency persists in a signal as the signal evolves, the higher its time percentage, and thus the brighter or hotter its color in the display. The persistent spectrum is used to identify signals hidden in other signals.

Figure 197 displays a sample persistent spectrum measurement.

Figure 197 Persistent spectrum measurement



To set measure setup for Sound Indicator

If you have configured test parameters as described in “Configuring spectrum measurements” on page 25, continue to set measure setup. You can change Center Frequency and Span by tapping the icons right below the result chart screen.

1 Tap the **Setup** ( ) icon on the side bar.

2 Tap **Sound Indicator**:

- **a** Tap to switch the **Sound** between **On** and **Off** to enable and disable the alarm sound.
- **b** Tap to switch the **Alarm Reference** to **Marker** to set the active marker position as the alarm reference.
- **c** Tap to switch the **Alarm Reference** to **Line** to set the limit as the alarm reference. The Reference Line Mode menu becomes activated to be set.
- **d** Select the Reference Line to specify a threshold for the reference line using the on-screen keyboard.
- **e** *Optional*: To adjust the volume for alarm sound, tap **Volume** and input from 1 to 10 using the on-screen keyboard.

To set measure setup for Interference ID

The Interference ID automatically classifies interfering signals over a designated spectrum and displays the list of possible signal types corresponding to the selected signal.

1 Tap the **Setup** ( ) icon on the side bar.

2 Tap Interference ID.

- **a** Tap to switch the Interference ID between On and Off to turn the Interference ID on and off.
- **b** Tap Threshold and input a value using the on-screen keyboard.

To set measure setup for POI

POI (Probability of Intercept) measure setup lets you configure the Mode (High/Normal) and corresponding RBW/Span range for interception performance.

1 Tap the **Setup** ( ) icon on the side bar.

2 Tap **POI Mode**. You can also access this menu using the Quick Access and Display Tab on top.

a Tap to switch the Mode between High and Normal. The following table shows RBW and Span setup range per Normal and High mode.

Table 116 RBW and Span setup ranges

Mode		A	B	C	D
Normal	POI	100 to 34 µs	392 to 136.5 µs	800.5 to 270.5 µs	3200 to 1076 µs
	Bandwidth	100 to 20 MHz	19 to 5 MHz	4 and 3 MHz	2 and 1 MHz
	RBW	30 kHz to 10 MHz	10 kHz to 1 MHz	3 kHz to 1 MHz	1 kHz to 300 kHz

Mode		A	B	C	D	E	F
High	POI	18.5 to 2 µs	29.5 to 4 µs	73.5 to 7.5 µs	147 to 15 µs	284 to 28 µs	587 to 56.5 µs
	Effective Bandwidth	122.88 MHz	61.4 MHz	30.72 MHz	15.36 MHz	7.68 MHz	3.84 MHz
	Display Bandwidth	100 MHz	50 MHz	25 MHz	14 MHz	7 MHz	3 MHz
	RBW	100 kHz to 30 MHz	100 kHz to 10 MHz	30 kHz to 10 MHz	10 kHz to 3 MHz	10 kHz to 3 MHz	3 kHz to 1 MHz

b Tap **Speed** and input a value using the on-screen keyboard.

To set the DPX marker

1 Tap **Menu > Marker > Marker Table**.

The marker setting table appears.

2 Tap **DPX**.

The vertical bar and horizontal bar appear. A DPX marker shows the hit rate of X-axis (amplitude) and Y-Axis, whereas a normal trace marker shows a value of the X-axis.

3 Tap the chart screen to move the DPX marker or move the vertical bar and horizontal bar.



NOTE

If you select the DPX marker, you can only use the Peak Search and Always Peak options. Delta pair is not available. See “Using marker” on page 41 for more details.

To set bitmap

1 Tap **Menu > Bitmap**.

2 Tap **Dot Persistence Time** and input a value using the on-screen keyboard. This represents the time that accumulates DPX data.

3 Tap to switch **Bitmap Scale** to **On** to enable auto scale or **Off** to disable auto scale.

If the **Bitmap Scale** is **On**, the point where the maximum hit represents maximum colors. If the **Bitmap Scale** is **Off**, the bluer color (closer to 0% of the color bar) is mapped with hit.

4 Tap **Bitmap Min** and input **%** value using the on-screen keyboard.

Bitmap Min represents unused bitmap color range. If you set it to 10%, the color matched with 10% or below does not show.

5 Tap **Bitmap Max** and input % value using the on-screen keyboard.

Bitmap Max represents max range of bitmap colors to be used. If you set it to 90%, the color that exceeds 90% does not show.

6 Tap **Hit Min** and input % value using the on-screen keyboard.

Hit Min represents the minimum number of hits not to be converted to colors. If you set it to 10%, the hit matched with 10% or below is not converted to colors.

7 Tap **Hit Max** and input % value using the on-screen keyboard.

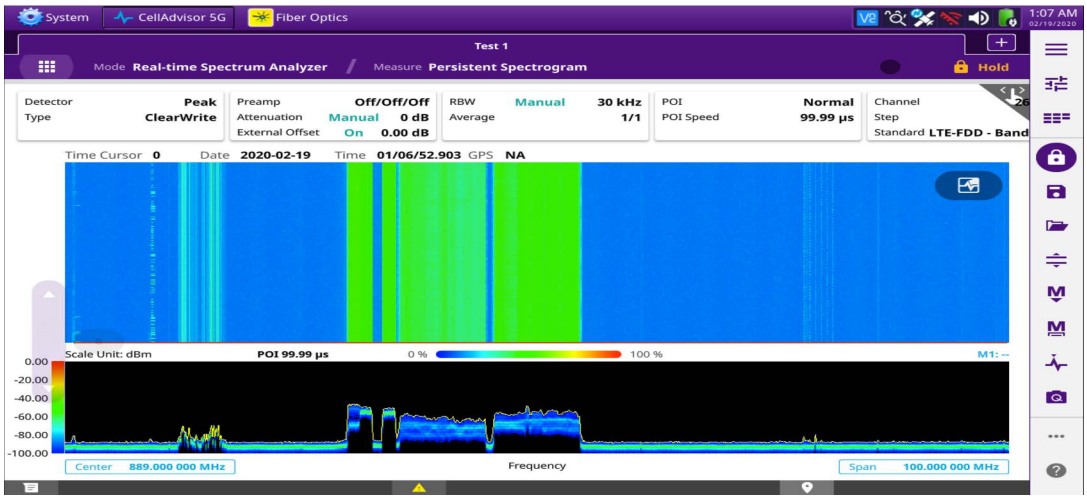
Hit Max represents the maximum number of hits to be converted to colors. If you set it to 90%, the hit matched with 90% or above shows with max colors.

RtSA persistent spectrogram

The persistent spectrogram is useful when attempting to identify periodic or intermittent signals as it captures spectrum actively over time and uses various colors to differentiate spectrum power levels. When the directional antenna is used to receive the signal, you will see a change in the amplitude of the tracked signal as you change the direction of the antenna and see a change in the Spectrogram colors. The source of the signal is located in the direction that results in the highest signal strength.

Figure 198 displays a sample persistent spectrogram measurement.

Figure 198 Persistent spectrogram measurement



To set measure setup

After configuring spectrum measurement as described in “Configuring spectrum measurements” on page 25, you can set the measure setup to continue your measurement.

1 Tap the **Setup** ( ) icon on the side bar.

2 Tap **Time Interval** to set the amount of time between each trace measurement using the on-screen keyboard.

3 Tap **Time Cursor** to **On** to set the time cursor on a specific trace position.

The Position menu becomes activated to be set. You can also move the time cursor up and down using the move bar on the left edge.

4 Tap **Position** to move the time cursor by inputting a value using the on-screen keyboard.

5 Tap **Type** to switch the chart view type to **3d Display** or **Normal**.

You can also change the cart view type using the icon on the chart screen.

6 Tap **POI Mode.** You can also access this menu via Quick Access and Display Tab on top.

a Tap to switch the Mode between High and Normal.The following table shows RBW and Span setup range per Normal and High Mode

Table 117 RBW and Span setup range

Mode		A	B	C	D
Normal	POI	100 to 34 µs	392 to 136.5 µs	800.5 to 270.5 µs	3200 to 1076 µs
	Bandwidth	100 to 20 MHz	19 to 5 MHz	4 and 3 MHz	2 and 1 MHz
	RBW	30 kHz to 10 MHz	10 kHz to 1 MHz	3 kHz to 1 MHz	1 kHz to 300 kHz

Mode		A	B	C	D	E	F
High	POI	18.5 to 2 µs	29.5 to 4 µs	73.5 to 7.5 µs	147 to 15 µs	284 to 28 µs	587 to 56.5 µs
	Effective Bandwidth	122.88 MHz	61.4 MHz	30.72 MHz	15.36 MHz	7.68 MHz	3.84 MHz
	Display Bandwidth	100 MHz	50 MHz	25 MHz	14 MHz	7 MHz	3 MHz
	RBW	100 kHz to 30 MHz	100 kHz to 10 MHz	30 kHz to 10 MHz	10 kHz to 3 MHz	10 kHz to 3 MHz	3 kHz to 1 MHz

b Tap **Speed** and input a value using the on-screen keyboard.

7 Tap **Reset/Restart** to start a new measurement.



NOTE

Enabling the time cursor puts the measurement on hold, allowing you to make post processing analysis for each measurement over time using the time cursor.

To set the DPX marker

1 Tap **Menu > Marker > Marker Table**.

The marker setting table appears.

2 Tap **DPX**.

The horizontal and vertical bars appear. A DPX marker shows the hit rate of X-axis (amplitude) and Y-axis whereas a normal trace marker shows a value of the x-axis.

3 Tap the chart screen to move the DPX marker or move the vertical bar and horizontal bar.



NOTE

If you select the DPX marker, you can only use Peak Search and Always Peak options. Delta pair is not available. See “Using marker” on page 41 for more information.

To set bitmap

1 Tap **Menu > Bitmap**.

2 Tap **Dot Persistence Time** and input a value using the on-screen keyboard. The dot persistence time represents the time that accumulates DPX data.

3 Tap to switch **Bitmap Scale** to **On** to enable auto scale or **Off** to disable auto scale. If the Bitmap Scale is On, the point where the maximum hit represents maximum colors. If the Bitmap Scale is Off, the bluer color (closer to 0% of the color bar) is mapped with a hit.

4 Tap Bitmap Min and input % value using the on-screen keyboard.

The Bitmap Min represents the unused bitmap color range. If you set it to 10%, the color matched with 10% or below does not show.

5 Tap Bitmap Max and input % value using the on-screen keyboard.

The Bitmap Max represents the maximum range of bitmap colors to be used. If you set it to 90%, the color that exceeds 90% does not show.

6 Tap **Hit Min** and input % value using the on-screen keyboard.

The Hit Min represents the minimum number of hits not to be converted to colors. If you set it to 10%, the hit matched with 10% or below is not converted to a color.

Tap Hit Max and input % value using the on-screen keyboard. The Hit Max represents the maximum number of hits to be converted to colors. If you set it to 90%, the hit matched with 90% or above shows with max colors.



NOTE

You can go to **Menu > Limit** to analyze your measurements with the reference line, multi-segment line, and channel limit table. See “Setting limit” on page 39 for more information.

Real-time spectrum replayer

The Real-time Spectrum Replayer allows you to retrieve and replay recorded real-time spectrum analyzer traces in interference analysis mode. These traces can be played back in the persistent spectrum, persistent spectrogram, or persistent RSSI. You can configure the limit line to create failure points when signals exceed it. The failure points are clearly displayed on the trace timeline for quick access during playback.

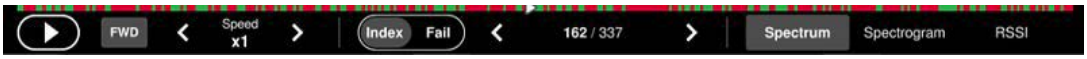
To replay a spectrum

1 Tap the **Setup** ( ) icon on the side bar.

2 Tap **Spectrum Replayer**. The **File Manager** window appears.

3 Select a file to be loaded and then tap **Load**. The replay bar appears on the bottom of the screen, as shown in Figure 199.

Figure 199 Replay bar



4 Tap **Play** to start playing.

5 Tap **FWD** or **REV** to change play direction to forward or reverse.

6 Tap the left or right arrow of **Speed** to select the speed option: **X1**, **X2**, **X3**, or **X4**.

7 Tap **Pause** to pause or stop playing data.

8 To move to a particular failure position directly and play from there, tap **Fail** on the **Index/Fail** switch and enter a value by using the on-screen keyboard.

9 Tap to change display mode to **spectrum**, **spectrogram**, or **RSSI**.

3D display (Waterfall) is not supported in case of spectrum logging.

10 *Optional*: Tap **Setup > Time Cursor On/Off** to display or dismiss the time cursor on the screen. This key becomes activated when you play logged data in the Spectrogram mode.

NOTE

If you connect a USB drive, do not remove it while playing to prevent freezing the USB port, which will require you to restart the instrument to get a USB drive recognized again.

TDD auto gated spectrum analysis

The following sections describe how to conduct TDD auto gated spectrum measurements.

Auto configuring parameters

For each measurement of TAGS, you can configure parameters automatically in the pop-up window.

To set auto configuration

1 Go to any measurement then tap the **Setup** ( ) icon on the side bar.

2 Tap to switch **Technology** between **NR** and **LTE**.

a If you select **NR**, do the following steps:

- Tap **Auto Configuration**.
- Select the parameters as required in the pop-up window: Center Frequency, Case, Bandwidth, SSB Periodicity.
- Click **SSB Auto Search** then tap the **Search** button. You can also type in SSB Frequency or GSCN manually.
- Once SSB is obtained, Sync LED at the background turns to green.
- Once the Frame and Slot format has been identified, it shows the values detected: Down Link Slot, Down Link Symbol, Up Link Slot, and Uplink Symbol.
- Tap the **Run** button to start TDD Auto Gated Spectrum when the auto detection is successful.
- Tap to start the **Analysis Mode** to determine the Frame and Slot Format manually.

b If you select **LTE**, do the following steps:

- Tap **Auto Configuration**.
- Tap the **Center Frequency** box and input the required value using the on-screen keyboard.
- Tap the **Channel Number** box and input the required value using the on-screen keyboard.
- Tap the **Search** button.
- Once the search is successful, Sync LED at the background turns to green.
- Once the Frame and Slot format has been identified, it shows the values detected: Bandwidth, Uplink-Downlink Config, Special Subframe Assignment.
- Tap the **Run** button to start TDD Auto Gated Spectrum when the auto detection is successful.
- Tap to start the **Analysis Mode** to determine the Frame and Slot Format manually.

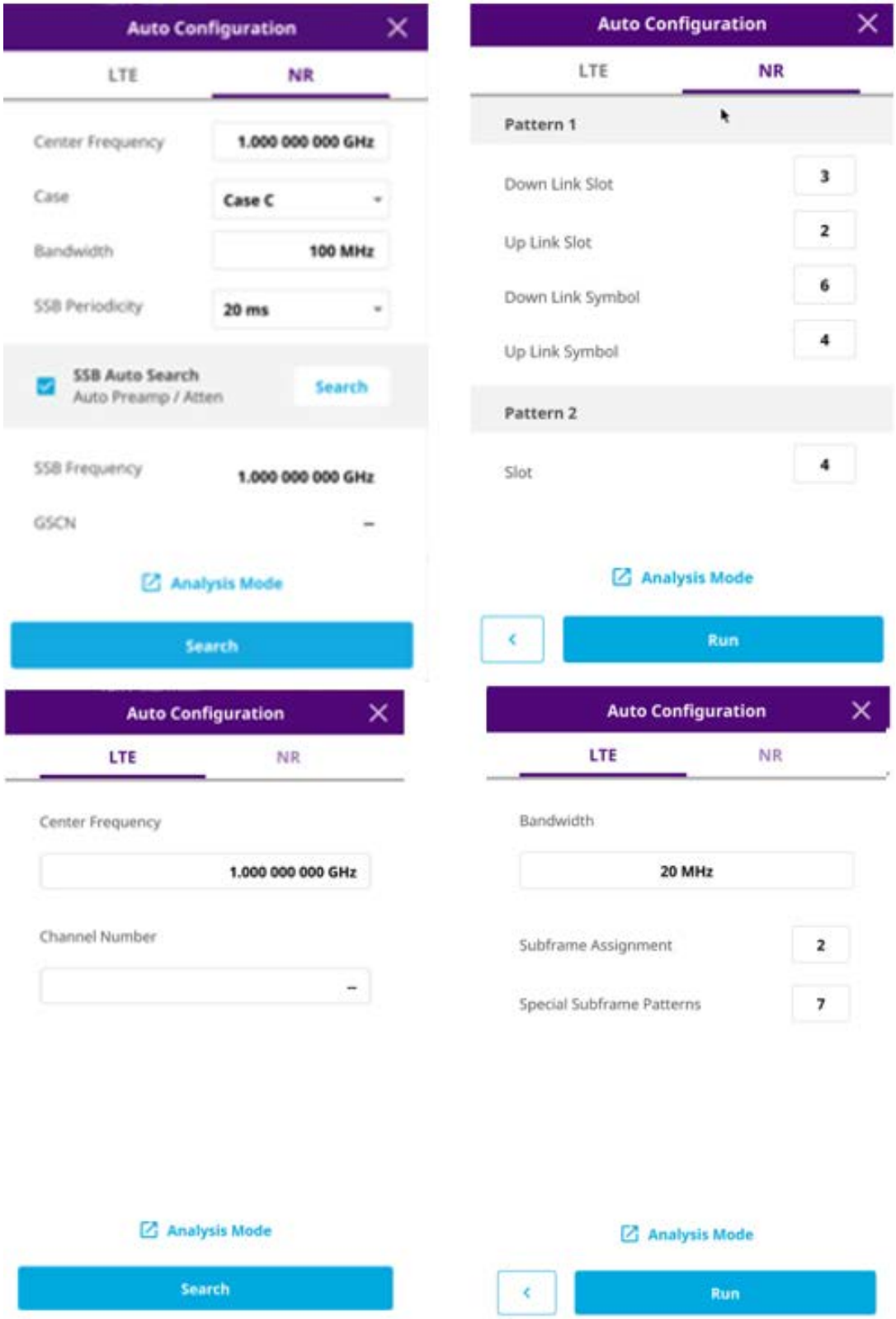


NOTE

Auto Search works with Standalone 5G NR network only. You need to check the deployment mode of your 5G NR Network if Auto Search does not work even with a strong RSRP.

Figure 200 displays a sample auto configuration.

Figure 200 Auto configuration



NOTE

Once you tap the Analysis Mode in the Auto Configuration Window, you can identify frame and slot formats.

To identify frame format

1 Tap **Deviation** to see the slot activity. Each bar represents the peak power of each slot.

2 Analyze the height variation of each bar.

3 When selecting **NR** tech, do the followings:

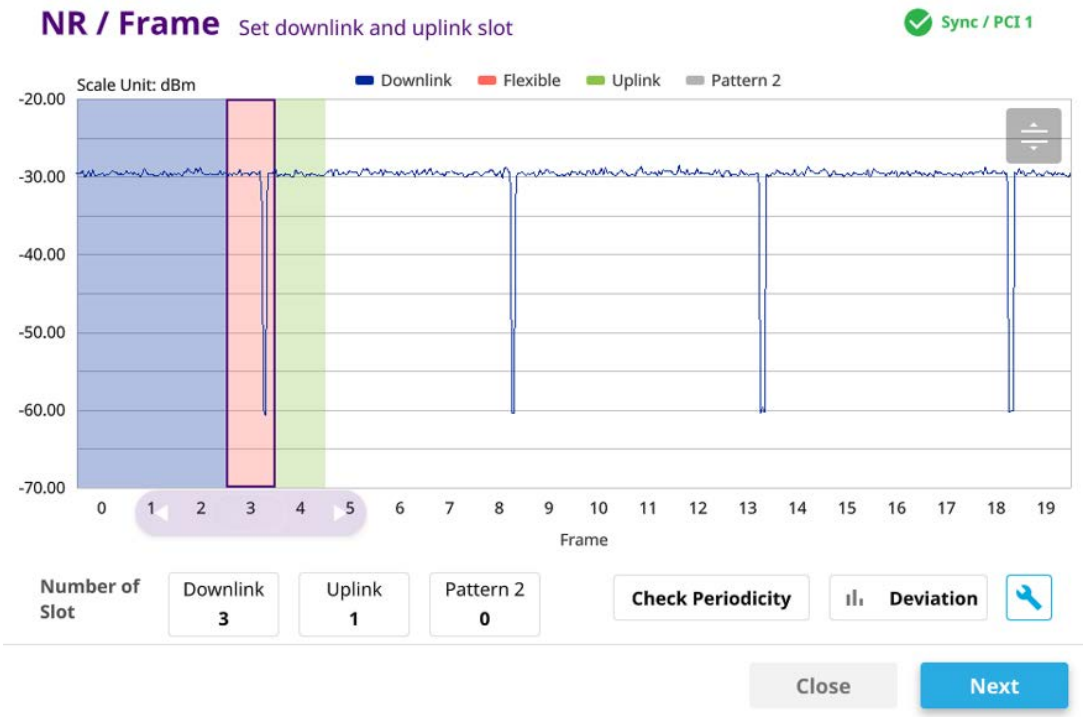
- **a** Configure **Number of Downlink Slot** and **Number of Uplink Slot**.
- **b** Tap **Check Periodicity**.
- **c** Verify if all UL slots assigned (in green color) shows relatively less power variation.
- **d** Select **Next** to move to Slot Format analysis.

4 When selecting **LTE** tech, do the followings:

- **a** Tap **Uplink-Downlink Config**.
- **b** Select the required assignment then tap the **Apply** button.
- **c** Select **Next** to move to Slot Format analysis.

Figure 201 displays a P vs T frame chart view.

Figure 201 P vs T frame chart view



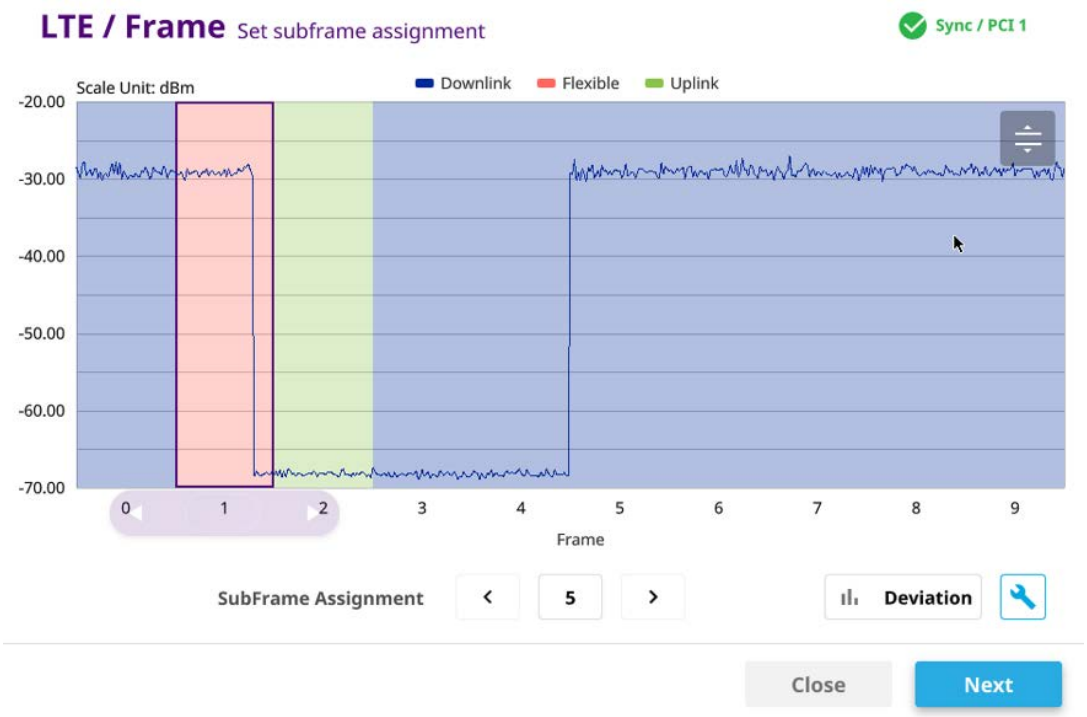
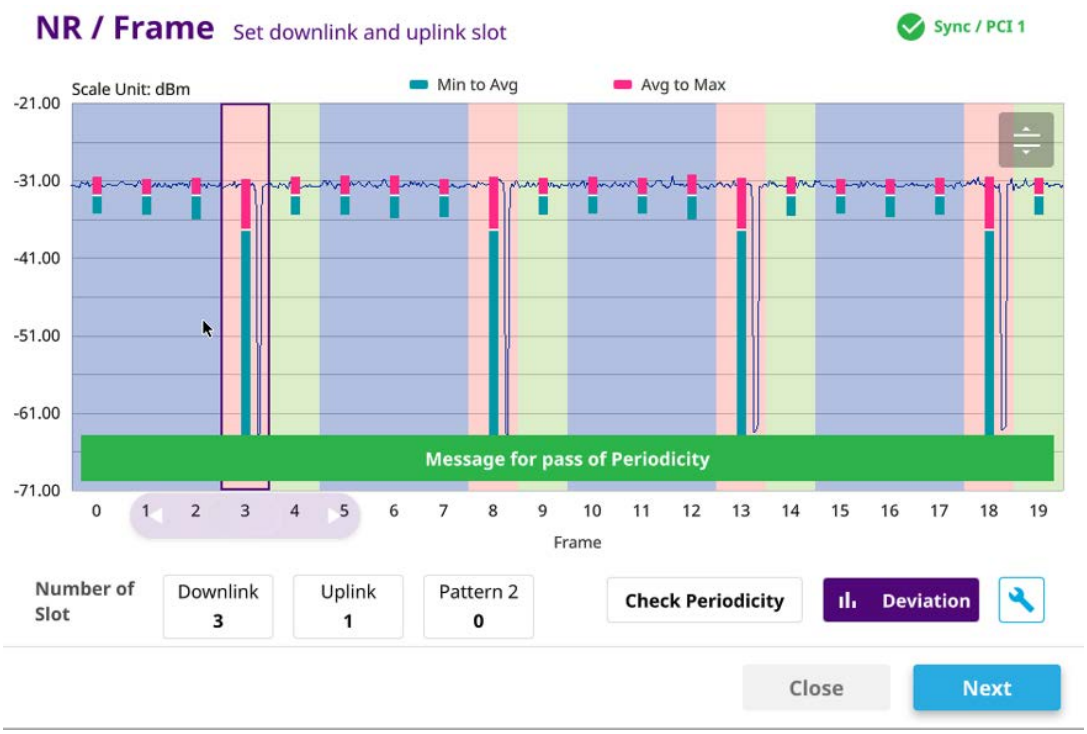
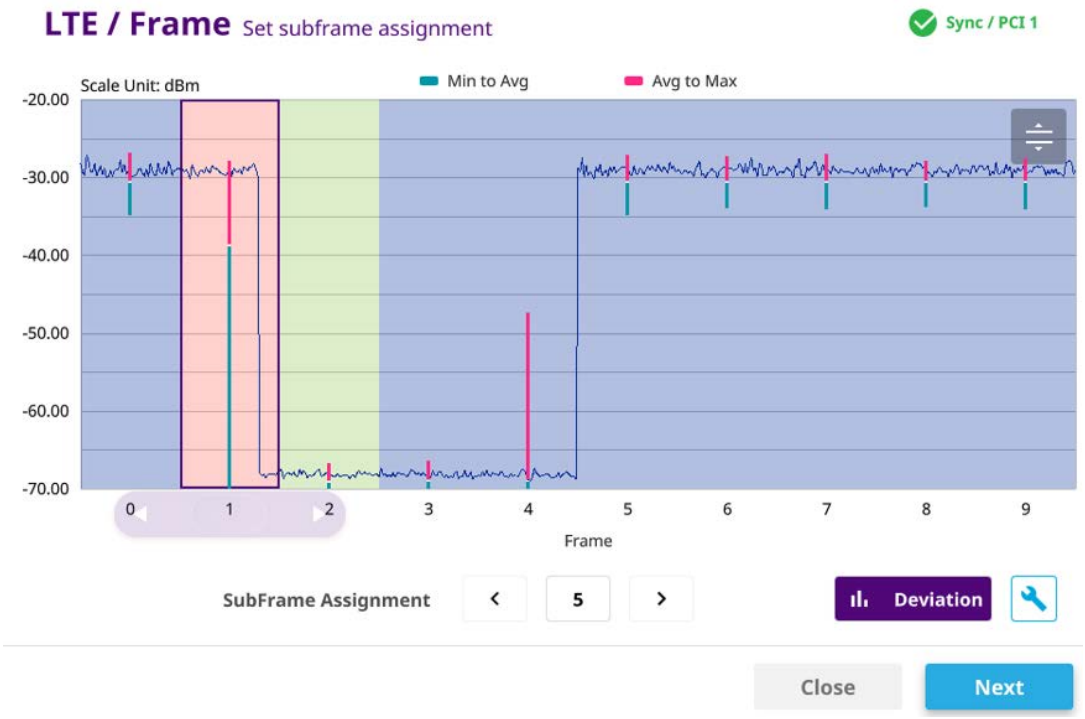


Figure 202 P vs T frame Deviation bar





NOTE
Figure 202 is an example of Check Periodicity with a success message.

To identify slot format

1 When selecting NR tech, do the followings:

   a Top chart shows symbol power variation for one special slot period where the DL to UL transition is made.

   b Check the Symbol Power activity and assign the number of DL symbol and UL symbol.

2 When selecting LTE tech, do the followings:

   a Top chart shows symbol power variation for one special slot period where the DL to UL transition is made.

   b Check the Symbol Power activity and assign the special subframe patterns (SPP).

NOTE
DL Symbols always start from the beginning of the slot and extended to the right, whereas the UL symbols start from the end of slot and extended to the left. The rest symbols are for FF and placed in between DL and UL symbols.

Figure 203 Slot format



To set gate window

1 Set the number of symbols to monitor.

By increasing the number of symbol width, ONA can provide RTSA Persistent Spectrum with better POI.

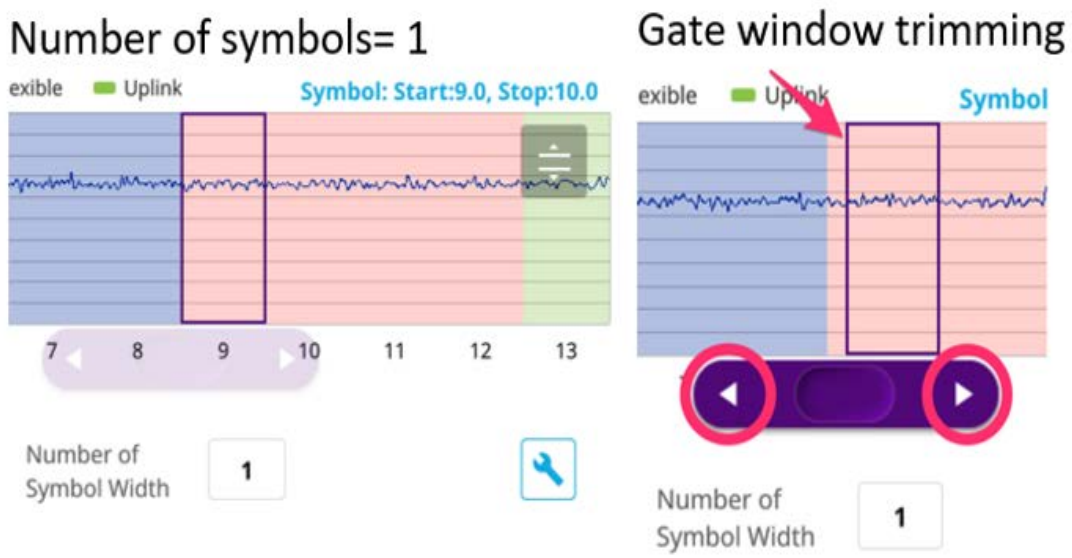
NOTE

Make sure that your Gate window is free from UL or DL signal activities as tradeoff is increasing possibility of involving delayed DL or UL.

2 Trim the start point of Gate window by using the control bar to avoid DL or UL signal activity caused by the propagation delay of DL signal and advanced signaling from UE to compensate the delay.

3 Tap the **Apply** button to run Gated Spectrum with a full chart view.

Figure 204 Gate window



NOTE

When you enter into Analysis Mode to identify frame/slot format, make sure to set four key parameters: number of downlink slot/uplink slot, number of downlink symbol/uplink symbol.

TAGS spectrum

You will be able to perform Spectrum Analysis in Guard Period for a specific measuring area. Before starting the measurement, you can set test parameters such as Amp/Scale, Average, Trace, Trigger, and Marker as described in “Configuring spectrum measurements” on page 25.

NOTE

Make sure to keep on gating on the GP of TDD signal, sync with SSB should be maintained. Therefore, Carrier & SSB frequency shouldn’t be changed, RBW should be Auto, and Span is to set 10 MHz to Carrier BW.

To set manual configuration for NR

1 Tap the **Setup** ( ) icon > **Manual Configuration (NR)** on the side bar.

2 Tap **Bandwidth/SSB SCS** then a Setting window appears.

   a If you select the operating frequency as FR1, select from the following:
   - SCS 15 kHz: 5, 10, 15, 20, 25, 30, 40, 50 MHz
   - SCS 30 kHz: 5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 MHz

3 Tap **SSB Center Frequency** and input the value using the on-screen keyboard.

4 Tap **GSCN** and input the value using the on-screen keyboard.

5 Tap **TDD Formats** then set **Downlink Slot**, **Downlink Symbol**, **Uplink Slot**, **Uplink Symbol** as required.

6 Tap **SSB Auto Search Mode** and do the following steps:

   a Tap **Auto Preamp/Atten** and switch **SSB Auto Search** to **Start** to set preamp and attenuation automatically.

   b Tap **Manual** and switch **SSB Auto Search** to **Start** for manually setting based on your need.

7 Tap **SSB Auto Search** between **Start** and **Stop**.

   a **Start**: to search SCS, type, and the number of SSB automatically. Once Start is selected, the progress bar appears. If it fails to perform the auto search, a fail message appears and the SSB switches to Manual.

   b **Stop**: to set the SSB periodicity based on the base station.

8 Tap **SSB Periodicity** and select the options from **5 ms**, **10 ms**, **20 ms**, **40 ms**, **80 ms**, **160 ms**. The SS burst period (SSB periodicity) is defined by each base station and network configurable. 20 ms is the default for the initial cell selection.

9 Tap to switch **PCI (Physical Cell ID)** to **Manual** or **Auto**.

10 Tap **PCI** and input a value from 0 to 1007 using the on-screen keyboard. The PCI switches to **Manual**.

11 Tap **Gate Window Settings** and input **Slot No**, **Start Symbol No**, and **Symbol Width**.

   You can view P vs T Slot format measurement screen once you tap **P vs T Slot view**.

12 Tap **Miscellaneous** > **Symbol Phase Comp** and select from the following choices: **Auto**, **Manual**, or **Off**.

   Symbol Phase Compensation is used to compensate for phase differences between symbols caused by upconversion. Users do not always use the instrument based on RF frequency. In this case, you can set it to Manual or Off.

   – **Auto**: Setting radio frequency to center frequency
   – **Manual**: Setting radio frequency as required
   – **Off**: Setting radio frequency to 0

To set manual configuration for LTE

1 Tap the **Setup** ( ) icon > **Manual Configuration (LTE)** on the side bar.

2 Tap **Uplink-Downlink Config** then input the required value using the on-screen keyboard.

3 Tap **Special Subframe Patterns** then input the required value using the on-screen keyboard.

4 Tap **Bandwidth** and select from the options: **1.4 MHz**, **3 MHz**, **5 MHz**, **10 MHz**, **15 MHz**, or **20 MHz**.

Figure 205 displays Spectrum measurement with TAGS.

Figure 205 Spectrum measurement with TAGS



TAGS spectrogram

You will be able to perform Spectrogram Analysis in Guard Period for a specific measuring area. Before starting the measurement, you can set test parameters such as Amp/Scale, Average, Trace, Trigger, and Marker as described in “Configuring spectrum measurements” on page 25.

NOTE

Make sure to keep on gating on the GP of TDD signal, sync with SSB should be maintained. Therefore, Carrier & SSB frequency shouldn’t be changed, RBW should be Auto, and Span is to set 10 MHz to Carrier BW.

To conduct spectrogram

1 Tap the **Setup** ( ) icon on the side bar of **Spectrogram Measure** mode.

2 Tap **Time Interval** and enter a value by using the on-screen keyboard to set the amount of time between each trace measurement.

3 Set the time cursor on a specific trace position:

- **a** Tap **Time Cursor** to **On**.
- **b** Tap **Position** to enter a value. You can also use the move bar (up and down arrows) in the lower left screen to move the time cursor.
- **c** To turn the time cursor off, tap **Time Cursor** to **Off**.



NOTE

Enabling the Time Cursor puts the measurement on hold, allowing you to make post-processing analysis for each measurement over time using the time cursor.

4 Tap **Reset/Restart** to start a new measurement.

5 Tap to switch **Type** to **3D** to **Normal**.

To set manual configuration for NR

1 Tap the **Setup** ( ) icon > **Manual Configuration (NR)** on the side bar.

2 Tap **Bandwidth/SSB SCS** then a Setting window appears.

- **a** If you select the operating frequency as FR1, select from the following:
  - SCS 15 kHz: 5, 10, 15, 20, 25, 30, 40, 50 MHz
  - SCS 30 kHz: 5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 MHz

3 Tap **SSB Center Frequency** and input the value using the on-screen keyboard.

4 Tap **GSCN** and input the value using the on-screen keyboard.

5 Tap **TDD Formats** then set **Downlink Slot**, **Downlink Symbol**, **Uplink Slot**, **Uplink Symbol** as required.

6 Tap **SSB Auto Search Mode** and do the following steps:

- **a** Tap **Auto Preamp/Atten** and switch **SSB Auto Search** to **Start** to set preamp and attenuation automatically.
- **b** Tap **Manual** and switch **SSB Auto Search** to **Start** for manually setting based on your need.

7 Tap **SSB Auto Search** between **Start** and **Stop**.

- **a** **Start**: to search SCS, type, and the number of SSB automatically. Once Start is selected, the progress bar appears. If it fails to perform the auto search, a fail message appears and the SSB switches to Manual.
- **b** **Stop**: to set the SSB periodicity based on the base station.

8 Tap **SSB Periodicity** and select the options from **5 ms**, **10 ms**, **20 ms**, **40 ms**, **80 ms**, **160 ms**. The SS burst period (SSB periodicity) is defined by each base station and network configurable. 20 ms is the default for the initial cell selection.

9 Tap to switch **PCI (Physical Cell ID)** to **Manual** or **Auto**.

10 Tap **PCI** and input a value from 0 to 1007 using the on-screen keyboard. The PCI switches to **Manual**.

11 Tap **Gate Window Settings** and input **Slot No**, **Start Symbol No**, and **Symbol Width**.

You can view P vs T Slot format measurement screen once you tap **P vs T Slot view**.

12 Tap **Miscellaneous** > **Symbol Phase Comp** and select from the following choices: **Auto**, **Manual**, or **Off**.

Symbol Phase Compensation is used to compensate for phase differences between symbols caused by up-conversion. Users do not always use the instrument based on RF frequency. In this case, you can set it to Manual or Off.

- **Auto**: Setting radio frequency to center frequency
- **Manual**: Setting radio frequency as required
- **Off**: Setting radio frequency to 0

To set manual configuration for LTE

1 Tap the **Setup** ( ) icon > **Manual Configuration (LTE)** on the side bar.

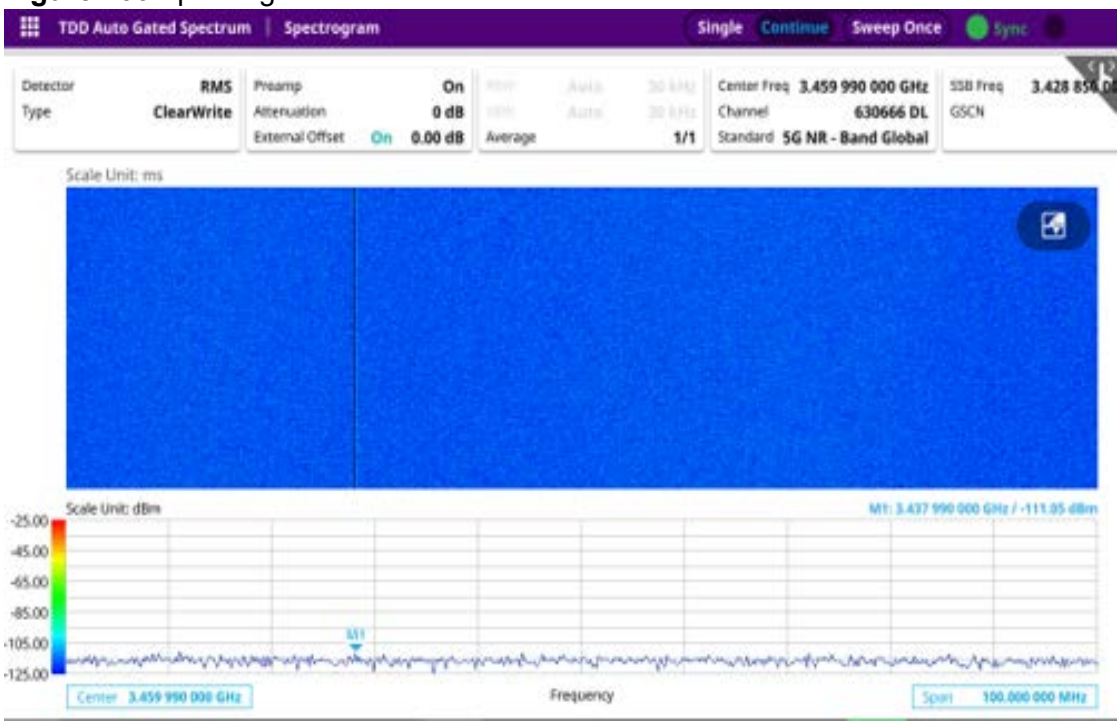
2 Tap **Uplink-Downlink Config** then input the required value using the on-screen keyboard.

3 Tap **Special Subframe Patterns** then input the required value using the on-screen keyboard.

4 Tap **Bandwidth** and select from the options: **1.4 MHz**, **3 MHz**, **5 MHz**, **10 MHz**, **15 MHz**, or **20 MHz**.

Figure 206 displays Spectrogram measurement with TAGS.

Figure 206 Spectrogram measurement



TAGS persistent spectrum

You will be able to perform Persistent Spectrum Analysis in Guard Period for a specific measuring area. Before starting the measurement, you can set test parameters such as Amp/Scale, Average, Trace, Trigger, and Marker as described in “Configuring spectrum measurements” on page 25.

NOTE

Make sure to keep on gating on the GP of TDD signal, sync with SSB should be maintained. Therefore, Carrier & SSB frequency shouldn’t be changed, RBW should be Auto, and Span is to set 10 MHz to Carrier BW.

To set manual configuration for NR

1 Tap the **Setup** ( ) icon > **Manual Configuration (NR)** on the side bar.

2 Tap **Bandwidth/SSB SCS** then a Setting window appears.

   a If you select the operating frequency as FR1, select from the following:
   - SCS 15 kHz: 5, 10, 15, 20, 25, 30, 40, 50 MHz
   - SCS 30 kHz: 5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 MHz

3 Tap **SSB Center Frequency** and input the value using the on-screen keyboard.

4 Tap **GSCN** and input the value using the on-screen keyboard.

5 Tap **TDD Formats** then set **Downlink Slot**, **Downlink Symbol**, **Uplink Slot**, **Uplink Symbol**, **Slot No.**, **Start Symbol No.**, and **Symbol Width** as required.

6 Tap **SSB Auto Search Mode** and do the following steps:

   a Tap **Auto Preamp/Atten** and switch **SSB Auto Search** to **Start** to set preamp and attenuation automatically.

   b Tap **Manual** and switch **SSB Auto Search** to **Start** for manually setting based on your need.

7 Tap **SSB Auto Search** between **Start** and **Stop**.

   a **Start**: to search SCS, type, and the number of SSB automatically. Once Start is selected, the progress bar appears. If it fails to perform the auto search, a fail message appears and the SSB switches to Manual.

   b **Stop**: to set the SSB periodicity based on the base station.

8 Tap **SSB Periodicity** and select the options from **5 ms**, **10 ms**, **20 ms**, **40 ms**, **80 ms**, **160 ms**. The SS burst period (SSB periodicity) is defined by each base station and network configurable. 20 ms is the default for the initial cell selection.

9 Tap to switch **PCI (Physical Cell ID)** to **Manual** or **Auto**.

10 Tap **PCI** and input a value from 0 to 1007 using the on-screen keyboard. The PCI switches to **Manual**.

11 Tap **Symbol Phase Comp** and select from the following choices: **Auto**, **Manual**, or **Off**.

   Symbol Phase Compensation is used to compensate for phase differences between symbols caused by up-conversion. Users do not always use the instrument based on RF frequency. In this case, you can set it to Manual or Off.

   – **Auto**: Setting radio frequency to center frequency
   – **Manual**: Setting radio frequency as required
   – **Off**: Setting radio frequency to 0

To set manual configuration for LTE

1 Tap the **Setup** ( ) icon > **Manual Configuration (LTE)** on the side bar.

2 Tap **Uplink-Downlink Config** then input the required value using the on-screen keyboard.

3 Tap **Special Subframe Patterns** then input the required value using the on-screen keyboard.

4 Tap **Bandwidth** and select from the options: **1.4 MHz**, **3 MHz**, **5 MHz**, **10 MHz**, **15 MHz**, or **20 MHz**.

To set the DPX marker

1 Tap the **Marker setting** ( ) icon on the side bar. The marker setting table appears.

2 Tap **DPX**.

   The horizontal and vertical bars appear. A DPX marker shows the hit rate of X-axis (amplitude) and Y-axis whereas a normal trace marker shows a value of the x-axis.

3 Tap the chart screen to move the DPX marker or move the vertical bar and horizontal bar.



NOTE

If you select the DPX marker, you can only use Peak Search and Always Peak options. Delta pair is not available. See “Using marker” on page 41 for more information.

To set bitmap

1 Tap **Menu > Bitmap**.

2 Tap **Dot Persistence Time** and input a value using the on-screen keyboard. The dot persistence time represents the time that accumulates DPX data.

3 Tap to switch **Bitmap Scale** to **On** to enable auto scale or **Off** to disable auto scale. If the Bitmap Scale is On, the point where the maximum hit represents maximum colors. If the Bitmap Scale is Off, the bluer color (closer to 0% of the color bar) is mapped with a hit.

4 Tap **Bitmap Min** and input % value using the on-screen keyboard.

The Bitmap Min represents the unused bitmap color range. If you set it to 10%, the color matched with 10% or below does not show.

5 Tap **Bitmap Max** and input % value using the on-screen keyboard.

The Bitmap Max represents the maximum range of bitmap colors to be used. If you set it to 90%, the color that exceeds 90% does not show.

6 Tap **Hit Min** and input % value using the on-screen keyboard.

The Hit Min represents the minimum number of hits not to be converted to colors. If you set it to 10%, the hit matched with 10% or below is not converted to a color.

7 Tap **Hit Max** and input % value using the on-screen keyboard. The Hit Max represents the maximum number of hits to be converted to colors. If you set it to 90%, the hit matched with 90% or above shows with max colors.

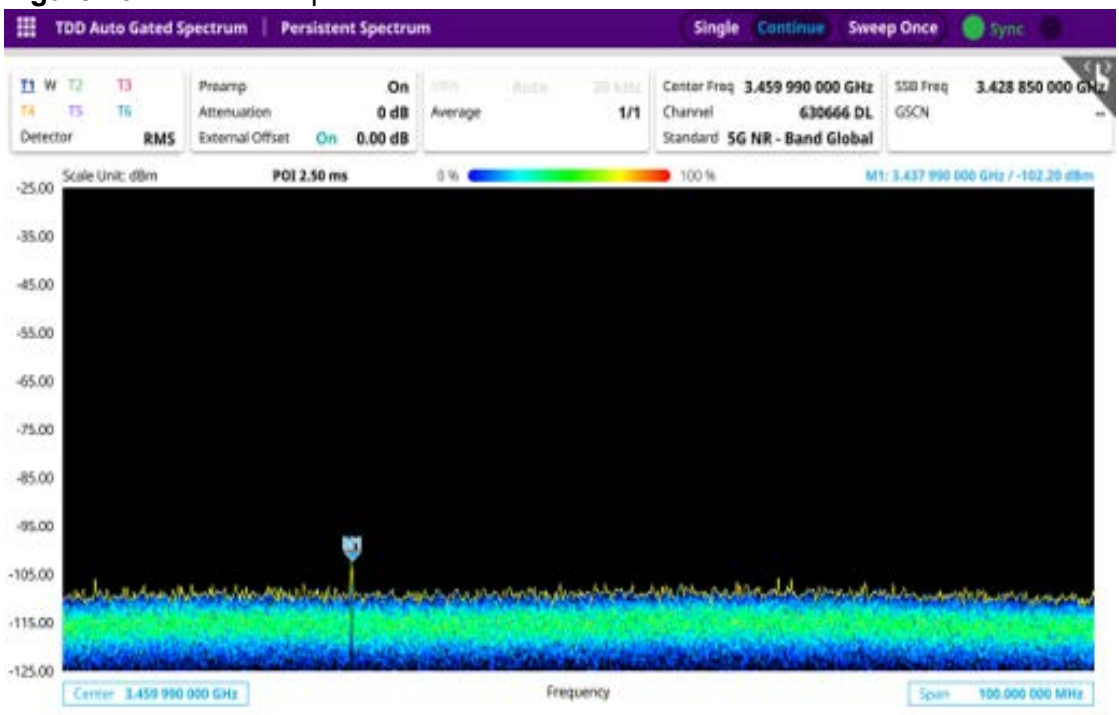


NOTE

You can go to **Menu > Limit** to analyze your measurements with the reference line, multi-segment line, and channel limit table. See “Setting limit” on page 39 for more information.

Figure 207 displays a sample persistent spectrum measurement with TAGS.

Figure 207 Persistent spectrum measurement



NOTE

Compared to Persistent Spectrum in RTSA, Persistent Spectrum in TAGS is especially useful when tracking the level of weak interference to find interference source.

TAGS persistent spectrogram

You will be able to perform Persistent Spectrogram Analysis in Guard Period for a specific measuring area. Before starting the measurement, you can set test parameters such as Amp/Scale, Average, Trace, Trigger, and Marker as described in “Configuring spectrum measurements” on page 25.

NOTE

Make sure to keep on gating on the GP of TDD signal, sync with SSB should be maintained. Therefore, Carrier & SSB frequency shouldn’t be changed, RBW should be Auto, and Span is to set 10 MHz to Carrier BW.

To conduct persistent spectrogram

1 Tap the **Setup** (⚙) icon on the side bar of **Spectrogram Measure** mode.

2 Tap **Time Interval** and enter a value by using the on-screen keyboard to set the amount of time between each trace measurement.

3 Set the time cursor on a specific trace position:

   a Tap **Time Cursor** to **On**.

   b Tap **Position** to enter a value. You can also use the move bar (up and down arrows) in the lower left screen to move the time cursor.

   c To turn the time cursor off, tap **Time Cursor** to **Off**.



NOTE

Enabling the Time Cursor puts the measurement on hold, allowing you to make post-processing analysis for each measurement over time using the time cursor.

4 Tap **Reset/Restart** to start a new measurement.

5 Tap to switch **Type** to **3D** to **Normal**.

To set manual configuration for NR

1 Tap the **Setup** ( ) icon > **Manual Configuration (NR)** on the side bar.

2 Tap **Bandwidth/SSB SCS** then a Setting window appears.

   a If you select the operating frequency as FR1, select from the following:
   - SCS 15 kHz: 5, 10, 15, 20, 25, 30, 40, 50 MHz
   - SCS 30 kHz: 5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 MHz

3 Tap **SSB Center Frequency** and input the value using the on-screen keyboard.

4 Tap **GSCN** and input the value using the on-screen keyboard.

5 Tap **TDD Formats** then set **Downlink Slot**, **Downlink Symbol**, **Uplink Slot**, **Uplink Symbol** as required.

6 Tap **SSB Auto Search Mode** and do the following steps:

   a Tap **Auto Preamp/Atten** and switch **SSB Auto Search** to **Start** to set preamp and attenuation automatically.

   b Tap **Manual** and switch **SSB Auto Search** to **Start** for manually setting based on your need.

7 Tap **SSB Auto Search** between **Start** and **Stop**.

   a **Start**: to search SCS, type, and the number of SSB automatically. Once Start is selected, the progress bar appears. If it fails to perform the auto search, a fail message appears and the SSB switches to Manual.

   b **Stop**: to set the SSB periodicity based on the base station.

8 Tap **SSB Periodicity** and select the options from **5 ms**, **10 ms**, **20 ms**, **40 ms**, **80 ms**, **160 ms**. The SS burst period (SSB periodicity) is defined by each base station and network configurable. 20 ms is the default for the initial cell selection.

9 Tap to switch **PCI (Physical Cell ID)** to **Manual** or **Auto**.

10 Tap **PCI** and input a value from 0 to 1007 using the on-screen keyboard. The PCI switches to **Manual**.

11 Tap **Gate Window Settings** and input **Slot No**, **Start Symbol No**, and **Symbol Width**.

You can view P vs T Slot format measurement screen once you tap **P vs T Slot view**.

12 Tap **Miscellaneous** > **Symbol Phase Comp** and select from the following choices: **Auto**, **Manual**, or **Off**.

Symbol Phase Compensation is used to compensate for phase differences between symbols caused by upconversion. Users do not always use the instrument based on RF frequency. In this case, you can set it to Manual or Off.

- **Auto**: Setting radio frequency to center frequency
- **Manual**: Setting radio frequency as required
- **Off**: Setting radio frequency to 0

To set manual configuration for LTE

1 Tap the **Setup** ( ) icon > **Manual Configuration (LTE)** on the side bar.

2 Tap **Uplink-Downlink Config** then input the required value using the on-screen keyboard.

3 Tap **Special Subframe Patterns** then input the required value using the on-screen keyboard.

4 Tap **Bandwidth** and select from the options: **1.4 MHz**, **3 MHz**, **5 MHz**, **10 MHz**, **15 MHz**, or **20 MHz**.

To set the DPX marker

1 Tap the **Marker setting** ( ) icon on the side bar. The marker setting table appears.

2 Tap **DPX**.

The horizontal and vertical bars appear. A DPX marker shows the hit rate of X-axis (amplitude) and Y-axis whereas a normal trace marker shows a value of the x-axis.

3 Tap the chart screen to move the DPX marker or move the vertical bar and horizontal bar.

NOTE

If you select the DPX marker, you can only use Peak Search and Always Peak options. Delta pair is not available. See “Using marker” on page 41 for more information.

To set bitmap

1 Tap **Menu > Bitmap**.

2 Tap **Dot Persistence Time** and input a value using the on-screen keyboard. The dot persistence time represents the time that accumulates DPX data.

3 Tap to switch **Bitmap Scale** to **On** to enable auto scale or **Off** to disable auto scale. If the Bitmap Scale is On, the point where the maximum hit represents maximum colors. If the Bitmap Scale is Off, the bluer color (closer to 0% of the color bar) is mapped with a hit.

4 Tap **Bitmap Min** and input % value using the on-screen keyboard.

The Bitmap Min represents the unused bitmap color range. If you set it to 10%, the color matched with 10% or below does not show.

5 Tap **Bitmap Max** and input % value using the on-screen keyboard.

The Bitmap Max represents the maximum range of bitmap colors to be used. If you set it to 90%, the color that exceeds 90% does not show.

6 Tap **Hit Min** and input % value using the on-screen keyboard.

The Hit Min represents the minimum number of hits not to be converted to colors. If you set it to 10%, the hit matched with 10% or below is not converted to a color.

7 Tap **Hit Max** and input % value using the on-screen keyboard. The Hit Max represents the maximum number of hits to be converted to colors. If you set it to 90%, the hit matched with 90% or above shows with max colors.

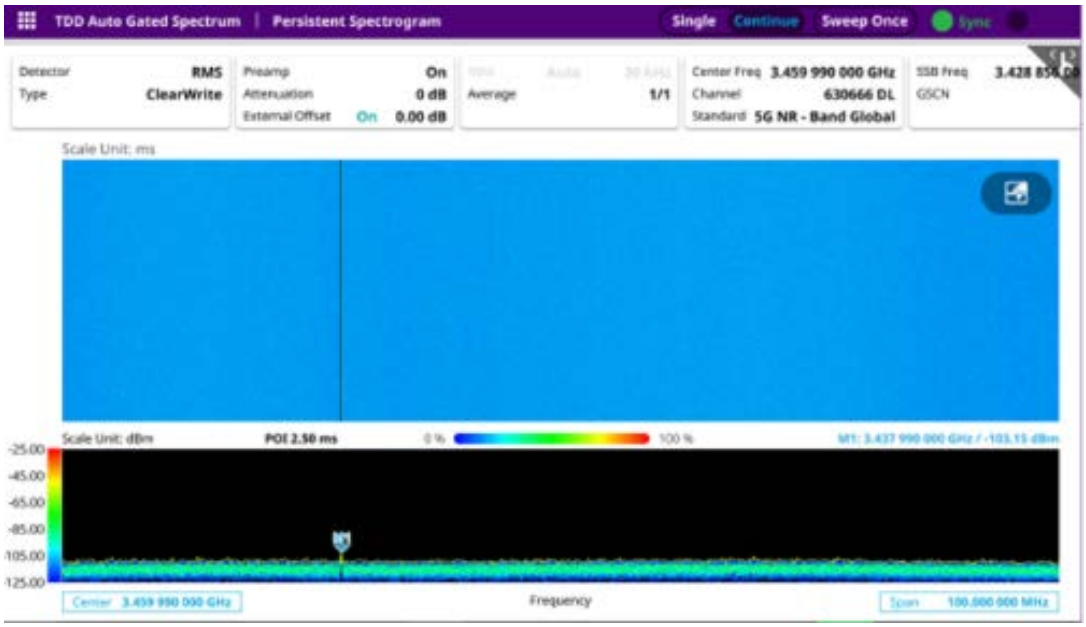


NOTE

You can go to **Menu > Limit** to analyze your measurements with the reference line, multi-segment line, and channel limit table. See “Setting limit” on page 39 for more information.

Figure 208 displays a sample persistent spectrogram measurement with TAGS.

Figure 208 Persistent spectrogram measurement



NOTE

Compared to Persistent Spectrum in RTSA, Persistent Spectrum in TAGS is especially useful when tracking the level of weak interference to find interference source.

TAGS spectrum replayer

The TDD Auto Gated Spectrum Replayer allows you to retrieve and replay recorded spectrum or real-time spectrum analyzer traces in interference analysis mode. The spectrum analyzer traces can be played back in the spectrum, spectrogram or RSSI and the real-time spectrum analyzer traces can be played back in persistent spectrum and persistent spectrogram. You can configure the limit line to create failure points when signals exceed it. The failure points are clearly displayed on the trace timeline for quick access during playback.

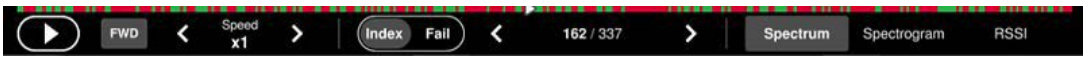
To replay a spectrum

1 Tap the **Setup** ( ) icon on the side bar.

2 Tap **Spectrum Replayer**. The **File Manager** window appears.

3 Select a file to be loaded and then tap **Load**. The replay bar appears on the bottom of the screen, as shown in Figure 209.

Figure 209 Replay bar



4 Tap **Play** to start playing.

5 Tap **FWD** or **REV** to change play direction to forward or reverse.

6 Tap the left or right arrow of **Speed** to select the speed option: **X1**, **X2**, **X3**, or **X4**.

7 Tap **Pause** to pause or stop playing data.

8 To move to a particular failure position directly and play from there, tap **Fail** on the **Index/Fail** switch and enter a value by using the on-screen keyboard.

9 Tap to change display mode to **spectrum**, **spectrogram**, or **RSSI**.

3D display (Waterfall) is not supported in case of spectrum logging.

10 *Optional*: Tap **Setup > Time Cursor On/Off** to display or dismiss the time cursor on the screen. This key becomes activated when you play logged data in the Spectrogram mode.



NOTE

If you connect a USB drive, do not remove it while playing to prevent freezing the USB port, which will require you to restart the instrument to get a USB drive recognized again.

RF Viewer analysis

Directional antenna

The directional antenna is used to monitor and analyze radio frequency (RF) signals in real time, helping users observe spectrum characteristics, signal strength, and interference.

Antenna connection

Before starting the measurement, you need to connect the Omni or Log periodic antenna to your instrument. In the Interference Finder and the Radar Chart modes, you can perform interference hunting using the optional AntennaAdvisor Handle after attaching a broadband directional antenna to it. The handle is a device that has a built-in GNSS antenna and LNA. The following are examples of the antenna and camera connection.

To connect an antenna and a camera

1 Mount a broadband antenna and a camera to your AntennaAdvisor Handle

2 Connect the **RF Type-N Jack** of the handle to the **RF In** port of the instrument.

3 Connect the **GNSS SMA** jack of the handle to the **GNSS port** of the instrument. The GNSS status indicator appears on the instrument screen.

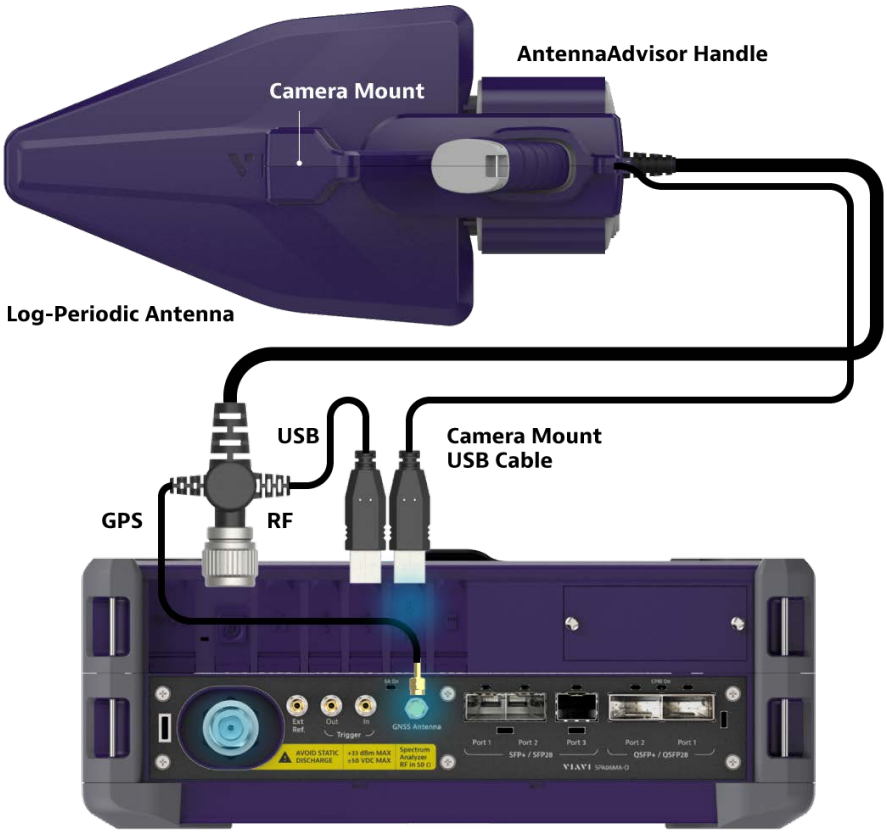
4 Connect the **USB plug** of the handle and the camera to the **USB Host port** of the instrument. The device icon appears in the system status bar on the screen.

NOTE

The AntennaAdvisor Handle is an optional item. It is recommended that you use a log periodic antenna with AntennaAdvisor handle to search more exact directional information. You can use a log periodic antenna or Omni antenna alone as well.

Figure 210 shows an example of an antenna and a connection.

Figure 210 Antenna and camera connection example



Initializing AntennaAdvisor

Once you have connected the AntennaAdvisor Handle to your instrument, antenna initialization is required to get the right azimuth data. You need to initialize the antenna handle to calibrate the built-in compass by completing the following steps. Note that you can adjust Bandwidth based on the center frequency of the interfering signal that you have identified in the Spectrum view by tapping **Setup > Bandwidth**. A message appears at the bottom of the screen to alert you if you have not performed initialization of your connected the antenna handle set.

To initialize AntennaAdvisor

1 Hold your antenna handle horizontally in its upright position.

2 Point the antenna to the north and tap **Setup > Initialize AntennaAdvisor**.

The message disappears and the red line for the current antenna direction moves to the 0° line and overlaps to let you know that the initialization has completed successfully.

To set measure setup

Once the antenna and camera are connected and initializing AntennaAdvisor, continue to set up the instrument as required.

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap **Bandwidth** and select the value from the following choices: **1.4 MHz**, **3 MHz**, **5 MHz**, **10 MHz**, **15 MHz** or **20 MHz**.

3 Tap **Dot Type** from the options: **Center**, **Channel**, or **Peak**

- Center: Displays the value at the center of the chart as a dot
- Channel: Displays the total power of the entire channel as a dot
- Peak: Displays the highest value within the channel as a dot

4 Tap **Reset** to clear the current setting or operations.

5 Tap **Transparency** to adjust the screen transparency.

6 Tap **Sound Indicator**.

a Tap to switch the **Sound** between **On** and **Off** to enable and disable the alarm sound.

b Tap to switch the **Alarm Reference** to **Marker** to set the active marker position as the alarm reference.

c Tap to switch the **Alarm Reference** to **Line** to set the limit as the alarm reference.

d Select **Reference Line** to specify a threshold for the reference line using the on-screen keyboard.

e *Optional:* To adjust the volume for alarm sound, tap **Volume** and input a value from 1 to 10 using the on-screen keyboard.

To set manual configuration for NR

1 Tap the **Setup** ( ) icon > **Manual Configuration (NR)** on the side bar.

2 Tap **Bandwidth/SSB SCS** then a Setting window appears.

a If you select the operating frequency as FR1, select from the following:

- SCS 15 kHz: 5, 10, 15, 20, 25, 30, 40, 50 MHz
- SCS 30 kHz: 5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 MHz

3 Tap **SSB Center Frequency** and input the value using the on-screen keyboard.

4 Tap **GSCN** and input the value using the on-screen keyboard.

5 Tap **TDD Formats** then set **Downlink Slot**, **Downlink Symbol**, **Uplink Slot**, **Uplink Symbol** as required.

6 Tap **SSB Auto Search Mode** and do the following steps:

   a Tap **Auto Preamp/Atten** and switch **SSB Auto Search** to **Start** to set preamp and attenuation automatically.

   b Tap **Manual** and switch **SSB Auto Search** to **Start** for manually setting based on your need.

7 Tap **SSB Auto Search** between **Start** and **Stop**.

   a **Start**: to search SCS, type, and the number of SSB automatically. Once Start is selected, the progress bar appears. If it fails to perform the auto search, a fail message appears and the SSB switches to Manual.

   b **Stop**: to set the SSB periodicity based on the base station.

8 Tap **SSB Periodicity** and select the options from **5 ms**, **10 ms**, **20 ms**, **40 ms**, **80 ms**, **160 ms**. The SS burst period (SSB periodicity) is defined by each base station and network configurable. 20 ms is the default for the initial cell selection.

9 Tap to switch **PCI (Physical Cell ID)** to **Manual** or **Auto**.

10 Tap **PCI** and input a value from 0 to 1007 using the on-screen keyboard. The PCI switches to **Manual**.

11 Tap **Gate Window Settings** and input **Slot No**, **Start Symbol No**, and **Symbol Width**.

   You can view P vs T Slot format measurement screen once you tap **P vs T Slot view**.

To set manual configuration for LTE

1 Tap the **Setup** ( ) icon > **Manual Configuration (LTE)** on the side bar.

2 Tap **Uplink-Downlink Config** then input the required value using the on-screen keyboard.

3 Tap **Special Subframe Patterns** then input the required value using the on-screen keyboard.

4 Tap **Bandwidth** and select from the options: **1.4 MHz**, **3 MHz**, **5 MHz**, **10 MHz**, **15 MHz**, or **20 MHz**.

To start a test

You can use the AntennaAdvisor to set the azimuth and elevation. Initialize AntennaAdvisor first to ensure accurate directional information.

1 When the **TRIGGER** button is pressed, the camera screen is captured and aligned to the center of the display.

2 While holding the **TRIGGER** button, moving the antenna displays a dot on the screen.

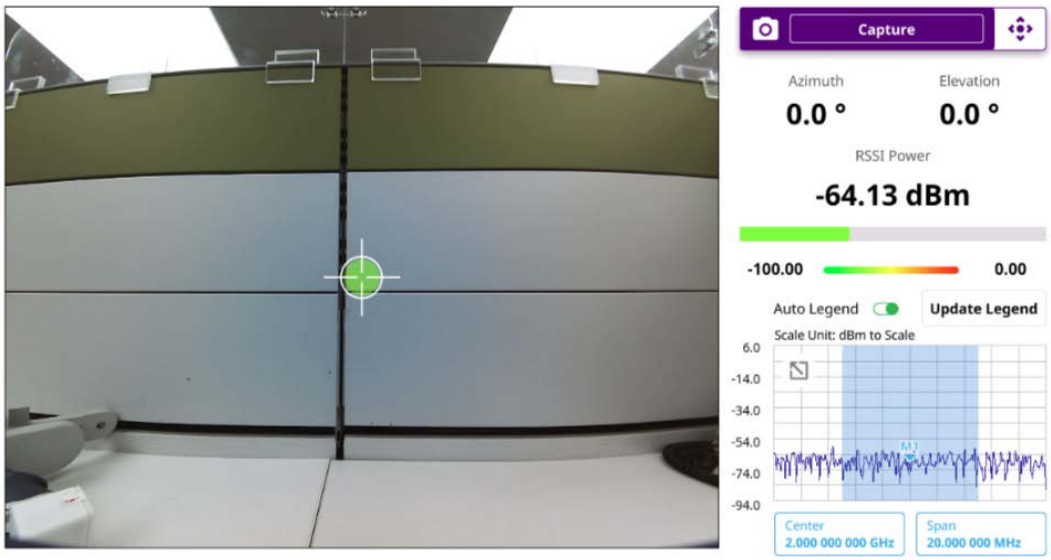
3 When the **TRIGGER** button is released, the measured screen is automatically saved.

4 RF power is displayed using legend colors, and the cross mark indicates the strongest power.

5 Pressing the **TRIGGER** button again returns to Step 1.

Figure 211 shows an example of an RF Viewer measurement.

Figure 211 RF Viewer measurement



NOTE

You can set Center Frequency and Span Frequency using the button.

Cell phase synchronization

The following sections describe how to perform cell phase synchronization.

Sync Analysis

Sync Analysis measures time difference between every signal (PCI). Sync Error is defined as the difference between the Primary PCI and target PCIs for Time Error. Once it exceeds a specific limit set by the user, the alarm will beep and the screen displays the interference signal as red.

Setting measure setup

After configuring the spectrum measurement in "Configuring spectrum measurements" on page 25, you can set the measure setup to continue your measurement. The measurement settings can be saved and recalled as a file by selecting File Type as Setup and load the file onto the instrument using the **Save/Load** icons on the side bar.

To set measure setup

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap **SSB Auto Search Mode** and do the following steps:

- **a** Tap **Auto Preamp/Atten** and switch **SSB Auto Search** to **Start** to set preamp and attenuation automatically.
- **b** Tap **Manual** and switch **SSB Auto Search** to **Start** for manually setting based on your need.

3 Tap **SSB Auto Search** between **Start** and **Stop**.

- **a** **Start**: to search SCS, type, and the number of SSB automatically. Once Start is selected, the progress bar appears. If it fails to perform the auto search, a fail message appears and the SSB switches to Manual.
- **b** **Stop**: to set the SSB periodicity based on the base station.

NOTE

You can go ahead with SSB Auto Search first to make your measurement/setting easier and faster. If the auto search is not successful, you can follow the procedure below for manual search.

4 Tap **Bandwidth/SSB SCS** and select the Setting in the pop-up window based on your need. SSB is an abbreviation for Synchronization Signal Block or SS Block and it refers to Synchronization PBCH block since the synchronization signal and PBCH channel are packed as a single block that always moves together. SSB should be detected first in 5G NR frame. See Table 118 below for the setting criteria based on the operating frequency.

5 Tap **Sync Raster Offset** to set the sync raster resolution to 180 kHz (FR1) or to 720 kHz (FR2) for carrier frequency center using the on-screen keyboard. See Table 119 below for the sync raster offset range per SSB SCS and sync raster resolution.

6 Tap **Sync SCS Offset** to fine-tune the offset using the SCS. See Table 120 below for the sync raster offset range per SSB SCS and sync raster resolution.

7 Tap **SSB Center Frequency** and input the value using the on-screen keyboard.

8 Tap **GSCN** and input the value using the on-screen keyboard.

9 Tap **L** to set the maximum number of SS-PBCH blocks within a single SS burst set (A set of SS being transmitted in 5 ms window of SS transmission) among 4, 8 and 64. Refer to the selection criteria based on the table in **Step 4**.

10 Tap **SSB Periodicity** and select the options from **5 ms**, **10 ms**, **20 ms**, **40 ms**, **80 ms**, **160 ms**. The SS burst period (SSB periodicity) is defined by each base station and network configurable. 20 ms is the default for the initial cell selection.

11 Tap to switch **PCI (Physical Cell ID)** to **Manual** or **Auto**.

12 Tap **PCI** and input a value from 0 to 1007 using the on-screen keyboard. The PCI switches to **Manual**.

13 Tap **Time Error Window** and select from the choices: **SSB Periodicity**, **Frame**, or **Half Frame**.

If you select Frame, the range is -5 ms to +5 ms based on 10 ms specified by 3GPP and if you select Half Frame, the range is -2.5 ms to +2.5 ms based on 5 ms specified by 3GPP.

14 Tap **Miscellaneous** > **Symbol Phase Comp** and select from the following choices: **Auto**, **Manual**, or **Off**.

Symbol Phase Compensation is used to compensate for phase differences between symbols caused by upconversion. Users do not always use the instrument based on RF frequency. In this case, you can set it to Manual or Off.

- **Auto**: Setting radio frequency to center frequency
- **Manual**: Setting radio frequency as required
- **Off**: Setting radio frequency to 0

To set limit

You will be able to judge any interfering signal is coming by setting the test limits to On.

1 Tap **Menu** > **Limit**.

2 Tap **Sync Error**.

a Tap to switch **Test Limits** to **On** or **Off**.

b Tap **Limit** and input the value using the on-screen keyboard. The default value is 3 µs.

3 Tap **Time Error**.

a Tap to switch **Test Limits** to **On** or **Off**.

b Tap **High Limit** or **Low Limit** and input the value using the on-screen keyboard.



NOTE

If you set the Time Error in Limit menu, you will check the Time Error values that you have set with green (pass) or fail (red) on the measurement screen. Refer to the below measurement screen.

Table 118 Setup per operating frequency

Operating frequency	L	Case	SCS	Slots in a burst period
< 3 GHz (FR1)	4	A {2,8} +14*n	15 kHz	5 (1 ms)
< 3 GHz (FR1)	4	B {4,8,16,20} +28*n	30 kHz	10 (0.5 ms)
< 3 GHz (FR1) For un-paired spectrum operation: < 1.88 GHz	4	C {2,8} +14*n	30 kHz	10 (0.5 ms)
3 to 6 GHz (FR1)	8	A {2,8} +14*n	15 kHz	5 (1 ms)
3 to 6 GHz (FR1)	8	B {4,8,16,20} +28*n	30 kHz	10 (0.5 ms)
3 to 6 GHz (FR1) For un-paired spectrum operation: 1.88 to 6 GHz	8	C {2,8} +14*n	30 kHz	10 (0.5 ms)
> 6 GHz (FR2)	64	D {4,8,16,20} +28*n	120 kHz	40 (0.125 ms)
> 6 GHz (FR2)	64	E {8,12,16,20,32,36,40,44} +56*n	240 kHz	80 (62.5 ms)

Table 119 Sync raster offset range per SSB SCS and sync raster resolution

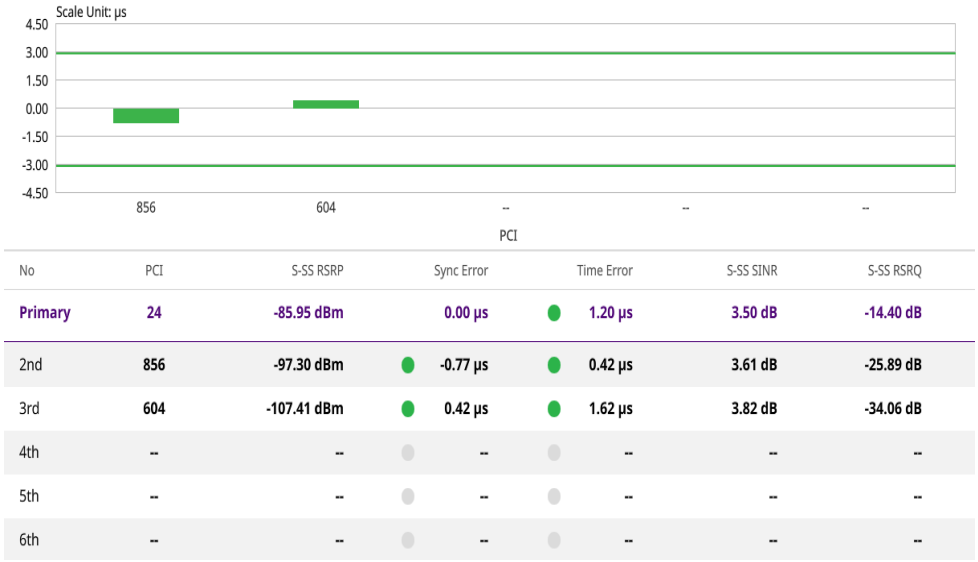
SSB SCS (kHz)	Sync Raster Resolution (kHz)	Sync Raster Offset Range	SSB Frequency = Center frequency
15	180	0 to 250	125
30	180	0 to 506	253
120	720	0 to 92	46
240	720	0 to 48	24

Table 120 Sync SCS offset range per SSB SCS and sync SCS resolution

SSB SCS (kHz)	Sync Raster Resolution (kHz)	Sync Raster Offset Range	SSB Frequency = Center Frequency
15	15	0 to 11	0
30	30	0 to 5	0
120	120	0 to 5	0
240	240	0 to 2	0

Figure 212 shows an example of Sync Analysis measurement.

Figure 212 RAN Sync Analysis measurement



No	PCI	S-SS RSRP	Sync Error	Time Error	S-SS SINR	S-SS RSRQ
Primary	24	-85.95 dBm	0.00 µs	1.20 µs	3.50 dB	-14.40 dB
2nd	856	-97.30 dBm	-0.77 µs	0.42 µs	3.61 dB	-25.89 dB
3rd	604	-107.41 dBm	0.42 µs	1.62 µs	3.82 dB	-34.06 dB
4th	--	--	--	--	--	--
5th	--	--	--	--	--	--
6th	--	--	--	--	--	--

- S-SS RSRP represents the average power of every symbol delivering S-SS.
- Sync Error represents the time offset of each PCI on the reference of Primary PCI.
- Time Error represents the time offset between Trigger Source and 5G NR frame start.

NOTE

You can go to Menu > Amp/Scale > Ref Time Error Offset to adjust scale on the chart.

Sync route map

5G sync route map traces the power level of the NR signal's beam and sync and time error corresponding to a particular time and geographical position and presents it in a geographical map as a measurement point. All the collected measurements can be exported for post-processing purposes.

Figure 213 shows an example of RAN sync route map measurement.

Figure 213 Sync route map with RAN Analyzer



Loading a map

To use any features related to maps, you need to download and install the maps on the instrument. The **VIAVI JDMapCreator** will help you to download maps. Ensure the JDMapCreator application on your computer is connected to the instrument via LAN. You can send a map file with a single layer to the instrument directly by using the **Send to EQP** menu in JDMapCreator. For information about how to use the JDMapCreator, see the *JDMapCreator 2.0 User Guide*.

To load a map

1 Plug in your USB flash drive that has a map file in .mcfv file type created in JDMapCreator.

2 Tap the **Load** ( ) icon on the side bar.

3 Navigate to the map file that you want to open.

The **File Information** pane displays the file properties, including its name, size, type, and date modified.

4 Tap the **Load** button on the screen.

Once you have loaded the map, you can also control the map using the following icons on the map.

Table 121 Map control icons

Icon	Description
	Tap to go to your current location on the map. Once tapped, the purple icon appears on the map, indicating your current location.
	Tap to switch to the full screen map view.

Table 121 Map control icons

Icon	Description
	Tap to zoom in the map.
	Tap to zoom out the map.
	Tap and select the area where you want to expand.

The left-most cell-site icon is activated when you import the cell-site information file.

To set measurement setup

Before starting the Route Map measurement, you need to set Spectrum measurements displayed on the quick access and display tab. See “Configuring spectrum measurements” on page 25 for more information.

1. If required, connect a GNSS receiver to your instrument for outdoor mapping. Indoor mapping does not necessarily need a GNSS antenna.
2. Tap the Setup ( ) icon on the side bar.
3. Tap **Map Config** to configure the map setting.
   a. Tap to switch the **Screen Mode** between **Map** and **Full**.
      - With the **Map** setting, you can view only the collected points that can be seen within the boundary of the loaded map.
      - With the **Full** setting, you can view all the collected points of the route without the loaded map
4. Tap **Bandwidth/SSB SCS** and select the Setting in the pop-up window based on your need. SSB is an abbreviation for Synchronization Signal Block or SS Block and it refers to Synchronization PBCH block since the synchronization signal and PBCH channel are packed as a single block that always moves together. SSB should be detected first in 5G NR frame. See Table 122 below for the setting criteria based on the operating frequency.
5. Tap **Sync Raster Offset** to set the sync raster resolution to 180 kHz (FR1) or to 720 kHz (FR2) for carrier frequency center using the on-screen keyboard. See Table 123 below for the sync raster offset range per SSB SCS and sync raster resolution.
6. Tap **Sync SCS Offset** to fine-tune the offset using the SCS. See Table 124 below for the sync raster offset range per SSB SCS and sync raster resolution.

7 Tap **L** to set the maximum number of SS-PBCH blocks within a single SS burst set (A set of SS being transmitted in 5 ms window of SS transmission) among 4, 8 and 64. Refer to the selection criteria based on the table in **Step 4**.

8 Tap **SSB Auto Search Mode** and do the following steps:

a Tap **Auto Preamp/Atten** and switch **SSB Auto Search** to **Start** to set preamp and attenuation automatically.

b Tap **Manual** and switch **SSB Auto Search** to **Start** for manually setting based on your need.

9 Tap **SSB Auto Search** between **Start** and **Stop**.

a **Start**: to search SCS, type, and the number of SSB automatically. Once Start is selected, the progress bar appears. If it fails to perform the auto search, a fail message appears and the SSB switches to Manual.

b **Stop**: to set the SSB periodicity based on the base station.

10 Tap **SSB Periodicity** and select the options from **5 ms**, **10 ms**, **20 ms**, **40 ms**, **80 ms**, 1**60 ms**. The SS burst period (SSB periodicity) is defined by each base station and network configurable. 20 ms is the default for the initial cell selection.

11 Tap **SSB Center Frequency** and input the value using the on-screen keyboard.

12 Tap **GSCN** and input the value using the on-screen keyboard.

13 Tap to switch **PCI (Physical Cell ID)** to **Manual** or **Auto**.

14 Tap **PCI** and input a value from 0 to 1007 using the on-screen keyboard. The PCI switches to **Manual**.

15 Tap **Time Error Window** and select from the choices: **SSB Periodicity**, **Frame**, or **Half Frame**.

If you select Frame, the range is -5 ms to +5 ms based on 10 ms specified by 3GPP and if you select Half Frame, the range is -2.5 ms to +2.5 ms based on 5 ms specified by 3GPP.

16 Tap **Miscellaneous** > **Symbol Phase Comp** and select from the following choices: **Auto**, **Manual**, or **Off**.

Symbol Phase Compensation is used to compensate for phase differences between symbols caused by upconversion. Users do not always use the instrument based on RF frequency. In this case, you can set it to Manual or Off.

– **Auto**: Setting radio frequency to center frequency
– **Manual**: Setting radio frequency as required
– **Off**: Setting radio frequency to 00.

Table 122 Setup per operating frequency

Operating frequency	L	Case	SCS	Slots in a burst period
< 3 GHz (FR1)	4	A {2,8} +14*n	15 kHz	5 (1 ms)

Table 122 Setup per operating frequency

Operating frequency	L	Case	SCS	Slots in a burst period
< 3 GHz (FR1)	4	B {4,8,16,20} +28*n	30 kHz	10 (0.5 ms)
< 3 GHz (FR1) For un-paired spectrum operation: < 1.88 GHz	4	C {2,8} +14*n	30 kHz	10 (0.5 ms)
3 to 6 GHz (FR1)	8	A {2,8} +14*n	15 kHz	5 (1 ms)
3 to 6 GHz (FR1)	8	B {4,8,16,20} +28*n	30 kHz	10 (0.5 ms)
3 to 6 GHz (FR1) For un-paired spectrum operation: 1.88 to 6 GHz	8	C {2,8} +14*n	30 kHz	10 (0.5 ms)
> 6 GHz (FR2)	64	D {4,8,16,20} +28*n	120 kHz	40 (0.125 ms)
> 6 GHz (FR2)	64	E {8,12,16,20,32,36,40,44} +56*n	240 kHz	80 (62.5 ms)

Table 123 Sync raster offset range per SSB SCS and sync raster resolution

SSB SCS (kHz)	Sync Raster Resolution (kHz)	Sync Raster Offset Range	SSB Frequency = Center frequency
15	180	0 to 250	125
30	180	0 to 506	253
120	720	0 to 92	46
240	720	0 to 48	24

Table 124 Sync SCS offset range per SSB SCS and sync SCS resolution

SSB SCS (kHz)	Sync Raster Resolution (kHz)	Sync Raster Offset Range	SSB Frequency = Center Frequency
15	15	0 to 11	0
30	30	0 to 5	0
120	120	0 to 5	0
240	240	0 to 2	0

To set limit

You can set the thresholds for the two different color indicators, red and green. When there is no interference signal, the color is displayed as green (pass). Otherwise, it is displayed as red (fail).

1 Tap **Menu** > **Limit**.

2 Tap **Sync Error**.

   a Tap to switch **Test Limits** to **On** or **Off**.

   b Tap **Limit** and input the value using the on-screen keyboard. The default value is 3 µs.

3 Tap **Time Error**.

   a Tap to switch **Test Limits** to **On** or **Off**.

   b Tap **High Limit** or **Low Limit** and input the value using the on-screen keyboard.



NOTE
If you set the Time Error in Limit menu, you will check the Time Error values that you have set with green (pass) or fail (red) on the measurement screen.

Logging data

To use any features related to maps, you need to download and install the maps on the instrument. The VIAVI JDMapCreator will help you download maps. Make sure the JDMapCreator application on your computer is connected to the instrument via LAN. You can send a map file with a single layer to the instrument directly by using the Send to EQP menu in JDMapCreator. For more information on how to use the JDMapCreator, see the *JDMapCreator 2.0 User Guide*.

To log data

1 Follow **steps 1 to 3** in Setting measure setup.

2 Tap the **Testing** button on the right panel of the map to start plotting on the map. Sync status is plotted on the map with color index. Green for sync pass and red for sync fail.

3 Tap the **Stop** (■) button to stop plotting.

4 Tap the **Pause** button (❚❚) to pause plotting, then the GNSS point cannot be plotted.

5 If you select the **Stop** button, the Plot Stop pop-up window appears, then tap **Yes**.

6 Tap **Yes** when the Save pop-up window appears and save the logging file to your USB.

Viewing the logging data

To view the logging data

1 Load the saved logging file using the **Load** () icon on the side bar. Make sure the file extension is .gomv.

2 Based on the judgement between pass or fail for 2nd sync error, the green (pass) or red (fail) color applies.

3 When you select a point on the map, a marker appears and the Information window appears on the right panel.



NOTE
When you load the result file, a pop-up message asking whether you want to load data only or data with map appears. If the current screen does not display all the loaded data, the screen mode will be automatically changed to Full.

Importing cellsite DB

You can import the site DB by creating the 5G site information form.

To import cellsite DB

1 Create the 5G site information with an excel file as below.

2 Input the two mandatory fields: **Lat (DecDeg)** and **Long (DecDeg)**.

3 Input the **Azimuth** field if you want to check the direction of antenna.

4 Make sure to save the file as (Comma delimited) (*.csv).

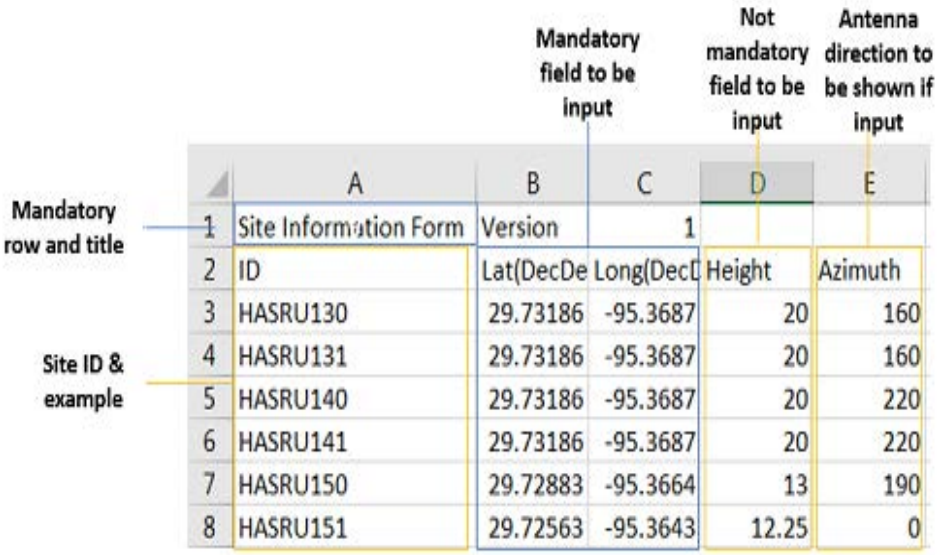
5 Copy the file to the USB memory stick and insert it to the **USB A** or **USB B** port of the instrument.

6 Tap the **Load** () icon on the side bar.

7 Import the saved file.
Once the file is loaded, the following cellsite information appears with an icon.

Figure 214 shows an example of an importing cellsite DB.

Figure 214 Importing Cellsite DB



Online route map

The following sections describe how to perform online route map.

Online OTA route map

Online OTA route map enables you to download a map automatically when connected to the network then you can continue route map measurement using the downloaded map whether you are online or offline. It traces the power level of the NR signal's beam and sync and time error corresponding to a particular time and geographical position and presents it in a geographical map as a measurement point. All the collected measurements can be exported for post-processing purposes.

Figure 215 shows an example of RAN Online OTA route map measurement.

Figure 215 Online OTA route map with RAN Analyzer



Controlling a map

To control a map

See the following table to control a map.

Table 125 Map control icons

Icon	Description
	Tap to go to your current location on the map. Once tapped, the purple icon appears on the map, indicating your current location.
	Tap to zoom in the map.
	Tap to zoom out the map.

The left-most cell-site icon is activated when you import the cell-site information file.

To set measurement setup

Before starting the Online OTA Route Map measurement, you need to set Spectrum measurements displayed on the quick access and display tab. See “Configuring spectrum measurements” on page 25 for more information.

1. Connect a GNSS receiver to your instrument for outdoor mapping.
2. Tap the **Setup** ( ) icon on the side bar.
3. Tap to switch **Plot Item** to **P-SS RSRP**, **S-SS RSRP**, **S-SS RSRQ**, **S-SS SINR**, or **PCI Dominance**.
4. Tap **Bandwidth/SSB SCS** and select the Setting in the pop-up window based on your need. SSB is an abbreviation for Synchronization Signal Block or SS Block and it refers to Synchronization PBCH block since the synchronization signal and PBCH channel are packed as a single block that always moves together. SSB should be detected first in 5G NR frame. See Table 126 below for the setting criteria based on the operating frequency.
5. Tap **Sync Raster Offset** to set the sync raster resolution to 180 kHz (FR1) or to 720 kHz (FR2) for carrier frequency center using the on-screen keyboard. See Table 127 below for the sync raster offset range per SSB SCS and sync raster resolution.
6. Tap **Sync SCS Offset** to fine-tune the offset using the SCS. See Table 128 below for the sync raster offset range per SSB SCS and sync raster resolution.

7 Tap **L** to set the maximum number of SS-PBCH blocks within a single SS burst set (A set of SS being transmitted in 5 ms window of SS transmission) among 4, 8 and 64. Refer to the selection criteria based on the table in **Step 4**.

8 Tap **SSB Auto Search Mode** and do the following steps:

a Tap **Auto Preamp/Atten** and switch **SSB Auto Search** to **Start** to set preamp and attenuation automatically.

b Tap **Manual** and switch **SSB Auto Search** to **Start** for manually setting based on your need.

9 Tap **SSB Auto Search** between **Start** and **Stop**.

a **Start**: to search SCS, type, and the number of SSB automatically. Once Start is selected, the progress bar appears. If it fails to perform the auto search, a fail message appears and the SSB switches to Manual.

b **Stop**: to set the SSB periodicity based on the base station.

10 Tap **SSB Periodicity** and select the options from **5 ms**, **10 ms**, **20 ms**, **40 ms**, **80 ms**, 1**60 ms**. The SS burst period (SSB periodicity) is defined by each base station and network configurable. 20 ms is the default for the initial cell selection.

11 Tap **SSB Center Frequency** and input the value using the on-screen keyboard.

12 Tap **GSCN** and input the value using the on-screen keyboard.

13 Tap to switch **PCI (Physical Cell ID)** to **Manual** or **Auto**.

14 Tap **PCI** and input a value from 0 to 1007 using the on-screen keyboard. The PCI switches to **Manual**.

15 Tap **Time Error Window** and select from the choices: **SSB Periodicity**, **Frame**, or **Half Frame**.

If you select Frame, the range is -5 ms to +5 ms based on 10 ms specified by 3GPP and if you select Half Frame, the range is -2.5 ms to +2.5 ms based on 5 ms specified by 3GPP

16 Tap **Miscellaneous** > **Symbol Phase Comp** and select from the following choices: **Auto**, **Manual**, or **Off**.

Symbol Phase Compensation is used to compensate for phase differences between symbols caused by upconversion. Users do not always use the instrument based on RF frequency. In this case, you can set it to Manual or Off.

– **Auto**: Setting radio frequency to center frequency
– **Manual**: Setting radio frequency as required
– **Off**: Setting radio frequency to 0

Table 126 Setup per operating frequency

Operating frequency	L	Case	SCS	Slots in a burst period
< 3 GHz (FR1)	4	A {2,8} +14*n	15 kHz	5 (1 ms)

Table 126 Setup per operating frequency

Operating frequency	L	Case	SCS	Slots in a burst period
< 3 GHz (FR1)	4	B {4,8,16,20} +28*n	30 kHz	10 (0.5 ms)
< 3 GHz (FR1) For un-paired spectrum operation: < 1.88 GHz	4	C {2,8} +14*n	30 kHz	10 (0.5 ms)
3 to 6 GHz (FR1)	8	A {2,8} +14*n	15 kHz	5 (1 ms)
3 to 6 GHz (FR1)	8	B {4,8,16,20} +28*n	30 kHz	10 (0.5 ms)
3 to 6 GHz (FR1) For un-paired spectrum operation: 1.88 to 6 GHz	8	C {2,8} +14*n	30 kHz	10 (0.5 ms)
> 6 GHz (FR2)	64	D {4,8,16,20} +28*n	120 kHz	40 (0.125 ms)
> 6 GHz (FR2)	64	E {8,12,16,20,32,36,40,44} +56*n	240 kHz	80 (62.5 ms)

Table 127 Sync raster offset range per SSB SCS and sync raster resolution

SSB SCS (kHz)	Sync Raster Resolution (kHz)	Sync Raster Offset Range	SSB Frequency = Center frequency
15	180	0 to 250	125
30	180	0 to 506	253
120	720	0 to 92	46
240	720	0 to 48	24

Table 128 Sync SCS offset range per SSB SCS and sync SCS resolution

SSB SCS (kHz)	Sync Raster Resolution (kHz)	Sync Raster Offset Range	SSB Frequency = Center Frequency
15	15	0 to 11	0
30	30	0 to 5	0
120	120	0 to 5	0
240	240	0 to 2	0

To set limit

You can set the thresholds for the two different color indicators, red and blue. The maximum value is the Limit for **Excellent**, and the minimum value is the Limit for **Poor**. See below to check the plot point color based on the Legend Color Table.

1 Tap the rectangle with value before color legend bar on the right panel.

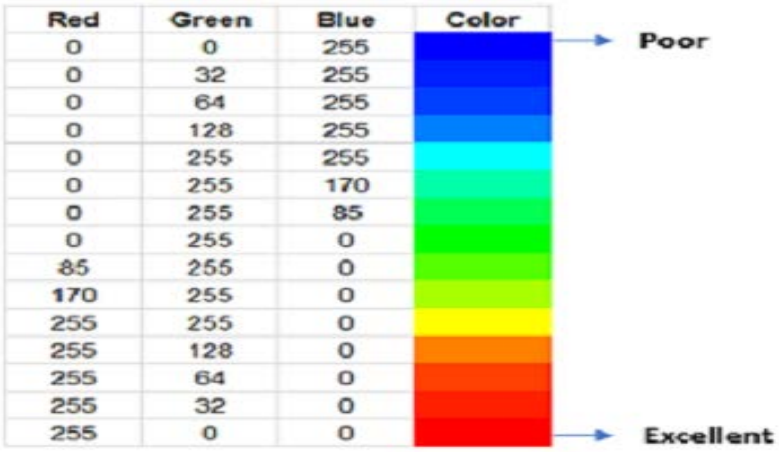
2 Set a value for **Poor** (minimum value) using the on-screen keyboard.

3 Tap the rectangle with value after color legend bar on the right panel.

4 Set a value for **Excellent** (maximum value) using the on-screen keyboard.

Figure 216 shows a legend color table.

Figure 216 Legend color table



Logging data

To log data

1 Follow **steps 1 to 3** in Setting measure setup.

2 Tap the **Testing** button on the right panel of the map to start plotting on the map. When you select a point on the map, a marker appears and the Information window appears on the right panel.

If you select the Plot Item to PCI Dominance, you will see the plotting circled dot and its edge with PCI legend color based on its received power and PCI Dominance color based on the threshold you have set respectively. If PCI Dominance is lower than the value you have set, it judges fail showing red in the edge. Otherwise, it judges pass showing green in the edge.

3 Tap the **Stop** (■) button to stop plotting.

4 Tap the **Pause** button (❚❚) to pause plotting, then the GNSS point cannot be plotted.

5 If you select the **Stop** button, the Plot Stop pop-up window appears, then tap **Yes**.

6 Tap **Yes** when the Save pop-up window appears and save the logging file to your USB.

If you go to **Limit** > **PCI Dominance** and set it, you can judge pass (green) or fail (red) with colors based on the limit you have set. For example, if it becomes smaller than the threshold, the fail indicator (red) can be identified in the PCI column of the Information window and the top right corner of the instrument at the same time.

Viewing the logging data

To view the logging data

1 Load the saved logging file using the **Load** ( ) icon on the side bar. Make sure the file extension is .orr.

2 If the **PCI** is set to **Auto**, the point on the map appears with a color representing the largest **S-SS-RSRP** value. When you select a point on the map, a marker appears and the Information window appears on the right panel.

3 Set the **PCI** to **Manual** and tap the **Select** button.

The Select PCI window appears.

4 Select PCI on the left and then the corresponding Beam Index appeared on the right.

5 Tap the **Apply** button.

The point color of the map changes to the corresponding SS-RSRP value, and if there is no detected Beam Index, the point will be hidden.

Importing cellsite DB

You can import the site DB by creating the 5G site information form.

To import cellsite DB

1 Create the 5G site information with an excel file as below.

2 Input the two mandatory fields: **Lat (DecDeg)** and **Long (DecDeg)**.

3 Input the **Azimuth** field if you want to check the direction of antenna.

4 Make sure to save the file as (Comma delimited) (*.csv).

5 Copy the file to the USB memory stick and insert it to the **USB A** or **USB B** port of the instrument.

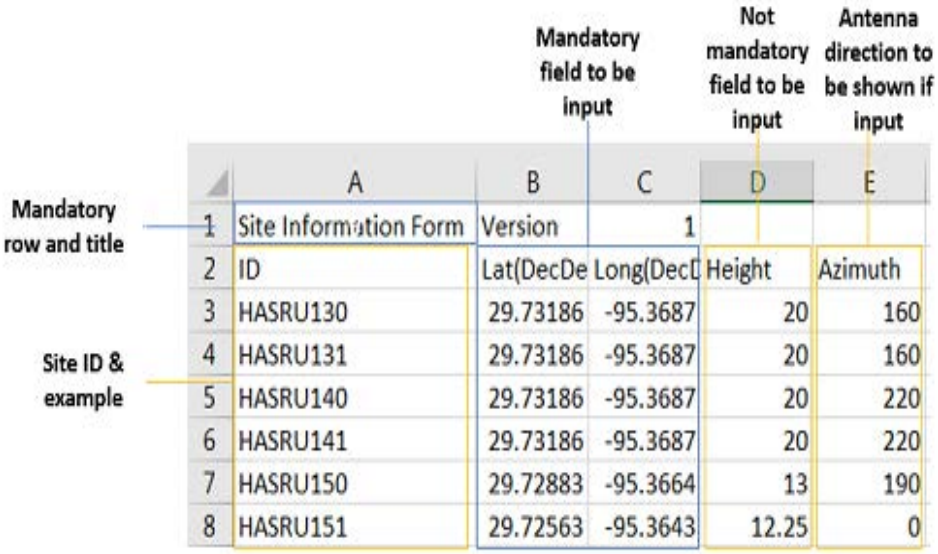
6 Tap the **Load** ( ) icon on the side bar.

7 Import the saved file.

Once the file is loaded, the following cellsite information appears with an icon.

Figure 217 shows an example of an importing cellsite DB.

Figure 217 Importing Cellsite DB



NOTE
If you have unsaved measurement data (map) and start measuring by tapping the Testing button or by tapping another measurement mode, a pop-up window will appear asking whether you will restore the unsaved data or not.

Creating a map

You can create a map online and continue conducting a route map analysis using the created map even when there is no Ethernet connection.

1 Tap the **Map Creator** button on the right panel at the bottom.

2 Tap the **Search** box and input the location using the on-screen keyboard and select one of the options as required.

3 Tap the **Zoom Level** box to capture the map with corresponding zoom level.

4 Tap the **Capture** button to start capturing the map.

Once the map is captured, the capturing completed pop-up will appear.

5 Select between the two options: Save in the system or Save as file.

6 Tap the **Done** button.

NOTE
If you have unsaved measurement data (map) and start measuring by tapping the Testing button or by tapping another measurement mode, a pop-up window will appear asking whether you will restore the unsaved data or not.

Online sync route map

Online sync route map enables you to download a map automatically when connected to the network then you can continue route map measurement using the downloaded map whether you are online or offline. It traces the power level of the NR signal's beam and sync and time error corresponding to a particular time and geographical position and presents it in a geographical map as a measurement point. All the collected measurements can be exported for post-processing purposes.

Figure 218 shows an example of 5G NR online sync route map measurement.

Figure 218 Online sync route map with 5G NR Signal Analyzer



Controlling a map

To control a map

See the following table to control a map.

Table 129 Map control icons

Icon	Description
	Tap to go to your current location on the map. Once tapped, the purple icon appears on the map, indicating your current location.
	Tap to zoom in the map.
	Tap to zoom out the map.

The left-most cell-site icon is activated when you import the cell-site information file.

To set measurement setup

Before starting the Online OTA Route Map measurement, you need to set Spectrum measurements displayed on the quick access and display tab. See “Configuring spectrum measurements” on page 25 for more information.

1. Connect a GNSS receiver to your instrument for outdoor mapping.
2. Tap the **Setup** ( ) icon on the side bar.
3. Tap to switch **Plot Item** to **P-SS RSRP**, **S-SS RSRP**, **S-SS RSRQ** or **S-SS SINR**.
4. Tap **Bandwidth/SSB SCS** and select the Setting in the pop-up window based on your need. SSB is an abbreviation for Synchronization Signal Block or SS Block and it refers to Synchronization PBCH block since the synchronization signal and PBCH channel are packed as a single block that always moves together. SSB should be detected first in 5G NR frame. See Table 130 below for the setting criteria based on the operating frequency.
5. Tap **Sync Raster Offset** to set the sync raster resolution to 180 kHz (FR1) or to 720 kHz (FR2) for carrier frequency center using the on-screen keyboard. See Table 131 below for the sync raster offset range per SSB SCS and sync raster resolution.
6. Tap **Sync SCS Offset** to fine-tune the offset using the SCS. See Table 132 below for the sync raster offset range per SSB SCS and sync raster resolution.

7 Tap **L** to set the maximum number of SS-PBCH blocks within a single SS burst set (A set of SS being transmitted in 5 ms window of SS transmission) among 4, 8 and 64. Refer to the selection criteria based on the table in **Step 4**.

8 Tap **SSB Auto Search Mode** and do the following steps:

a Tap **Auto Preamp/Atten** and switch **SSB Auto Search** to **Start** to set preamp and attenuation automatically.

b Tap **Manual** and switch **SSB Auto Search** to **Start** for manually setting based on your need.

9 Tap **SSB Auto Search** between **Start** and **Stop**.

a **Start**: to search SCS, type, and the number of SSB automatically. Once Start is selected, the progress bar appears. If it fails to perform the auto search, a fail message appears and the SSB switches to Manual.

b **Stop**: to set the SSB periodicity based on the base station.

10 Tap **SSB Periodicity** and select the options from **5 ms**, **10 ms**, **20 ms**, **40 ms**, **80 ms**, 1**60 ms**. The SS burst period (SSB periodicity) is defined by each base station and network configurable. 20 ms is the default for the initial cell selection.

11 Tap **SSB Center Frequency** and input the value using the on-screen keyboard.

12 Tap **GSCN** and input the value using the on-screen keyboard.

13 Tap to switch **PCI (Physical Cell ID)** to **Manual** or **Auto**.

14 Tap **PCI** and input a value from 0 to 1007 using the on-screen keyboard. The PCI switches to **Manual**.

15 Tap **Time Error Window** and select from the choices: **SSB Periodicity**, **Frame**, or **Half Frame**.

If you select Frame, the range is -5 ms to +5 ms based on 10 ms specified by 3GPP and if you select Half Frame, the range is -2.5 ms to +2.5 ms based on 5 ms specified by 3GPP

16 Tap **Miscellaneous** > **Symbol Phase Comp** and select from the following choices: **Auto**, **Manual**, or **Off**.

Symbol Phase Compensation is used to compensate for phase differences between symbols caused by upconversion. Users do not always use the instrument based on RF frequency. In this case, you can set it to Manual or Off.

– **Auto**: Setting radio frequency to center frequency
– **Manual**: Setting radio frequency as required
– **Off**: Setting radio frequency to 0

Table 130 Setup per operating frequency

Operating frequency	L	Case	SCS	Slots in a burst period
< 3 GHz (FR1)	4	A {2,8} +14*n	15 kHz	5 (1 ms)

Table 130 Setup per operating frequency

Operating frequency	L	Case	SCS	Slots in a burst period
< 3 GHz (FR1)	4	B {4,8,16,20} +28*n	30 kHz	10 (0.5 ms)
< 3 GHz (FR1) For un-paired spectrum operation: < 1.88 GHz	4	C {2,8} +14*n	30 kHz	10 (0.5 ms)
3 to 6 GHz (FR1)	8	A {2,8} +14*n	15 kHz	5 (1 ms)
3 to 6 GHz (FR1)	8	B {4,8,16,20} +28*n	30 kHz	10 (0.5 ms)
3 to 6 GHz (FR1) For un-paired spectrum operation: 1.88 to 6 GHz	8	C {2,8} +14*n	30 kHz	10 (0.5 ms)
> 6 GHz (FR2)	64	D {4,8,16,20} +28*n	120 kHz	40 (0.125 ms)
> 6 GHz (FR2)	64	E {8,12,16,20,32,36,40,44} +56*n	240 kHz	80 (62.5 ms)

Table 131 Sync raster offset range per SSB SCS and sync raster resolution

SSB SCS (kHz)	Sync Raster Resolution (kHz)	Sync Raster Offset Range	SSB Frequency = Center frequency
15	180	0 to 250	125
30	180	0 to 506	253
120	720	0 to 92	46
240	720	0 to 48	24

Table 132 Sync SCS offset range per SSB SCS and sync SCS resolution

SSB SCS (kHz)	Sync Raster Resolution (kHz)	Sync Raster Offset Range	SSB Frequency = Center Frequency
15	15	0 to 11	0
30	30	0 to 5	0
120	120	0 to 5	0
240	240	0 to 2	0

To set limit

You can set the thresholds for the two different color indicators, red and green. When there is no interference signal, the color is displayed as green (pass). Otherwise, it is displayed as red (fail).

1 Tap **Menu** > **Limit**.

2 Tap **Sync Error**.

   a Tap to switch **Test Limits** to **On** or **Off**.

   b Tap **Limit** and input the value using the on-screen keyboard. The default value is 3 µs.

3 Tap **Time Error**.

   a Tap to switch **Test Limits** to **On** or **Off**.

   b Tap **High Limit** or **Low Limit** and input the value using the on-screen keyboard.



NOTE
If you set the Time Error in Limit menu, you will check the Time Error values that you have set with green (pass) or fail (red) on the measurement screen.

Logging data

To log data

1 Follow **steps 1 to 3** in Setting measure setup.

2 Tap the **Testing** button on the right panel of the map to start plotting on the map. When you select a point on the map, a marker appears and the Information window appears on the right panel.

3 Tap the **Stop** (■) button to stop plotting.

4 Tap the **Pause** button (❚❚) to pause plotting, then the GNSS point cannot be plotted.

5 If you select the **Stop** button, the Plot Stop pop-up window appears, then tap **Yes**.

6 Tap **Yes** when the Save pop-up window appears and save the logging file to your USB.

Viewing the logging data

To view the logging data

1 Load the saved logging file using the **Load** ( ) icon on the side bar. Make sure the file extension is .orr.

2 If the **PCI** is set to **Auto**, the point on the map appears with a color representing the largest **S-SS-RSRP** value. When you select a point on the map, a marker appears and the Information window appears on the right panel.

3 Set the **PCI** to **Manual** and tap the **Select** button.

The Select PCI window appears.

4 Select PCI on the left and then the corresponding Beam Index appeared on the right.

5 Tap the **Apply** button.

The point color of the map changes to the corresponding SS-RSRP value, and if there is no detected Beam Index, the point will be hidden.

Importing cellsite DB

You can import the site DB by creating the 5G site information form.

To import cellsite DB

1 Create the 5G site information with an excel file as below.

2 Input the two mandatory fields: **Lat (DecDeg)** and **Long (DecDeg)**.

3 Input the **Azimuth** field if you want to check the direction of antenna.

4 Make sure to save the file as (Comma delimited) (*.csv).

5 Copy the file to the USB memory stick and insert it to the **USB A** or **USB B** port of the instrument.

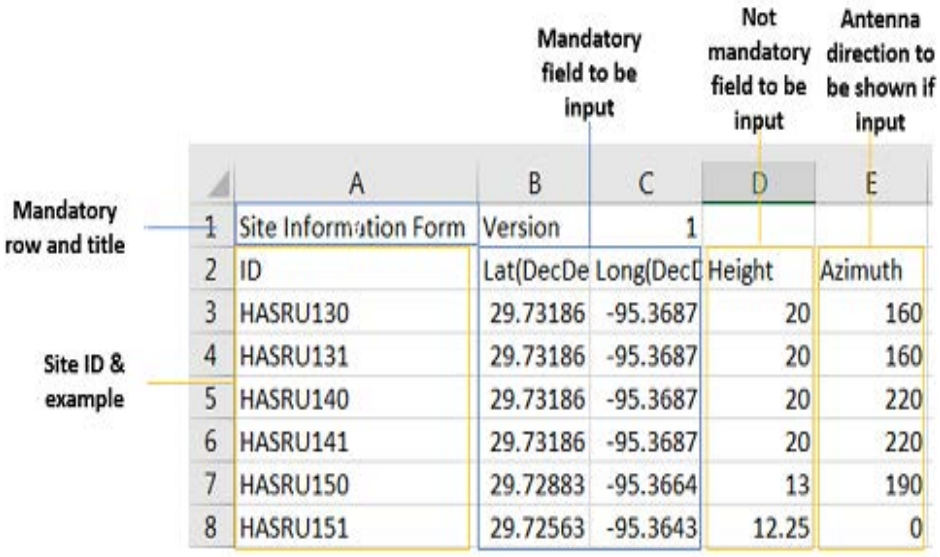
6 Tap the **Load** ( ) icon on the side bar.

7 Import the saved file.

Once the file is loaded, the following cellsite information appears with an icon.

Figure 219 shows an example of an importing cellsite DB.

Figure 219 Importing Cellsite DB



Creating a map

You can create a map online and continue conducting a route map analysis using the created map even when there is no Ethernet connection.

1 Tap the **Map Creator** button on the right panel at the bottom.

2 Tap the **Search** box and input the location using the on-screen keyboard and select one of the options as required.

3 Tap the **Zoom Level** box to capture the map with corresponding zoom level.

4 Tap the **Capture** button to start capturing the map.

Once the map is captured, the capturing completed pop-up will appear.

5 Select between the two options: Save in the system or Save as file.

6 Tap the **Done** button.

NOTE
If you have unsaved measurement data (map) and start measuring by tapping the Testing button or by tapping another measurement mode, a pop-up window will appear asking whether you will restore the unsaved data or not.

13

Using Blind Scanner

This chapter describes how to use the Blind Scanner. Topics covered in this chapter include:

- “Introduction” on page 546
- “Selecting mode and measure” on page 546
- “Configuring blind scan” on page 546
- “Performing blind scan” on page 549
- “Performing blind scan (FR2)” on page 552

Introduction

In the CBRS band, service providers using General Authorized Access (GAA) spectrum have limited knowledge of the channels that may be assigned to them and other collocated services.

Using Blind Scan, you can scan the frequency range or frequency bands of interest, showing the active channels in use. Once RF channels are discovered, you can select one of those channels for deeper signal and beam analysis.

Blind Scan provides an auto-discovery mode that quickly detects active RF channels at any selected location, enabling you to validate active 4G, 5G and 5G DSS services, particularly in CBRS band and DAS environments.

Blind Scanner supports the following measurements:

- Blind Scanner
- Blind Scanner (FR2) Not support 6G module.

Selecting mode and measure

The following procedure describes how to start measurement.

To select mode and measure

1 Tap **Blind Scanner** on the **MODE** panel.

2 Tap any measurement mode from the following choices:
   – **Blind Scan > Blind Scanner** or **Blind Scanner (FR2)**

Configuring blind scan

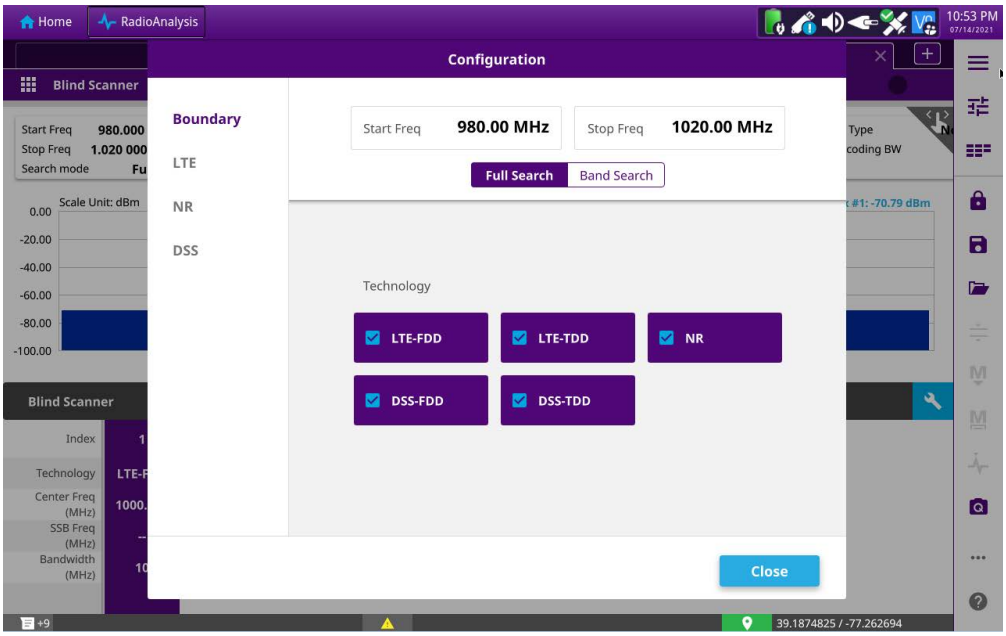
The following procedure describes how to configure Blind Scan.

To configure Blind Scan

1 Tap the **Setup** (⚙) icon on the side bar, then tap **Configuration**. Or tap **Configuration** icon on the right side of the screen.

2 The **Configuration** page appears, as shown in as shown in Figure 220.

Figure 220 Configuration page



3 On the left side of the page, tap **Boundary.**

4 Tap **Start Freq** and enter the start frequency of the range you want to scan using the on-screen keyboard.

5 Tap **Stop Freq** and enter the stop frequency of the range you want to scan using the on-screen keyboard.

   a Tap **Full Search** to search the selected technology that is within the range of start frequency and stop frequency.

   b Tap **Band Search** to search the user-defined band and technology from the band list within the range of start frequency and stop frequency.

6 In the Technology section, tap to select the technology type(s) to be included in the scan.

7 On the left side of the page, tap a technology type to configure its specific parameters. Table 133 describes the parameters.

Table 133 Technology parameters

Parameter	Description
LTE (FR1/FR2)	
CP Type	Specifies the cyclic prefix (CP) of the signal. The options are: – Normal – Extended
NR (FR2)	
SCS	Specifies the Subcarrier Spacing (SCS) mode used by the signal. The options are: – 120 kHz – 240 kHz

Table 133 Technology parameters

Parameter	Description
Periodicity	Specifies the periodicity of the signal. The options are: – 5 ms – 10 ms – 20 ms – 40 ms – 80 ms – 160 ms
Search Type	Specifies the signal type to search. The options are: – GSCN – NR-ARFCN
DSS (FR1)	
CP Type	Specifies the CP of the signal. The options are: – Normal – Extended
SCS	Specifies the SCS mode used by the signal. The options are: – 30 kHz – 15 kHz
Periodicity	Specifies the periodicity of the signal. The options are: – 5 ms – 10 ms – 20 ms – 40 ms – 80 ms – 160 ms
SSB Step	Specifies the Synchronization Signal/PBCH block (SSB) type to scan. The options are: – GSCN – NR-ARFCN

8 Tap **Close.**

9 Go back to the **Setup** menu and tap to enable or disable **Consistent Mode**.

– Select **Consistent Mode** On to prevent fluctuations or reductions in the number of detected carriers under unchanged reception conditions. This mode also ensures previously discovered carriers are retained. Entries from earlier scans are marked with an asterisk (*).

Performing blind scan

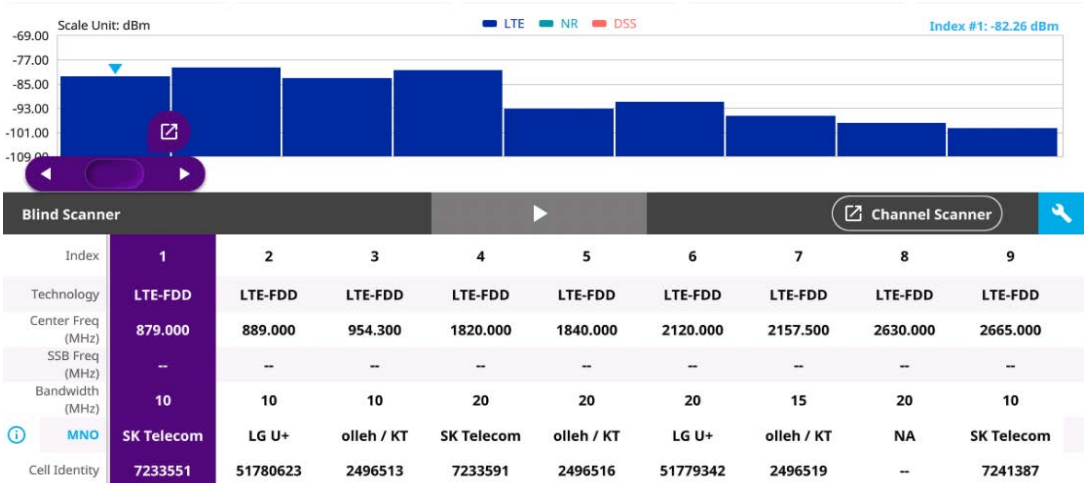
The following procedure describes how to perform Blind Scan.

To perform Blind Scan

1 Tap the Start Scan (▶) button to start the Blind Scan.

2 When the scan is complete, the results appear on the screen, as shown in Figure 221.

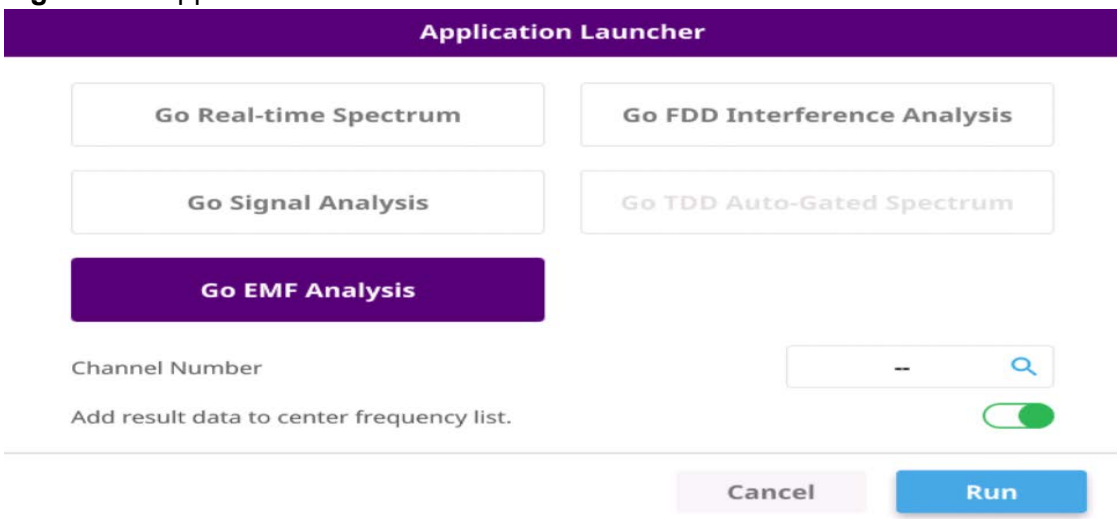
Figure 221 Blind Scan result



3 To further analyze the results with a single channel, tap the **Application Launcher** button ( ).

4 The **Application Launcher** screen appears, as shown in Figure 222.

Figure 222 Application Launcher screen



5 Select the analysis type you wish to perform, then tap **Run**.

a If you select LTE-FDD/DSS-FDD, the Go FDD Interference Analysis option is enabled.

- This option requires the Interference Analyzer license and will take you to the Spectrum of the Interference Analyzer.

b If you select LTE-TDD/DSS-TDD, the Go TDD Auto Gated Spectrum option is enabled.

- This requires the TDD Auto Gated Spectrum license and will take you to the Spectrum of TAGS.
- If you don't have the TAGS license, it will instead take you to Gated Sweep in the Spectrum Analyzer (license required as well).

c If you select LTE-FDD/TDD or DSS-FDD/TDD (common):

- Go Signal Analysis is enabled only if you have the LTE-FDD/TDD or DSS Signal Analysis (select between FDD and TDD) license, and it will take you to the OTA ID Scanner in the respective LTE-FDD/TDD or DSS Signal Analyzer.
- Go Real-time Spectrum is enabled only if you have the Real-time Spectrum Analyzer license, and it takes you to the Persistent Spectrum of the Real-time Spectrum Analyzer.
- Go EMF Analysis is enabled only if you have the 5G EMF Analyzer license, and it will take you to the EMF LTE FDD/TDD Analysis.

d If you select NR, the following options may be enabled:

- Go Signal Analysis > OTA Analysis in 5G NR Signal Analyzer (license required). Without the license, it will go to 5G NR Signal Analysis in the RAN Analyzer (license required).
- Go Real-time Spectrum > Persistent Spectrum in Real-time Spectrum Analyzer (license required). Without the license, it will go to RTSA Persistent Spectrum in the RAN Analyzer (license required).
- Go TDD Auto-Gated Spectrum > Spectrum of TAGS (license required). Without the license, it will go to TAGS Analysis in the RAN Analyzer (license required)
- Go EMF Analysis > EMF 5G NR Beam Analysis (license required).



NOTE

If you switch between IA, SiA, and BS modes, the last searched carrier will remain, allowing you to continue measurements for other carriers.

NOTE

When you set add result data to center frequency list to On (Green), based on the tech you chose, you can add the result data to Center Frequency List.

See below for more details:

- LTE-FDD/TDD, NR: Spectrum Analyzer, Real-time Spectrum Analyzer
- LTE-FDD: LTE-FDD Signal Analyzer
- LTE-TDD: LTE TDD Signal Analyzer
- NR: 5G NR Signal Analyzer
- DSS-FDD/TDD: DSS Analyzer
- LTE-FDD/TDD, NR: Multi-RAT Analyzer

Once blind scan search is done and if you want to check the result table values, go to each tech you chose > Menu > Frequency > Center Frequency List. You are able to see the added result data.

6 To further analyze the results with multi channels, tap the **Channel Scanner** button at the top right of the blind scanner result table.

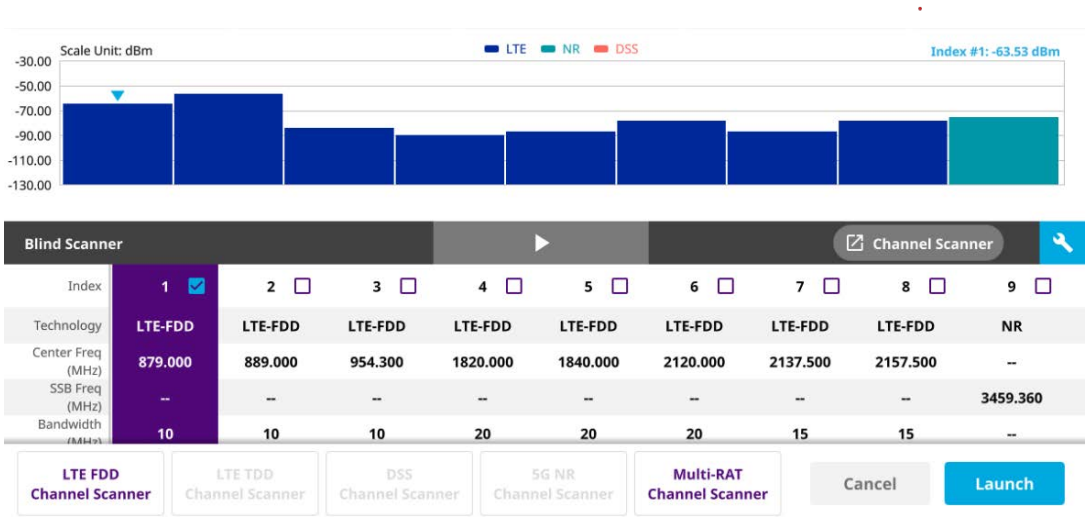
7 A list of supported channels will display and you can identify apps that support multi-channel.

8 Select the carriers to analyze.

9 Tap the measurement that you want to navigate to.

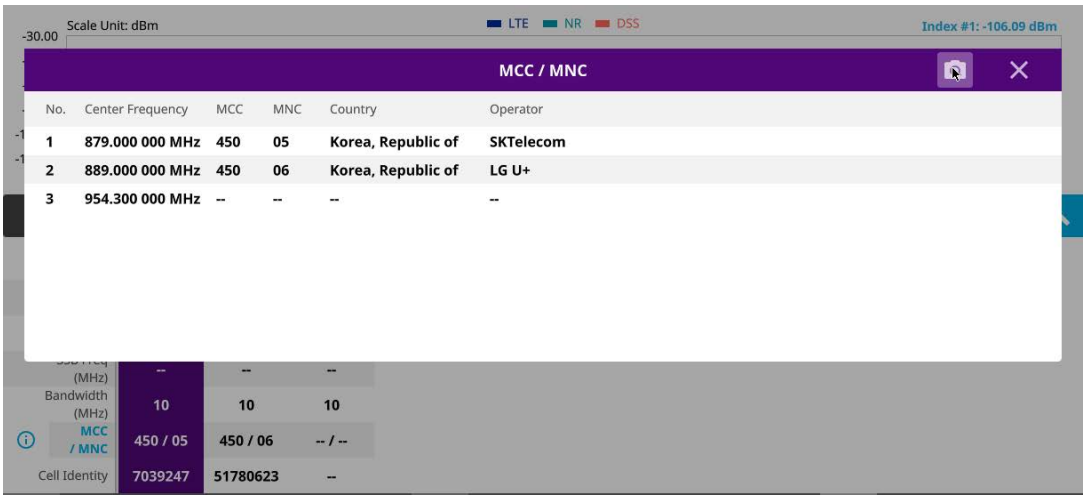
10 Tap the **Launch** button.

Figure 223 Navigate to Channel Scanner



11 *Optiona*l. Tap the **Information** icon to check Mobile Country Codes (MCC) and Mobile Network Codes (MNC). The screen is shown in Figure 224.

Figure 224 MCC and MNC information



NOTE

You can check the MCC and MNC information only if you select LTE tech.

Performing blind scan (FR2)

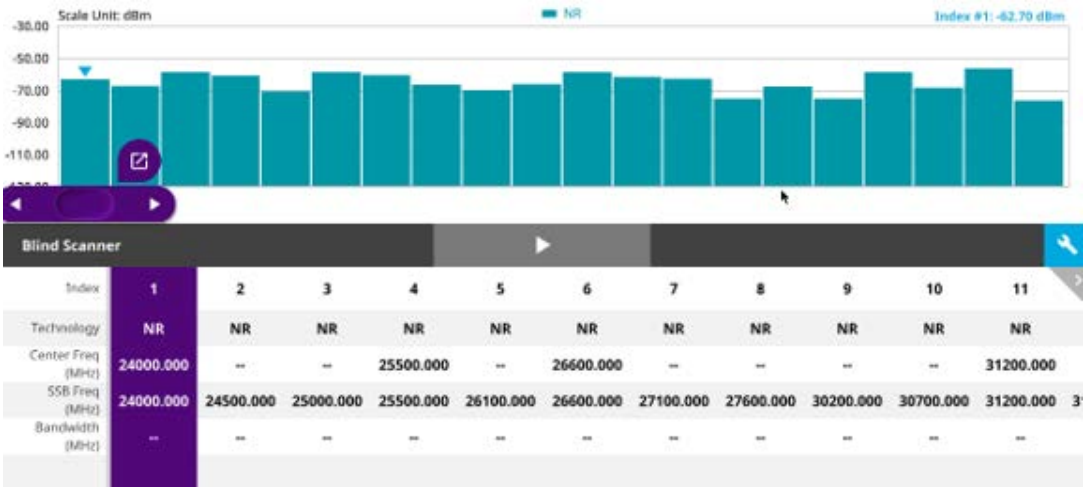
The following procedure describes how to perform Blind Scan (FR2). The frequency range is extended to 44 GHz.

To perform Blind Scan

1 Tap the **Start Scan** (▶) button to start the Blind Scan.

2 When the scan is complete, the results appear on the screen, as shown in Figure 225.

Figure 225 Blind Scan (FR2) result



3 To further analyze the results with a single channel, tap the **Application Launcher** button ( ).

4 Select the analysis type you wish to perform, then tap **Run**.

a If you select LTE-FDD/DSS-FDD, the Go FDD Interference Analysis option is enabled.

- This option requires the Interference Analyzer license and will take you to the Spectrum of the Interference Analyzer.

b If you select LTE-TDD/DSS-TDD, the Go TDD Auto Gated Spectrum option is enabled.

- This requires the TDD Auto Gated Spectrum license and will take you to the Spectrum of TAGS.
- If you don't have the TAGS license, it will instead take you to Gated Sweep in the Spectrum Analyzer (license required as well).

c If you select LTE-FDD/TDD or DSS-FDD/TDD (common):

- Go Signal Analysis is enabled only if you have the LTE-FDD/TDD or DSS Signal Analysis (select between FDD and TDD) license, and it will take you to the OTA ID Scanner in the respective LTE-FDD/TDD or DSS Signal Analyzer.
- Go Real-time Spectrum is enabled only if you have the Real-time Spectrum Analyzer license, and it takes you to the Persistent Spectrum of the Real-time Spectrum Analyzer.
- Go EMF Analysis is enabled only if you have the 5G EMF Analyzer license, and it will take you to the EMF LTE FDD/TDD Analysis.

d If you select NR, the following options may be enabled:

- Go Signal Analysis > OTA Analysis in 5G NR Signal Analyzer (license required). Without the license, it will go to 5G NR Signal Analysis in the RAN Analyzer (license required).
- Go Real-time Spectrum > Persistent Spectrum in Real-time Spectrum Analyzer (license required). Without the license, it will go to RTSA Persistent Spectrum in the RAN Analyzer (license required).
- Go TDD Auto-Gated Spectrum > Spectrum of TAGS (license required). Without the license, it will go to TAGS Analysis in the RAN Analyzer (license required)
- Go EMF Analysis > EMF 5G NR Beam Analysis (license required)

NOTE

If you move to IA and SiA and back to BS, the last searched carrier will remain and you can continue measuring for other carriers.

14

Using Multi-RAT Signal Analyzer

This chapter describes how to use the Multi-RAT Signal Analyzer. Topics covered in this chapter include:

- “Introduction” on page 556
- “Selecting mode and measure” on page 556
- “Conducting OTA analysis” on page 556
- “Online route map” on page 582

Introduction

VIAVI Multi-RAT (Non-standalone) Signal Analyzer focuses on enhanced mobile broadband to provide higher data bandwidth and reliable connectivity. In Multi-RAT mode, 5G networks will be aided by existing 4G infrastructure which means 5G system does not operate alone but utilizes LTE-NR dual connectivity if needed. The instrument provides LTE and NR measurement simultaneously with easy setup.

Multi-RAT supports N type and K type port selection automatically using top right panel () icon. You will need to connect the RF input port correctly on your instrument based on the frequency range (9 kHz to 18 GHz/9 kHz to 44 GHz).

Its main 5G Multi-RAT test functions are focused on over-the-air measurement such as Multi-RAT analyzer, Multi-RAT scanner, Multi-RAT route map, and online Multi-RAT route map.

- OTA Analysis
  - Multi-RAT Analyzer
  - Multi-RAT Scanner
  - Multi-RAT Route Map
- Online Route Map
  - Online Multi-RAT Route Map

Selecting mode and measure

The following procedure describes how to select the mode and measure.

To select mode and measure

1. Tap **Multi-RAT Signal Analyzer** on the **Mode** panel.
2. Tap any measurement mode from the following choices:
   - **OTA Analysis > Multi-RAT Analyzer**, **Multi-RAT Scanner**, or **Multi-RAT Route Map**
   - **Online Route Map > Online Multi-RAT Route Map**

Conducting OTA analysis

The following sections describe how to conduct OTA analysis.

Multi-RAT analyzer

Multi-RAT Analyzer provides combined functions which are available in OTA ID Scanner in LTE mode and Beam Analyzer in 5G NR mode.

- **S-SS RSRP (Secondary Synchronization Signal – Reference Signal Received Power)** — linear average over the power contributions (in Watts) of the resource elements which carry secondary synchronization signals
- **P-SS RSRP (Primary Synchronization Signal – Reference Signal Received Power)** — average power measurement through all the primary sync signals
- **S-SS SINR (Secondary Synchronization Signal – Signal to Interference plus Noise Ratio)** — linear average over the power contribution (in Watts) of the resource elements carrying secondary synchronization signals divided by the linear average of the noise and interference power contribution (in Watts) over the resource elements carrying secondary synchronization signals within the considered measurement frequency bandwidth
- **S-SS RSRQ (Secondary Synchronization Signal – Reference Signal Received Quality)** — ratio of N x SS-RSRP/NR carrier RSSI. Here N refers to number of resource blocks in NR carrier RSSI measurement Bandwidth
- **P-SS SNR (Primary Synchronization Signal – Signal to Noise Ratio) —** ratio of signal power to the noise power through the primary sync signals

Multi-RAT Analyzer also provides the seven strongest LTE signal with corresponding power levels during its transmission period, and includes:

- **RSRP (Reference Signal Received Power) –** linear average over the power contributions (in Watts) of the resource elements that carry cell-specific reference signals (CRS) within the considered measurement frequency bandwidths
- **RSRQ (Reference Signal Received Quality) – N×RSRP/(E-UTRA carrier RSSI),** where N is the number of Resource Block(RB)'s of the E-UTRA carrier Received Signal Strength Indicator(RSSI) measurement bandwidth
- **P-SS SNR (Primary Synchronization Signal – Signal to Noise Ratio) —** ratio of signal power to the noise power through the primary sync signals
- **RS SINR (Reference Signal-Signal to Noise and Interference Ratio)** — linear average over the power contribution (in Watts) of the resource elements carrying cell-specific reference signals divided by the linear average of the noise and interference power contribution (in Watts) over the resource elements carrying cell-specific reference signals within the same frequency bandwidth
- **S-SS RSSI (Secondary Synchronization Signal – Received Signal Strength Indicator) —** linear average of the total received power (in Watts) observed only in secondary synchronization signal
- **P-SS RSRP (Primary Synchronization Signal – Reference Signal Received Power) —** average power measurement through all the primary sync signals
- **S-SS RSRP (Secondary Synchronization Signal – Reference Signal Received Power) —** linear average over the power contributions (in Watts) of the resource elements which carry secondary synchronization signals

To set measure setup

The setup menus for Multi-RAT analyzer are available in the screen with two categories: general setting and carrier setting. You can set up to 8 carriers for each NR and LTE simultaneously.

General setting

1 Tap the **Setup** ( ) icon > **Configuration** in the side bar.

2 Tap **General Setting** on the screen.

3 To set the reference level, tap the number under NR or LTE and input the reference level using the on-screen keyboard.

4 Tap to switch the **Sweep Speed** between **Fast** and **Normal**.
- **Fast**: measuring PCI, RSRP, RSRQ, P-SS SNR, RS SINR, S-SS RSSI, P-SS RSRP, S-SS RSRP for one signal with the strongest RSRP for LTE carrier/ measuring PCI, SSB Index, S-SS RSRP, P-SS RSRP, P-SS SNR, S-SS SINR, S-SS RSRQ for one signal with the strongest S-SS RSRP for NR carrier
- **Normal**: measuring PCI, RSRP, RSRQ, P-SS SNR, RS SINR, S-SS RSSI, P-SS RSRP, S-SS RSRP for six signals with top-down order based on the strongest RSRP signal for LTE carrier/ measuring PCI, SSB Index, S-SS RSRP, P-SS RSRP, P-SS SNR, S-SS SINR, S-SS RSRQ for eight signals with top-down order based on the strongest S-SS RSRP signal for NR carrier

5 Tap **Trigger** to set **Internal**, **External** or **GNSS** as required.
- **Internal**: when starting a signal processing using the internal reference clock and creating a trigger
- **External**: when starting a signal processing based on the external input trigger
- **GNSS**: When synchronizing the signal processing via the GNSS receiver. If you want to check the time error correctly, set the trigger to GNSS

6 Tap to switch **Sorting Type** to **PCI** or **RSRP** as required.

7 Tap **Frequency Reference** to set the clock source.
- **Internal**: Uses a 10 MHz internal clock
- **External**: Uses external 10 MHz, 13 MHz, or 15 MHz clock automatically set by the instrument
- **GNSS**: Uses a built-in GNSS as a frequency and timing source

Carrier setting

1 Tap the number to switch the carrier on or off for **NR** or **LTE** in the **Carrier Configuration** box. You can select up to 8 carriers.

2 Tap to select a carrier in the drop-down box and rename a carrier using the **Edit** icon next to the drop-down box.

3 If you select NR, do the following steps:

a Select **Center Frequency** to set the center frequency using the on-screen keyboard.
- If you apply **Center Frequency**, **Channel No**, and **Bandwidth, SSB Frequency, SCS, GSCN, and Periodicity** all at once, tap the **Center Frequency List** ( ) icon and do the following:

i Tap the **Add (+)** icon and input Center Frequency, Channel No, and Bandwidth as required using the on-screen keyboard.

ii Tap the **Apply** button to apply the changes. The screen moves to the Center Frequency List table.

iii Highlight the one of the added lists and tap the **Configuration** icon that appears in gray to change the applied values.

iv Tap the **Delete** icon to delete the selected list(s).

v Tap the **Toothed Wheel** ( ) icon to load the applied parameters based on the center frequency input values. You need to input the required center frequency in the Setting table in advance.



NOTE
You will be able to multi-select the added items and apply them all at once only if the carrier number is On. If the carrier 1 and 3 are On and you highlight No. 0,3, and 4, the first two highlighted lists, 0 and 3 are applied to each carrier 1 and 3.

b Select **Channel Standard** to set the channel standard for the selected carrier using the on-screen keyboard.

If the MIMO is set to 2x2, the antenna ports 2 and 3 are disabled.

c Select **Channel Number** to set the channel number for the selected index using the on-screen keyboard.

d Tap **External Offset** and input the value using the on-screen keyboard and tap to switch the external offset to **On** (green) or **Off** (gray) as desired.

e Tap **Attenuation** and input the value using the on-screen keyboard if you want to set it manually (**Manual**). Or tap it to set **Auto**.

f Tap to switch **Preamp 1** and **Auto** to **On** (green) or **Off** (gray).

g Tap to switch **PCI** (**Physical Cell ID**) to **Manual** (number) or **Auto** and input a value in the number box from 0 to 1007 using the on-screen keyboard.

h Tap the **Bandwidth/SSB SCS** box and select the Setting in the pop-up window based on your need. SSB is an abbreviation for Synchronization Signal Block or SS Block and it actually refers to Synchronization PBCH block since the synchronization signal and PBCH channel are packed as a

single block that always moves together. SSB should be detected first in 5G NR frame. See Table 134 below for the setting criteria based on the operating frequency.

i Tap **L** to set the maximum number of SS-PBCH blocks within a single SS burst set (A set of SS being transmitted in 5 ms window of SS transmission) among **4**, **8** and **64**.

j Tap the **SSB Period** box and select the options from **5 ms**, **10 ms**, **20 ms**, **40 ms**, **80 ms**, or **160 ms**. The SS burst period (SSB periodicity) is defined by each base station and network configurable. 20 ms is the default for the initial cell selection.

k Tap the **Auto Search** box and select the options from **Auto Preamp/Atten** or **Manual**.

Auto Preamp/Atten to set preamp and attenuation automatically or Manual for user-defined settings.

l Tap the **Start** button in **Auto Search** box to search SCS, type, and the number of SSB automatically or the **Stop** button to set the SSB period based on the base station.

Once the **Start** button is tapped, the progress bar appears.

m Tap the **SSB Frequency** button and input the required value using the on-screen keyboard.

n Tap the **GSCN** box and input the required value using the on-screen keyboard.

Based on the GSCN input frequency, the SSB Frequency, Sync Raster Offset, and Sync SCS Offset are automatically

changed.

o Tap **Sync Raster Offset** box to manually set the required value using the on-screen keyboard.

p Tap **Sync SCS Offset** box to manually set the required value using the on-screen keyboard.

Table 134 Setup per operating frequency

Operating frequency	L	Case	SCS	Slots in a burst period
< 3 GHz (FR1)	4	A {2,8} +14*n	15 kHz	5 (1 ms)
< 3 GHz (FR1)	4	B {4,8,16,20} +28*n	30 kHz	10 (0.5 ms)

Table 134 Setup per operating frequency

Operating frequency	L	Case	SCS	Slots in a burst period
< 3 GHz (FR1) For un-paired spectrum operation: < 1.88 GHz	4	C {2,8} +14*n	30 kHz	10 (0.5 ms)
3 to 6 GHz (FR1)	8	A {2,8} +14*n	15 kHz	5 (1 ms)
3 to 6 GHz (FR1)	8	B {4,8,16,20} +28*n	30 kHz	10 (0.5 ms)
3 to 6 GHz (FR1) For un-paired spectrum operation: < 1.88 to 6 GHz	8	C {2,8} +14*n	30 kHz	10 (0.5 ms)
> 6 GHz (FR2)	64	D {4,8,16,20} +28*n	120 kHz	40 (0.125 ms)
> 6 GHz (FR2)	64	E {8,12,16,20,32,36,40,44} +56*n	240 kHz	80 (62.5 ms)

4 If you select LTE, do the following step:

a Select **Center Frequency** to set the center frequency using the on-screen keyboard.

b Select **Channel Standard** to set the channel standard for the selected carrier using the on-screen keyboard.

If the MIMO is set to 2x2, the antenna ports 2 and 3 are disabled.

c Select **Channel Number** to set the channel number for the selected index using the on-screen keyboard.

d Tap **External Offset** and input the value using the on-screen keyboard and tap to switch the external offset to **On** (green) or **Off** (gray) as desired.

e Tap **Attenuation** and input the value using the on-screen keyboard if you want to set it manually (**Manual**). Or tap it to set **Auto**.

f Tap to switch **Preamp 1** and **Auto** to **On** (green) or **Off** (gray).

g Tap to switch **PCI** (**Physical Cell ID**) to **Manual** (number) or **Auto** and input a value in the number box from 0 to 1007 using the on-screen keyboard.

h Tap to switch **LTE Mode** to **TDD** or **FDD**.

i Tap **Bandwidth** and input the value using the on-screen keyboard.

j Tap to switch **Cyclic Prefix** to **Extended** or **Normal**.

k *Optional.* The **NTN Configuration** box appears only if the ONA-SP-LTE-NTN license is available.

- Tap to turn **NTN Configuration On**.
- Tap **Settings**.
- Tap MCC and MNC and input the required values.
- Tap the **Done** button.

l If NTN cannot be found using the PLMN (MCC/MNC) information:

- Set **Apply Test** to **On** (green).
- Input the required NTN PCI from 1 to 20.
- Tap the **Done** button to complete the NTN configuration.

5 If you set up 1 or 2 carriers, the graph chart appears based on the setting.

a Tap the **Magnifier** ()icon of the selected carrier. This enables you to check the beam information without changing the measurement mode to Beam Analyzer.

The beam information pops up for the selected carrier.

- Select the **Auto Scale** () to automatically set the reference and attenuation level.
- Select the **Quick Save** () icon to capture the current screen.
- Select the **Close** ()icon to close the Beam Information window.

b Tap the **Information** ()icon of the selected carrier to see the setup information.

6 If you set up 3 or more carriers, the carrier information table appears based on the setting.

a Refer to **a** to **b** in **step 4** above.

- Select the **Auto Scale** ( ) to automatically set the reference and attenuation level.
- Select the **Quick Save** ( ) icon to capture the current screen.
- Select the **Close** ( )icon to close the Beam Information window.

b Tap the **Carrier Information Table** ( ) icon to see the carrier information list.

c Tap the **Chart** ( ) icon to see the carrier information graph.

Figure 226 displays a Multi-RAT Analyzer with sweep normal measurement.

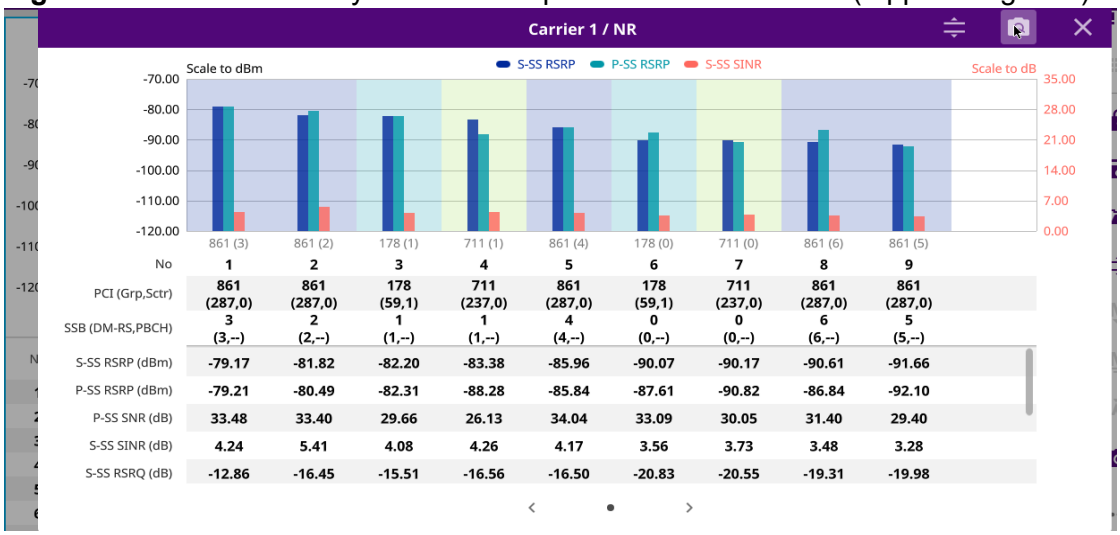
Figure 226 Multi-RAT Analyzer with sweep normal measurement



No	PCI (Grp,Sctr)	SSB (DM-RS,PBCH)	S-SS RSRP (dBm)	P-SS RSRP (dBm)	P-SS SNR (dB)	S-SS SINR (dB)
1	861 (287,0)	2 (2,--)	-94.70	-92.17	20.94	4.94
2	178 (59,1)	4 (4,--)	-98.09	-94.77	25.10	3.24
3	861 (287,0)	4 (4,--)	-99.26	-98.82	29.37	3.25
4	178 (59,1)	0 (0,--)	-99.59	-97.42	18.92	3.51
5	861 (287,0)	1 (1,--)	-99.62	-101.26	10.30	3.48
6	861 (287,0)	0 (0,--)	-101.66	-99.24	26.44	3.55
7	861 (287,0)	3 (3,--)	-102.50	-102.69	10.62	3.47
8	861 (287,0)	6 (6,--)	-103.57	-101.45	24.92	3.31

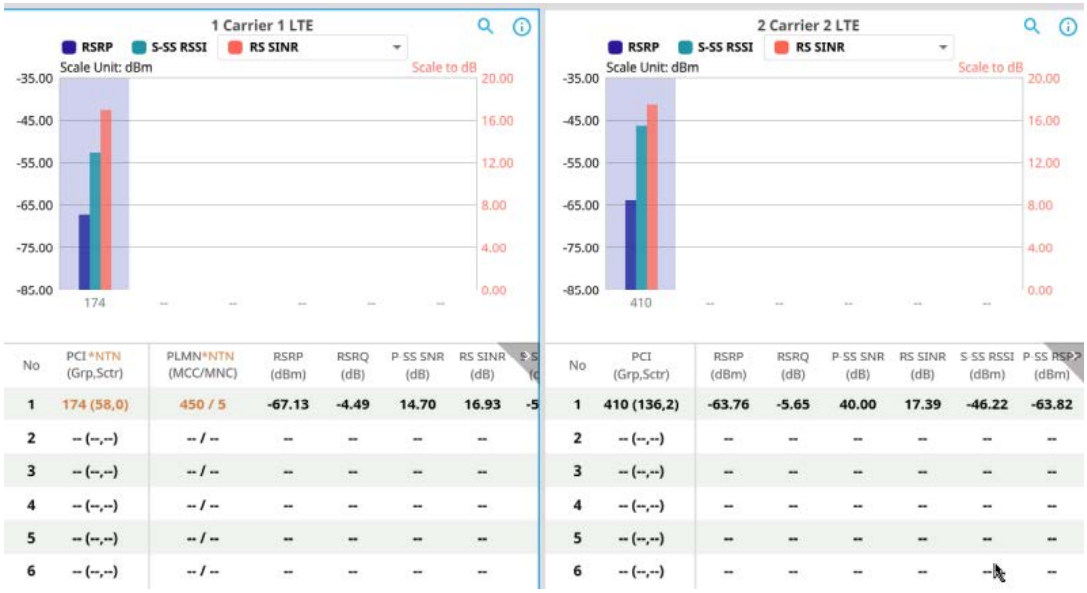
No	PCI (Grp,Sctr)	RSRP (dBm)	RSRQ (dB)	P-SS SNR (dB)	RS SINR (dB)	S-SS RSSI (dBm)	P-SS RSRP (dBm)
1	410 (136,2)	-44.39	-5.38	40.00	28.74	-26.75	-44.88
2	-- (--,--)	--	--	--	--	--	--
3	-- (--,--)	--	--	--	--	--	--
4	-- (--,--)	--	--	--	--	--	--
5	-- (--,--)	--	--	--	--	--	--
6	-- (--,--)	--	--	--	--	--	--

Figure 227 Multi-RAT Analyzer with sweep normal measurement (tapped Magnifier)



No	1	2	3	4	5	6	7	8	9
PCI (Grp,Sctr)	861 (287,0)	861 (287,0)	178 (59,1)	711 (237,0)	861 (287,0)	178 (59,1)	711 (237,0)	861 (287,0)	861 (287,0)
SSB (DM-RS,PBCH)	3 (3,--)	2 (2,--)	1 (1,--)	1 (1,--)	4 (4,--)	0 (0,--)	0 (0,--)	6 (6,--)	5 (5,--)
S-SS RSRP (dBm)	-79.17	-81.82	-82.20	-83.38	-85.96	-90.07	-90.17	-90.61	-91.66
P-SS RSRP (dBm)	-79.21	-80.49	-82.31	-88.28	-85.84	-87.61	-90.82	-86.84	-92.10
P-SS SNR (dB)	33.48	33.40	29.66	26.13	34.04	33.09	30.05	31.40	29.40
S-SS SINR (dB)	4.24	5.41	4.08	4.26	4.17	3.56	3.73	3.48	3.28
S-SS RSRQ (dB)	-12.86	-16.45	-15.51	-16.56	-16.50	-20.83	-20.55	-19.31	-19.98

Figure 228 Multi-RAT Analyzer with NTN



Multi-RAT scanner

Multi-RAT Scanner provides combined functions which are available in Carrier Scanner in 5G NR mode and Channel Scanner in LTE mode.

Multi-RAT Scanner provides Channel Scanner function that is a radio receiver that can automatically tune or scan two or more discrete frequencies and multi-channels, indicating when it finds a signal on one of them and then continuing scanning when that frequency goes silent.

Multi-RAT Scanner also provides an easy and fast response power measurements of up to eight single component carriers of 100 MHz.
The power measurement for each carrier includes:

- **S-SS RSRP (Secondary Synchronization Signal – Reference Signal Received Power)** — linear average over the power contributions (in Watts) of the resource elements which carry secondary synchronization signals
- **P-SS SNR (Primary Synchronization Signal – Signal to Noise Ratio)** — ratio of signal power to the noise power through the primary sync signals
- **Channel Power** — integrated power of the entire channel bandwidth (100 MHz) during an entire transmission frame (10ms)
- **Antenna** — 0,1,2,3 peak antenna port among 4 antenna ports

To set measure setup

After configuring the spectrum measurement in “Configuring spectrum measurements” on page 25, you can set the measure setup to continue your measurement. The setup menus for Multi-RAT analyzer are available in the screen with two categories: general

setting and carrier setting. You can setup up to 8 carriers for each NR and LTE simultaneously.

General setting

1 Tap the **Setup** ( ) icon > **Configuration** in the side bar.

2 Tap **General Setting** on the screen.

3 To set the reference level, tap the number under NR or LTE and input the reference level using the on-screen keyboard.

4 Tap to switch the **Sweep Speed** between **Fast** and **Normal**.
- **Fast**: measuring PCI, RSRP, Channel Power and S-SS RSSI for one signal with the strongest RSRP for LTE carrier/ measuring PCI, S-SS RSRP and Channel Power for one signal with the strongest S-SS RSRP for NR carrier
- **Normal**: measuring PCI, RSRP, Channel Power, RS EVM, Frequency Error, Time Error and S-SS RSSI for six signals with top-down order based on the strongest RSRP signal for LTE carrier/ measuring PCI, SSB Index, S-SS RSRP, Channel Power, PBCH EVM, Frequency Error, Time Error, S-SS RSSI and PBCH DM-RS EVM for eight signals with top-down order based on the strongest S-SS RSRP signal for NR carrier

5 Tap **Trigger** to set **Internal**, **External** or **GNSS** as required.
- **Internal**: when starting a signal processing using the internal reference clock and creating a trigger
- **External**: when starting a signal processing based on the external input trigger
- **GNSS**: When synchronizing the signal processing via the GNSS receiver. If you want to check the time error correctly, set the trigger to GNSS

6 Tap to switch **Sorting Type** to **PCI** or **RSRP** as required.

7 Tap **Frequency Reference** to set the clock source.
- **Internal**: Uses a 10 MHz internal clock
- **External**: Uses external 10 MHz, 13 MHz, or 15 MHz clock automatically set by the instrument
- **GNSS**: Uses a built-in GNSS as a frequency and timing source

Carrier setting

1 Tap the number to switch the carrier on or off for **NR** or **LTE** in the **Carrier Configuration** box. You can select up to 8 carriers.

2 If you select NR, do the following steps:

a Select **Center Frequency** to set the center frequency using the on-screen keyboard.

- If you apply **Center Frequency**, **Channel No**, and **Bandwidth, SSB Frequency, SCS, GSCN, and Periodicity** all at once, tap the **Center Frequency List** ( ) icon and do the following:

i Tap the **Add (+)** icon and input Center Frequency, Channel No, and Bandwidth as required using the on-screen keyboard.

ii Tap the **Apply** button to apply the changes. The screen moves to the Center Frequency List table.

iii Highlight the one of the added lists and tap the **Configuration** icon that appears in gray to change the applied values.

iv Tap the **Delete** icon to delete the selected list(s).

v Tap the **Toothed Wheel** ( ) icon to load the applied parameters based on the center frequency input values. You need to input the required center frequency in the Setting table in advance.

NOTE
You will be able to multi-select the added items and apply them all at once only if the carrier number is On. If the carrier 1 and 3 are On and you highlight No. 0,3, and 4, the first two highlighted lists, 0 and 3 are applied to each carrier 1 and 3.

b Select **Channel Standard** to set the channel standard for the selected carrier using the on-screen keyboard.

If the MIMO is set to 2x2, the antenna ports 2 and 3 are disabled.

c Select **Channel Number** to set the channel number for the selected index using the on-screen keyboard.

d Tap **External Offset** and input the value using the on-screen keyboard and tap to switch the external offset to **On** (green) or **Off** (gray) as desired.

e Tap **Attenuation** and input the value using the on-screen keyboard if you want to set it manually (**Manual**). Or tap it to set **Auto**.

f Tap to switch **Preamp 1** and **Auto** to **On** (green) or **Off** (gray).

g Tap to switch **PCI** (**Physical Cell ID**) to **Manual** (number) or **Auto** and input a value in the number box from 0 to 1007 using the on-screen keyboard.

h Tap the **Bandwidth/SSB SCS** box and select the Setting in the pop-up window based on your need. SSB is an abbreviation for Synchronization Signal Block or SS Block and it actually refers to Synchronization PBCH block since the synchronization signal and PBCH channel are packed as a

single block that always moves together. SSB should be detected first in 5G NR frame. See Table 135 below for the setting criteria based on the operating frequency.

i Tap **L** to set the maximum number of SS-PBCH blocks within a single SS burst set (A set of SS being transmitted in 5 ms window of SS transmission) among **4**, **8** and **64**.

j Tap the **SSB Period** box and select the options from **5 ms**, **10 ms**, **20 ms**, **40 ms**, **80 ms**, or **160 ms**. The SS burst period (SSB periodicity) is defined by each base station and network configurable. 20 ms is the default for the initial cell selection.

k Tap the **Auto Search** box and select the options from **Auto Preamp/Atten** or **Manual**.

Auto Preamp/Atten to set preamp and attenuation automatically or Manual for user-defined settings.

l Tap the **Start** button in **Auto Search** box to search SCS, type, and the number of SSB automatically or the **Stop** button to set the SSB period based on the base station.

Once the **Start** button is tapped, the progress bar appears.

m Tap the **SSB Frequency** button and input the required value using the on-screen keyboard.

n Tap the **GSCN** box and input the required value using the on-screen keyboard.

Based on the GSCN input frequency, the SSB Frequency, Sync Raster Offset, and Sync SCS Offset are automatically

changed.

o Tap **Sync Raster Offset** box to manually set the required value using the on-screen keyboard.

p Tap **Sync SCS Offset** box to manually set the required value using the on-screen keyboard.

3 *Optional.* Tap the **Column** icon to change the parameters' order as required using the up and down arrows.

Table 135 Setup per operating frequency

Operating frequency	L	Case	SCS	Slots in a burst period
< 3 GHz (FR1)	4	A {2,8} +14*n	15 kHz	5 (1 ms)
< 3 GHz (FR1)	4	B {4,8,16,20} +28*n	30 kHz	10 (0.5 ms)

Table 135 Setup per operating frequency

Operating frequency	L	Case	SCS	Slots in a burst period
< 3 GHz (FR1) For unpaired spectrum operation: < 1.88 GHz	4	C {2,8} +14*n	30 kHz	10 (0.5 ms)
3 to 6 GHz (FR1)	8	A {2,8} +14*n	15 kHz	5 (1 ms)
3 to 6 GHz (FR1)	8	B {4,8,16,20} +28*n	30 kHz	10 (0.5 ms)
3 to 6 GHz (FR1) For unpaired spectrum operation: < 1.88 to 6 GHz	8	C {2,8} +14*n	30 kHz	10 (0.5 ms)
> 6 GHz (FR2)	64	D {4,8,16,20} +28*n	120 kHz	40 (0.125 ms)
> 6 GHz (FR2)	64	E {8,12,16,20,32,36,40,44} +56*n	240 kHz	80 (62.5 ms)

4 If you select LTE, do the following step:

a Select **Center Frequency** to set the center frequency using the on-screen keyboard.

b Select **Channel Standard** to set the channel standard for the selected carrier using the on-screen keyboard.

If the MIMO is set to 2x2, the antenna ports 2 and 3 are disabled.

c Select **Channel Number** to set the channel number for the selected index using the on-screen keyboard.

d Tap **External Offset** and input the value using the on-screen keyboard and tap to switch the external offset to **On** (green) or **Off** (gray) as desired.

e Tap **Attenuation** and input the value using the on-screen keyboard if you want to set it manually (**Manual**). Or tap it to set **Auto**.

f Tap to switch **Preamp 1** and **Auto** to **On** (green) or **Off** (gray).

g Tap to switch **PCI** (**Physical Cell ID**) to **Manual** (number) or **Auto** and input a value in the number box from 0 to 1007 using the on-screen keyboard.

h Tap to switch **LTE Mode** to **TDD** or **FDD**.

i Tap **Bandwidth** and input the value using the on-screen keyboard.

j Tap to switch **Cyclic Prefix** to **Extended** or **Normal**.

k *Optional.* The **NTN Configuration** box appears only if the ONA-SP-LTE-NTN license is available.

- Tap to turn **NTN Configuration On**.
- Tap **Settings**.
- Tap MCC and MNC and input the required values.
- Tap the **Done** button.

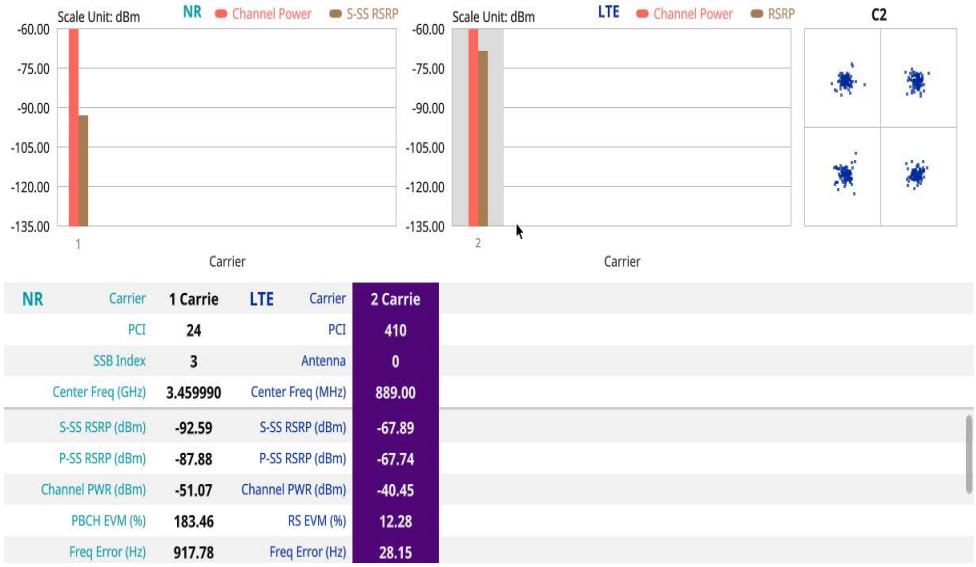
l If NTN cannot be found using the PLMN (MCC/MNC) information:

- Set **Apply Test** to **On** (green).
- Input the required NTN PCI from 1 to 20.
- Tap the **Done** button to complete the NTN configuration.

5 Once the carrier setup is done, the carrier setup information appears on the top left screen.

Figure 229 shows an example of Multi-RAT scanner with LTE and NR carrier (When tapped LTE carrier) measurement.

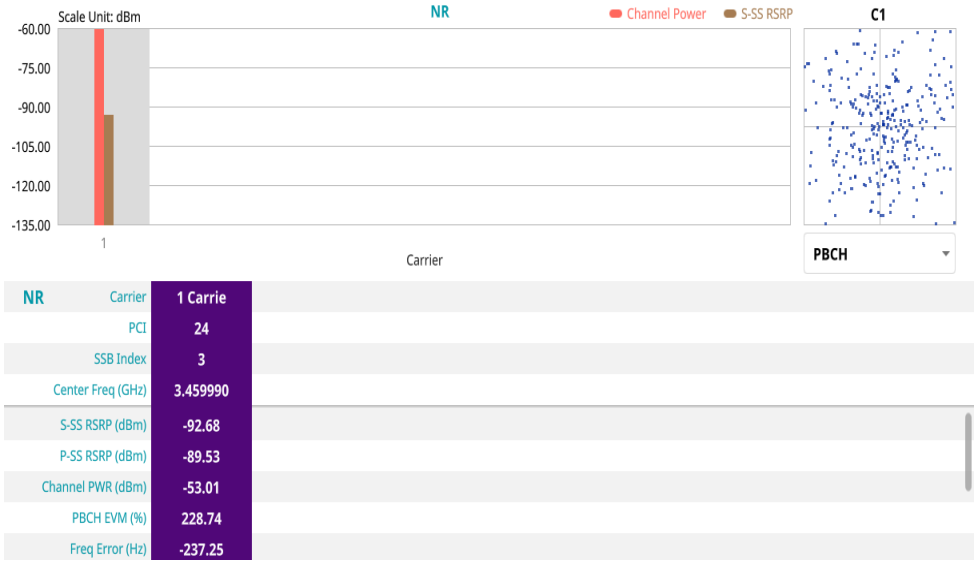
Figure 229 Multi-RAT scanner with LTE and NR carrier measurement.



NOTE

If you want to see the constellation information, tap and select the carrier number that you want to check. If tapped, the carrier information will be highlighted in purple and constellation information will appear.

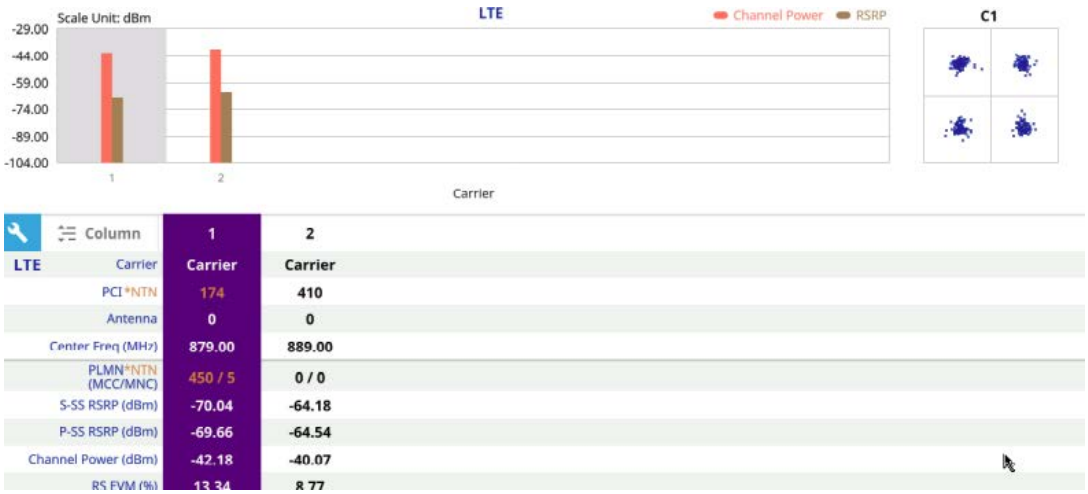
Figure 230 Multi-RAT scanner with only NR carrier measurement.



NOTE

If you tap the **Close** (X) button of the Carrier Setting screen, the above list appears with constellation information for each carrier. If you select NR carrier, you can select to view either PBCH or PBCH DM-RS under the constellation information.

Figure 231 Multi-RAT scanner with NTN.



Multi-RAT route map

Multi-RAT route map traces the power level of the NR signal's beam and the power level of the strongest LTE signal in terms of RSRP and corresponding to a particular time and geographical position and presents it in a geographical map as a measurement point. All the collected measurements can be exported for post-processing purposes, including data of the eight strongest beams for each measurement point, including its measurement time and geographical location.

Figure 232 shows an example of Multi-RAT route map measurement.

Figure 232 Multi-RAT route map measurement

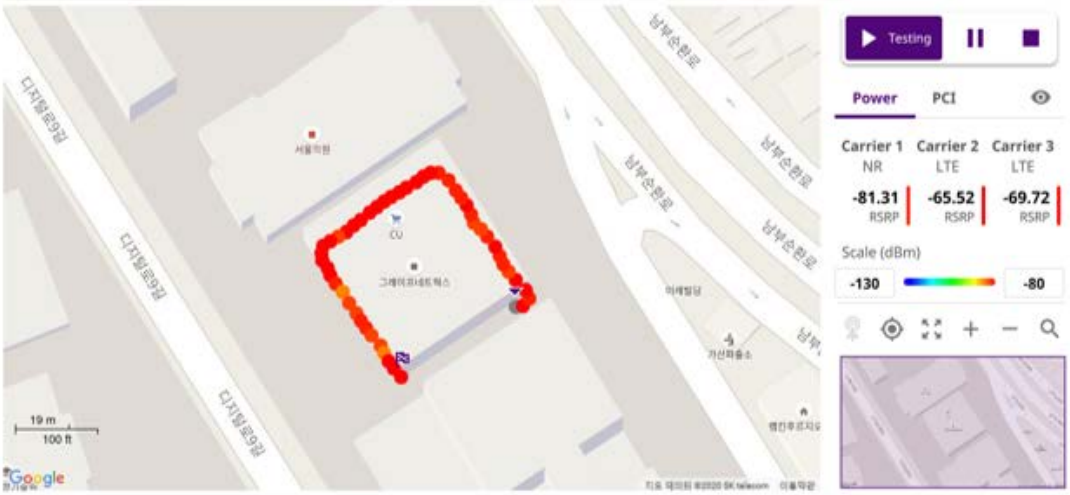
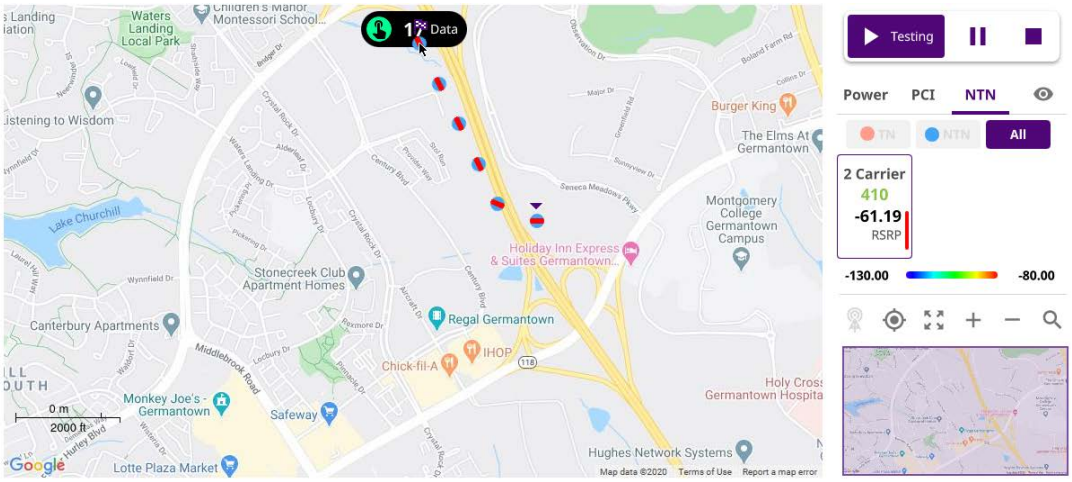


Figure 233 Multi-RAT route map with NTN



Loading a map

To use any features related to maps, you need to download and install the maps on the instrument. The VIAVI JDMapCreator will help you download maps. Make sure the JDMapCreator application on your computer is connected to the instrument via LAN. You can send a map file with a single layer to the instrument directly by using the Send to EQP menu in JDMapCreator. For more information on how to use the JDMapCreator, see the *JDMapCreator 2.0 User Guide*.

To load a map

1. Plug in your USB flash drive that has a map with a file type of .mcfv created in JDMapCreator.
2. Tap the **Load** ( ) icon on the side bar.
3. Navigate to the map file that you want to open.

   The **File Information** pane displays the file properties, including its name, size, type, and date modified.
4. Tap the **Load** button on the screen.
5. Once you have loaded the map, you can also control the map using the following icons on the map.

Table 136 Map icons

Icon	Description
	Tap to go to your current location on the map. Once tapped, a purple icon appears on the map, indicating your current location.
	Tap to switch to the full screen map view.

Table 136 Map icons

Icon	Description
	Tap to zoom in on the map.
	Tap to zoom out on the map.
	Tap and select the area that you want to expand.

The left-most cell-site icon is activated when you import the cell-site information file.

To set measurement setup

Before starting the Route Map measurement, you need to set Spectrum measurements displayed on the quick access and display tab. See “Configuring spectrum measurements” on page 25 for more information. The setup menus for Multi-RAT route map are available in the screen with two categories: general setting and carrier setting. For Map Configuration, you need to tap Menu icon on the side bar.

1. If required, connect a GNSS receiver to your instrument for outdoor mapping. Indoor mapping does not necessarily need a GNSS antenna.
2. Tap the **Setup** (⚙) icon on the side bar.
3. Tap to switch the **Plot Point** to **GNSS**, **Position**, or **Time**.
   - **a** To collect data/plot points automatically as you move around in a vehicle or outside, select **GNSS**, then tap to switch the **Screen Mode** between **Map** and **Full**.
     - With the **Map** setting, you can view only the collected points that can be seen within the boundary of the loaded map.
     - With the **Full** setting, you can view all the collected points of the route without the loaded map.
   - **b** To collect data/plot points manually in an indoor layout without a GNSS antenna, select **Position** (If you tap the **Start** button on the right panel of the map, the Undo icon appears).
4. Tap to switch **Plot Item** to **RSRP**, **RSRQ**, **SINR**, **SNR**, or **PCI Dominance**.
5. Tap **Configuration** to continue with carrier setting or general setting.

General setting

1. Tap **General Setting** on the screen.

2 To set the reference level, tap the number under NR or LTE and input the reference level using the on-screen keyboard.

3 Tap to switch the **Sweep Speed** between **Fast** and **Normal**.
- **Fast**: measuring PCI, RSRP, RSRQ, P-SS SNR, RS SINR, S-SS RSSI, P-SS Power, S-SS Power for one signal with the strongest RSRP for LTE carrier/ measuring PCI, SSB Index, S-SS RSRP, P-SS RSRP, P-SS SNR, S-SS SINR, S-SS RSRQ for one signal with the strongest S-SS RSRP for NR carrier
- **Normal**: measuring PCI, RSRP, RSRQ, P-SS SNR, RS SINR, S-SS RSSI, P-SS Power, S-SS Power for six signals with top-down order based on the strongest RSRP signal for LTE carrier/ measuring PCI, SSB Index, S-SS RSRP, P-SS RSRP, P-SS SNR, S-SS SINR, S-SS RSRQ for eight signals with top-down order based on the strongest S-SS RSRP signal for NR carrier

4 Tap **Trigger** to set **Internal**, **External** or **GNSS** as required.
- **Internal**: when starting a signal processing using the internal reference clock and creating a trigger
- **External**: when starting a signal processing based on the external input trigger
- **GNSS**: When synchronizing the signal processing via the GNSS receiver. If you want to check the time error correctly, set the trigger to GNSS

5 Tap to switch **Sorting Type** to **PCI** or **RSRP** as required.

6 Tap **Frequency Reference** to set the clock source.
- **Internal**: Uses a 10 MHz internal clock
- **External**: Uses external 10 MHz, 13 MHz, or 15 MHz clock automatically set by the instrument
- **GNSS**: Uses a built-in GNSS as a frequency and timing source

Carrier setting

1 Tap the number to switch the carrier on or off for **NR** or **LTE** in the **Carrier Configuration** box. You can select up to 8 carriers.

2 If you select NR, do the following steps:

a Select **Center Frequency** to set the center frequency using the on-screen keyboard.

- If you apply **Center Frequency**, **Channel No**, and **Bandwidth, SSB Frequency, SCS, GSCN, and Periodicity** all at once, tap the **Center Frequency List** ( ) icon and do the following:

i Tap the **Add (+)** icon and input Center Frequency, Channel No, and Bandwidth as required using the on-screen keyboard.

ii Tap the **Apply** button to apply the changes. The screen moves to the Center Frequency List table.

iii Highlight the one of the added lists and tap the **Configuration** icon that appears in gray to change the applied values.

iv Tap the **Delete** icon to delete the selected list(s).

v Tap the **Toothed Wheel** ( ) icon to load the applied parameters based on the center frequency input values. You need to input the required center frequency in the Setting table in advance.

NOTE
You will be able to multi-select the added items and apply them all at once only if the carrier number is On. If the carrier 1 and 3 are On and you highlight No. 0,3, and 4, the first two highlighted lists, 0 and 3 are applied to each carrier 1 and 3.

b Select **Channel Standard** to set the channel standard for the selected carrier using the on-screen keyboard.

If the MIMO is set to 2x2, the antenna ports 2 and 3 are disabled.

c Select **Channel Number** to set the channel number for the selected index using the on-screen keyboard.

d Tap **External Offset** and input the value using the on-screen keyboard and tap to switch the external offset to **On** (green) or **Off** (gray) as desired.

e Tap **Attenuation** and input the value using the on-screen keyboard if you want to set it manually (**Manual**). Or tap it to set **Auto**.

f Tap to switch **Preamp 1** and **Auto** to **On** (green) or **Off** (gray).

g Tap to switch **PCI** (**Physical Cell ID**) to **Manual** (number) or **Auto** and input a value in the number box from 0 to 1007 using the on-screen keyboard.

h Tap the **Bandwidth/SSB SCS** box and select the Setting in the pop-up window based on your need. SSB is an abbreviation for Synchronization Signal Block or SS Block and it actually refers to Synchronization PBCH block since the synchronization signal and PBCH channel are packed as a single block that always moves together. SSB should be detected first in 5G NR frame. See Table 137 below for the setting criteria based on the operating frequency.

i Tap **L** to set the maximum number of SS-PBCH blocks within a single SS burst set (A set of SS being transmitted in 5 ms window of SS transmission) among **4**, **8** and **64**.

j Tap the **SSB Period** box and select the options from **5 ms**, **10 ms**, **20 ms**, **40 ms**, **80 ms**, or **160 ms**. The SS burst period (SSB periodicity) is defined by each base station and network configurable. 20 ms is the default for the initial cell selection.

k Tap the **Auto Search** box and select the options from **Auto Preamp/Atten** or **Manual**.

Auto Preamp/Atten to set preamp and attenuation automatically or Manual for user-defined settings.

l Tap the **Start** button in **Auto Search** box to search SCS, type, and the number of SSB automatically or the **Stop** button to set the SSB period based on the base station.

Once the **Start** button is tapped, the progress bar appears.

m Tap the **SSB Frequency** button and input the required value using the on-screen keyboard.

n Tap the **GSCN** box and input the required value using the on-screen keyboard.

Based on the GSCN input frequency, the SSB Frequency, Sync Raster Offset, and Sync SCS Offset are automatically

changed.

o Tap **Sync Raster Offset** box to manually set the required value using the on-screen keyboard.

p Tap **Sync SCS Offset** box to manually set the required value using the on-screen keyboard.

Table 137 Setup per operating frequency

Operating frequency	L	Case	SCS	Slots in a burst period
< 3 GHz (FR1)	4	A {2,8} +14*n	15 kHz	5 (1 ms)
< 3 GHz (FR1)	4	B {4,8,16,20} +28*n	30 kHz	10 (0.5 ms)
< 3 GHz (FR1) For un-paired spectrum operation: < 1.88 GHz	4	C {2,8} +14*n	30 kHz	10 (0.5 ms)
3 to 6 GHz (FR1)	8	A {2,8} +14*n	15 kHz	5 (1 ms)
3 to 6 GHz (FR1)	8	B {4,8,16,20} +28*n	30 kHz	10 (0.5 ms)
3 to 6 GHz (FR1) For un-paired spectrum operation: < 1.88 to 6 GHz	8	C {2,8} +14*n	30 kHz	10 (0.5 ms)
> 6 GHz (FR2)	64	D {4,8,16,20} +28*n	120 kHz	40 (0.125 ms)

Table 137 Setup per operating frequency

Operating frequency	L	Case	SCS	Slots in a burst period
> 6 GHz (FR2)	64	E {8,12,16,20,32,36,40,44} +56*n	240 kHz	80 (62.5 ms)

3 If you select LTE, do the following step:

a Select **Center Frequency** to set the center frequency using the on-screen keyboard.

b Select **Channel Standard** to set the channel standard for the selected carrier using the on-screen keyboard.

If the MIMO is set to 2x2, the antenna ports 2 and 3 are disabled.

c Select **Channel Number** to set the channel number for the selected index using the on-screen keyboard.

d Tap **External Offset** and input the value using the on-screen keyboard and tap to switch the external offset to **On** (green) or **Off** (gray) as desired.

e Tap **Attenuation** and input the value using the on-screen keyboard if you want to set it manually (**Manual**). Or tap it to set **Auto**.

f Tap to switch **Preamp 1** and **Auto** to **On** (green) or **Off** (gray).

g *Optional.* The **NTN Configuration** box appears only if the ONA-SP-LTE-NTN license is available.

- Tap to turn **NTN Configuration On**.
- Tap **Settings**.
- Tap MCC and MNC and input the required values.
- Tap the **Done** button.

h If NTN cannot be found using the PLMN (MCC/MNC) information:

- Set **Apply Test** to **On** (green).
- Input the required NTN PCI from 1 to 20.
- Tap the **Done** button to complete the NTN configuration.

i Tap to switch **LTE Mode** to **TDD** or **FDD**.

NOTE
The instrument does not automatically save the collected data. It is recommended that you save the result. Otherwise, you will lose all the collected data.

To set limit

You can set the thresholds for the two different color indicators. The maximum value is the Limit for **Excellent**, and the minimum value is the Limit for **Poor**. Only if you set the

Plot Item to RSRP, you can manually input the max and min power using the on-screen keyboard in the right side of the screen indicating Scale. For other cases, the max power and min power are fixed, and you cannot edit it. See below to check the plot point color based on the Legend Color Table.

1 Tap the rectangle with value before color legend bar on the right panel.

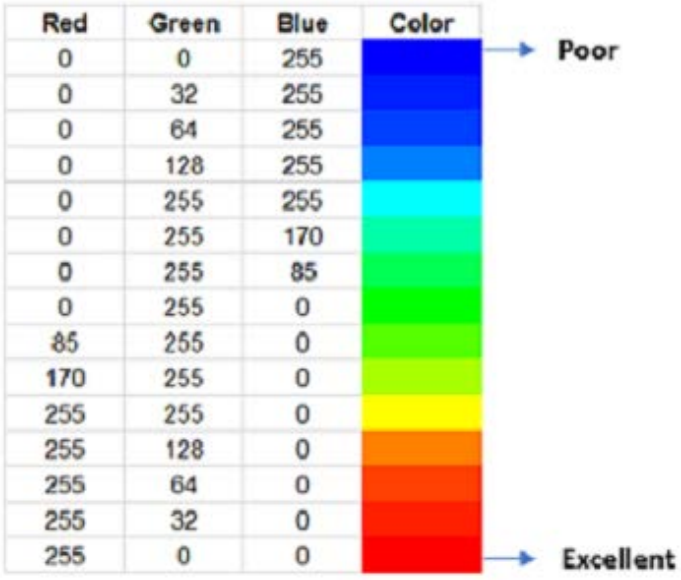
2 Set a value for **Poor** (minimum value) using the on-screen keyboard.

3 Tap the rectangle with value after color legend bar on the right panel.

4 Set a value for **Excellent** (maximum value) using the on-screen keyboard.

Figure 234 shows a legend color table.

Figure 234 Legend color table



Logging data

To use any features related to maps, you need to download and install the maps on the instrument. The VIAVI JDMapCreator will help you download maps. Make sure the JDMapCreator application on your computer is connected to the instrument via LAN. You can send a map file with a single layer to the instrument directly by using the Send to EQP menu in JDMapCreator. For more information on how to use the JDMapCreator, see the *JDMapCreator 2.0 User Guide*.

To log data

1 Follow **steps 1 to 5** in Setting measure setup.

2 Tap the **Testing** ( ) button on the right panel of the map to start plotting on the map. When you select a point on the map, a marker appears and the Information window appears on the right panel.

3 Tap the **Stop** ( ) button to stop plotting.

4 Tap the **Pause** button ( ) to pause plotting, then the GNSS point cannot be plotted.

5 If you start test and select **Menu** > **Map** > **Plot Point** > **Position**, you can undo by tapping the **Testing** button.

6 If you select the **Stop** button, the Plot Stop pop-up window appears, then tap **Yes**.

7 Tap **Yes** when the Save pop-up window appears and save the logging file to your USB.

If you go to **General Setting** > **PCI Dominance** and set it, you can judge pass (green) or fail (red) with colors based on the limit you have set. For example, if it becomes smaller than the threshold, the fail indicator (red) can be identified in the PCI column of the Information window and the top right corner of the instrument at the same time.

Viewing the logging data

To view the logging data

1 Load the saved logging file using the **Load** ( ) icon on the side bar. Make sure the file extension is .gomv.

2 If **Power** is selected, you can view the selected carrier(s)'s power related parameters based on the **Plot Item** parameter (RSRP, RSRQ, SINR, or SNR) that you have selected.

3 If the **PCI** is set to **Auto**, the point on the map appears with a color representing the highest **S-SS RSRP** value.
When you select a point on the map, a marker appears and the Information window appears on the right panel.

4 Set the **PCI** to **Manual** and tap the **Select** button.
The Select PCI window appears.

5 Select **PCI** on the left and then the corresponding Beam Index appeared on the right.

6 Tap the **Apply** button.
The point color of the map changes to the corresponding SS-RSRP value, and if there is no detected Beam Index, the point will be hidden.

NOTE
When you load the result file, a pop-up message asking whether you want to load data only or data with map appears. If the current screen does not display all the loaded data, the screen mode will be automatically changed to Full.

Importing cellsite DB

You can import the site DB by creating the 5G site information form.

To import cellsite DB

1 Create the 5G site information with an excel file as below.

2 Input the two mandatory fields: **Lat (DecDeg)** and **Long (DecDeg)**.

3 Input the **Azimuth** field if you want to check the direction of antenna.

4 Make sure to save the file as **CSV** (Comma delimited) (*.csv).

5 Copy the file to the USB memory stick and insert it to the **USB A** or **USB B** port of the instrument.

6 Tap the **Load** ( ) icon on the side bar.

7 Import the saved file.

Once the file is loaded, the following cellsite information appears with an icon.

Figure 235 shows an example of an importing cellsite DB.

Figure 235 Importing Cellsite DB

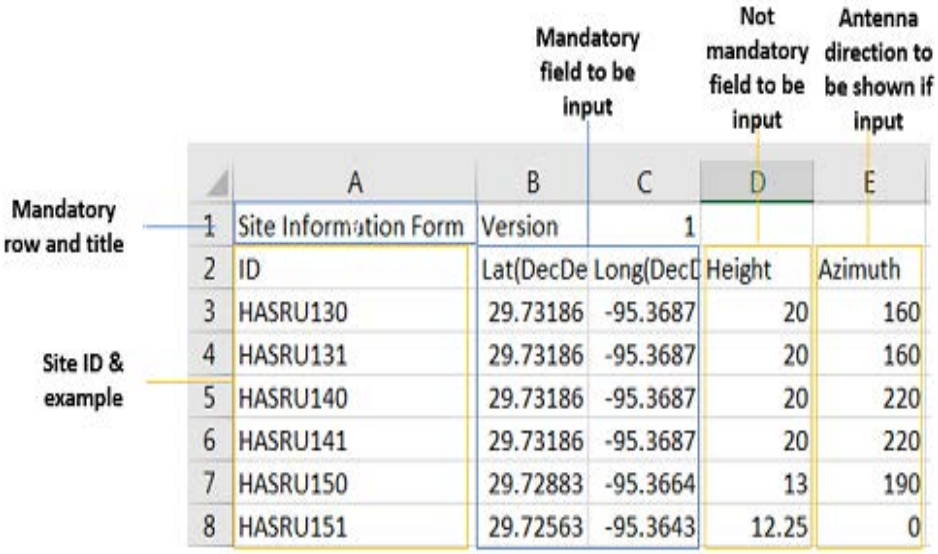
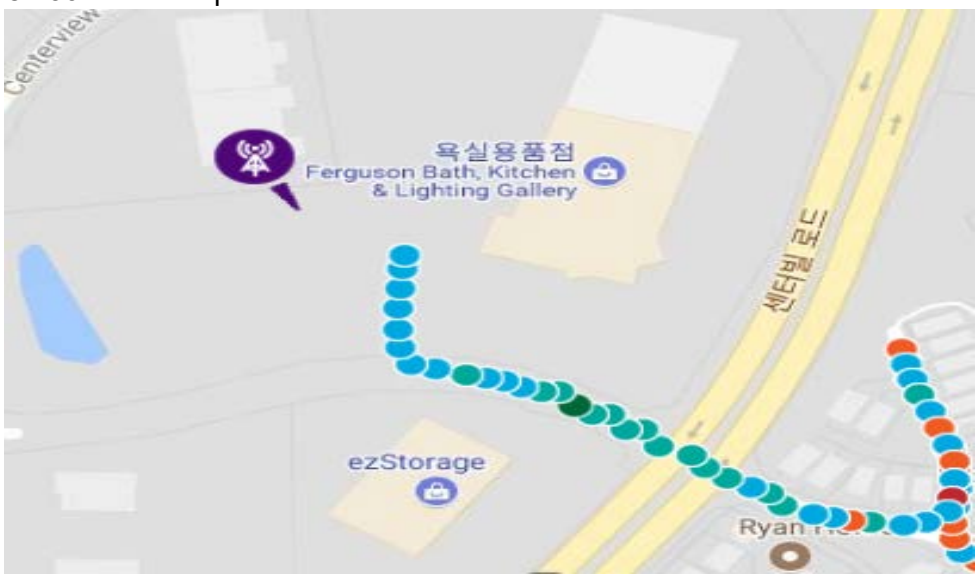


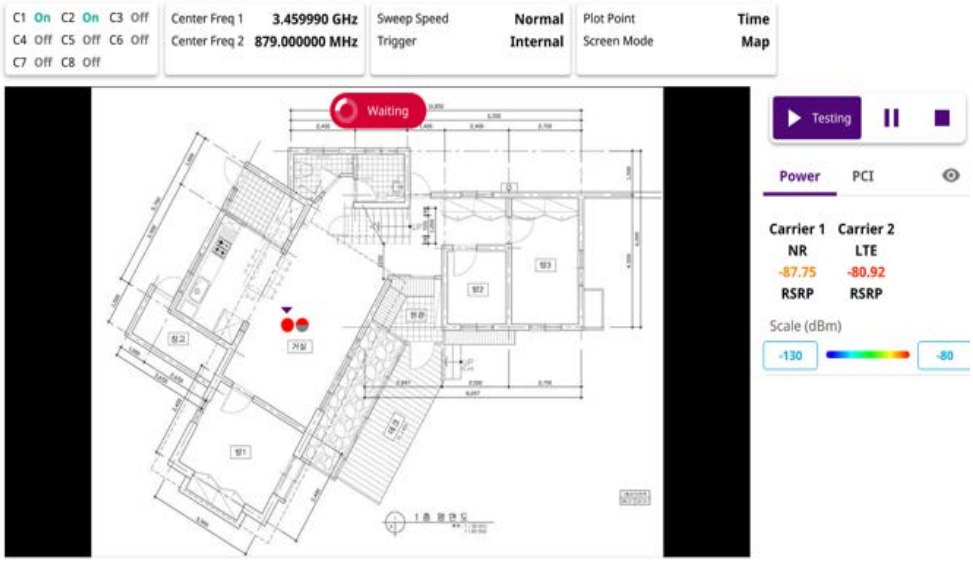
Figure 236 Route map measurement with site information screen



NOTE

The purple icon indicates the base station (site) location and the direction of antenna. If the site is beyond the latitude and longitude of the map file, it will not show.

Figure 237 Multi-RAT route map measurement (Plot Point to Time)



NOTE

When you setup Plot Point to Time and tap the start/testing button, you can't touch the screen to active. After the waiting indicator(Waiting) stops, the active indicator(00 Data) shows up.

Online route map

The following sections describe how to perform online route map.

Online Multi-RAT route map

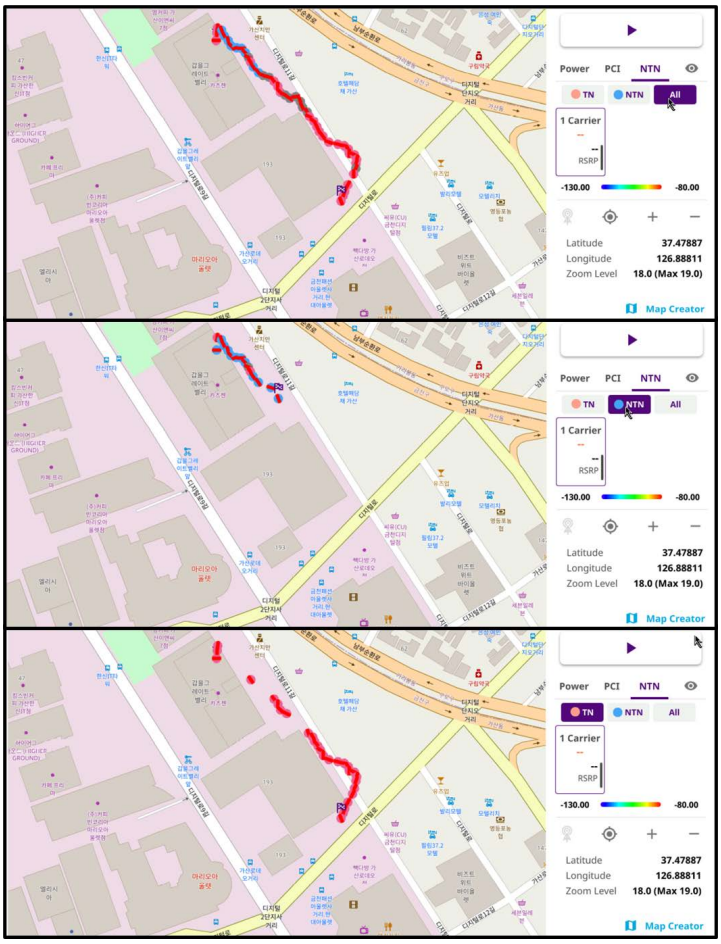
Online Multi-RAT route map enables you to download a map automatically when connected to the network then you can continue route map measurement using the downloaded map whether you are online or offline. It traces the power level of the NR signal's beam and the power level of the strongest LTE signal in terms of RSRP and corresponding to a particular time and geographical position and presents it in a geographical map as a measurement point. All the collected measurements can be exported for post-processing purposes, including data of the eight strongest beams for each measurement point, including its measurement time and geographical location.

Figure 238 shows an example of online Multi-RAT route map measurement.

Figure 238 Online Multi-RAT route map measurement



Figure 239 Online Multi-RAT route map with NTN



Controlling a map

To control a map

1 See the following table to control a map.

Table 138 Map icons

Icon	Description
	Tap to go to your current location on the map. Once tapped, a purple icon appears on the map, indicating your current location.
+	Tap to zoom in on the map.
−	Tap to zoom out on the map.

The left-most cell-site icon is activated when you import the cell-site information file.

To set measurement setup

Before starting the Route Map measurement, you need to set Spectrum measurements displayed on the quick access and display tab. See “Configuring spectrum measurements” on page 25 for more information. The setup menus for Multi-RAT route map are available in the screen with two categories: general setting and carrier setting. For Map Configuration, you need to tap Menu icon on the side bar.

1 Connect a GNSS receiver to your instrument for outdoor mapping.

2 Tap the **Setup** ( ) icon on the side bar.

3 Tap to switch **Plot Item** to **RSRP**, **RSRQ**, **SINR**, **SNR**, or **PCI Dominance**.

4 Tap **Configuration** to continue with carrier setting or general setting.

General setting

1 Tap **General Setting** on the screen.

2 To set the reference level, tap the number under NR or LTE and input the reference level using the on-screen keyboard.

3 Tap to switch the **Sweep Speed** between **Fast** and **Normal**.
- **Fast**: measuring PCI, RSRP, RSRQ, P-SS SNR, RS SINR, S-SS RSSI, P-SS Power, S-SS Power for one signal with the strongest RSRP for LTE carrier/ measuring PCI, SSB Index, S-SS RSRP, P-SS RSRP, P-SS SNR, S-SS SINR, S-SS RSRQ for one signal with the strongest S-SS RSRP for NR carrier
- **Normal**: measuring PCI, RSRP, RSRQ, P-SS SNR, RS SINR, S-SS RSSI, P-SS Power, S-SS Power for six signals with top-down order based on the strongest RSRP signal for LTE carrier/ measuring PCI, SSB Index, S-SS RSRP, P-SS RSRP, P-SS SNR, S-SS SINR, S-SS RSRQ for eight signals with top-down order based on the strongest S-SS RSRP signal for NR carrier

4 Tap **Trigger** to set **Internal**, **External** or **GNSS** as required.
- **Internal**: when starting a signal processing using the internal reference clock and creating a trigger
- **External**: when starting a signal processing based on the external input trigger
- **GNSS**: When synchronizing the signal processing via the GPS receiver. If you want to check the time error correctly, set the trigger to GNSS

5 Tap to switch **Sorting Type** to **PCI** or **RSRP** as required.

6 Tap **Frequency Reference** to set the clock source.
- **Internal**: Uses a 10 MHz internal clock
- **External**: Uses external 10 MHz, 13 MHz, or 15 MHz clock automatically set by the instrument
- **GNSS**: Uses a built-in GNSS as a frequency and timing source

Carrier setting

1 Tap the number to switch the carrier on or off for **NR** or **LTE** in the **Carrier Configuration** box. You can select up to 8 carriers.

2 If you select NR, do the following steps:

a Select **Center Frequency** to set the center frequency using the on-screen keyboard.

- If you apply **Center Frequency**, **Channel No**, and **Bandwidth, SSB Frequency, SCS, GSCN, and Periodicity** all at once, tap the **Center Frequency List** ( ) icon and do the following:

i Tap the **Add (+)** icon and input Center Frequency, Channel No, and Bandwidth as required using the on-screen keyboard.

ii Tap the **Apply** button to apply the changes. The screen moves to the Center Frequency List table.

iii Highlight the one of the added lists and tap the **Configuration** icon that appears in gray to change the applied values.

iv Tap the **Delete** icon to delete the selected list(s).

v Tap the **Toothed Wheel** ( ) icon to load the applied parameters based on the center frequency input values. You need to input the required center frequency in the Setting table in advance.



NOTE
You will be able to multi-select the added items and apply them all at once only if the carrier number is On. If the carrier 1 and 3 are On and you highlight No. 0,3, and 4, the first two highlighted lists, 0 and 3 are applied to each carrier 1 and 3.

b Select **Channel Standard** to set the channel standard for the selected carrier using the on-screen keyboard.

If the MIMO is set to 2x2, the antenna ports 2 and 3 are disabled.

c Select **Channel Number** to set the channel number for the selected index using the on-screen keyboard.

d Tap **External Offset** and input the value using the on-screen keyboard and tap to switch the external offset to **On** (green) or **Off** (gray) as desired.

e Tap **Attenuation** and input the value using the on-screen keyboard if you want to set it manually (**Manual**). Or tap it to set **Auto**.

f Tap to switch **Preamp 1** and **Auto** to **On** (green) or **Off** (gray).

g Tap to switch **PCI** (**Physical Cell ID**) to **Manual** (number) or **Auto** and input a value in the number box from 0 to 1007 using the on-screen keyboard.

h Tap the **Bandwidth/SSB SCS** box and select the Setting in the pop-up window based on your need. SSB is an abbreviation for Synchronization Signal Block or SS Block and it actually refers to Synchronization PBCH block since the synchronization signal and PBCH channel are packed as a

single block that always moves together. SSB should be detected first in 5G NR frame. See Table 139 below for the setting criteria based on the operating frequency.

i Tap **L** to set the maximum number of SS-PBCH blocks within a single SS burst set (A set of SS being transmitted in 5 ms window of SS transmission) among **4**, **8** and **64**.

j Tap the **SSB Period** box and select the options from **5 ms**, **10 ms**, **20 ms**, **40 ms**, **80 ms**, or **160 ms**. The SS burst period (SSB periodicity) is defined by each base station and network configurable. 20 ms is the default for the initial cell selection.

k Tap the **Auto Search** box and select the options from **Auto Preamp/Atten** or **Manual**.

Auto Preamp/Atten to set preamp and attenuation automatically or Manual for user-defined settings.

l Tap the **Start** button in **Auto Search** box to search SCS, type, and the number of SSB automatically or the **Stop** button to set the SSB period based on the base station.

Once the **Start** button is tapped, the progress bar appears.

m Tap the **SSB Frequency** button and input the required value using the on-screen keyboard.

n Tap the **GSCN** box and input the required value using the on-screen keyboard.

Based on the GSCN input frequency, the SSB Frequency, Sync Raster Offset, and Sync SCS Offset are automatically

changed.

o Tap **Sync Raster Offset** box to manually set the required value using the on-screen keyboard.

p Tap **Sync SCS Offset** box to manually set the required value using the on-screen keyboard.

Table 139 Setup per operating frequency

Operating frequency	L	Case	SCS	Slots in a burst period
< 3 GHz (FR1)	4	A {2,8} +14*n	15 kHz	5 (1 ms)
< 3 GHz (FR1)	4	B {4,8,16,20} +28*n	30 kHz	10 (0.5 ms)

Table 139 Setup per operating frequency

Operating frequency	L	Case	SCS	Slots in a burst period
< 3 GHz (FR1) For un-paired spectrum operation: < 1.88 GHz	4	C {2,8} +14*n	30 kHz	10 (0.5 ms)
3 to 6 GHz (FR1)	8	A {2,8} +14*n	15 kHz	5 (1 ms)
3 to 6 GHz (FR1)	8	B {4,8,16,20} +28*n	30 kHz	10 (0.5 ms)
3 to 6 GHz (FR1) For un-paired spectrum operation: < 1.88 to 6 GHz	8	C {2,8} +14*n	30 kHz	10 (0.5 ms)
> 6 GHz (FR2)	64	D {4,8,16,20} +28*n	120 kHz	40 (0.125 ms)
> 6 GHz (FR2)	64	E {8,12,16,20,32,36,40,44} +56*n	240 kHz	80 (62.5 ms)

3 If you select LTE, do the following step:

a Select **Center Frequency** to set the center frequency using the on-screen keyboard.

b Select **Channel Standard** to set the channel standard for the selected carrier using the on-screen keyboard.

If the MIMO is set to 2x2, the antenna ports 2 and 3 are disabled.

c Select **Channel Number** to set the channel number for the selected index using the on-screen keyboard.

d Tap **External Offset** and input the value using the on-screen keyboard and tap to switch the external offset to **On** (green) or **Off** (gray) as desired.

e Tap **Attenuation** and input the value using the on-screen keyboard if you want to set it manually (**Manual**). Or tap it to set **Auto**.

f Tap to switch **Preamp 1** and **Auto** to **On** (green) or **Off** (gray).

g *Optional.* The **NTN Configuration** box appears only if the ONA-SP-LTE-NTN license is available.

- Tap to turn **NTN Configuration On**.
- Tap **Settings**.
- Tap MCC and MNC and input the required values.
- Tap the **Done** button.

h If NTN cannot be found using the PLMN (MCC/MNC) information:

- Set **Apply Test** to **On** (green).
- Input the required NTN PCI from 1 to 20.
- Tap the **Done** button to complete the NTN configuration.

i Tap to switch **LTE Mode** to **TDD** or **FDD**.



NOTE
The instrument does not automatically save the collected data. It is recommended that you save the result. Otherwise, you will lose all the collected data.

To set limit

You can set the thresholds for the two different color indicators. The maximum value is the Limit for **Excellent**, and the minimum value is the Limit for **Poor**. Only if you set the Plot Item to RSRP, you can manually input the max and min power using the on-screen keyboard in the right side of the screen indicating Scale. For other cases, the max power and min power are fixed, and you cannot edit it. See below to check the plot point color based on the Legend Color Table.

1 Tap the rectangle with value before color legend bar on the right panel.

Logging data

To log data

1 Follow **steps 1 to 5** in Setting measure setup.

2 Tap the **Testing** ( ) button on the right panel of the map to start plotting on the map. When you select a point on the map, a marker appears and the Information window appears on the right panel.

3 Tap the **Stop** ( ) button to stop plotting.

4 Tap the **Pause** button ( ) to pause plotting, then the GNSS point cannot be plotted.

5 If you select the **Stop** button, the Plot Stop pop-up window appears, then tap **Yes**.

6 Tap **Yes** when the Save pop-up window appears and save the logging file to your USB.

If you go to **General Setting** > **PCI Dominance** and set it, you can judge pass (green) or fail (red) with colors based on the limit you have set. For example, if it becomes smaller than the threshold, the fail indicator (red) can be identified in the PCI column of the Information window and the top right corner of the instrument at the same time.

Viewing the logging data

To view the logging data

1 Load the saved logging file using the **Load** ( ) icon on the side bar. Make sure the file extension is .orr.

2 If **Power** is selected, you can view the selected carrier(s)'s power related parameters based on the **Plot Item** parameter (RSRP, RSRQ, SINR, or SNR) that you have selected.

3 If the **PCI** is set to **Auto**, the point on the map appears with a color representing the highest **S-SS RSRP** value.
When you select a point on the map, a marker appears and the Information window appears on the right panel.

4 Set the **PCI** to **Manual** and tap the **Select** button.
The Select PCI window appears.

5 Select **PCI** on the left and then the corresponding Beam Index appeared on the right.

6 Tap the **Apply** button.
The point color of the map changes to the corresponding SS-RSRP value, and if there is no detected Beam Index, the point will be hidden.

Importing cellsite DB

You can import the site DB by creating the 5G site information form.

To import cellsite DB

1 Create the 5G site information with an excel file as below.

2 Input the two mandatory fields: **Lat (DecDeg)** and **Long (DecDeg)**.

3 Input the **Azimuth** field if you want to check the direction of antenna.

4 Make sure to save the file as **CSV** (Comma delimited) (*.csv).

5 Copy the file to the USB memory stick and insert it to the **USB A** or **USB B** port of the instrument.

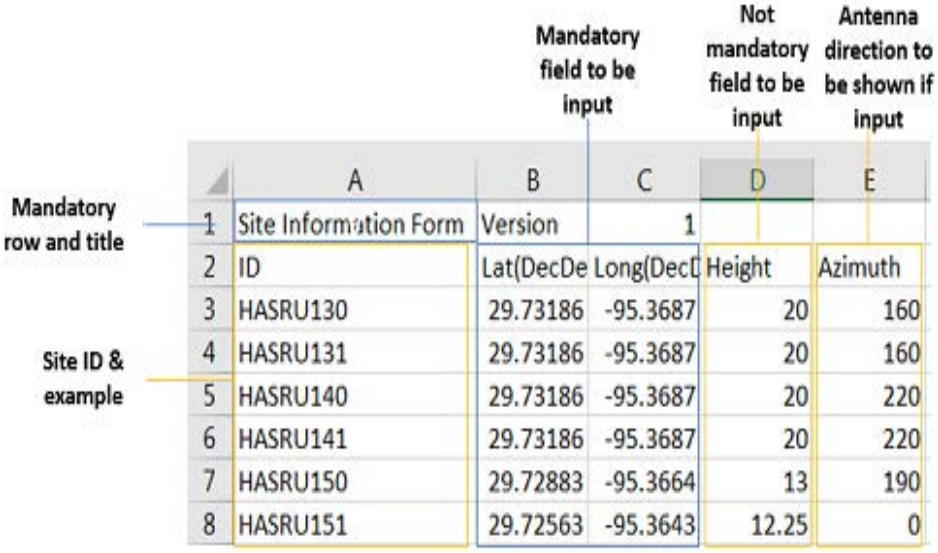
6 Tap the **Load** ( ) icon on the side bar.

7 Import the saved file.

Once the file is loaded, the following cellsite information appears with an icon.

Figure 240 shows an example of an importing cellsite DB.

Figure 240 Importing Cellsite DB



Creating a map

You can create a map online and continue conducting a route map analysis using the created map even when there is no Ethernet connection.

1 Tap the **Map Creator** button on the right panel at the bottom.

2 Tap the **Search** box and input the location using the on-screen keyboard and select one of the options as required.

3 Tap the **Zoom Level** box to capture the map with corresponding zoom level.

4 Tap the **Capture** button to start capturing the map.

Once the map is captured, the capturing completed pop-up will appear.

5 Select between the two options: Save in the system or Save as file.

6 Tap the **Done** button.



NOTE
If you have unsaved measurement data (map) and start measuring by tapping the Testing button or by tapping another measurement mode, a pop-up window will appear asking whether you will restore the unsaved data or not.

15

Using 5G DSS Signal Analyzer

This chapter describes how to use the 5G DSS Signal Analyzer. Topics covered in this chapter include:

- “Introduction” on page 594
- “Selecting mode and measure” on page 594
- “RF analysis” on page 595
- “OTA analysis” on page 604
- “Signal analysis” on page 632
- “Online route map” on page 655

Introduction

Dynamic Spectrum Sharing (DSS) Signal Analyzer allows the deployment of both 4G LTE and 5G NR in the same frequency band and dynamically allocates spectrum resources between the two technologies based on user demand.

The module provides following measurements for 5G DSS analysis:

- RF Analysis
  - Spectrum
  - Channel Power
  - Occupied Bandwidth
  - Spectrum Emission Mask
  - ACLR
  - Multi-ACLR
  - Spurious Emissions
- OTA Analysis
  - OTA Channel Scanner
  - OTA ID Scanner
  - OTA Multipath Profile
  - OTA Control Channel
  - OTA Route Map
  - Freq/Time/Power variation
  - Power vs Time (Frame)
  - Power vs Time (Slot)
- Signal Analysis
  - Constellation
  - Channel Mapper
  - Control Channel
  - Subframe
  - Frame
  - Time Alignment Error
- Online Route Map
  - Online OTA Route Map

Selecting mode and measure

The following procedure describes how to start measurement.

To select mode and measure

1 Tap **5G DSS Signal Analyzer** on the **MODE** panel.

2 Tap any measurement mode from the following choices:

- **Spectrum Analysis > Spectrum**
- **RF Analysis > Channel Power**, **Occupied Bandwidth**, **Spectrum Emission Mask**, **ACLR**, **Multi-ACLR**, or **Spurious Emissions**
- **Power vs Time > Power vs Time (Frame)**, **Power vs Time (Slot)**
- **Modulation Analysis > Constellation**, **Channel Mapper**, **Control Channel**, **Subframe**, **Frame**, or **Time Alignment Error**
- **OTA Analysis > OTA Channel Scanner**, **OTA ID Scanner**, **OTA Multipath Profile**, **OTA Control Channel**, **OTA Route Map**, or **Freq/Time/Power Variation**
- **Online Route Map > Online OTA Route Map**

RF analysis

The following sections describe how to perform RF analysis.



You can quickly access the Auto Gain feature by tapping the Auto Gain icon in the top right corner of the measurement screen. If you tap the Auto Gain icon, the following icon appears. + indicates the attenuation increases by 5 each time. - indicates the attenuation decreases by 5 each time. The third one is auto scale and it automatically adjusts scales.You can tap X to exit the Auto Gain feature.

Spectrum

After configuring the spectrum measurement, you can configure the measurements just as in Spectrum mode. For more information, see “Configuring spectrum measurements” on page 25.The measurement settings can be saved and recalled as a File Type as Setup and load the file onto the instrument using the **Save/Load** icons on the side bar.

To set measure setup

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap **Bandwidth** from the following choices: **5 MHz**, **10 MHz**, **15 MHz**, or **20 MHz**.

3 Tap to switch **Duplex/Duplex Type** to **TDD** or **FDD**.

To set trigger (SPA06MA module only)

1 Tap the **Menu > Trigger**.

2 Tap **Trigger** and select the options from **Internal**, **External**, or **GNSS**.

3 Tap **Freq. Ref.**(Frequency Reference) to set the clock source.

- **Internal**: Uses a 10 MHz internal clock
- **External**: Uses external 10 MHz, 13 MHz, or 15 MHz clock automatically set by the instrument
- **GNSS**: Uses a built-in GNSS as a frequency and timing source
- **TEM2**: Uses TEM2 pps as a frequency and timing source

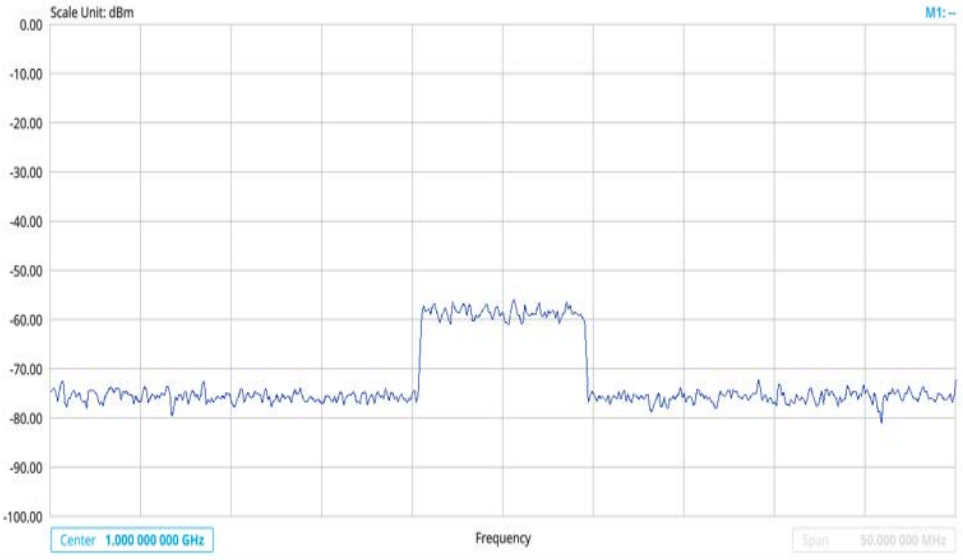
  Be aware TEM2 setting is available only when it is connected.

NOTE

Make sure to set Frequency Reference for all measurement mode in 5G DSS Signal Analyzer to sync the proper clock source.

Figure 241 shows an example of spectrum measurement.

Figure 241 5G DSS spectrum measurement



Channel power

The Channel Power measurement is a common test used in the wireless industry to measure the total transmitted power of a radio within a defined frequency channel. It acquires a number of points representing the input signal in the time domain, transforms this information into the frequency domain using Fast Fourier Transform (FFT), and then calculates the channel power. The effective resolution bandwidth of the frequency domain trace is proportional to the number of points acquired for the FFT.

The channel power measurement identifies the total RF power, power spectral density, and Peak to Average Ratio (PAR) of the signal within the channel bandwidth.

Setting measure setup

After configuring the spectrum measurement in “Configuring spectrum measurements” on page 25, you can set the measure setup to continue your measurement. The

measurement settings can be saved and recalled as a file by selecting File Type as Setup and load the file onto the instrument using the **Save/Load** icons on the side bar.

To set measure setup

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap **Bandwidth** from the following choices: **5 MHz**, **10 MHz**, **15 MHz**, or **20 MHz**.

3 Tap to switch **Duplex/Duplex Type** to **TDD** or **FDD**.

4 Tap **Menu** > **BW/AVG** > **Average** to set the number of measurements to be averaged using the on-screen keyboard.

The input value range is from 1 to 100.

To set the limit

1 Tap **Menu > Limit**.

2 Tap to switch the **Test Limits** to **On** or **Off** to enable or disable Pass/Fail indication. The result table color for Pass is green, and the result table color for Fail is red.

3 Tap **High Limit** to set the upper threshold using the on-screen keyboard.

4 Tap **Low Limit** to set the lower threshold using the on-screen keyboard.

5 *Optional.* Tap the **Save** icon on the side bar and select the save option from the choices available for your measurement mode.

Figure 242 shows an example of channel power measurement.

Figure 242 5G DSS channel power measurement



The Channel Power measurement result shows channel power and spectrum density in a user specified channel bandwidth. The peak to average ratio (PAR) is shown at the bottom of the screen as well. The shaded area on the display indicates the channel bandwidth.

Occupied bandwidth

The Occupied Bandwidth measures the percentage of the transmitted power within a specified bandwidth. The percentage is typically 99%.

Setting measure setup

After configuring the spectrum measurement in "Configuring spectrum measurements" on page 25, you can set the measure setup to continue your measurement. The measurement settings can be saved and recalled as a file by selecting File Type as Setup and load the file onto the instrument using the **Save/Load** icons on the side bar.

To set measure setup

1. Tap the **Setup** ( ) icon in the side bar.
2. Tap **Bandwidth** from the following choices: **5 MHz**, **10 MHz**, **15 MHz**, or **20 MHz**.
3. Tap to switch **Duplex/Duplex Type** to **TDD** or **FDD**.
4. Tap **Menu** > **BW/AVG** > **Average** to set the number of measurements to be averaged using the on-screen keyboard.

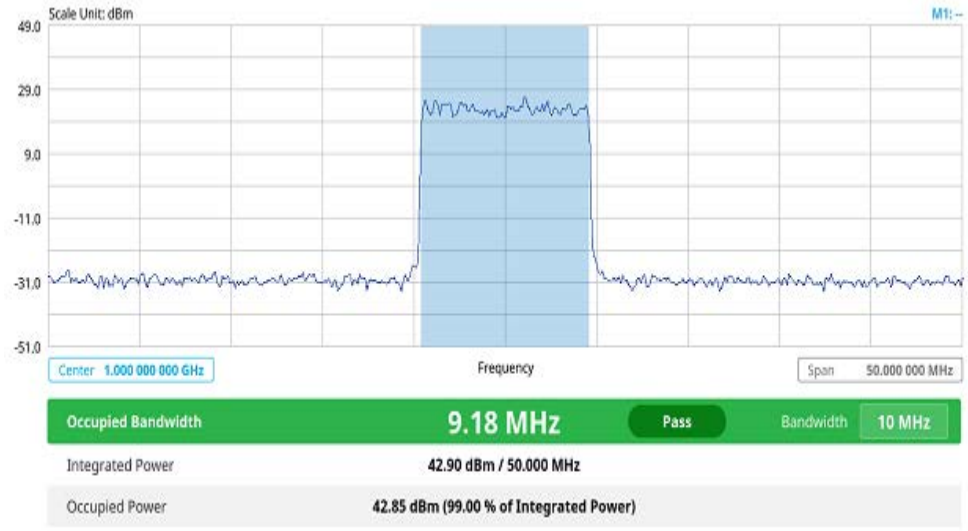
   The input value range is from 1 to 100.

To set the limit

1. Tap **Menu > Limit**.
2. Tap to switch the **Test Limits** to **On** or **Off** to enable or disable Pass/Fail indication. The result table color for Pass is green, and the result table color for Fail is red.
3. Tap **High Limit** to set the upper threshold using the on-screen keyboard.
4. *Optional.* Tap the **Save** icon on the side bar and select the save option from the choices available for your measurement mode.

Figure 243 shows an example of occupied bandwidth measurement.

Figure 243 5G DSS occupied bandwidth measurement



The Occupied Bandwidth measurement shows both power across the band and power bandwidth in a user specified percentage to determine the amount of spectrum used by a modulated signal. Occupied bandwidth is typically calculated as the bandwidth containing 99% of the transmitted power.

Spectrum emission mask

The Spectrum Emission Mask (SEM) measurement is to identify and determine the power level of out-of-band spurious emission outside the necessary channel bandwidth and modulated signal. It measures the power ratio between in-band and adjacent channels. The instrument indicates either Pass or Fail based on the specified limit of the signal.

Setting measure setup

After configuring the spectrum measurement in “Configuring spectrum measurements” on page 25, you can set the measure setup to continue your measurement. The measurement settings can be saved and recalled as a file by selecting File Type as Setup and load the file onto the instrument using the **Save/Load** icons on the side bar.

To set measure setup

1. Tap the **Setup** ( ) icon in the side bar.
2. Tap **Bandwidth** from the following choices: **5 MHz**, **10 MHz**, **15 MHz**, or **20 MHz**.
3. Tap to switch **Duplex/Duplex Type** to **TDD** or **FDD**.
4. Tap **Mask Type** and select from the following options: **Wide Area BS A**, **Wide Area BS B**, **Local Area BS**, or **Home BS**.

   The category is defined with base station type. Set Wide Area BS A/B for macro cell, Local Area Base Station for pico cell, and Home Base Station for femtocell.

5 Tap **Menu** > **BW/AVG** > **Average** to set the number of measurements to be averaged using the on-screen keyboard.

The input value range is from 1 to 100.

To set the limit

1 Tap **Menu > Limit**.

2 Tap to switch the **Test Limits** to **On** or **Off** to enable or disable Pass/Fail indication. The result table color for Pass is green, and the result table color for Fail is red.

3 *Optional.* Tap the **Save** icon on the side bar and select the save option from the choices available for your measurement mode.

Figure 244 shows an example of spectrum emission mask measurement.

Figure 244 5G DSS spectrum emission mask measurement



If Lower Peak or Upper Peak indicate Fail, the mask line becomes red.

ACLR

The Adjacent Channel Power Ratio (ACPR) designated by the 3GPP WCDMA specifications as the Adjacent Channel Leakage Power Ratio (ACLR), is the power contained in a specified frequency channel bandwidth relative to the total carrier power. It may also be expressed as a ratio of power spectral densities between the carrier and the specified offset frequency band.

Setting measure setup

After configuring the spectrum measurement in “Configuring spectrum measurements” on page 25, you can set the measure setup to continue your measurement. The measurement settings can be saved and recalled as a file by selecting File Type as Setup and load the file onto the instrument using the **Save/Load** icons on the side bar.

To set measure setup

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap **Bandwidth** from the following choices: **5 MHz**, **10 MHz**, **15 MHz**, or **20 MHz**.

3 Tap to switch **Duplex/Duplex Type** to **TDD** or **FDD**.

4 Tap **Menu** > **BW/AVG** > **Average** to set the number of measurements to be averaged using the on-screen keyboard.

The input value range is from 1 to 100.

To set the limit

1 Tap **Menu > Limit**.

2 Tap to switch the **Test Limits** to **On** or **Off** to enable or disable Pass/Fail indication. The result table color for Pass is green, and the result table color for Fail is red.

3 *Optional.* Tap the **Save** icon on the side bar and select the save option from the choices available for your measurement mode.

Figure 245 shows an example of ACLR measurement.

Figure 245 5G DSS ACLR measurement



Multi-ACLR

The Multi-ACLR measurement is used to perform multi-channel ACLR measurements with as many channels as possible. It helps you to measure ACLR in multi-channel transmitting Base Station environment.

Setting measure setup

After configuring the spectrum measurement in “Configuring spectrum measurements” on page 25, you can set the measure setup to continue your measurement. The measurement settings can be saved and recalled as a file by selecting File Type as Setup and load the file onto the instrument using the **Save/Load** icons on the side bar.

To set measure setup

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap **Bandwidth** from the following choices: **5 MHz**, **10 MHz**, **15 MHz**, or **20 MHz**.

3 Tap to switch **Duplex/Duplex Type** to **TDD** or **FDD**.

4 Tap **Menu** > **BW/AVG** > **Average** to set the number of measurements to be averaged using the on-screen keyboard.

The input value range is from 1 to 100.

To set the limit

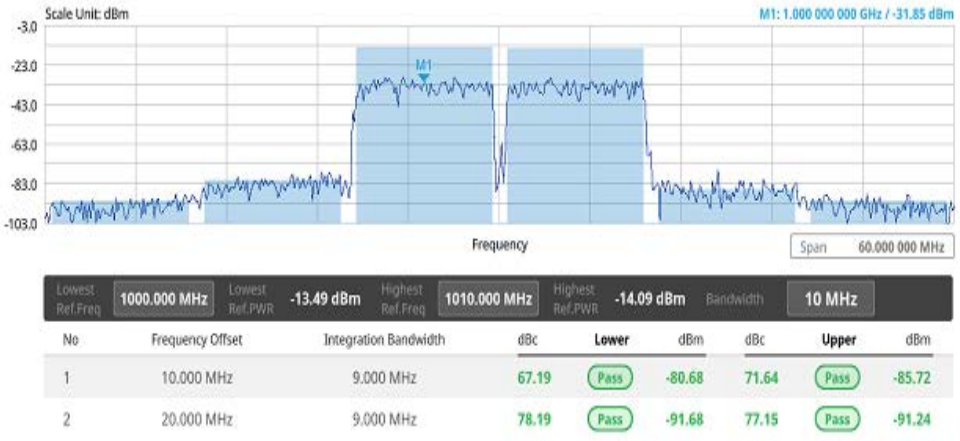
1 Tap **Menu > Limit**.

2 Tap to switch the **Test Limits** to **On** or **Off** to enable or disable Pass/Fail indication. The result table color for Pass is green, and the result table color for Fail is red.

3 *Optional.* Tap the **Save** icon on the side bar and select the save option from the choices available for your measurement mode.

Figure 246 shows an example of Multi-ACLR measurement.

Figure 246 5G DSS Multi-ACLR measurement



NOTE

You can set the Lowest Ref. Frequency and Highest Ref. Frequency by tapping the rectangle with value using the on-screen keyboard.

Spurious emissions

The Spurious Emissions measurement is to identify or determine the power level of in-band or out-of-band spurious emissions within the necessary channel bandwidth and modulated signal. The instrument indicates either Pass or Fail based on the specified limit of the signal.

Setting measure setup

After configuring the spectrum measurement in "Configuring spectrum measurements" on page 25, you can set the measure setup to continue your measurement. The measurement settings can be saved and recalled as a file by selecting File Type as Setup and load the file onto the instrument using the **Save/Load** icons on the side bar.

To set measure setup

1. Tap the **Setup** ( ) icon in the side bar.
2. Tap to switch **Duplex/Duplex Type** to **TDD** or **FDD**.
3. Tap to switch **Measure Type** to **Full** or **Examine**.
   - **Full** lets the instrument automatically changes the selected range from one another.
   - **Examine** displays only the selected range.
4. Tap **Configuration** or the **Configuration**( ) icon.
   a. Tap **Range** under the chart screen and switch to **On** to display or **Off** to hide the selected range in the result table.

      You can select the range number between **1** and **20** to add as a new or change the existing settings.

   b. Tap **Start Frequency/Stop Frequency** and enter the value for the selected range using the on-screen keyboard.

   c. Tap **Start Limit/Stop Limit** and enter the lower limit/upper limit for Pass/Fail indication.

   d. Tap **Attenuation/RBW/VBW** and specify or select the value.
5. Tap **Menu > BW/VBW > Average** to enter the value between **1** and **100** to set the number of measurements to be averaged.

To set limit

1. Tap **Menu > Limit**.
2. Tap to switch the **Test Limits** to **On** or **Off** to enable or disable Pass/Fail indication.

   The result table color for Pass is green, and the result table color for Fail is red.
3. *Optional*: Tap the **Save** hot key on the side bar and select the save option from the choices available for your measurement mode.

Figure 247 shows an example of spurious emissions measurement.

Figure 247 5G DSS spurious emissions measurement



NOTE

You can only set the frequency range and attenuation by tapping the Configuration icon. If you select the first icon next to the Range table above, it only shows the selected range and if you select the second icon next to the Range table, it keeps moving from the first selected range to the final selected range.

OTA analysis

The following sections describe how to perform OTA analysis.

OTA channel scanner

The Channel Scanner is a radio receiver that can automatically tune or scan two or more discrete frequencies and multi-channels, indicating when it finds a signal on one of them and then continuing scanning when that frequency goes silent.

Setting measure setup

After configuring spectrum measurement in “Configuring spectrum measurements” on page 25, you can set the measure setup to continue your measurement. The measurement settings can be saved and recalled as a file by selecting File Type as Setup and load the file onto the instrument using the **Save/Load** icons on the side bars.

To set measure setup

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap to switch **Radio Config** and set **Duplex Type** (FDD/TDD), **DSS Type** (Co-channel) and **Technology** (LTE/NR) and other related parameters as below:

You can select Co-channel to find NR frequency based on the LTE operating frequency in co-channel and select Adjacent channel to search both LTE and NR frequency. Note that Adjacent channel will be available in the next release.

- When **LTE** is selected as **Technology**, do the following steps:
  - Select **Bandwidth** (MHz) from the following choices: **20**, **15**, **10**, or **5**.
  - Select **MIMO** between **2x2** and **4x4** to set the number of antenna ports. If the MIMO is set to 2x2, the antenna ports 2 and 3 are disabled.
  - Select **Cyclic Prefix** between **Normal** and **Extended**. Cyclic prefix works as a buffer region or guard interval to protect the OFDM signals from inter symbol interference.
    - **Normal**: Intended to be sufficient for the majority of scenarios
    - **Extended**: Intended for scenarios with particularly high delay spread
  - Select **PHICH Ng** between **Normal** and **Extended** and then to set the number of PHICH groups (Ng): 1/6, 1/2, 1, or 2. The PHICH group value/Ng is decided based on the number of PHICH groups per subframe. PHICH duration is a higher layer parameter configured either as Normal or Extended that says the demodulator how many symbols per subframe are used by PHICH.
    - **Normal**: There are 8 PHICH sequences in one PHICH group (4 symbols).
    - **Extended**: There are 4 PHICH sequences in one PHICH group (2 symbols)
- When **NR** is selected as **Technology**, do the following steps:
  - Select sub-Carrier Spacing as 15 kHz (Case A). The standard for NR SCS is 15 kHz. The instrument supports 15 kHz of sub-carrier spacing.

3 Tap to switch **CFI** to **Manual** or **Auto**.

- **Auto** lets the instrument set the number of OFDM symbols used for transmitting PDCCHs in a subframe.
- **Manual** sets the number of OFDM symbols manually. The set of OFDM symbols that can be used for PDCCH in a subframe is given by 0, 2, 3 or 4 in 1.4 MHz bandwidth and 1, 2 or 3 in other bandwidths.

4 Tap **CFI** and input a value from 1 to 3 as desired using the on-screen keyboard.

5 Tap **PDSCH**, and then select the PDSCH modulation type option: **Auto**, **QPSK**, **16 QAM**, **64 QAM**, **256 QAM**, **LTE E-TM3.3**, **LTE E-TM3.2**, **LTE E-TM3.1a**, **LTE E-TM3.1**, **LTE E-TM2a**, **LTE E-TM2**, **LTE E-TM1.2** or **LTE E-TM1.1**.

If two or more modulation types are used in a frame, select **Auto**. If the PDSCH uses the same modulation type in a frame or in a subframe, select a specific modulation type to get more accurate EVM.

6 Tap **PDSCH Threshold** to set the threshold for PDSCH and enter a value by using the on-screen keyboard.

7 Tap **PDSCH Precoding** to set **On** or **Off** to enable or disable the PDSCH precoding.

To configure General settings

You can configure trigger setting in the general setting section.

1 Tap the **Configuration** icon in the detected list table or **Setup** > **Configuration**.

2 Tap Trigger to set **Internal**, **External** or **GNSS** as required.

- **Internal**: when starting a signal processing using the internal reference clock and creating a trigger
- **External**: when starting a signal processing based on the external input trigger
- **GNSS**: When synchronizing the signal processing via the GNSS receiver

To configure Carrier settings

You can configure up to three carriers in the carrier setting section.

1 Tap the **Index** box. You can select up to 3 carriers.

2 Select the carrier number from 1 to 3 and set the following:

a Tap the **Center Frequency** box and input the value using the on-screen keyboard.

- If you apply **Center Frequency**, **Channel No**, and **Bandwidth, SSB Frequency, SCS, GSCN, and Periodicity** all at once, tap the **Center Frequency List** ( ) icon and do the following:

i Tap the **Add (+)** icon and input Center Frequency, Channel No, and Bandwidth as required using the on-screen keyboard.

ii Tap the **Apply** button to apply the changes. The screen moves to the Center Frequency List table.

iii Highlight the one of the added lists and tap the **Configuration** icon that appears in gray to change the applied values.

iv Tap the **Delete** icon to delete the selected list(s).

v Tap the **Toothed Wheel** ( ) icon to load the applied parameters based on the center frequency input values. You need to input the required center frequency in the Setting table in advance.

NOTE
You will be able to multi-select the added items and apply them all at once only if the carrier number is On. If the carrier 1 and 3 are On and you highlight No. 0,3, and 4, the first two highlighted lists, 0 and 3 are applied to each carrier 1 and 3.

NOTE
If you input the center frequency, the instrument automatically searches SSB frequency and displays the searched NR frequency in the Detected List table.

b Tap the **Channel Standard** box and choose one from the pop-up window and tap the Apply button.

c Tap the **Channel Number** box and input the value using the on-screen keyboard.

d Tap the **Bandwidth** box and input the value using the on-screen keyboard.

e Tap the **Add** button to add more carriers and set from step **a** to **d**.

f Tap the **External Offset** box and input the value using the on-screen keyboard and tap to switch the external offset to **On** (green) or **Off** (gray) as desired.

g Tap the **Attenuation** box and input the value using the on-screen keyboard if you want to set it manually (**Manual**). Or tap it to set **Auto**.

h Tap to switch the **Preamp** box **1** to **On** (green) or **Off** (gray).

i Tap to switch the **SSB Auto Search** to **On** or **Off.**

j Tap **SSB frequency** and input the value using the on-screen keyboard.

k Tap **GSCN** and input the value from 2 to 26639 using the on-screen keyboard. If you need to search SSB based on ARFCN raster, it would take too long time since ARFCN raster is very narrow. Therefore, it is recommended that you define a SSB searching frequency in wider steps. This is the usage/purpose of GSCN. You can search the frequency corresponding to GSCN in maximum 100 MHz bandwidth of ARFCN that the instrument supports.

NOTE
Based on the GSCN input frequency, the SSB Frequency is automatically changed.

l Tap to switch **LTE PCI Mode** to **Manual** or **Auto** and input a value from 0 to 503.

The **PCI** switches to **Manual**.

m Tap **NR PCI Mode** to **Manual** or **Auto** and input a value from 0 to 1007. The **PCI** switches to **Manual**.

NOTE

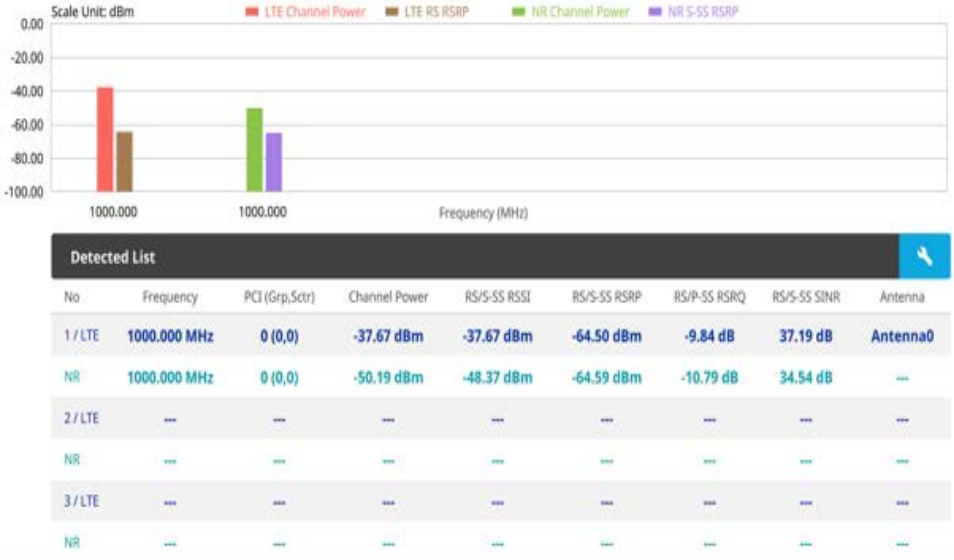
You can set Auto to let the instrument detect the Physical Cell ID for the LTE/NR signal automatically and Manual to set the specific Physical Cell ID for the LTE/NR signal manually in order to speed up the synchronization with a BTS.

To set the limit

1. Tap **Menu > Limit**.
2. Tap to select **Limit Line** to **on** or **off**.
3. Enter the **Limit Line** value using the on-screen keyboard as required once limit line is on.

Figure 248 shows an example of OTA channel scanner measurement.

Figure 248 5G DSS OTA Channel Scanner measurement



NOTE

OTA Channel Scanner displays LTE signal with RS channel and NR signal with SS channel during its transmission period.

OTA ID Scanner

The LTE mobile receives signals from multiple base stations, all of which share the same spectrum and are present at the same time. Each base station has unique scrambling code assigned to the particular base station and it differentiates its signal from other base stations in the area.

The ID Scanner shows key parameters such as RSRP (Reference Signal Received Power) and RSRQ (Reference Signal Received Quality) that predict the downlink coverage quickly. RSRPs from entire cells help to rank between the different cells as input for handover and cell reselection decisions. RSRQ provides additional information when RSRP is not sufficient to make a reliable handover or cell reselection decision.

Setting measure setup

After configuring spectrum measurement in “Configuring spectrum measurements” on page 25, you can set the measure setup to continue your measurement. The measurement settings can be saved and recalled as a file by selecting File Type as Setup and load the file onto the instrument using the **Save/Load** icons on the side bars.

To set measure setup

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap to switch **Carrier Auto Search** to **Start** to start searching the SSB frequency and apply it or to **Stop** to stop searching.

NOTE
If searching is unavailable, the instrument displays a pop-up message saying that it fails to detect NR (SSB)
frequency.

3 Tap to switch **Radio Config** and set **Duplex Type** (FDD/TDD), **DSS Type** (Co-channel) and **Technology** (LTE/NR) and other related parameters as below:

You can select Co-channel to find NR frequency based on the LTE operating frequency in co-channel and select Adjacent channel to search both LTE and NR frequency. Note that Adjacent channel will be available in the next release.

- When **LTE** is selected as **Technology**, do the following steps:
  - Select **Bandwidth** (MHz) from the following choices: **20**, **15**, **10**, or **5**.
  - Select **MIMO** between **2x2** and **4x4** to set the number of antenna ports. If the MIMO is set to 2x2, the antenna ports 2 and 3 are disabled.
  - Select **Cyclic Prefix** between **Normal** and **Extended**. Cyclic prefix works as a buffer region or guard interval to protect the OFDM signals from inter symbol interference.
    - **Normal**: Intended to be sufficient for the majority of scenarios
    - **Extended**: Intended for scenarios with particularly high delay spread
  - Select **PHICH Ng** between **Normal** and **Extended** and then to set the number of PHICH groups (Ng): 1/6, 1/2, 1, or 2. The PHICH group value/Ng is decided based on the number of PHICH groups per subframe. PHICH

duration is a higher layer parameter configured either as Normal or Extended that says the demodulator how many symbols per subframe are used by PHICH.

- **Normal**: There are 8 PHICH sequences in one PHICH group (4 symbols).
- **Extended**: There are 4 PHICH sequences in one PHICH group (2 symbols)

- When **NR** is selected as **Technology**, do the following steps:
  – Select Sub-Carrier Spacing as 15 kHz (Case A). The standard for NR SCS is 15 kHz. The instrument supports 15 kHz of sub-carrier spacing.

4 Tap to switch **CFI** to **Manual** or **Auto**.

– **Auto** lets the instrument set the number of OFDM symbols used for transmitting PDCCHs in a subframe.

– **Manual** sets the number of OFDM symbols manually. The set of OFDM symbols that can be used for PDCCH in a subframe is given by 0, 2, 3 or 4 in 1.4 MHz bandwidth and 1, 2 or 3 in other bandwidths.

5 Tap **CFI** and input a value from 1 to 3 as desired using the on-screen keyboard.

6 Tap **SSB frequency** and input the value using the on-screen keyboard.

7 Tap **GSCN** and input the value from 2 to 26639 using the on-screen keyboard. If you need to search SSB based on ARFCN raster, it would take too long time since ARFCN raster is very narrow. Therefore, it is recommended that you define a SSB searching frequency in wider steps. This is the usage/purpose of GSCN. You can search the frequency corresponding to GSCN in maximum 100 MHz bandwidth of ARFCN that the instrument supports.



NOTE

Based on the GSCN input frequency, the SSB Frequency is automatically changed.

8 Tap **PCI** (**Physical Cell ID**) and select between **LTE PCI** and **NR PCI**.

– Tap to switch **LTE PCI Mode** to **Manual** or **Auto** and input a value from 0 to 503.

The **PCI** switches to **Manual**.

– Tap **NR PCI Mode** to **Manual** or **Auto** and input a value from 0 to 1007.

The **PCI** switches to **Manual**.



NOTE

You can set Auto to let the instrument detect the Physical Cell ID for the LTE/NR signal automatically and Manual to set the specific Physical Cell ID for the LTE/NR signal manually in order to speed up the synchronization with a BTS.

9 Tap **PDSCH**, and then select the PDSCH modulation type option: **Auto**, **QPSK**, **16 QAM**, **64 QAM**, **256 QAM**, **LTE E-TM3.3**, **LTE E-TM3.2**, **LTE E-TM3.1a**, **LTE E-TM3.1**, **LTE E-TM2a**, **LTE E-TM2**, **LTE E-TM1.2** or **LTE E-TM1.1**.

If two or more modulation types are used in a frame, select **Auto**. If the PDSCH uses the same modulation type in a frame or in a subframe, select a specific modulation type to get more accurate EVM.

10 Tap **PDSCH Threshold** to set the threshold for PDSCH and enter a value by using the on-screen keyboard.

11 Tap **PDSCH Precoding** to set **On** or **Off** to enable or disable the PDSCH precoding.

Figure 249 shows an example of OTA ID Scanner measurement.

Figure 249 5G DSS OTA ID Scanner measurement



No	PCI (Grp,Sctr)	RSRP (dBm)	RSRQ (dB)	P-SS SNR (dB)	RS SINR (dB)	S-SS RSSI (dBm)	P-SS RSRP (dBm)	S-SS RSRP (dBm)	S-SS Ec/Io (dB)
1	0 (0,0)	-57.04	-9.85	24.89	23.85	-24.98	-57.07	-57.07	-0.01
2	---	---	---	---	---	---	---	---	---
3	---	---	---	---	---	---	---	---	---
4	---	---	---	---	---	---	---	---	---
5	---	---	---	---	---	---	---	---	---
6	---	---	---	---	---	---	---	---	---

No	PCI (Grp,Sctr)	SSB Index (DM-RS,PBCH)	S-SS RSRP (dBm)	P-SS RSRP (dBm)	P-SS SNR (dB)	S-SS SINR (dB)	S-SS RSRQ (dB)
1	0 (0,0)	2 (2,---)	-57.04	-57.01	33.55	16.99	-10.51
2	---	--- (---,---)	---	---	---	---	---
3	---	--- (---,---)	---	---	---	---	---
4	---	--- (---,---)	---	---	---	---	---
5	---	--- (---,---)	---	---	---	---	---
6	---	--- (---,---)	---	---	---	---	---
7	---	--- (---,---)	---	---	---	---	---
8	---	--- (---,---)	---	---	---	---	---



NOTE

OTA ID Scanner displays LTE signal with RS channel and NR signal with SS channel during its transmission period. You can select signals between RSRQ/ S-SS Ec/Io and RS SINR based on your need by tapping the down arrow button on the graph chart.

OTA multipath profile

The Multipath Profile enables you to determine RF environmental conditions of testing area. It indicates the amount of power of the dominant pilot signal that is dispersed outside the main correlation peak due to multipath echoes that are expressed in dB. This value should be very small ideally.

The Multipath Profile is the result of portions of the original broadcast signal arriving at the receiving antenna out of phase. This can be caused by the signal being reflected off objects such as buildings or being refracted through the atmosphere differently from the main signal.

Setting measure setup

After configuring spectrum measurement in "Configuring spectrum measurements" on page 25, you can set the measure setup to continue your measurement. The measurement settings can be saved and recalled as a file by selecting File Type as Setup and load the file onto the instrument using the **Save/Load** icons on the side bars

To set measure setup

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap to switch **Carrier Auto Search** to **Start** to start searching the SSB frequency and apply it or to **Stop** to stop searching.

NOTE
If searching is unavailable, the instrument displays a pop-up message saying that it fails to detect NR (SSB)
frequency.

3 Tap to switch **Radio Config** and set **Duplex Type** (FDD/TDD), **DSS Type** (Co-channel) and **Technology** (LTE/NR) and other related parameters as below:

You can select Co-channel to find NR frequency based on the LTE operating frequency in co-channel and select Adjacent channel to search both LTE and NR frequency. Note that Adjacent channel will be available in the next release.

- When **LTE** is selected as **Technology**, do the following steps:
  - Select **Bandwidth** (MHz) from the following choices: **20**, **15**, **10**, or **5**.
  - Select **MIMO** between **2x2** and **4x4** to set the number of antenna ports. If the MIMO is set to 2x2, the antenna ports 2 and 3 are disabled.
  - Select **Cyclic Prefix** between **Normal** and **Extended**. Cyclic prefix works as a buffer region or guard interval to protect the OFDM signals from inter symbol interference.
    - **Normal**: Intended to be sufficient for the majority of scenarios
    - **Extended**: Intended for scenarios with particularly high delay spread
  - Select **PHICH Ng** between **Normal** and **Extended** and then to set the number of PHICH groups (Ng): 1/6, 1/2, 1, or 2. The PHICH group value/Ng is decided based on the number of PHICH groups per subframe. PHICH duration is a higher layer parameter configured either as Normal or Extended that says the demodulator how many symbols per subframe are used by PHICH.
    - **Normal**: There are 8 PHICH sequences in one PHICH group (4 symbols).
    - **Extended**: There are 4 PHICH sequences in one PHICH group (2 symbols)
- When **NR** is selected as **Technology**, do the following steps:
  - Select Sub-Carrier Spacing as 15 kHz (Case A). The standard for NR SCS is 15 kHz. The instrument supports 15 kHz of sub-carrier spacing.

4 Tap **LTE RS Window** and select from the options: **2 µs, 4 µs,** or **8 µs**

5 Tap **RS Sync Window** and select between **Default** and **Symmetrical**.

If you select **Symmetrical**, it will show the symmetrical view for the measurement screen.

6 Tap to switch **CFI** to **Manual** or **Auto**.

– **Auto** lets the instrument set the number of OFDM symbols used for transmitting PDCCHs in a subframe.

– **Manual** sets the number of OFDM symbols manually. The set of OFDM symbols that can be used for PDCCH in a subframe is given by 0, 2, 3 or 4 in 1.4 MHz bandwidth and 1, 2 or 3 in other bandwidths.

7 Tap **CFI** and input a value from 1 to 3 as desired using the on-screen keyboard.

8 Tap **SSB frequency** and input the value using the on-screen keyboard.

9 Tap **GSCN** and input the value from 2 to 26639 using the on-screen keyboard. If you need to search SSB based on ARFCN raster, it would take too long time since ARFCN raster is very narrow. Therefore, it is recommended that you define a SSB searching frequency in wider steps. This is the usage/purpose of GSCN. You can search the frequency corresponding to GSCN in maximum 100 MHz bandwidth of ARFCN that the instrument supports.



NOTE

Based on the GSCN input frequency, the SSB Frequency is automatically changed.

10 Tap **PCI** (**Physical Cell ID**) and select between **LTE PCI** and **NR PCI**.

– Tap to switch **LTE PCI Mode** to **Manual** or **Auto** and input a value from 0 to 503.

The **PCI** switches to **Manual**.

– Tap **NR PCI Mode** to **Manual** or **Auto** and input a value from 0 to 1007.

The **PCI** switches to **Manual**.



NOTE

You can set Auto to let the instrument detect the Physical Cell ID for the LTE/NR signal automatically and Manual to set the specific Physical Cell ID for the LTE/NR signal manually in order to speed up the synchronization with a BTS.

11 Tap **PDSCH**, and then select the PDSCH modulation type option: **Auto**, **QPSK**, **16 QAM**, **64 QAM**, **256 QAM**, **LTE E-TM3.3**, **LTE E-TM3.2**, **LTE E-TM3.1a**, **LTE E-TM3.1**, **LTE E-TM2a**, **LTE E-TM2**, **LTE E-TM1.2** or **LTE E-TM1.1**.

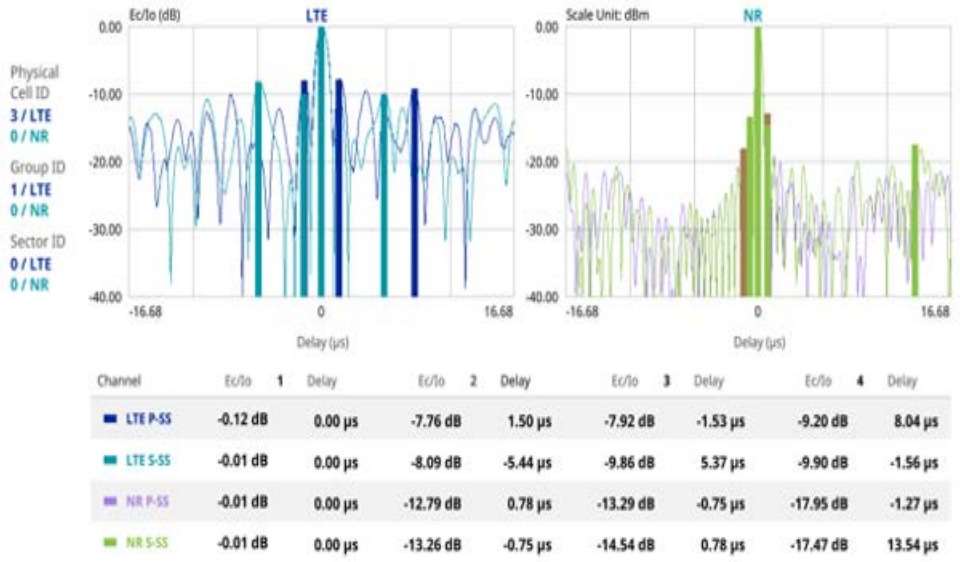
If two or more modulation types are used in a frame, select **Auto**. If the PDSCH uses the same modulation type in a frame or in a subframe, select a specific modulation type to get more accurate EVM.

12 Tap **PDSCH Threshold** to set the threshold for PDSCH and enter a value by using the on-screen keyboard.

13 Tap **PDSCH Precoding** to set **On** or **Off** to enable or disable the PDSCH precoding.

Figure 250 shows an example of OTA multipath profile measurement.

Figure 250 5G DSS OTA multipath profile measurement



OTA Control Channel

DL RS power is the resource element power of Downlink Reference Symbol. The absolute DL RS power is indicated on the BCH. The absolute accuracy is defined as the maximum deviation between the DL RS power indicated on the BCH and the DL RS power at the BS antenna connector.

The OTA Control Channel provides summary of all control channels including RS power trend over time. GPS coordinates (latitude and longitude) will be displayed on the screen if a GPS antenna is connected and locked to the GPS satellites.

Setting measure setup

After configuring spectrum measurement in “Configuring spectrum measurements” on page 25, you can set the measure setup to continue your measurement. The measurement settings can be saved and recalled as a file by selecting File Type as Setup and load the file onto the instrument using the **Save/Load** icons on the side bars

To set measure set up

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap to switch **Carrier Auto Search** to **Start** to start searching the SSB frequency and apply it or to **Stop** to stop searching.

NOTE
If searching is unavailable, the instrument displays a pop-up message saying that it fails to detect NR (SSB)
frequency.

3 Tap to switch **Radio Config** and set **Duplex Type** (FDD/TDD), **DSS Type** (Co-channel), and **Technology** (LTE/NR) and other related parameters as below.

You can select Co-channel to find NR frequency based on the LTE operating frequency in co-channel and select Adjacent channel to search both LTE and NR frequency. Note that Adjacent channel will be available in the next release.

- When **LTE** is selected as **Technology**, do the following steps:
  - Select **Bandwidth** (MHz) from the following choices: **20**, **15**, **10**, or **5**.
  - Select **MIMO** between **2x2** and **4x4** to set the number of antenna ports. If the MIMO is set to 2x2, the antenna ports 2 and 3 are disabled.
  - Select **Cyclic Prefix** between **Normal** and **Extended**. Cyclic prefix works as a buffer region or guard interval to protect the OFDM signals from inter symbol interference.
    - **Normal**: Intended to be sufficient for the majority of scenarios
    - **Extended**: Intended for scenarios with particularly high delay spread
  - Select **PHICH Ng** between **Normal** and **Extended** and then to set the number of PHICH groups (Ng): 1/6, 1/2, 1, or 2. The PHICH group value/Ng is decided based on the number of PHICH groups per subframe. PHICH duration is a higher layer parameter configured either as Normal or Extended that says the demodulator how many symbols per subframe are used by PHICH.
    - **Normal**: There are 8 PHICH sequences in one PHICH group (4 symbols).
    - **Extended**: There are 4 PHICH sequences in one PHICH group (2 symbols)
- When **NR** is selected as **Technology**, do the following steps:
  - Select sub-Carrier Spacing as 15 kHz (Case A). The standard for NR SCS is 15 kHz. The instrument supports 15 kHz of sub-carrier spacing.

4 Tap **Antenna Port** to assign an antenna port number automatically or manually, and select from **Auto**, **Antenna 0**, **Antenna 1**, **Antenna 2**, or **Antenna 3**.

If the MIMO is set to 2x2, the antenna ports 2 and 3 are disabled.

5 Tap to switch **CFI** to **Manual** or **Auto**.

- **Auto** lets the instrument set the number of OFDM symbols used for transmitting PDCCHs in a subframe.
- **Manual** sets the number of OFDM symbols manually.
- The set of OFDM symbols that can be used for PDCCH in a subframe is given by 0, 2, 3 or 4 in 1.4 MHz bandwidth and 1, 2 or 3 in other bandwidths.

6 Tap **CFI** and input a value from 1 to 3 as desired using the on-screen keyboard.

7 Tap **SSB frequency** and input the value using the on-screen keyboard.

8 Tap **GSCN** and input the value from 2 to 26639 using the on-screen keyboard. If you need to search SSB based on ARFCN raster, it would take too long time since ARFCN raster is very narrow. Therefore, it is recommended that you define

a SSB searching frequency in wider steps. This is the usage/purpose of GSCN. You can search the frequency corresponding to GSCN in maximum 100 MHz bandwidth of ARFCN that the instrument supports.



NOTE

Based on the GSCN input frequency, the SSB Frequency is automatically changed.

9 Tap **PCI** (Physical Cell ID) and select between **LTE PCI** and **NR PCI**.

a Tap to switch **LTE PCI Mode** to **Manual** or **Auto** and input a value from 0 to 503.

The **PCI** switches to **Manual**.

b Tap **NR PCI Mode** to **Manual** or **Auto** and input a value from 0 to 1007.

The **PCI** switches to **Manual**.



NOTE

You can set Auto to let the instrument detect the Physical Cell ID for the LTE/NR signal automatically and Manual to set the specific Physical Cell ID for the LTE/NR signal manually in order to speed up the synchronization with a BTS.

10 Tap **PDSCH**, and then select the PDSCH modulation type option: **Auto**, **QPSK**, **16 QAM**, **64 QAM**, **256 QAM**, **LTE E-TM3.3**, **LTE E-TM3.2**, **LTE E-TM3.1a**, **LTE E-TM3.1**, **LTE E-TM2a**, **LTE E-TM2**, **LTE E-TM1.2** or **LTE E-TM1.1**.

If two or more modulation types are used in a frame, select **Auto**. If the PDSCH uses the same modulation type in a frame or in a subframe, select a specific modulation type to get more accurate EVM.

11 Tap **PDSCH Threshold** to set the threshold for PDSCH and enter a value by using the on-screen keyboard.

12 Tap **PDSCH Precoding** to set **On** or **Off** to enable or disable the PDSCH precoding.

13 Tap **Menu** > **Display** and select **EVM** or **Power**.

The screen changes according to the selected options.

14 Tap **Menu** > **Display** and select **Reset** to refresh your measurement screen.

You can check the EVM Peak is changed at the right bottom of the measurement screen when you tap Reset.

To set limit

1 Tap **Menu** > **Limit**.

2 If you want to set the NR limit, tap **NR Limit** and set the limits depending on your selected measurement mode:

To set the limit for	Set
P-SS EVM (Primary Synchronization Signal Error Vector Magnitude)	Test limits On/Off, High Limit using the on-screen keyboard
S-SS EVM (Secondary Synchronization Signal Error Vector Magnitude)	Test limits On/Off, High Limit using the on-screen keyboard

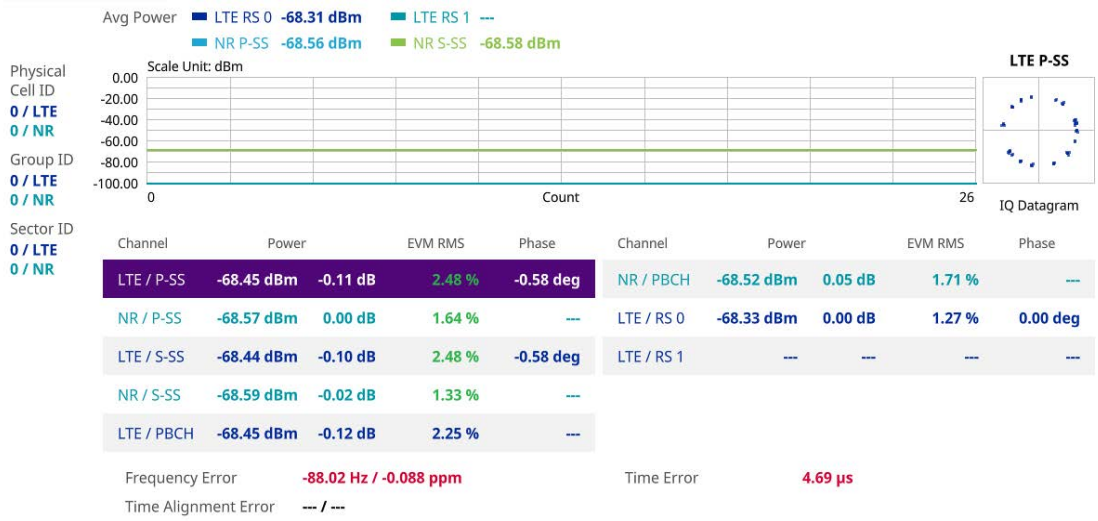
3 Tap **LTE Limit** and set the limits depending on your selected measurement mode:

To set the limit for	Set
RS EVM (Root Mean Square (RMS) average of the reference signal for data error vector magnitude)	Test limits On/Off, High Limit using the on-screen keyboard
P-SS EVM (Primary Synchronization Signal Error Vector Magnitude)	Test limits On/Off, High Limit using the on-screen keyboard
S-SS EVM (Secondary Synchronization Signal Error Vector Magnitude)	Test limits On/Off, High Limit using the on-screen keyboard
Frequency Error	Test limits On/Off, High/Low Limit using the on-screen keyboard
Time Error	Test limits On/Off, High/Low Limit using the on-screen keyboard
Time Alignment Error	Test limits On/Off, High Limit using the on-screen keyboard

4 *Optional.* Tap the **Save** icon on the side bar and select the save option from the choices available for your measurement mode.

Figure 251 shows an example of OTA Control Channel measurement.

Figure 251 5G DSS OTA Control Channel measurement



OTA Route Map

5G route map traces the power level of the strongest beam corresponding to a particular time and geographical position and presents it in a geographical map as a measurement point. All the collected measurements can be exported for post-processing purposes, including data of the eight strongest beams for each measurement point, including its measurement time and geographical location.

Figure 252 shows an example of 5G DSS OTA Route Map measurement.

Figure 252 OTA Route Map with 5G DSS Signal Analyzer



Loading a map

To use any features related to maps, you need to download and install the maps on the instrument. The **VIAVI JDMapCreator** will help you to download maps. Ensure the JDMapCreator application on your computer is connected to the instrument via LAN. You can send a map file with a single layer to the instrument directly by using the **Send**

to EQP menu in JDMapCreator. For information about how to use the JDMapCreator, see the *JDMapCreator 2.0 User Guide*.

To load a map

1. Plug in your USB flash drive that has a map file in .mcfv file type created in JDMapCreator.
2. Tap the **Load** () icon on the side bar.
3. Navigate to the map file that you want to open.

   The **File Information** pane displays the file properties, including its name, size, type, and date modified.
4. Tap the **Load** button on the screen.

Once you have loaded the map, you can also control the map using the following icons on the map.

Table 140 Map control icons

Icon	Description
	Tap to go to your current location on the map. Once tapped, the purple icon appears on the map, indicating your current location.
	Tap to switch to the full screen map view.
	Tap to zoom in the map.
	Tap to zoom out the map.
	Tap and select the area where you want to expand.

The left-most cell-site icon is activated when you import the cell-site information file.

To set measurement setup

NOTE

Before starting the Route Map measurement, you need to set Spectrum measurements displayed on the quick access and display tab. See “Configuring spectrum measurements” on page 25 for more information.

1 If required, connect a GNSS receiver to your instrument for outdoor mapping. Indoor mapping does not necessarily need a GNSS antenna.

2 Tap the Setup ( ) icon on the side bar.

3 Tap **Map Config** to configure the map setting.

   a Tap to switch the **Plot Point** to **GNSS**, **Position**, or **Time**.

   - To collect data/plot points automatically as you move around in a vehicle or outside, select **GNSS**.
   - To collect data/plot points manually in an indoor layout without a GNSS antenna, select **Position**.
   - To collect data/plot points based on time, select **Time**.

   b Tap to switch **Plot Item DSS** to **RSRP**, **RSRQ**, **SINR**, or **SNR**.

   c Tap to switch the **Screen Mode** between **Map** and **Full**.

   - With the **Map** setting, you can view only the collected points that can be seen within the boundary of the loaded map.
   - With the **Full** setting, you can view all the collected points of the route without the loaded map

4 Tap to switch **Carrier Auto Search** to **Start** to start searching the SSB frequency and apply it or to **Stop** to stop searching.

NOTE

If searching is unavailable, the instrument displays a pop-up message saying that it fails to detect NR (SSB)

frequency.

5 Tap to switch **Radio Config** and set **Duplex Type** (FDD/TDD), **DSS Type** (Co-channel), and **Technology** (LTE/NR) and other related parameters as below.

You can select Co-channel to find NR frequency based on the LTE operating frequency in co-channel and select Adjacent channel to search both LTE and NR frequency. Note that Adjacent channel will be available in the next release.

- When **LTE** is selected as **Technology**, do the following steps:
  - Select **Bandwidth** (MHz) from the following choices: **20**, **15**, **10**, or **5**.
  - Select **MIMO** between **2x2** and **4x4** to set the number of antenna ports. If the MIMO is set to 2x2, the antenna ports 2 and 3 are disabled.
  - Select **Cyclic Prefix** between **Normal** and **Extended**. Cyclic prefix works as a buffer region or guard interval to protect the OFDM signals from inter symbol interference.
    - **Normal**: Intended to be sufficient for the majority of scenarios
    - **Extended**: Intended for scenarios with particularly high delay spread
  - Select **PHICH Ng** between **Normal** and **Extended** and then to set the number of PHICH groups (Ng): 1/6, 1/2, 1, or 2. The PHICH group value/Ng is decided based on the number of PHICH groups per subframe. PHICH duration is a higher layer parameter configured either as Normal or Extended that says the demodulator how many symbols per subframe are used by PHICH.
    - **Normal**: There are 8 PHICH sequences in one PHICH group (4 symbols).
    - **Extended**: There are 4 PHICH sequences in one PHICH group (2 symbols)
- When **NR** is selected as **Technology**, do the following steps:
  - Select sub-Carrier Spacing as 15 kHz (Case A). The standard for NR SCS is 15 kHz. The instrument supports 15 kHz of sub-carrier spacing.

6 Tap to switch **CFI** to **Manual** or **Auto**.

- **Auto** lets the instrument set the number of OFDM symbols used for transmitting PDCCHs in a subframe.
- **Manual** sets the number of OFDM symbols manually. The set of OFDM symbols that can be used for PDCCH in a subframe is given by 0, 2, 3 or 4 in 1.4 MHz bandwidth and 1, 2 or 3 in other bandwidths.

7 Tap **CFI** and input a value from 1 to 3 as desired using the on-screen keyboard.

8 Tap **SSB frequency** and input the value using the on-screen keyboard.

9 Tap **GSCN** and input the value from 2 to 26639 using the on-screen keyboard. If you need to search SSB based on ARFCN raster, it would take too long time since ARFCN raster is very narrow. Therefore, it is recommended that you define a SSB searching frequency in wider steps. This is the usage/purpose of GSCN. You can search the frequency corresponding to GSCN in maximum 100 MHz bandwidth of ARFCN that instrument supports.



NOTE

Based on the GSCN input frequency, the SSB Frequency is automatically changed.

10 Tap **PCI** (Physical Cell ID) and select between **LTE PCI** and **NR PCI**.

a Tap to switch **LTE PCI Mode** to **Manual** or **Auto** and input a value from 0 to 503.

The **PCI** switches to **Manual**.

b Tap **NR PCI Mode** to **Manual** or **Auto** and input a value from 0 to 1007.

The **PCI** switches to **Manual**.



NOTE

You can set Auto to let the instrument detect the Physical Cell ID for the LTE/NR signal automatically and Manual to set the specific Physical Cell ID for the LTE/NR signal manually in order to speed up the synchronization with a BTS.

11 Tap **PDSCH**, and then select the PDSCH modulation type option: **Auto**, **QPSK**, **16 QAM**, **64 QAM**, **256 QAM**, **LTE E-TM3.3**, **LTE E-TM3.2**, **LTE E-TM3.1a**, **LTE E-TM3.1**, **LTE E-TM2a**, **LTE E-TM2**, **LTE E-TM1.2** or **LTE E-TM1.1**.

If two or more modulation types are used in a frame, select **Auto**. If the PDSCH uses the same modulation type in a frame or in a subframe, select a specific modulation type to get more accurate EVM.

12 Tap **PDSCH Threshold** to set the threshold for PDSCH and enter a value by using the on-screen keyboard.

13 Tap **PDSCH Precoding** to set **On** or **Off** to enable or disable the PDSCH precoding.



NOTE

The instrument does not automatically save the collected data. It is recommended that you save the result. Otherwise, you will lose all the collected data.

To set limit

You can set the thresholds for the two different color indicators, red and blue. The maximum value is the Limit for **Excellent**, and the minimum value is the Limit for **Poor**. See below to check the plot point color based on the Legend Color Table.

1 Tap the rectangle with value before color legend bar on the right panel.

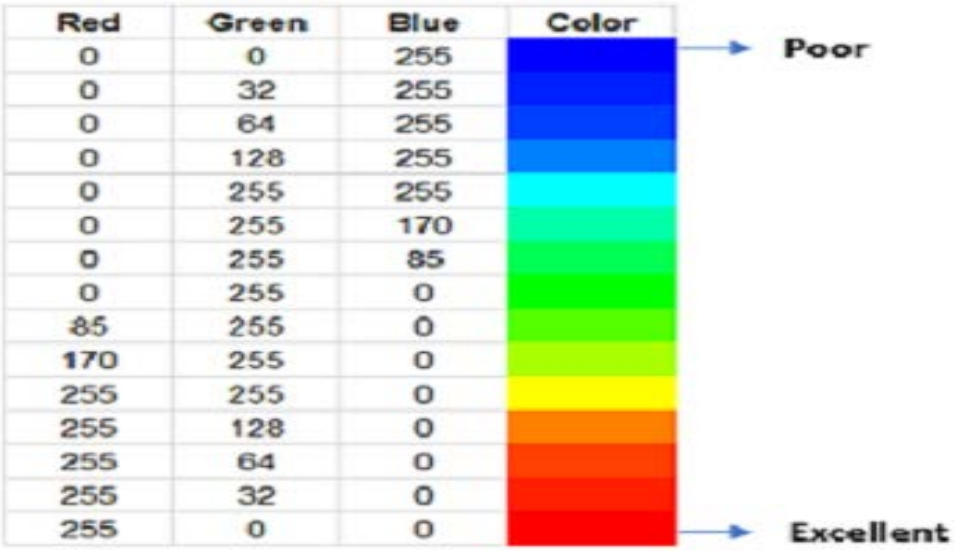
2 Set a value for **Poor** (minimum value) using the on-screen keyboard.

3 Tap the rectangle with value after color legend bar on the right panel.

4 Set a value for **Excellent** (maximum value) using the on-screen keyboard.

Figure 253 shows a legend color table.

Figure 253 Legend color table



Logging data

To use any features related to maps, you need to download and install the maps on the instrument. The VIAVI JDMapCreator will help you download maps. Make sure the JDMapCreator application on your computer is connected to the instrument via LAN. You can send a map file with a single layer to the instrument directly by using the Send to EQP menu in JDMapCreator. For more information on how to use the JDMapCreator, see the *JDMapCreator 2.0 User Guide*.

To log data

1. Follow **steps 1 to 3** in Setting measure setup.
2. Tap the **Testing** ( ) button on the right panel of the map to start plotting on the map. When you select a point on the map, a marker appears and the Information window appears on the right panel.
3. Tap the **Stop** ( ) button to stop plotting.
4. Tap the **Pause** button ( ) to pause plotting, then the GNSS point cannot be plotted.
5. If you start test and select **Setup** > **Map Config** > **Plot Point** > **Position**, you can undo by tapping the **Testing** button.
6. If you select the **Stop** button, the Plot Stop pop-up window appears, then tap **Yes**.
7. Tap **Yes** when the Save pop-up window appears and save the logging file to your USB.

Viewing the logging data

To view the logging data

1. Load the saved logging file using the **Load** () icon on the side bar. Make sure the file extension is .gomv.
2. If the **PCI** is set to **Auto**, the point on the map appears with a color representing the largest **S-SS-RSRP** value. When you select a point on the map, a marker appears and the Information window appears on the right panel.
3. Set the **PCI** to **Manual** and tap the **Select** button.

   The Select PCI window appears.
4. Select PCI on the left and then the corresponding Beam Index appeared on the right.
5. Tap the **Apply** button.

   The point color of the map changes to the corresponding SS-RSRP value, and if there is no detected Beam Index, the point will be hidden.

Importing cellsite DB

You can import the site DB by creating the 5G site information form.

To import cellsite DB

1. Create the 5G site information with an excel file as below.
2. Input the two mandatory fields: **Lat (DecDeg)** and **Long (DecDeg)**.
3. Input the **Azimuth** field if you want to check the direction of antenna.
4. Make sure to save the file as (Comma delimited) (*.csv).
5. Copy the file to the USB memory stick and insert it to the **USB A** or **USB B** port of the instrument.
6. Tap the **Load** () icon on the side bar.
7. Import the saved file.

   Once the file is loaded, the following cellsite information appears with an icon.

Figure 254 shows an example of an importing cellsite DB.

Figure 254 Importing Cellsite DB

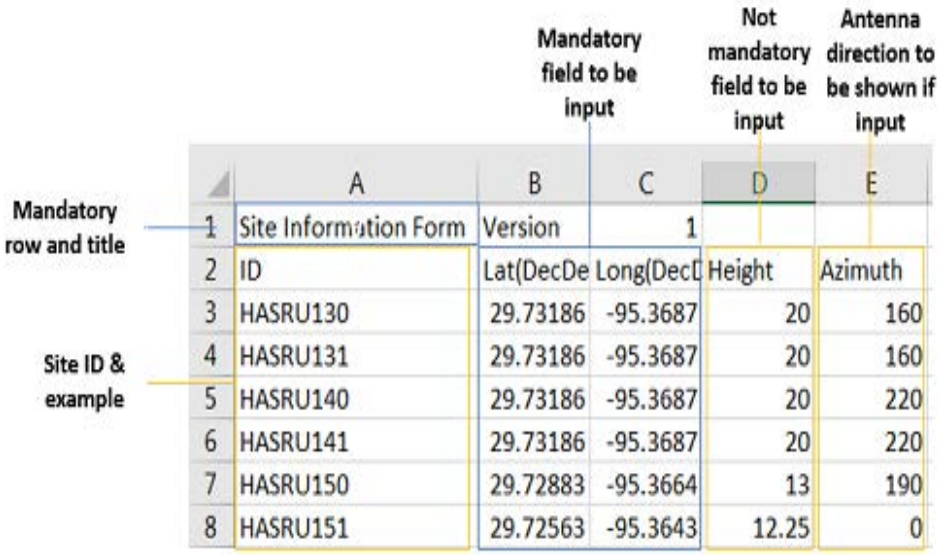
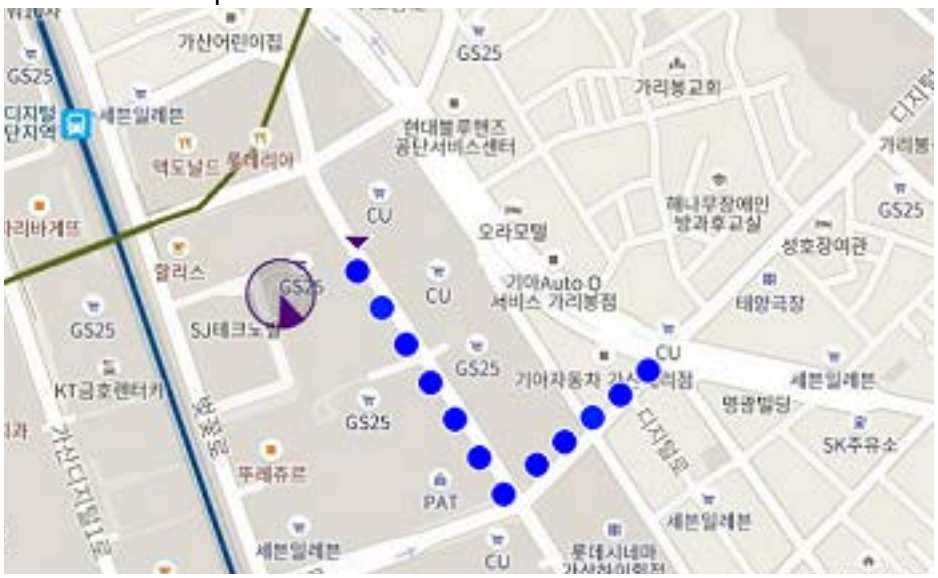


Figure 255 Route map measurement with site information screen



NOTE

If the Plot Point is set to Position, you can tap the estimated area by point. If you tap incorrectly, you can tap Undo icon on the map, and then it will delete the point you have tapped incorrectly.

Freq/Time/Power Variation

Frequency, time, and power variation shows the frequency, time, and power error trend based on the time elapsed.

Setting measure setup

After configuring the spectrum measurement in "Configuring spectrum measurements" on page 25, you can set the measure setup to continue your measurement. The measurement settings can be saved and recalled as a file by selecting File Type as Setup and load the file onto the instrument using the **Save/Load** icons on the side bar.

To set measure set up

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap to switch **Carrier Auto Search** to **Start** to start searching the SSB frequency and apply it or to **Stop** to stop searching.

NOTE
If searching is unavailable, the instrument displays a pop-up message saying that it fails to detect NR (SSB)
frequency.

3 Tap to switch **Radio Config** and set **Duplex Type** (FDD/TDD), **DSS Type** (Co-channel), and **Technology** (LTE/NR) and other related parameters as below.

You can select Co-channel to find NR frequency based on the LTE operating frequency in co-channel and select Adjacent channel to search both LTE and NR frequency. Note that Adjacent channel will be available in the next release.

- When **LTE** is selected as **Technology**, do the following steps:
  - Select **Bandwidth** (MHz) from the following choices: **20**, **15**, **10**, or **5**.
  - Select **MIMO** between **2x2** and **4x4** to set the number of antenna ports. If the MIMO is set to 2x2, the antenna ports 2 and 3 are disabled.
  - Select **Cyclic Prefix** between **Normal** and **Extended**. Cyclic prefix works as a buffer region or guard interval to protect the OFDM signals from inter symbol interference.
    - **Normal**: Intended to be sufficient for the majority of scenarios
    - **Extended**: Intended for scenarios with particularly high delay spread
  - Select **PHICH Ng** between **Normal** and **Extended** and then to set the number of PHICH groups (Ng): 1/6, 1/2, 1, or 2. The PHICH group value/Ng is decided based on the number of PHICH groups per subframe. PHICH duration is a higher layer parameter configured either as Normal or Extended that says the demodulator how many symbols per subframe are used by PHICH.
    - **Normal**: There are 8 PHICH sequences in one PHICH group (4 symbols).
    - **Extended**: There are 4 PHICH sequences in one PHICH group (2 symbols)
- When **NR** is selected as **Technology**, do the following steps:
  - Select sub-Carrier Spacing as 15 kHz (Case A). The standard for NR SCS is 15 kHz. The instrument supports 15 kHz of sub-carrier spacing.

4 Tap **Antenna Port** to assign an antenna port number automatically or manually, and select from **Auto**, **Antenna 0**, **Antenna 1**, **Antenna 2**, or **Antenna 3**.

If the MIMO is set to 2x2, the antenna ports 2 and 3 are disabled.

5 Tap to switch **CFI** to **Manual** or **Auto**.

- **Auto** lets the instrument set the number of OFDM symbols used for transmitting PDCCHs in a subframe.
- **Manual** sets the number of OFDM symbols manually.
- The set of OFDM symbols that can be used for PDCCH in a subframe is given by 0, 2, 3 or 4 in 1.4 MHz bandwidth and 1, 2 or 3 in other bandwidths.

6 Tap **CFI** and input a value from 1 to 3 as desired using the on-screen keyboard.

7 Tap **SSB frequency** and input the value using the on-screen keyboard.

8 Tap **GSCN** and input the value from 2 to 26639 using the on-screen keyboard. If you need to search SSB based on ARFCN raster, it would take too long time since ARFCN raster is very narrow. Therefore, it is recommended that you define a SSB searching frequency in wider steps. This is the usage/purpose of GSCN. You can search the frequency corresponding to GSCN in maximum 100 MHz bandwidth of ARFCN that the instrument supports.



NOTE

Based on the GSCN input frequency, the SSB Frequency is automatically changed.

9 Tap **PCI** (Physical Cell ID) and select between **LTE PCI** and **NR PCI**.

a Tap to switch **LTE PCI Mode** to **Manual** or **Auto** and input a value from 0 to 503.

The **PCI** switches to **Manual**.

b Tap **NR PCI Mode** to **Manual** or **Auto** and input a value from 0 to 1007.

The **PCI** switches to **Manual**.



NOTE

You can set Auto to let the instrument detect the Physical Cell ID for the LTE/NR signal automatically and Manual to set the specific Physical Cell ID for the LTE/NR signal manually in order to speed up the synchronization with a BTS.

10 Tap **PDSCH**, and then select the PDSCH modulation type option: **Auto**, **QPSK**, **16 QAM**, **64 QAM**, **256 QAM**, **LTE E-TM3.3**, **LTE E-TM3.2**, **LTE E-TM3.1a**, **LTE E-TM3.1**, **LTE E-TM2a**, **LTE E-TM2**, **LTE E-TM1.2** or **LTE E-TM1.1**.

If two or more modulation types are used in a frame, select **Auto**. If the PDSCH uses the same modulation type in a frame or in a subframe, select a specific modulation type to get more accurate EVM.

11 Tap **PDSCH Threshold** to set the threshold for PDSCH and enter a value by using the on-screen keyboard.

12 Tap **PDSCH Precoding** to set **On** or **Off** to enable or disable the PDSCH precoding.

13 Tap **Menu** > **Display** and select Reset to refresh your measurement.

NOTE

If you want to set the reference level and scale, tap Menu > Amp/Scale > Reference. You can set Reference Freq Error Offset, Scale Division (Freq Error), Reference Time Error Offset, Scale Division (Time Error), Reference Level, and Scale Division (Power) on demand using the on-screen keyboard. You can also select the unit on the keyboard.

Figure 256 shows an example of 5G DSS Freq/Time/Power Variation by frequency/time.

Figure 256 5G DSS Freq/Time/Power Variation by Frequency/Time



NOTE

You can tap the Distance box and input the value that you want to compensate for distance. When distance is entered, the time will show the value with distance correction. Make sure the default value for Distance is 0.

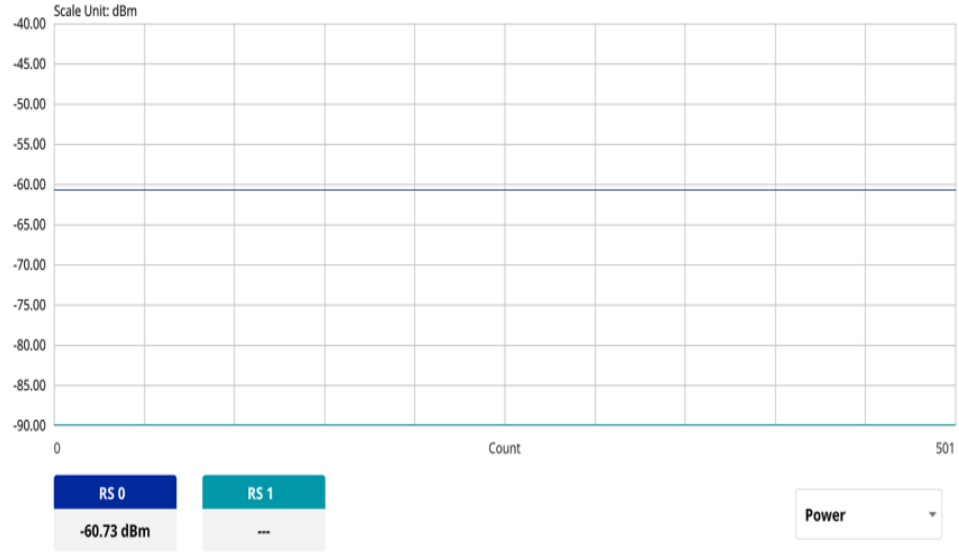
You can see the selected trace being plotted on the chart based on the selection from drop-down menu: Frequency, Time, Frequency/Time, or Power.

NOTE

When you select the Frequency/Time trace to be plotted, the Limit toggle icon will appear in the middle of the measurement screen. Once the Limit menu is turned on, the limit line will be displayed based on your selection of either Frequency or Time.

Figure 257 shows an example of 5G DSS Freq/Time/Power Variation by power.

Figure 257 5G DSS Freq/Time/Power Variation by power



Power vs Time (Frame)

The Power vs. Time (Frame) measures the modulation envelope in the time domain, showing the power of each time slot in a DSS signal.

Setting measure setup

After configuring the spectrum measurement in "Configuring spectrum measurements" on page 25, you can set the measure setup to continue your measurement. The measurement settings can be saved and recalled as a file by selecting File Type as Setup and load the file onto the instrument using the **Save/Load** icons on the side bar.

To set measure setup

1. Tap the **Setup** ( ) icon in the side bar.
2. Tap **Bandwidth** from the following choices: **5 MHz**, **10 MHz**, **15 MHz**, or **20 MHz**.
3. Tap to switch **Duplex/Duplex Type** to **TDD** or **FDD**.
4. Tap **Subframe Number** from 0 to 9.
5. Tap to switch PCI (Physical Cell ID) to **Manual** or **Auto**.
   - **Auto** lets the instrument detect the Physical Cell ID for the DSS signal automatically.
   - **Manual** sets the specific Physical Cell ID for the DSS signal manually in order to speed up the synchronization with a BTS.
6. Tap **PCI** and input a value from 0 to 503 using the on-screen keyboard.

   The **PCI** switches to **Manual**.
7. Tap **Antenna Port** to assign an antenna port number automatically or manually, and select from **Auto**, **Antenna 0**, **Antenna 1**, **Antenna 2**, or **Antenna 3**.

If the MIMO is set to 2x2, the antenna ports 2 and 3 are disabled.

8 Select **MIMO** between **2x2** and **4x4** to set the number of antenna ports.

9 Select **Cyclic Prefix** between **Normal** and **Extended**.

Cyclic prefix works as a buffer region or guard interval to protect the OFDM signals from inter symbol interference.

- **Normal**: Intended to be sufficient for the majority of scenarios
- **Extended**: Intended for scenarios with particularly high delay spread

To set the limit

1 Tap **Menu > Limit**.

2 Tap the test items and set the limits depending on your selected measurement mode:

To set the limit for	Set
Subframe Power	Test limits On/Off, High Limit/Low Limit using the on-screen keyboard
Frame Average Power	Test limits On/Off, High Limit/Low Limit using the on-screen keyboard
Time Error	Test limits On/Off, High Limit/Low Limit using the on-screen keyboard
IQ Origin Offset	Test limits On/Off, High Limit using the on-screen keyboard

3 *Optional.* Tap the **Save** icon on the side bar and select the save option from the choices available for your measurement mode.

Figure 258 shows an example of Power vs Time (Frame) measurement.

Figure 258 5G DSS Power vs Time (Frame) measurement



Power vs Time (Slot)

The Power vs. Time (Slot) measures the modulation envelope in the time domain, showing the power of each time slot in a DSS signal.

NOTE

In this measurement, desirable level of the input power is lower than -10 dBm. If the input power to be measured is -10 dBm or higher, it is highly recommended that you use an external attenuator.

Setting measure setup

After configuring the spectrum measurement in "Configuring spectrum measurements" on page 25, you can set the measure setup to continue your measurement. The measurement settings can be saved and recalled as a file by selecting File Type as Setup and load the file onto the instrument using the **Save/Load** icons on the side bar.

To set measure setup

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap **Bandwidth** from the following choices: **5 MHz**, **10 MHz**, **15 MHz**, or **20 MHz**.

3 Tap to switch **Duplex/Duplex Type** to **TDD** or **FDD**.

4 Tap **Subframe Number** from 0 to 9.

5 Tap to switch PCI (Physical Cell ID) to **Manual** or **Auto**.

- **Auto** lets the instrument detect the Physical Cell ID for the DSS signal automatically.
- **Manual** sets the specific Physical Cell ID for the DSS signal manually in order to speed up the synchronization with a BTS.

6 Tap **PCI** and input a value from 0 to 503 using the on-screen keyboard.

The **PCI** switches to **Manual**.

7 Tap **Antenna Port** to assign an antenna port number automatically or manually, and select from **Auto**, **Antenna 0**, **Antenna 1**, **Antenna 2**, or **Antenna 3**.

If the MIMO is set to 2x2, the antenna ports 2 and 3 are disabled.

8 Select **MIMO** between **2x2** and **4x4** to set the number of antenna ports.

9 Select **Cyclic Prefix** between **Normal** and **Extended**.

Cyclic prefix works as a buffer region or guard interval to protect the OFDM signals from inter symbol interference.

- **Normal**: Intended to be sufficient for the majority of scenarios
- **Extended**: Intended for scenarios with particularly high delay spread

To set the limit

1 Tap **Menu > Limit**.

2 Tap the test items and set the limits depending on your selected measurement mode:

To set the limit for	Set
Slot Average Power	Test limits On/Off, High Limit/Low Limit using the on-screen keyboard
Off Power	Test limits On/Off, High Limit/Low Limit using the on-screen keyboard
Transition Period	Test limits On/Off, High Limit/Low Limit using the on-screen keyboard

3 *Optional.* Tap the **Save** icon on the side bar and select the save option from the choices available for your measurement mode.

Figure 259 shows an example of Power vs Time (Slot) measurement.

Figure 259 5G DSS Power vs Time (Slot) measurement



NOTE

You can set the number of slot from 0 to 19 by tapping the Slot No. box using the on-screen keyboard.

Signal analysis

The following sections describe how to conduct signal analysis.

Constellation

The Constellation is used to observe some aspects of modulation accuracy and can reveal certain fault mechanisms such as I/Q amplitude imbalance or quadrature imbalance. It displays constellation diagram by modulation types.

Setting measure setup

After configuring spectrum measurement in "Configuring spectrum measurements" on page 25, you can set the measure setup to continue your measurement. The measurement settings can be saved and recalled as a file by selecting File Type as Setup and load the file onto the instrument using the **Save/Load** icons on the side bars.

To set measure setup

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap to switch **Carrier Auto Search** to **Start** to start searching the SSB frequency and apply it or to **Stop** to stop searching.

NOTE
If searching is unavailable, the instrument displays a pop-up message saying that it fails to detect NR (SSB)
frequency.

3 Tap to switch **Radio Config** and set **Duplex Type** (FDD/TDD), **DSS Type** (Co-channel) and **Technology** (LTE/NR) and other related parameters as below:

You can select Co-channel to find NR frequency based on the LTE operating frequency in co-channel and select Adjacent channel to search both LTE and NR frequency. Note that Adjacent channel will be available in the next release.

- When **LTE** is selected as **Technology**, do the following steps:
  - Select **Bandwidth** (MHz) from the following choices: **20**, **15**, **10**, or **5**.
  - Select **MIMO** between **2x2** and **4x4** to set the number of antenna ports. If the MIMO is set to 2x2, the antenna ports 2 and 3 are disabled.
  - Select **Cyclic Prefix** between **Normal** and **Extended**. Cyclic prefix works as a buffer region or guard interval to protect the OFDM signals from inter symbol interference.
    - **Normal**: Intended to be sufficient for the majority of scenarios
    - **Extended**: Intended for scenarios with particularly high delay spread
  - Select **PHICH Ng** between **Normal** and **Extended** and then to set the number of PHICH groups (Ng): 1/6, 1/2, 1, or 2. The PHICH group value/Ng is decided based on the number of PHICH groups per subframe. PHICH

duration is a higher layer parameter configured either as Normal or Extended that says the demodulator how many symbols per subframe are used by PHICH.

- **Normal**: There are 8 PHICH sequences in one PHICH group (4 symbols).
- **Extended**: There are 4 PHICH sequences in one PHICH group (2 symbols)

- When **NR** is selected as **Technology**, do the following steps:
  – Select Sub-Carrier Spacing as 15 kHz (Case A). The standard for NR SCS is 15 kHz. The instrument supports 15 kHz of sub-carrier spacing.

4 Tap **Subframe Number** from 0 to 9.

5 Tap **Antenna Port** to assign an antenna port number automatically or manually, and select from **Auto**, **Antenna 0**, or **Antenna1**.

If the MIMO is set to 2x2, the antenna ports 2 and 3 are disabled.

6 Tap to switch **CFI** to **Manual** or **Auto**.

– **Auto** lets the instrument set the number of OFDM symbols used for transmitting PDCCHs in a subframe.

– **Manual** sets the number of OFDM symbols manually. The set of OFDM symbols that can be used for PDCCH in a subframe is given by 0, 2, 3 or 4 in 1.4 MHz bandwidth and 1, 2 or 3 in other bandwidths.

7 Tap **CFI** and input a value from 1 to 3 as desired using the on-screen keyboard.

8 Tap **SSB frequency** and input the value using the on-screen keyboard.

9 Tap **GSCN** and input the value from 2 to 26639 using the on-screen keyboard. If you need to search SSB based on ARFCN raster, it would take too long time since ARFCN raster is very narrow. Therefore, it is recommended that you define a SSB searching frequency in wider steps. This is the usage/purpose of GSCN. You can search the frequency corresponding to GSCN in maximum 100 MHz bandwidth of ARFCN that the instrument supports.



NOTE

Based on the GSCN input frequency, the SSB Frequency is automatically changed.

10 Tap **PCI** (**Physical Cell ID**) and select between **LTE PCI** and **NR PCI**.

– Tap to switch **LTE PCI Mode** to **Manual** or **Auto** and input a value from 0 to 503.

The **PCI** switches to **Manual**.

– Tap **NR PCI Mode** to **Manual** or **Auto** and input a value from 0 to 1007.

The **PCI** switches to **Manual**.



NOTE

You can set Auto to let the instrument detect the Physical Cell ID for the LTE/NR signal automatically and Manual to set the specific Physical Cell ID for the LTE/NR signal manually in order to speed up the synchronization with a BTS.

11 Tap **PDSCH**, and then select the PDSCH modulation type option: **Auto**, **QPSK**, **16 QAM**, **64 QAM**, **256 QAM**, **LTE E-TM3.3**, **LTE E-TM3.2**, **LTE E-TM3.1a**, **LTE E-TM3.1**, **LTE E-TM2a**, **LTE E-TM2**, **LTE E-TM1.2** or **LTE E-TM1.1**.

If two or more modulation types are used in a frame, select **Auto**. If the PDSCH uses the same modulation type in a frame or in a subframe, select a specific modulation type to get more accurate EVM.

12 Tap **PDSCH Threshold** to set the threshold for PDSCH and enter a value by using the on-screen keyboard.

13 Tap **PDSCH Precoding** to set **On** or **Off** to enable or disable the PDSCH precoding.

14 Tap **Menu** > **Display** and select **Reset** to refresh your measurement screen.

To set the limit

1 Tap **Menu > Limit**.

2 Tap **NR Limit** and set the limits depending on your selected measurement mode:

To set the limit for	Set
Frequency error	Test limits On/Off, High/Low Limit
PDSCH EVM	Test limits On/Off, High Limit for QPSK, 16 QAM, 64 QAM, or 256 QAM
Data EVM RMS	Test limits On/Off, High Limit
Data EVM Peak	Test limits On/Off, High Limit for QPSK, 16 QAM, 64 QAM, or 256 QAM
Time Error	Test limits On/Off, High/Low Limit

3 **LTE Limit** and set the limits depending on your selected measurement mode:

To set the limit for	Set
Frequency error	Test limits On/Off, High/Low Limit
PDSCH EVM	Test limits On/Off, High Limit for QPSK, 16 QAM, 64 QAM, or 256 QAM
Data EVM RMS	Test limits On/Off, High Limit
Data EVM Peak	Test limits On/Off, High Limit for QPSK, 16 QAM, 64 QAM, or 256 QAM
DL RS power	Test limits On/Off, High/Low Limit
Time Error	Test limits On/Off, High/Low Limit

4 *Optional.* Tap the **Save** icon on the side bar and select the save option from the choices available for your measurement mode.

Figure 260 shows an example of DSS constellation measurement.

Figure 260 5G DSS constellation measurement



Channel mapper

The DSS Channel mapper displays NR and LTE signal location based on sub carrier and symbol spacing with different colors within the resource block.

Setting measure setup

After configuring spectrum measurement in “Configuring spectrum measurements” on page 25, you can set the measure setup to continue your measurement. The measurement settings can be saved and recalled as a file by selecting File Type as Setup and load the file onto the instrument using the **Save/Load** icons on the side bars.

To set measure setup

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap to switch **Carrier Auto Search** to **Start** to start searching the SSB frequency and apply it or to **Stop** to stop searching.

NOTE
If searching is unavailable, the instrument displays a pop-up message saying that it fails to detect NR (SSB)
frequency.

3 Tap to switch **Radio Config** and set **Duplex Type** (FDD/TDD), **DSS Type** (Co-channel) and **Technology** (LTE/NR) and other related parameters as below:

You can select Co-channel to find NR frequency based on the LTE operating frequency in co-channel and select Adjacent channel to search both LTE and NR frequency. Note that Adjacent channel will be available in the next release.

- When **LTE** is selected as **Technology**, do the following steps:
  - Select **Bandwidth** (MHz) from the following choices: **20**, **15**, **10**, or **5**.
  - Select **MIMO** between **2x2** and **4x4** to set the number of antenna ports. If the MIMO is set to 2x2, the antenna ports 2 and 3 are disabled.
  - Select **Cyclic Prefix** between **Normal** and **Extended**. Cyclic prefix works as a buffer region or guard interval to protect the OFDM signals from inter symbol interference.
    - **Normal**: Intended to be sufficient for the majority of scenarios
    - **Extended**: Intended for scenarios with particularly high delay spread
  - Select **PHICH Ng** between **Normal** and **Extended** and then to set the number of PHICH groups (Ng): 1/6, 1/2, 1, or 2. The PHICH group value/Ng is decided based on the number of PHICH groups per subframe. PHICH duration is a higher layer parameter configured either as Normal or Extended that says the demodulator how many symbols per subframe are used by PHICH.
    - **Normal**: There are 8 PHICH sequences in one PHICH group (4 symbols).
    - **Extended**: There are 4 PHICH sequences in one PHICH group (2 symbols)
- When **NR** is selected as **Technology**, do the following steps:
  - Select Sub-Carrier Spacing as 15 kHz (Case A). The standard for NR SCS is 15 kHz. The instrument supports 15 kHz of sub-carrier spacing.

4 Tap **Antenna Port** to assign an antenna port number automatically or manually, and select from **Auto**, **Antenna 0**, or **Antenna1**.

If the MIMO is set to 2x2, the antenna ports 2 and 3 are disabled.

5 Tap to switch **CFI** to **Manual** or **Auto**.

- **Auto** lets the instrument set the number of OFDM symbols used for transmitting PDCCHs in a subframe.
- **Manual** sets the number of OFDM symbols manually. The set of OFDM symbols that can be used for PDCCH in a subframe is given by 0, 2, 3 or 4 in 1.4 MHz bandwidth and 1, 2 or 3 in other bandwidths.

6 Tap **CFI** and input a value from 1 to 3 as desired using the on-screen keyboard.

7 Tap **SSB frequency** and input the value using the on-screen keyboard.

8 Tap **GSCN** and input the value from 2 to 26639 using the on-screen keyboard. If you need to search SSB based on ARFCN raster, it would take too long time since ARFCN raster is very narrow. Therefore, it is recommended that you define a SSB searching frequency in wider steps. This is the usage/purpose of GSCN. You can search the frequency corresponding to GSCN in maximum 100 MHz bandwidth of ARFCN that the instrument supports.



NOTE

Based on the GSCN input frequency, the SSB Frequency is automatically changed.

9 Tap **PCI** (**Physical Cell ID**) and select between **LTE PCI** and **NR PCI**.

– Tap to switch **LTE PCI Mode** to **Manual** or **Auto** and input a value from 0 to 503.

The **PCI** switches to **Manual**.

– Tap **NR PCI Mode** to **Manual** or **Auto** and input a value from 0 to 1007.

The **PCI** switches to **Manual**.

NOTE
You can set Auto to let the instrument detect the Physical Cell ID for the LTE/NR signal automatically and Manual to set the specific Physical Cell ID for the LTE/NR signal manually in order to speed up the synchronization with a BTS.

10 Tap **PDSCH**, and then select the PDSCH modulation type option: **Auto**, **QPSK**, **16 QAM**, **64 QAM**, **256 QAM**, **LTE E-TM3.3**, **LTE E-TM3.2**, **LTE E-TM3.1a**, **LTE E-TM3.1**, **LTE E-TM2a**, **LTE E-TM2**, **LTE E-TM1.2** or **LTE E-TM1.1**.

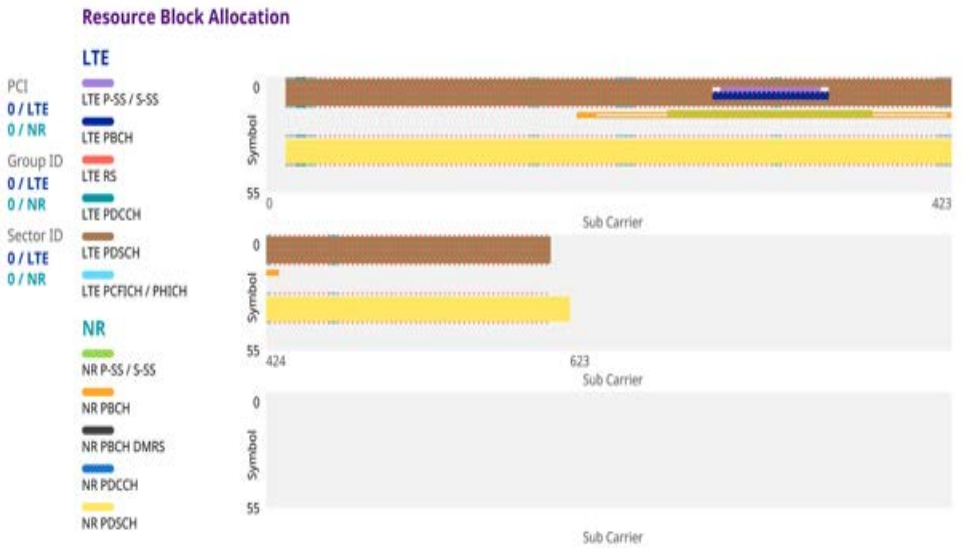
If two or more modulation types are used in a frame, select **Auto**. If the PDSCH uses the same modulation type in a frame or in a subframe, select a specific modulation type to get more accurate EVM.

11 Tap **PDSCH Threshold** to set the threshold for PDSCH and enter a value by using the on-screen keyboard.

12 Tap **PDSCH Precoding** to set **On** or **Off** to enable or disable the PDSCH precoding.

Figure 261 shows an example of DSS channel mapper measurement.

Figure 261 5G DSS channel mapper measurement



Control channel

The Control Channel measures the constellation for the specified control channel as well as modulation accuracy of the control channel at the specified subframe.

Setting measure setup

After configuring spectrum measurement in "Configuring spectrum measurements" on page 25, you can set the measure setup to continue your measurement. The measurement settings can be saved and recalled as a file by selecting File Type as Setup and load the file onto the instrument using the **Save/Load** icons on the side bars.

To set measure setup

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap to switch **Carrier Auto Search** to **Start** to start searching the SSB frequency and apply it or to **Stop** to stop searching.

NOTE
If searching is unavailable, the instrument displays a pop-up message saying that it fails to detect NR (SSB)
frequency.

3 Tap to switch **Radio Config** and set **Duplex Type** (FDD/TDD), **DSS Type** (Co-channel) and **Technology** (LTE/NR) and other related parameters as below:

You can select Co-channel to find NR frequency based on the LTE operating frequency in co-channel and select Adjacent channel to search both LTE and NR frequency. Note that Adjacent channel will be available in the next release.

- When **LTE** is selected as **Technology**, do the following steps:
  - Select **Bandwidth** (MHz) from the following choices: **20**, **15**, **10**, or **5**.
  - Select **MIMO** between **2x2** and **4x4** to set the number of antenna ports. If the MIMO is set to 2x2, the antenna ports 2 and 3 are disabled.
  - Select **Cyclic Prefix** between **Normal** and **Extended**. Cyclic prefix works as a buffer region or guard interval to protect the OFDM signals from inter symbol interference.
    - **Normal**: Intended to be sufficient for the majority of scenarios
    - **Extended**: Intended for scenarios with particularly high delay spread
  - Select **PHICH Ng** between **Normal** and **Extended** and then to set the number of PHICH groups (Ng): 1/6, 1/2, 1, or 2. The PHICH group value/Ng is decided based on the number of PHICH groups per subframe. PHICH duration is a higher layer parameter configured either as Normal or Extended that says the demodulator how many symbols per subframe are used by PHICH.
    - **Normal**: There are 8 PHICH sequences in one PHICH group (4 symbols).
    - **Extended**: There are 4 PHICH sequences in one PHICH group (2 symbols)
- When **NR** is selected as **Technology**, do the following steps:
  - Select Sub-Carrier Spacing as 15 kHz (Case A). The standard for NR SCS is 15 kHz. The instrument supports 15 kHz of sub-carrier spacing.

4 Tap **Subframe Number** from 0 to 9.

5 Tap **Antenna Port** to assign an antenna port number automatically or manually, and select from **Auto**, **Antenna 0**, or **Antenna1**.

If the MIMO is set to 2x2, the antenna ports 2 and 3 are disabled.

6 Tap to switch **CFI** to **Manual** or **Auto**.

– **Auto** lets the instrument set the number of OFDM symbols used for transmitting PDCCHs in a subframe.

– **Manual** sets the number of OFDM symbols manually. The set of OFDM symbols that can be used for PDCCH in a subframe is given by 0, 2, 3 or 4 in 1.4 MHz bandwidth and 1, 2 or 3 in other bandwidths.

7 Tap **CFI** and input a value from 1 to 3 as desired using the on-screen keyboard.

8 Tap **SSB frequency** and input the value using the on-screen keyboard.

9 Tap **GSCN** and input the value from 2 to 26639 using the on-screen keyboard. If you need to search SSB based on ARFCN raster, it would take too long time since ARFCN raster is very narrow. Therefore, it is recommended that you define a SSB searching frequency in wider steps. This is the usage/purpose of GSCN. You can search the frequency corresponding to GSCN in maximum 100 MHz bandwidth of ARFCN that the instrument supports.



NOTE

Based on the GSCN input frequency, the SSB Frequency is automatically changed.

10 Tap **PCI** (**Physical Cell ID**) and select between **LTE PCI** and **NR PCI**.

– Tap to switch **LTE PCI Mode** to **Manual** or **Auto** and input a value from 0 to 503.

The **PCI** switches to **Manual**.

– Tap **NR PCI Mode** to **Manual** or **Auto** and input a value from 0 to 1007.

The **PCI** switches to **Manual**.



NOTE

You can set Auto to let the instrument detect the Physical Cell ID for the LTE/NR signal automatically and Manual to set the specific Physical Cell ID for the LTE/NR signal manually in order to speed up the synchronization with a BTS.

11 Tap **PDSCH**, and then select the PDSCH modulation type option: **Auto**, **QPSK**, **16 QAM**, **64 QAM**, **256 QAM**, **LTE E-TM3.3**, **LTE E-TM3.2**, **LTE E-TM3.1a**, **LTE E-TM3.1**, **LTE E-TM2a**, **LTE E-TM2**, **LTE E-TM1.2** or **LTE E-TM1.1**.

If two or more modulation types are used in a frame, select **Auto**. If the PDSCH uses the same modulation type in a frame or in a subframe, select a specific modulation type to get more accurate EVM.

12 Tap **PDSCH Threshold** to set the threshold for PDSCH and enter a value by using the on-screen keyboard.

13 Tap **PDSCH Precoding** to set **On** or **Off** to enable or disable the PDSCH precoding.

14 Tap **EVM Detection Mode** to set **Combine** or **Single**.

- **Combine**: Testing on multiple antennas connected to your instrument series with a 2x1 or 4x1 combiner or an antenna
- **Single**: Testing on one single antenna connected to your instrument series with a cable

15 Tap **Menu** > **Display** and select **Reset** to refresh your measurement screen.

You can check the EVM Peak is changed at the right bottom of the measurement screen when you tap **Reset**.

To set the limit

1 Tap **Menu > Limit**.

2 Tap **NR Limit** and set the limits depending on your selected measurement mode:

To set the limit for	Set
Frequency error	Test limits On/Off, High/Low Limit
EVM PSS	Test limits On/Off, High Limit
EVM SSS	Test limits On/Off, High Limit
Power PSS	Test limits On/Off, High/Low Limit Note that based on the **Reference Mode** you have chosen from **Menu** > **Reference Mode** between **Absolute** and **Relative**, you can set the first high/low limit when you chose absolute, and second high/low limit when you chose relative.
Power SSS	Test limits On/Off, High/Low Limit Note that based on the **Reference Mode** you have chosen from **Menu** > **Reference Mode** between **Absolute** and **Relative**, you can set the first high/low limit when you chose absolute, and second high/low limit when you chose relative.
Power PBCH	Test limits On/Off, High/Low Limit Note that based on the **Reference Mode** you have chosen from **Menu** > **Reference Mode** between **Absolute** and **Relative**, you can set the first high/low limit when you chose absolute, and second high/low limit when you chose relative.
Time Error	Test limits On/Off, High/Low Limit

3 **LTE Limit** and set the limits depending on your selected measurement mode:

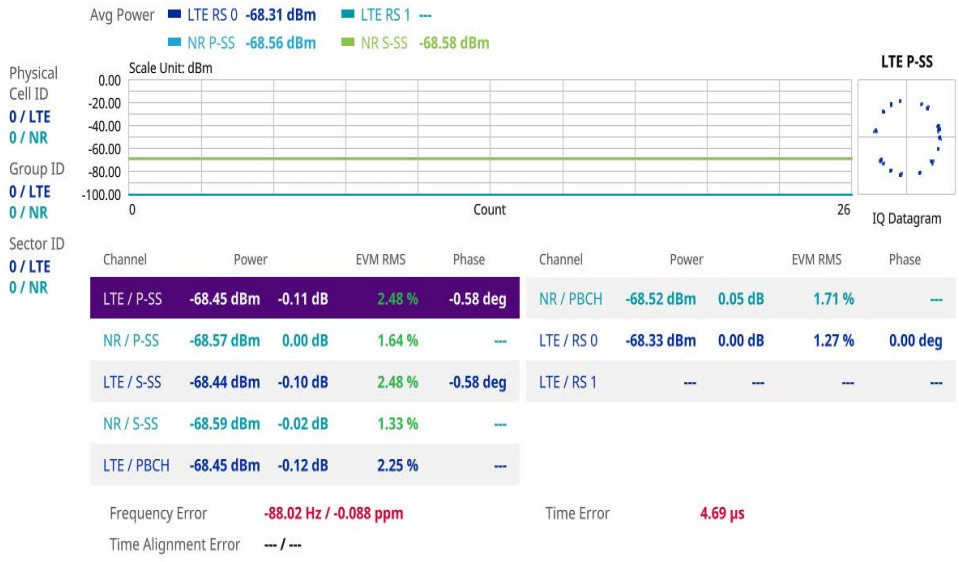
To set the limit for	Set
Frequency error	Test limits On/Off, High/Low Limit
RS EVM	Test limits On/Off, High Limit

To set the limit for	Set
P-SS EVM	Test limits On/Off, High Limit
S-SS EVM	Test limits On/Off, High Limit
DL RS power	Test limits On/Off, High/Low Limit
P-SS Power	Test limits On/Off, High/Low Limit Note that based on the **Reference Mode** you have chosen from **Menu** > **Reference Mode** between **Absolute** and **Relative**, you can set the first high/low limit when you chose absolute, and second high/low limit when you chose relative.
S-SS Power	Test limits On/Off, High/Low Limit Note that based on the **Reference Mode** you have chosen from **Menu** > **Reference Mode** between **Absolute** and **Relative**, you can set the first high/low limit when you chose absolute, and second high/low limit when you chose relative.
PBCH Power	Test limits On/Off, High/Low Limit Note that based on the **Reference Mode** you have chosen from **Menu** > **Reference Mode** between **Absolute** and **Relative**, you can set the first high/low limit when you chose absolute, and second high/low limit when you chose relative.
IQ Origin Offset	Test limits On/Off, High Limit

4 *Optional.* Tap the **Save** icon on the side bar and select the save option from the choices available for your measurement mode.

Figure 262 shows an example of DSS control channel measurement.

Figure 262 5G DSS control channel measurement



Subframe

The Subframe measures the modulation accuracy of all the data and control channels at the specified subframe (1 ms).

Setting measure setup

After configuring spectrum measurement in "Configuring spectrum measurements" on page 25, you can set the measure setup to continue your measurement. The measurement settings can be saved and recalled as a file by selecting File Type as Setup and load the file onto the instrument using the **Save/Load** icons on the side bars.

To set measure setup

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap to switch **Carrier Auto Search** to **Start** to start searching the SSB frequency and apply it or to **Stop** to stop searching.



NOTE
If searching is unavailable, the instrument displays a pop-up message saying that it fails to detect NR (SSB)
frequency.

3 Tap to switch **Radio Config** and set **Duplex Type** (FDD/TDD), **DSS Type** (Co-channel) and **Technology** (LTE/NR) and other related parameters as below:

You can select Co-channel to find NR frequency based on the LTE operating frequency in co-channel and select Adjacent channel to search both LTE and NR frequency. Note that Adjacent channel will be available in the next release.

- When **LTE** is selected as **Technology**, do the following steps:
  - Select **Bandwidth** (MHz) from the following choices: **20**, **15**, **10**, or **5**.
  - Select **MIMO** between **2x2** and **4x4** to set the number of antenna ports. If the MIMO is set to 2x2, the antenna ports 2 and 3 are disabled.
  - Select **Cyclic Prefix** between **Normal** and **Extended**. Cyclic prefix works as a buffer region or guard interval to protect the OFDM signals from inter symbol interference.
    - **Normal**: Intended to be sufficient for the majority of scenarios
    - **Extended**: Intended for scenarios with particularly high delay spread
  - Select **PHICH Ng** between **Normal** and **Extended** and then to set the number of PHICH groups (Ng): 1/6, 1/2, 1, or 2. The PHICH group value/Ng is decided based on the number of PHICH groups per subframe. PHICH

duration is a higher layer parameter configured either as Normal or Extended that says the demodulator how many symbols per subframe are used by PHICH.

- **Normal**: There are 8 PHICH sequences in one PHICH group (4 symbols).
- **Extended**: There are 4 PHICH sequences in one PHICH group (2 symbols)

- When **NR** is selected as **Technology**, do the following steps:
  – Select Sub-Carrier Spacing as 15 kHz (Case A). The standard for NR SCS is 15 kHz. The instrument supports 15 kHz of sub-carrier spacing.

4 Tap **Subframe Number** from 0 to 9.

5 Tap **Antenna Port** to assign an antenna port number automatically or manually, and select from **Auto**, **Antenna 0**, or **Antenna1**.

If the MIMO is set to 2x2, the antenna ports 2 and 3 are disabled.

6 Tap to switch **CFI** to **Manual** or **Auto**.

– **Auto** lets the instrument set the number of OFDM symbols used for transmitting PDCCHs in a subframe.

– **Manual** sets the number of OFDM symbols manually. The set of OFDM symbols that can be used for PDCCH in a subframe is given by 0, 2, 3 or 4 in 1.4 MHz bandwidth and 1, 2 or 3 in other bandwidths.

7 Tap **CFI** and input a value from 1 to 3 as desired using the on-screen keyboard.

8 Tap **SSB frequency** and input the value using the on-screen keyboard.

9 Tap **GSCN** and input the value from 2 to 26639 using the on-screen keyboard. If you need to search SSB based on ARFCN raster, it would take too long time since ARFCN raster is very narrow. Therefore, it is recommended that you define a SSB searching frequency in wider steps. This is the usage/purpose of GSCN. You can search the frequency corresponding to GSCN in maximum 100 MHz bandwidth of ARFCN that the instrument supports.



NOTE

Based on the GSCN input frequency, the SSB Frequency is automatically changed.

10 Tap **PCI** (**Physical Cell ID**) and select between **LTE PCI** and **NR PCI**.

– Tap to switch **LTE PCI Mode** to **Manual** or **Auto** and input a value from 0 to 503.

The **PCI** switches to **Manual**.

– Tap **NR PCI Mode** to **Manual** or **Auto** and input a value from 0 to 1007.

The **PCI** switches to **Manual**.



NOTE

You can set Auto to let the instrument detect the Physical Cell ID for the LTE/NR signal automatically and Manual to set the specific Physical Cell ID for the LTE/NR signal manually in order to speed up the synchronization with a BTS.

11 Tap **PDSCH**, and then select the PDSCH modulation type option: **Auto**, **QPSK**, **16 QAM**, **64 QAM**, **256 QAM**, **LTE E-TM3.3**, **LTE E-TM3.2**, **LTE E-TM3.1a**, **LTE E-TM3.1**, **LTE E-TM2a**, **LTE E-TM2**, **LTE E-TM1.2** or **LTE E-TM1.1**.

If two or more modulation types are used in a frame, select **Auto**. If the PDSCH uses the same modulation type in a frame or in a subframe, select a specific modulation type to get more accurate EVM.

12 Tap **PDSCH Threshold** to set the threshold for PDSCH and enter a value by using the on-screen keyboard.

13 Tap **PDSCH Precoding** to set **On** or **Off** to enable or disable the PDSCH precoding.

14 Tap **EVM Detection Mode** to set **Combine** or **Single**.

– **Combine**: Testing on multiple antennas connected to your instrument series with a 2x1 or 4x1 combiner or an antenna

– **Single**: Testing on one single antenna connected to your instrument series with a cable

15 Tap **Menu** > **Display** and select **Reset** to refresh your measurement screen.

a Tap **Reset** to refresh your measurement screen.

You can check the EVM Peak is changed at the right bottom of the measurement screen when you tap Reset.

b Tap to switch **Chart** to **On** or **Off**.

You can check the Chart view when On is selected. You can check Channel Summary with Subframe in a table when Off is selected.

To set the limit

1 Tap **Menu > Limit**.

2 Tap **NR Limit** and set the limits depending on your selected measurement mode:

To set the limit for	Set
Frequency error	Test limits On/Off, High/Low Limit
PDSCH EVM	Test limits On/Off, High Limit for QPSK, 16 QAM, 64 QAM, 256 QAM
Data EVM RMS	Test limits On/Off, High Limit
Data EVM Peak	Test limits On/Off, High Limit for QPSK, 16 QAM, 64 QAM, 256 QAM
P-SS EVM	Test limits On/Off, High Limit
S-SS EVM	Test limits On/Off, High Limit

To set the limit for	Set
P-SS Power	Test limits On/Off, High/Low Limit Note that based on the **Reference Mode** you have chosen from **Menu** > **Reference Mode** between **Absolute** and **Relative**, you can set the first high/low limit when you chose absolute, and second high/low limit when you chose relative.
S-SS Power	Test limits On/Off, High/Low Limit Note that based on the **Reference Mode** you have chosen from **Menu** > **Reference Mode** between **Absolute** and **Relative**, you can set the first high/low limit when you chose absolute, and second high/low limit when you chose relative.
PBCH Power	Test limits On/Off, High/Low Limit Note that based on the **Reference Mode** you have chosen from **Menu** > **Reference Mode** between **Absolute** and **Relative**, you can set the first high/low limit when you chose absolute, and second high/low limit when you chose relative.
Time Error	Test limits On/Off, High/Low Limit

3 **LTE Limit** and set the limits depending on your selected measurement mode:

To set the limit for	Set
Frequency error	Test limits On/Off, High/Low Limit
PDSCH EVM	Test limits On/Off, High Limit for QPSK, 16 QAM, 64 QAM, 256 QAM
Data EVM RMS	Test limits On/Off, High Limit
Data EVM Peak	Test limits On/Off, High Limit
RS EVM	Test limits On/Off, High Limit
P-SS EVM	Test limits On/Off, High Limit
S-SS EVM	Test limits On/Off, High Limit
DL RS power	Test limits On/Off, High/Low Limit
P-SS Power	Test limits On/Off, High/Low Limit Note that based on the **Reference Mode** you have chosen from **Menu** > **Reference Mode** between **Absolute** and **Relative**, you can set the first high/low limit when you chose absolute, and second high/low limit when you chose relative.

To set the limit for	Set
S-SS Power	Test limits On/Off, High/Low Limit Note that based on the **Reference Mode** you have chosen from **Menu** > **Reference Mode** between **Absolute** and **Relative**, you can set the first high/low limit when you chose absolute, and second high/low limit when you chose relative.
PBCH Power	Test limits On/Off, High/Low Limit Note that based on the **Reference Mode** you have chosen from **Menu** > **Reference Mode** between **Absolute** and **Relative**, you can set the first high/low limit when you chose absolute, and second high/low limit when you chose relative.
Subframe Power	Test limits On/Off, High/Low Limit
OFDM Symbol Power	Test limits On/Off, High/Low Limit
Time Error	Test limits On/Off, High/Low Limit

4 *Optional.* Tap the **Save** icon on the side bar and select the save option from the choices available for your measurement mode.

To set maker

If you tap the **Chart** to **On** under **Display Menu**, you can use **Marker** to place a marker at a specific symbol.

1 Tap **Menu** > **Marker**.

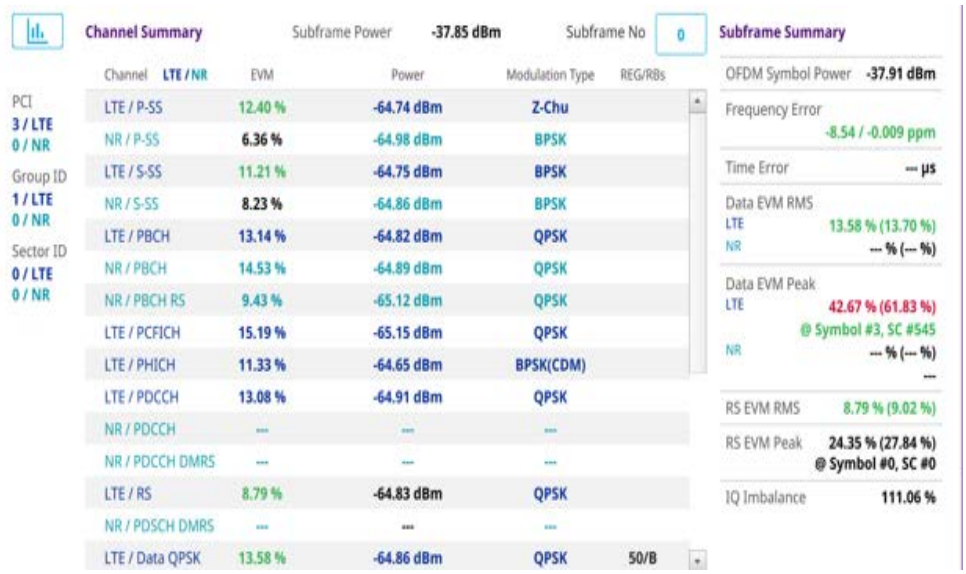
2 Tap **Marker View** between **On** and **Off** to display or dismiss the marker on the chart.

3 Tap **Symbol** to select the symbol number to which the marker is placed.

4 Enter the value using the on-screen keyboard and tap the **Apply** button.

Figure 263 shows an example of DSS subframe measurement.

Figure 263 5G DSS subframe measurement



NOTE
You can directly set Subframe number from 0 to 9 by tapping the Number box next to Subframe No. If you enter subframe number 1, you will see NR data. Right before the Channel Summary, you can tap the Chart icon to see the result in a chart view.

Figure 264 5G DSS subframe measurement (bar chart)



NOTE
You can tap the Reset button next to Subframe Summary on the right side of the screen to refresh the measurement result screen.

Frame

The Frame measures the modulation accuracy of all the data and control channels at the frame (1 ms).

Setting measure setup

After configuring spectrum measurement in "Configuring spectrum measurements" on page 25, you can set the measure setup to continue your measurement. The measurement settings can be saved and recalled as a file by selecting File Type as Setup and load the file onto the instrument using the **Save/Load** icons on the side bars.

To set measure setup

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap to switch **Carrier Auto Search** to **Start** to start searching the SSB frequency and apply it or to **Stop** to stop searching.

NOTE
If searching is unavailable, the instrument displays a pop-up message saying that it fails to detect NR (SSB)
frequency.

3 Tap to switch **Radio Config** and set **Duplex Type** (FDD/TDD), **DSS Type** (Co-channel) and **Technology** (LTE/NR) and other related parameters as below:

You can select Co-channel to find NR frequency based on the LTE operating frequency in co-channel and select Adjacent channel to search both LTE and NR frequency. Note that Adjacent channel will be available in the next release.

- When **LTE** is selected as **Technology**, do the following steps:
  - Select **Bandwidth** (MHz) from the following choices: **20**, **15**, **10**, or **5**.
  - Select **MIMO** between **2x2** and **4x4** to set the number of antenna ports. If the MIMO is set to 2x2, the antenna ports 2 and 3 are disabled.
  - Select **Cyclic Prefix** between **Normal** and **Extended**. Cyclic prefix works as a buffer region or guard interval to protect the OFDM signals from inter symbol interference.
    - **Normal**: Intended to be sufficient for the majority of scenarios
    - **Extended**: Intended for scenarios with particularly high delay spread
  - Select **PHICH Ng** between **Normal** and **Extended** and then to set the number of PHICH groups (Ng): 1/6, 1/2, 1, or 2. The PHICH group value/Ng is decided based on the number of PHICH groups per subframe. PHICH

duration is a higher layer parameter configured either as Normal or Extended that says the demodulator how many symbols per subframe are used by PHICH.

- **Normal**: There are 8 PHICH sequences in one PHICH group (4 symbols).
- **Extended**: There are 4 PHICH sequences in one PHICH group (2 symbols)

- When **NR** is selected as **Technology**, do the following steps:
  – Select Sub-Carrier Spacing as 15 kHz (Case A). The standard for NR SCS is 15 kHz. The instrument supports 15 kHz of sub-carrier spacing.

4 Tap **Antenna Port** to assign an antenna port number automatically or manually, and select from **Auto**, **Antenna 0**, or **Antenna1**.

If the MIMO is set to 2x2, the antenna ports 2 and 3 are disabled.

5 Tap to switch **CFI** to **Manual** or **Auto**.

– **Auto** lets the instrument set the number of OFDM symbols used for transmitting PDCCHs in a subframe.

– **Manual** sets the number of OFDM symbols manually. The set of OFDM symbols that can be used for PDCCH in a subframe is given by 0, 2, 3 or 4 in 1.4 MHz bandwidth and 1, 2 or 3 in other bandwidths.

6 Tap **CFI** and input a value from 1 to 3 as desired using the on-screen keyboard.

7 Tap **SSB frequency** and input the value using the on-screen keyboard.

8 Tap **GSCN** and input the value from 2 to 26639 using the on-screen keyboard. If you need to search SSB based on ARFCN raster, it would take too long time since ARFCN raster is very narrow. Therefore, it is recommended that you define a SSB searching frequency in wider steps. This is the usage/purpose of GSCN. You can search the frequency corresponding to GSCN in maximum 100 MHz bandwidth of ARFCN that the instrument supports.



NOTE

Based on the GSCN input frequency, the SSB Frequency is automatically changed.

9 Tap **PCI** (**Physical Cell ID**) and select between **LTE PCI** and **NR PCI**.

– Tap to switch **LTE PCI Mode** to **Manual** or **Auto** and input a value from 0 to 503.

The **PCI** switches to **Manual**.

– Tap **NR PCI Mode** to **Manual** or **Auto** and input a value from 0 to 1007.

The **PCI** switches to **Manual**.



NOTE

You can set Auto to let the instrument detect the Physical Cell ID for the LTE/NR signal automatically and Manual to set the specific Physical Cell ID for the LTE/NR signal manually in order to speed up the synchronization with a BTS.

10 Tap **PDSCH**, and then select the PDSCH modulation type option: **Auto**, **QPSK**, **16 QAM**, **64 QAM**, **256 QAM**, **LTE E-TM3.3**, **LTE E-TM3.2**, **LTE E-TM3.1a**, **LTE E-TM3.1**, **LTE E-TM2a**, **LTE E-TM2**, **LTE E-TM1.2** or **LTE E-TM1.1**.

If two or more modulation types are used in a frame, select **Auto**. If the PDSCH uses the same modulation type in a frame or in a subframe, select a specific modulation type to get more accurate EVM.

11 Tap **PDSCH Threshold** to set the threshold for PDSCH and enter a value by using the on-screen keyboard.

12 Tap **PDSCH Precoding** to set **On** or **Off** to enable or disable the PDSCH precoding.

13 Tap **EVM Detection Mode** to set **Combine** or **Single**.

- **Combine**: Testing on multiple antennas connected to your instrument series with a 2x1 or 4x1 combiner or an antenna
- **Single**: Testing on one single antenna connected to your instrument series with a cable

14 Tap to switch **Select Half Block** to **Second** or **First**.

If you set First, it will show the average value of Subframe 1 to 4 and Second it will show the average value of subframe 5 to 9.

15 Tap **Menu** > **Display** and select **Reset** to refresh your measurement screen.

You can check the EVM Peak is changed at the right bottom of the measurement screen when you tap Reset.

To set the limit

1 Tap **Menu > Limit**.

2 Tap **NR Limit** and set the limits depending on your selected measurement mode:

To set the limit for	Set
Frequency error	Test limits On/Off, High/Low Limit
PDSCH EVM	Test limits On/Off, High Limit for QPSK, 16 QAM, 64 QAM, 256 QAM
Data EVM RMS	Test limits On/Off, High Limit
Data EVM Peak	Test limits On/Off, High Limit for QPSK, 16 QAM, 64 QAM, 256 QAM
P-SS EVM	Test limits On/Off, High Limit
S-SS EVM	Test limits On/Off, High Limit
P-SS Power	Test limits On/Off, High/Low Limit Note that based on the **Reference Mode** you have chosen from **Menu** > **Reference Mode** between **Absolute** and **Relative**, you can set the first high/low limit when you chose absolute, and second high/low limit when you chose relative.

To set the limit for	Set
S-SS Power	Test limits On/Off, High/Low Limit Note that based on the **Reference Mode** you have chosen from **Menu** > **Reference Mode** between **Absolute** and **Relative**, you can set the first high/low limit when you chose absolute, and second high/low limit when you chose relative.
PBCH Power	Test limits On/Off, High/Low Limit Note that based on the **Reference Mode** you have chosen from **Menu** > **Reference Mode** between **Absolute** and **Relative**, you can set the first high/low limit when you chose absolute, and second high/low limit when you chose relative.

3 **LTE Limit** and set the limits depending on your selected measurement mode:

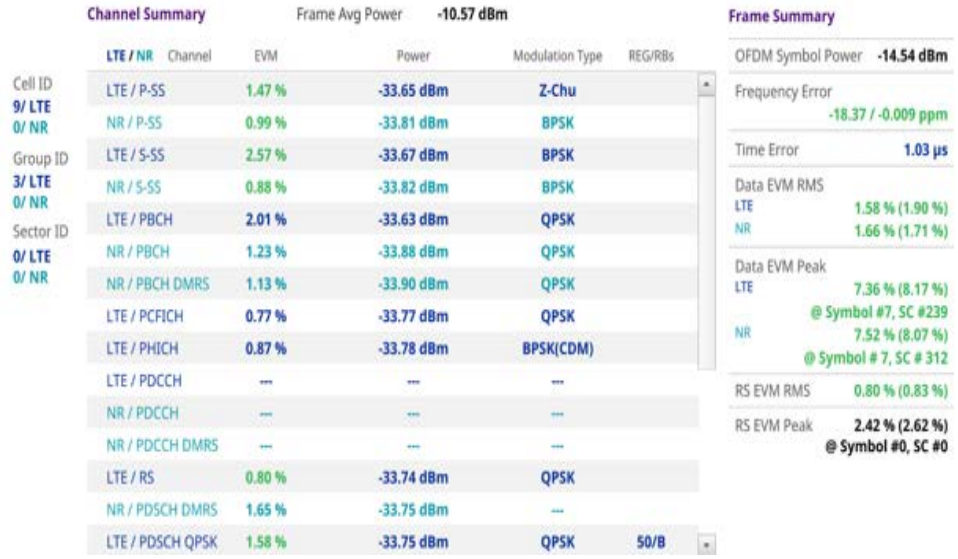
To set the limit for	Set
Frequency error	Test limits On/Off, High/Low Limit
PDSCH EVM	Test limits On/Off, High Limit for QPSK, 16 QAM, 64 QAM, 256 QAM
Data EVM RMS	Test limits On/Off, High Limit
Data EVM Peak	Test limits On/Off, High Limit
RS EVM	Test limits On/Off, High Limit
P-SS EVM	Test limits On/Off, High Limit
S-SS EVM	Test limits On/Off, High Limit
DL RS power	Test limits On/Off, High/Low Limit
P-SS Power	Test limits On/Off, High/Low Limit Note that based on the **Reference Mode** you have chosen from **Menu** > **Reference Mode** between **Absolute** and **Relative**, you can set the first high/low limit when you chose absolute, and second high/low limit when you chose relative.
S-SS Power	Test limits On/Off, High/Low Limit Note that based on the **Reference Mode** you have chosen from **Menu** > **Reference Mode** between **Absolute** and **Relative**, you can set the first high/low limit when you chose absolute, and second high/low limit when you chose relative.

To set the limit for	Set
PBCH Power	Test limits On/Off, High/Low Limit Note that based on the **Reference Mode** you have chosen from **Menu** > **Reference Mode** between **Absolute** and **Relative**, you can set the first high/low limit when you chose absolute, and second high/low limit when you chose relative.
Frame Average Power	Test limits On/Off, High/Low Limit
OFDM Symbol Power	Test limits On/Off, High/Low Limit
IQ Origin Offset	Test limits On/Off, High Limit

4 *Optional.* Tap the **Save** icon on the side bar and select the save option from the choices available for your measurement mode.

Figure 265 shows an example of DSS frame measurement.

Figure 265 5G DSS frame measurement



Time alignment error

In eNode-B supporting Tx Diversity transmission, signals are transmitted from two or more antennas. These signals shall be aligned. The time alignment error in Tx diversity is specified as the delay between the signals from two antennas at the antenna ports.

Setting measure setup

After configuring spectrum measurement in “Configuring spectrum measurements” on page 25, you can set the measure setup to continue your measurement. The

measurement settings can be saved and recalled as a file by selecting File Type as Setup and load the file onto the instrument using the **Save/Load** icons on the side bars.

To set measure setup

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap to switch **Carrier Auto Search** to **Start** to start searching the SSB frequency and apply it or to **Stop** to stop searching.

NOTE
If searching is unavailable, the instrument displays a pop-up message saying that it fails to detect NR (SSB)
frequency.

3 Tap to switch **Radio Config** and set **Duplex Type** (FDD/TDD), **DSS Type** (Co-channel) and **Technology** (LTE/NR) and other related parameters as below:

You can select Co-channel to find NR frequency based on the LTE operating frequency in co-channel and select Adjacent channel to search both LTE and NR frequency. Note that Adjacent channel will be available in the next release.

- When **LTE** is selected as **Technology**, do the following steps:
  - Select **Bandwidth** (MHz) from the following choices: **20**, **15**, **10**, or **5**.
  - Select **MIMO** between **2x2** and **4x4** to set the number of antenna ports. If the MIMO is set to 2x2, the antenna ports 2 and 3 are disabled.
  - Select **Cyclic Prefix** between **Normal** and **Extended**. Cyclic prefix works as a buffer region or guard interval to protect the OFDM signals from inter symbol interference.
    - **Normal**: Intended to be sufficient for the majority of scenarios
    - **Extended**: Intended for scenarios with particularly high delay spread
  - Select **PHICH Ng** between **Normal** and **Extended** and then to set the number of PHICH groups (Ng): 1/6, 1/2, 1, or 2. The PHICH group value/Ng is decided based on the number of PHICH groups per subframe. PHICH duration is a higher layer parameter configured either as Normal or Extended that says the demodulator how many symbols per subframe are used by PHICH.
    - **Normal**: There are 8 PHICH sequences in one PHICH group (4 symbols).
    - **Extended**: There are 4 PHICH sequences in one PHICH group (2 symbols)
- When **NR** is selected as **Technology**, do the following steps:
  - Select Sub-Carrier Spacing as 15 kHz (Case A). The standard for NR SCS is 15 kHz. The instrument supports 15 kHz of sub-carrier spacing.

4 Tap **Antenna Port** to assign an antenna port number automatically or manually, and select from **Auto**, **Antenna 0**, or **Antenna1**.

If the MIMO is set to 2x2, the antenna ports 2 and 3 are disabled.

5 Tap to switch **CFI** to **Manual** or **Auto**.
   – **Auto** lets the instrument set the number of OFDM symbols used for transmitting PDCCHs in a subframe.
   – **Manual** sets the number of OFDM symbols manually. The set of OFDM symbols that can be used for PDCCH in a subframe is given by 0, 2, 3 or 4 in 1.4 MHz bandwidth and 1, 2 or 3 in other bandwidths.

6 Tap **CFI** and input a value from 1 to 3 as desired using the on-screen keyboard.

7 Tap **SSB frequency** and input the value using the on-screen keyboard.

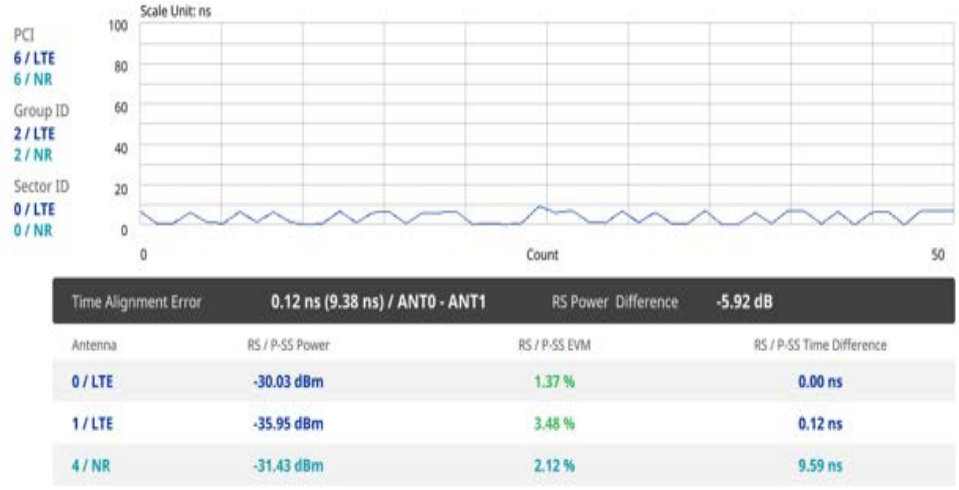
8 Tap **GSCN** and input the value from 2 to 26639 using the on-screen keyboard. If you need to search SSB based on ARFCN raster, it would take too long time since ARFCN raster is very narrow. Therefore, it is recommended that you define a SSB searching frequency in wider steps. This is the usage/purpose of GSCN. You can search the frequency corresponding to GSCN in maximum 100 MHz bandwidth of ARFCN that the instrument supports.

NOTE

Based on the GSCN input frequency, the SSB Frequency is automatically changed.

Figure 266 shows an example of DSS time alignment error measurement.

Figure 266 5G DSS time alignment error measurement



Online route map

The following sections describe how to perform online route map.

Online OTA route map

DSS online OTA route map enables you to download a map automatically when connected to the network then you can continue route map measurement using the downloaded map whether you are online or offline. It traces the power level of the strongest beam corresponding to a particular time and geographical position and presents it in a geographical map as a measurement point. All the collected measurements can be exported for post-processing purposes, including data of the eight strongest beams for each measurement point, including its measurement time and geographical location.

Figure 267 shows an example of 5G DSS Online OTA Route Map measurement.

Figure 267 Online OTA Route Map with 5G DSS Signal Analyzer



Controlling a map

To control a map

See the following table to control a map.

Table 141 Map control icons

Icon	Description
	Tap to go to your current location on the map. Once tapped, the purple icon appears on the map, indicating your current location.
	Tap to zoom in the map.
	Tap to zoom out the map.

The left-most cell-site icon is activated when you import the cell-site information file.

To set measurement setup

NOTE

Before starting the Route Map measurement, you need to set Spectrum measurements displayed on the quick access and display tab. See “Configuring spectrum measurements” on page 25 for more information.

1 Connect a GNSS receiver to your instrument for outdoor mapping.

2 Tap the **Setup** ( ) icon on the side bar.

3 Tap to switch **Plot Item DSS** to **RSRP**, **RSRQ**, **SINR**, or **SNR**.

4 Tap to switch **Carrier Auto Search** to **Start** to start searching the SSB frequency and apply it or to **Stop** to stop searching.

NOTE

If searching is unavailable, the instrument displays a pop-up message saying that it fails to detect NR (SSB) frequency.

5 Tap to switch **Radio Config** and set **Duplex Type** (FDD/TDD), **DSS Type** (Co-channel), and **Technology** (LTE/NR) and other related parameters as below.

You can select Co-channel to find NR frequency based on the LTE operating frequency in co-channel and select Adjacent channel to search both LTE and NR frequency. Note that Adjacent channel will be available in the next release.

- When **LTE** is selected as **Technology**, do the following steps:
  - Select **Bandwidth** (MHz) from the following choices: **20**, **15**, **10**, or **5**.
  - Select **MIMO** between **2x2** and **4x4** to set the number of antenna ports. If the MIMO is set to 2x2, the antenna ports 2 and 3 are disabled.
  - Select **Cyclic Prefix** between **Normal** and **Extended**. Cyclic prefix works as a buffer region or guard interval to protect the OFDM signals from inter symbol interference.
    - **Normal**: Intended to be sufficient for the majority of scenarios
    - **Extended**: Intended for scenarios with particularly high delay spread
  - Select **PHICH Ng** between **Normal** and **Extended** and then to set the number of PHICH groups (Ng): 1/6, 1/2, 1, or 2. The PHICH group value/Ng is decided based on the number of PHICH groups per subframe. PHICH duration is a higher layer parameter configured either as Normal or Extended that says the demodulator how many symbols per subframe are used by PHICH.
    - **Normal**: There are 8 PHICH sequences in one PHICH group (4 symbols).
    - **Extended**: There are 4 PHICH sequences in one PHICH group (2 symbols)

- When **NR** is selected as **Technology**, do the following steps:
  - Select sub-Carrier Spacing as 15 kHz (Case A). The standard for NR SCS is 15 kHz. The instrument supports 15 kHz of sub-carrier spacing.

6 Tap to switch **CFI** to **Manual** or **Auto**.

- **Auto** lets the instrument set the number of OFDM symbols used for transmitting PDCCHs in a subframe.
- **Manual** sets the number of OFDM symbols manually. The set of OFDM symbols that can be used for PDCCH in a subframe is given by 0, 2, 3 or 4 in 1.4 MHz bandwidth and 1, 2 or 3 in other bandwidths.

7 Tap **CFI** and input a value from 1 to 3 as desired using the on-screen keyboard.

8 Tap **SSB frequency** and input the value using the on-screen keyboard.

9 Tap **GSCN** and input the value from 2 to 26639 using the on-screen keyboard. If you need to search SSB based on ARFCN raster, it would take too long time since ARFCN raster is very narrow. Therefore, it is recommended that you define a SSB searching frequency in wider steps. This is the usage/purpose of GSCN. You can search the frequency corresponding to GSCN in maximum 100 MHz bandwidth of ARFCN that instrument supports.



NOTE

Based on the GSCN input frequency, the SSB Frequency is automatically changed.

10 Tap **PCI** (Physical Cell ID) and select between **LTE PCI** and **NR PCI**.

a Tap to switch **LTE PCI Mode** to **Manual** or **Auto** and input a value from 0 to 503.

The **PCI** switches to **Manual**.

b Tap **NR PCI Mode** to **Manual** or **Auto** and input a value from 0 to 1007.

The **PCI** switches to **Manual**.



NOTE

You can set Auto to let the instrument detect the Physical Cell ID for the LTE/NR signal automatically and Manual to set the specific Physical Cell ID for the LTE/NR signal manually in order to speed up the synchronization with a BTS.

11 Tap **PDSCH**, and then select the PDSCH modulation type option: **Auto**, **QPSK**, **16 QAM**, **64 QAM**, **256 QAM**, **LTE E-TM3.3**, **LTE E-TM3.2**, **LTE E-TM3**.**1a**, **LTE E-TM3.1**, **LTE E-TM2a**, **LTE E-TM2**, **LTE E-TM1.2** or **LTE E-TM1.1**.

If two or more modulation types are used in a frame, select **Auto**. If the PDSCH uses the same modulation type in a frame or in a subframe, select a specific modulation type to get more accurate EVM.

12 Tap **PDSCH Threshold** to set the threshold for PDSCH and enter a value by using the on-screen keyboard.

13 Tap **PDSCH Precoding** to set **On** or **Off** to enable or disable the PDSCH precoding.

NOTE

The instrument does not automatically save the collected data. It is recommended that you save the result. Otherwise, you will lose all the collected data.

To set limit

You can set the thresholds for the two different color indicators, red and blue. The maximum value is the Limit for **Excellent**, and the minimum value is the Limit for **Poor**. See below to check the plot point color based on the Legend Color Table.

1 Tap the rectangle with value before color legend bar on the right panel.

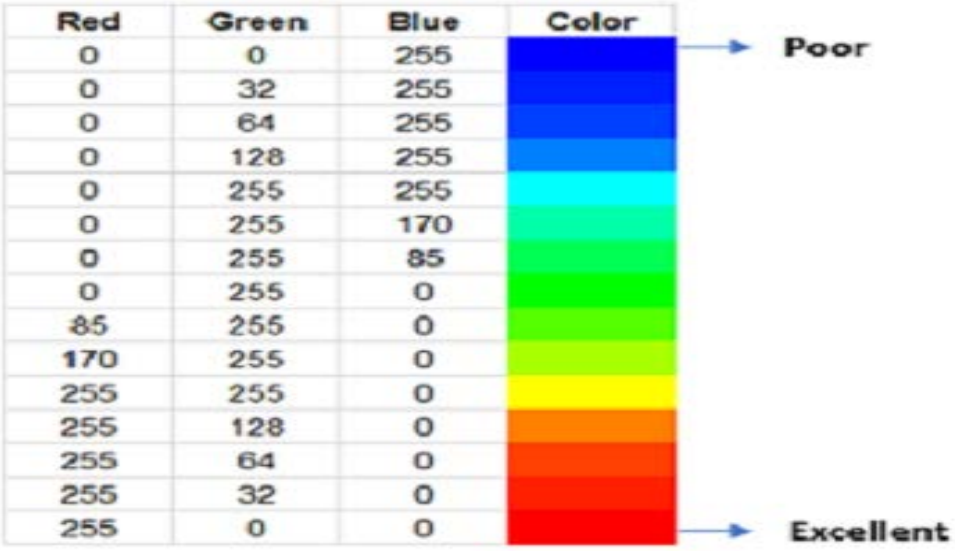
2 Set a value for **Poor** (minimum value) using the on-screen keyboard.

3 Tap the rectangle with value after color legend bar on the right panel.

4 Set a value for **Excellent** (maximum value) using the on-screen keyboard.

Figure 268 shows a legend color table.

Figure 268 Legend color table



Logging data

To log data

1 Follow **steps 1 to 3** in Setting measure setup.

2 Tap the **Testing** ( ) button on the right panel of the map to start plotting on the map. When you select a point on the map, a marker appears and the Information window appears on the right panel.

3 Tap the **Stop** ( ) button to stop plotting.

4 Tap the **Pause** button ( ) to pause plotting, then the GNSS point cannot be plotted.

5 If you select the **Stop** button, the Plot Stop pop-up window appears, then tap **Yes**.

6 Tap **Yes** when the Save pop-up window appears and save the logging file to your USB.

Viewing the logging data

To view the logging data

1 Load the saved logging file using the **Load** ( ) icon on the side bar. Make sure the file extension is .orr.

2 If the **PCI** is set to **Auto**, the point on the map appears with a color representing the largest **S-SS-RSRP** value. When you select a point on the map, a marker appears and the Information window appears on the right panel.

3 Set the **PCI** to **Manual** and tap the **Select** button.

The Select PCI window appears.

4 Select PCI on the left and then the corresponding Beam Index appeared on the right.

5 Tap the **Apply** button.

The point color of the map changes to the corresponding SS-RSRP value, and if there is no detected Beam Index, the point will be hidden.

Importing cellsite DB

You can import the site DB by creating the 5G site information form.

To import cellsite DB

1 Create the 5G site information with an excel file as below.

2 Input the two mandatory fields: **Lat (DecDeg)** and **Long (DecDeg)**.

3 Input the **Azimuth** field if you want to check the direction of antenna.

4 Make sure to save the file as (Comma delimited) (*.csv).

5 Copy the file to the USB memory stick and insert it to the **USB A** or **USB B** port of the instrument.

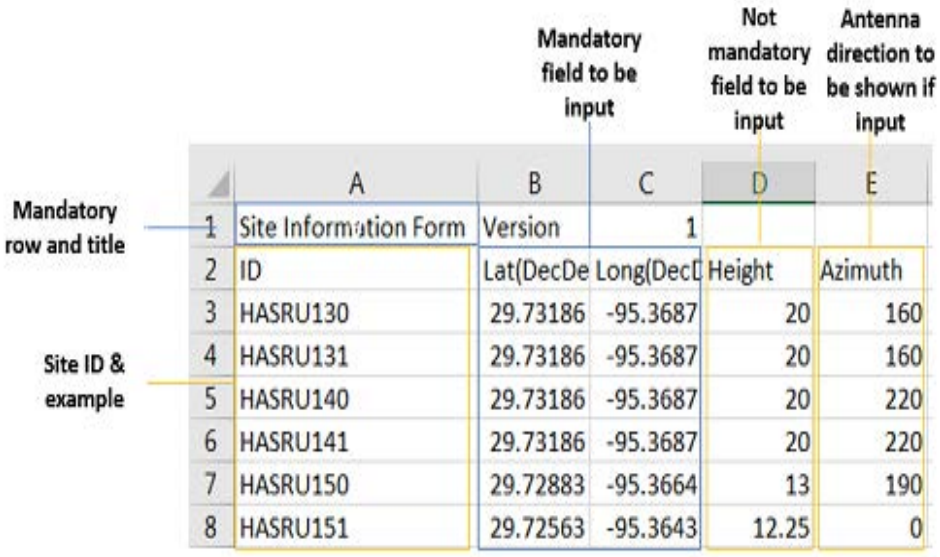
6 Tap the **Load** ( ) icon on the side bar.

7 Import the saved file.

Once the file is loaded, the following cellsite information appears with an icon.

Figure 269 shows an example of an importing cellsite DB.

Figure 269 Importing Cellsite DB



Creating a map

You can create a map online and continue conducting a route map analysis using the created map even when there is no Ethernet connection.

1 Tap the **Map Creator** button on the right panel at the bottom.

2 Tap the **Search** box and input the location using the on-screen keyboard and select one of the options as required.

3 Tap the **Zoom Level** box to capture the map with corresponding zoom level.

4 Tap the **Capture** button to start capturing the map.

Once the map is captured, the capturing completed pop-up will appear.

5 Select between the two options: Save in the system or Save as file.

6 Tap the **Done** button.

NOTE
If you have unsaved measurement data (map) and start measuring by tapping the Testing button or by tapping another measurement mode, a pop-up window will appear asking whether you will restore the unsaved data or not.

16

Using LTE/LTE-A FDD Analyzer

This chapter describes how to use the LTE/LTE-A FDD Analyzer. Topics covered in this chapter include:

- “Introduction” on page 664
- “Selecting mode and measure” on page 665
- “RF analysis” on page 665
- “OTA analysis” on page 674
- “Signal analysis” on page 696
- “Online route map” on page 715

Introduction

The LTE/LTE-A FDD Analyzer is the optimal portable test solution for installation and maintenance of cellular base stations and cell sites, running with external AC power or battery for the field. Its touch-based user interface has been specifically designed with customized menus and simple calibration procedures, providing service providers with accurate and reliable LTE/LTE-A FDD measurement results.

The LTE/LTE-A FDD Analyzer performs the following measurements:

- RF Analysis
  - Spectrum
  - Channel Power
  - Occupied Bandwidth
  - Spectrum Emission Mask
  - ACLR
  - Multi-ACLR
  - Spurious Emissions (Not supported in SPA06MA-O yet)
- OTA Analysis
  - OTA Channel Scanner
  - OTA ID Scanner
  - OTA Multipath Profile
  - OTA Control Channel
  - OTA Datagram
  - OTA Route Map
  - Freq/Time/Power Variation
- Signal Analysis
  - Constellation
  - Data Channel (Not supported in SAP06MA-O yet)
  - Control Channel (Not supported in SPA06MA-O yet)
  - Subframe
  - Frame
  - Time Alignment Error (Not supported in SPA06MA-O yet)
  - Data Allocation Map
  - Carrier Aggregation (Not supported in SPA06MA-O yet)
  - Power vs Time (Frame)
  - Power Statistics CCDF (Not supported in SPA06MA-O yet)
- Online Route Map Analysis
  - Online OTA Route Map

Selecting mode and measure

The following procedure describes how to start measurement.

To start measurement

1 Tap **LTE/LTE-A FDD Analyzer** on the **MODE** panel.

2 Tap any measurement mode from the following choices:

- **RF Analysis > Spectrum, Channel Power, Occupied Bandwidth, Spectrum Emission Mask, ACLR, Multi-ACLR, or Spurious Emissions**
- **OTA Analysis > OTA Channel Scanner, OTA ID Scanner, OTA Multipath Profile, OTA Control Channel, OTA Route Map, Freq/Time/Power Variation**
- **Signal Analysis > Constellation, Data Channel, Control Channel, Subframe, Frame, Time Alignment Error, Data Allocation Map,** or **Carrier Aggregation, Power vs Time (Frame)**
- **Online Route Map > Online OTA Route Map**

RF analysis

The following sections describe how to conduct RF analysis.



You can quickly access the Auto Gain feature by tapping the Auto Gain icon in the top right corner of the measurement screen. If you tap the Auto Gain icon, the following icon appears. + indicates the attenuation increases by 5 each time. - indicates the attenuation decreases by 5 each time. The third one is auto scale and it automatically adjusts scales.You can tap X to exit the Auto Gain feature.

Spectrum

The following procedures describe how to perform LTE/LTE-A FDD spectrum analysis.

To set measure setup

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap **Bandwidth** and select the value from the following choices: **1.4 MHz**, **3 MHz**, **5 MHz**, **10 MHz**, **15 MHz** or **20 MHz**.

3 Tap the **Center Frequency** (Center 1.000 000 000 GHz)icon under the chart screen to set the center frequency using the on-screen keyboard.

To set trigger

1 Tap the **Menu > Trigger**.

2 Tap **Trigger** and select the options from **Internal**, **External**, or **GNSS**.

3 Tap **Freq. Ref.**(Frequency Reference) to set the clock source.

- **Internal**: Uses a 10 MHz internal clock
- **External**: Uses external 10 MHz, 13 MHz, or 15 MHz clock automatically set by the instrument
- **GNSS**: Uses a built-in GNSS as a frequency and timing source
- **TEM2**: Uses TEM2 pps as a frequency and timing source

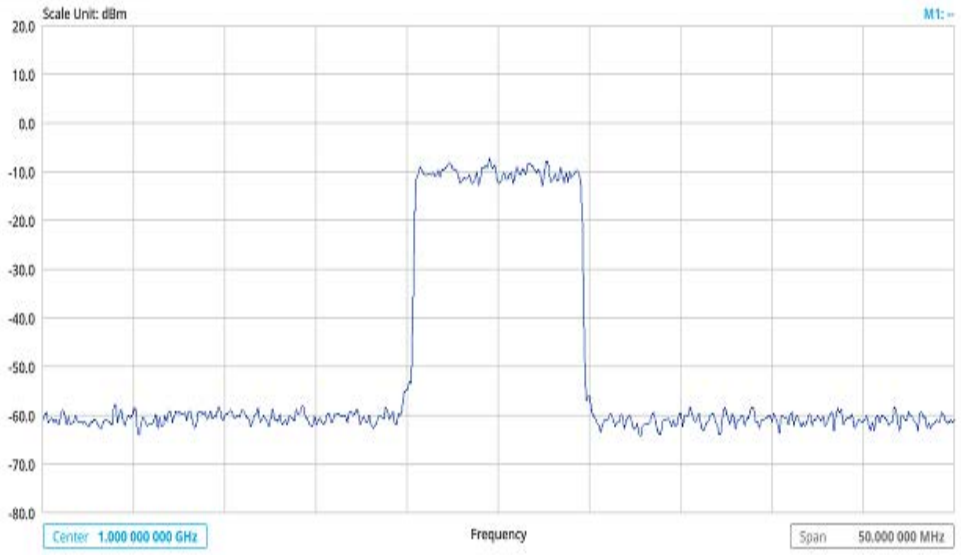
  Be aware TEM2 setting is available only when it is connected.

NOTE

Make sure to set Frequency Reference for all measurement mode in LTE-LTE-A FDD Analyzer to sync the proper clock source.

Figure 270 shows an example of LTE/LTE-A FDD spectrum measurement.

Figure 270 LTE/LTE-A FDD spectrum measurement



Channel power

The Channel Power measurement is a common test used in the wireless industry to measure the total transmitted power of a radio within a defined frequency channel. It acquires a number of points representing the input signal in the time domain, transforms this information into the frequency domain using Fast Fourier Transform (FFT), and then calculates the channel power. The effective resolution bandwidth of the frequency domain trace is proportional to the number of points acquired for the FFT.

The channel power measurement identifies the total RF power and power spectral density (PSD) of the signal in the LTE channel bandwidth.

Setting measure setup

After configuring the spectrum measurement in "Configuring spectrum measurements" on page 25, you can set the measure setup to continue your measurement.

To set measure setup

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap **Bandwidth** and select the value from the following choices: **1.4 MHz**, **3 MHz**, **5 MHz**, **10 MHz**, **15 MHz**, or **20 MHz**.

You can also tap the rectangle with value,(

) under the chart screen and input the value using the on-screen keyboard.

3 Tap the **Center Frequency** (

)icon under the chart screen to set the center frequency using the on-screen keyboard.

4 Tap **Menu** > **BW/AVG** > **Average** to set the number of measurements to be averaged using the on-screen keyboard. The input value range is from 1 to 100.

To set limit

1 Tap **Menu > Limit**.

2 Tap to switch the **Test Limits** to **On** or **Off** to enable or disable Pass/Fail indication.

The result table color for Pass is green, and the result table color for Fail is red.

3 Tap **High Limit** to set the upper threshold using the on-screen keyboard.

4 Tap **Low Limit** to set the lower threshold using the on-screen keyboard.

5 *Optional*: Tap the **Save** hot key on the side bar and select the save option from the choices available for your measurement mode.

Figure 271 shows an example of LTE/LTE-A FDD channel power measurement.

Figure 271 LTE/LTE-A FDD channel power measurement



NOTE

Channel Power measurement result shows channel power and spectrum density in a user specified channel bandwidth. The peak to average ratio (PAR) is shown at the bottom of the screen as well. The shaded area on the display indicates the channel bandwidth.

Occupied bandwidth

The Occupied Bandwidth measures the percentage of the transmitted power within a specified bandwidth. The percentage is typically 99%.

Setting measure setup

After configuring the spectrum measurement in "Configuring spectrum measurements" on page 25, you can set the measure setup to continue your measurement.

To set measure setup

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap **Bandwidth** and select the value from the following choices: **1.4 MHz**, **3 MHz**, **5 MHz**, **10 MHz**, **15 MHz**, or **20 MHz**.

You can also tap the rectangle with value,(Bandwidth 10 MHz) under the chart screen and input the value using the on-screen keyboard.

3 Tap the **Center Frequency** (Center 1.000 000 000 GHz)icon under the chart screen to set the center frequency using the on-screen keyboard.

4 Tap **Menu** > **BW/AVG** > **Average** to set the number of measurements to be averaged using the on-screen keyboard. The input value range is from 1 to 100.

To set limit

1 Tap **Menu > Limit**.

2 Tap to switch the **Test Limits** to **On** or **Off** to enable or disable Pass/Fail indication.

The result table color for Pass is green, and the result table color for Fail is red.

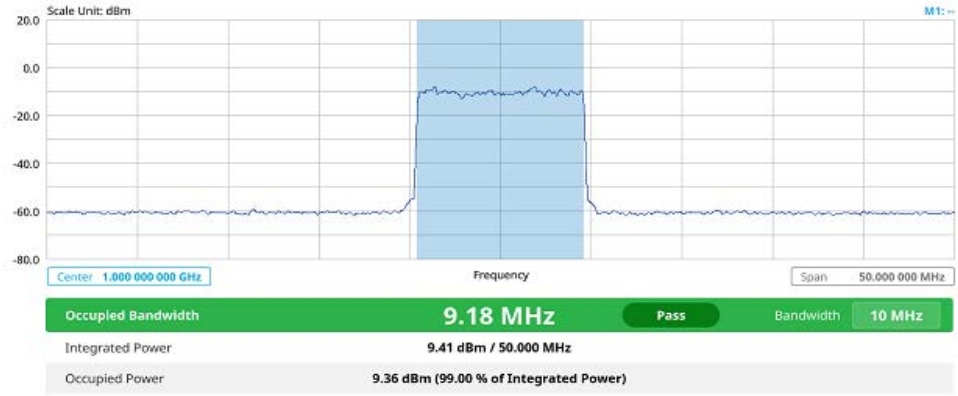
3 Tap **High Limit** to set the upper threshold using the on-screen keyboard.

4 Tap **Low Limit** to set the lower threshold using the on-screen keyboard.

5 *Optional*: Tap the **Save** hot key on the side bar and select the save option from the choices available for your measurement mode.

Figure 272 shows an example of LTE/LTE-A FDD occupied bandwidth measurement.

Figure 272 LTE/LTE-A FDD occupied bandwidth measurement



NOTE
The Occupied Bandwidth measurement shows both power across the band and power bandwidth in a user specified percentage to determine the amount of spectrum used by a modulated signal. Occupied bandwidth is typically calculated as the bandwidth containing 99% of the transmitted power.

Spectrum emission mask

The Spectrum Emission Mask (SEM) measurement is to identify and determine the power level of out-of-band spurious emission outside the necessary channel bandwidth and modulated signal. It measures the power ratio between in-band and adjacent channels. The instrument indicates either Pass or Fail based on the specified limit of the signal.

Setting measure setup

After configuring the spectrum measurement in “Configuring spectrum measurements” on page 25, you can set the measure setup to continue your measurement.

To set measure setup

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap **Bandwidth** and select the value from the following choices: **1.4 MHz**, **3 MHz**, **5 MHz**, **10 MHz**, **15 MHz**, or **20 MHz**.

You can also tap the rectangle with value,(

) under the chart screen and input the value using the on-screen keyboard.

3 Tap **Mask Type** and select the type from the following choices: **Wide Area BS A**, **Wide Area BS B**, **Local Area BS**, or **Home BS**

To set limit

1 Tap **Menu > Limit**.

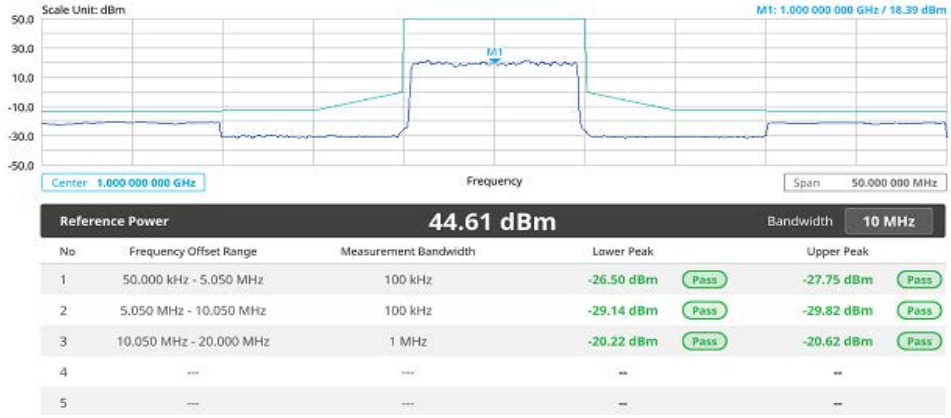
2 Tap to switch the **Test Limits** to **On** or **Off** to enable or disable Pass/Fail indication.

The result table color for Pass is green, and the result table color for Fail is red.

3 *Optional*: Tap the **Save** hot key on the side bar and select the save option from the choices available for your measurement.

Figure 273 shows an example of LTE/LTE-A FDD spectrum emission mask measurement.

Figure 273 LTE/LTE-A FDD spectrum emission mask measurement



NOTE

If Lower Peak or Upper Peak indicates Fail, the mask line becomes red.
If the Trace View is set to Off, the Reference Power, Lower Peak, and Upper Peak is not shown. If the Trace View is set to On and the Trace Type is selected other than Clear Write, the Reference Power, Lower Peak, and Upper Peak is shown with value and "*" at the end of the value.

ACLR

The Adjacent Channel Power Ratio (ACPR) designated by the 3GPP LTE/LTE-A specifications as the Adjacent Channel Leakage Power Ratio (ACLR), is the power contained in a specified frequency channel bandwidth relative to the total carrier power. It may also be expressed as a ratio of power spectral densities between the carrier and the specified offset frequency band.

Setting measure setup

After configuring the spectrum measurement in "Configuring spectrum measurements" on page 25, you can set the measure setup to continue your measurement.

To set measure setup

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap **Bandwidth** and select the value from the following choices: **1.4 MHz**, **3 MHz**, **5 MHz**, **10 MHz**, **15 MHz**, or **20 MHz**.

You can also tap the rectangle with value,(Bandwidth 10 MHz) under the chart screen and input the value using the on-screen keyboard.

To set limit

1 Tap **Menu > Limit**.

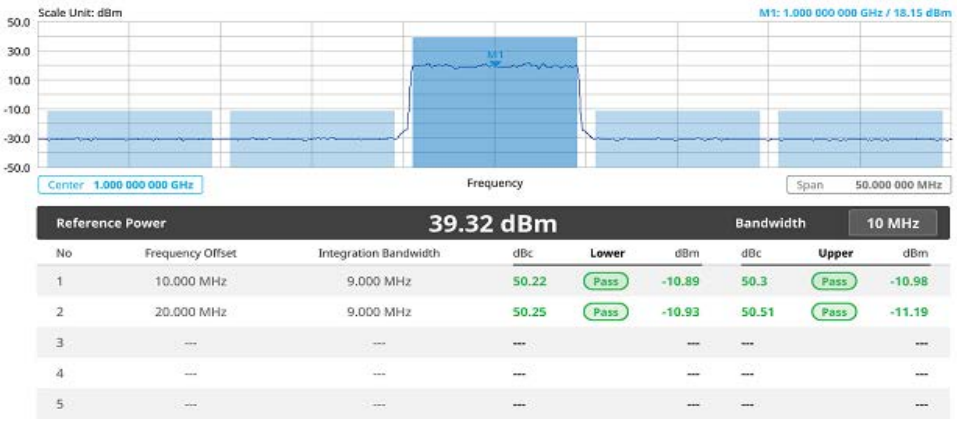
2 Tap to switch the **Test Limits** to **On** or **Off** to enable or disable Pass/Fail indication.

The result table color for Pass is green, and the result table color for Fail is red.

3 *Optional*: Tap the **Save** hot key on the side bar and select the save option from the choices available for your measurement.

Figure 274 shows an example of LTE/LTE-A FDD ACLR measurement.

Figure 274 LTE/LTE-A FDD ACLR measurement



Multi-ACLR

The Multi-ACLR measurement is used to perform multi-channel ACLR measurements with as many channels as possible. It helps you to measure ACLR in multi-channel transmitting Base Station environment.

Setting measure setup

After configuring the spectrum measurement in "Configuring spectrum measurements" on page 25, you can set the measure setup to continue your measurement.

To set measure setup

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap **Bandwidth** and select the value from the following choices: **1.4 MHz**, **3 MHz**, **5 MHz**, **10 MHz**, **15 MHz**, or **20 MHz**.

You can also tap the rectangle with value,(Bandwidth 10 MHz) under the chart screen and input the value using the on-screen keyboard.

3 Tap **Lowest Frequency** to set the starting center frequency and enter the value using the on-screen keyboard.

4 Tap **Highest Frequency** to set the stopping center frequency and enter the value using the on-screen keyboard.

5 Tap **Lowest Channel Number** to set the starting channel and enter the value using the on-screen keyboard.

6 Tap **Highest Channel Number** to set the stopping channel and enter the value using the on-screen keyboard.

7 Tap **Channel Standard** to select channel standard from a pop-up window and tap the **Apply** button.

To set limit

1 Tap **Menu > Limit**.

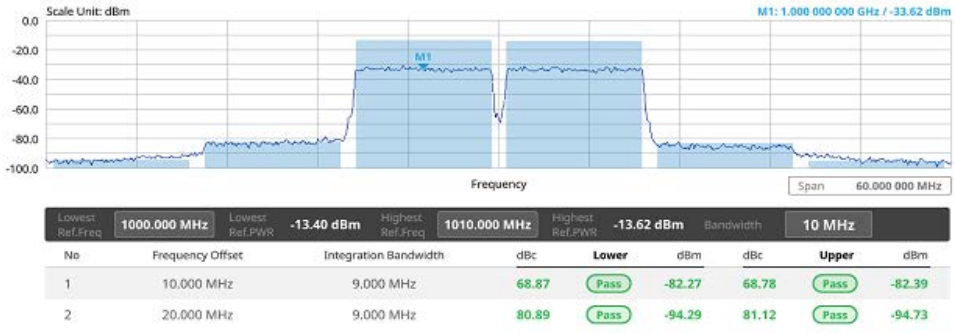
2 Tap to switch the **Test Limits** to **On** or **Off** to enable or disable Pass/Fail indication.

The result table color for Pass is green, and the result table color for Fail is red.

3 *Optional*: Tap the **Save** hot key on the side bar and select the save option from the choices available for your measurement.

Figure 275 shows an example of LTE/LTE-A FDD Multi-ACLR measurement.

Figure 275 LTE/LTE-A FDD Multi-ACLR measurement



NOTE
You can set the Lowest Ref. Frequency and Highest Ref. Frequency by tapping the rectangle with value using the on-screen keyboard.

Spurious emissions

The Spurious Emissions measurement is to identify or determine the power level of in-band or out-of-band spurious emissions within the necessary channel bandwidth and modulated signal. The instrument indicates either Pass or Fail based on the specified limit of the signal.

Note that this feature is not supported in SPA06MA-O yet.

Setting measure setup

After configuring the spectrum measurement in "Configuring spectrum measurements" on page 25, you can set the measure setup to continue your measurement. The frequency setting is not used in the Spurious Emissions mode.

To set measure setup

1. Tap the **Setup** ( ) icon in the side bar.
2. Tap Configuration or the **Configuration**( ) icon.
3. Tap **Range** under the chart screen and switch to **On** to display or **Off** to hide the selected range in the result table.

   You can select the range number between **1** and **20** to add as a new or change the existing settings.
4. Tap **Start Frequency/Stop Frequency** and enter the value for the selected range using the on-screen keyboard.
5. Tap **Start Limit/Stop Limit** and enter the lower limit/upper limit for Pass/Fail indication.
6. Tap **Attenuation/RBW/VBW** and specify or select the value.
7. Tap **Measurement Type** between **Full** and **Examine**.

   The **Examine** mode displays only the selected range while the **Full** mode lets the instrument automatically change the selected range from one another.
8. Tap **Average** on the box of upper screen and enter the value between **1** and **100** to set the number of measurements to be averaged.

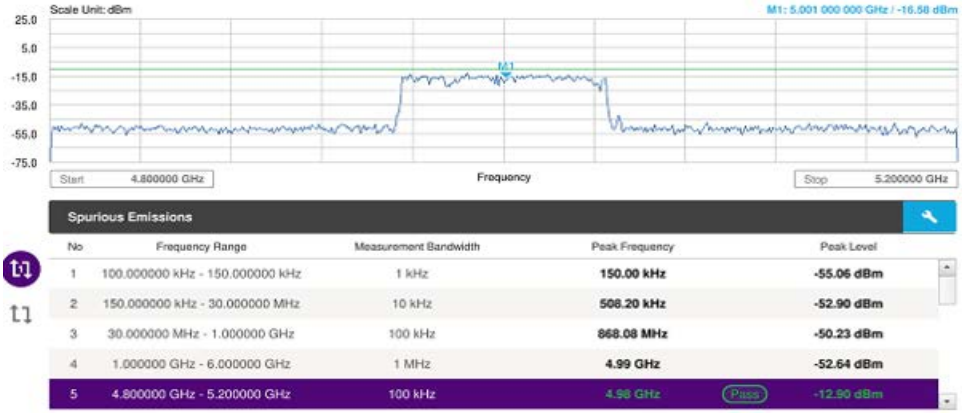
   You can also access this menu through **Menu > Average** on the side bar.

To set limit

1. Tap **Menu > Limit**.
2. Tap to switch the **Test Limits** to **On** or **Off** to enable or disable Pass/Fail indication.
3. *Optional*: Tap the **Save** hot key on the side bar and select the save option from the choices available for your measurement.

Figure 276 shows an example of LTE/LTE-A FDD spurious emissions measurement.

Figure 276 LTE/LTE-A FDD spurious emissions measurement



NOTE
You can only set the frequency range and attenuation by tapping the Configuration icon. If you select the first icon next to the Range table above, it only shows the selected range and if you select the second icon next to the Range table, it keeps moving from the first selected range to the final selected range.

OTA analysis

The following sections describe how to perform OTA analysis.

OTA channel scanner

The OTA Channel Scanner is a radio receiver that can automatically tune or scan two or more discrete frequencies and multi-channels, indicating when it finds a signal on one of them and then continuing scanning when that frequency goes silent.

Setting measure setup

After configuring the spectrum measurement in “Configuring spectrum measurements” on page 25, you can set the measure setup to continue your measurement. The measurement settings can be saved and recalled as a file by selecting File Type as Setup and load the file onto the instrument using the **Save/Load** icons on the side bar.

To set measure setup

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap to switch **MIB Decoding** to **On** when you do not know the number of transmitter antennas and Bandwidth or otherwise to **Off**.

3 Tap the **MIMO** and select **2x2** or **4x4** to select the number of antenna ports.

4 Tap **CA Configuration** or tap the **Configuration** ( ) icon.

General Setting and Carrier Setting table appear.

General setting

1 Tap **Trigger** to set **Internal**, **External** or **GNSS** as required.

- **Internal**: when starting a signal processing using the internal reference clock and creating a trigger
- **External**: when starting a signal processing based on the external input trigger
- **GNSS**: When synchronizing the signal processing via the GNSS receiver. If you want to check the time error correctly, set the trigger to GNSS

Carrier setting

1 Tap **Index** to select up to 6 numbers of carriers.

2 Select **Center Frequency** to set the center frequency using the on-screen keyboard.

a If you apply **Center Frequenc**, **Channel No**, and **Bandwidth** all at once, tap the **Center Frequency List** ( ) icon and do the following:

- Tap the **Add** (+) icon and input **Center Frequency**, **Channel No**, and **Bandwidth** as required using the on-screen keyboard.
- Tap the **Apply** button to apply the changes. The screen moves to the Center Frequency List table.
- Highlight the one of the added lists and tap the **Configuration** icon that appears in gray to change the applied values.
- Tap the **Delete** icon to delete the selected list(s).



NOTE
You will be able to multi-select the added items and apply them all at once only if the Index number is On. If the Index 1 and 3 are On and you highlight No. 0,3,and 4, the first two highlighted lists, 0 and 3 are applied to each carrier 1 and 3.

3 Select **Channel Standard** to set the channel standard for the selected index using the on-screen keyboard.

4 Select **Channel Number** to set the channel number for the selected index using the on-screen keyboard.

5 Select **Bandwidth** from the following options: **1.4 MHz**, **3 MHz**, **5 MHz**, **10 MHz**, **15 MHz**, or **20 MHz**.

6 Tap the **External Offset** box and input the value using the on-screen keyboard and tap to switch the external offset to **On** (green) or **Off** (gray) as desired.

7 Tap the **Attenuation** box and input the value using the on-screen keyboard if you want to set it manually (**Manual**). Or tap it to set **Auto**.

8 Tap to switch the **Preamp** box **1**, **2**, and **Auto** to **On** (green) or **Off** (gray).

9 Tap the **Add** button to add Index or **Delete** button to delete the selected Index.

10 *Optional.* The **NTN Configuration** box appears only if the ONA-SP-LTE-NTN license is available.

a Tap **Settings** to open the **NTN Configuration** window.

b Tap MCC and MNC and input the required values.

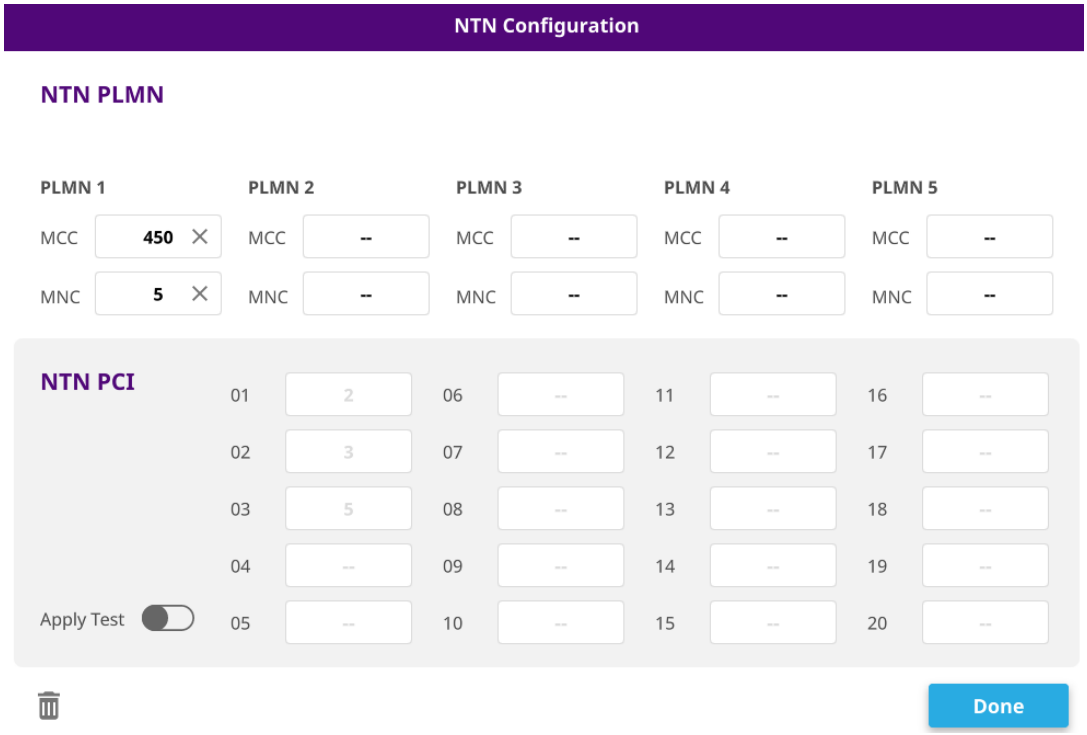
c Tap the **Done** button.

d If NTN cannot be found using the PLMN (MCC/MNC) information:

- Set **Apply Test** to **On** (green).
- Input the required NTN PCI from 1 to 20.
- Tap the **Done** button to complete the NTN configuration.

Figure 277 shows an example of NTN Configuration Window.

Figure 277 NTN Configuration Window



To set limit

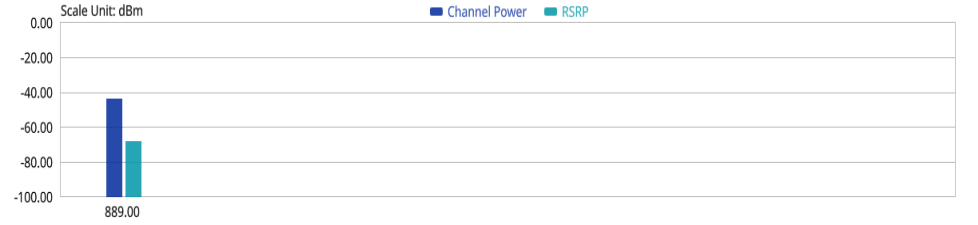
1 Tap **Menu** > **Limit**.

2 Tap to switch **Limit Line** to **On** or **Off**.

3 Tap **Limit Line** and input the value using the on-screen keyboard to enable or disable Pass/Fail indication.

Figure 278 shows an example of OTA LTE/LTE-A FDD channel scanner measurement.

Figure 278 LTE/LTE-A FDD OTA channel scanner measurement



No	Frequency (MHz)	PCI (Grp,Sctr)	Channel Power (dBm)	RSSI (dBm)	RSRP (dBm)	RSRQ (dB)	S-SS RSRP (dBm)	P-SS RSRP (dBm)	Time Error (µs)	Freq Error (ppm)	RS SINR (dB)
1	889.00	410 (136,2)	-43.72	-45.76	-68.15	-5.85	-68.32	-67.78	0.00	0.01	16.87
2	--	--	--	--	--	--	--	--	--	--	--
3	--	--	--	--	--	--	--	--	--	--	--
4	--	--	--	--	--	--	--	--	--	--	--
5	--	--	--	--	--	--	--	--	--	--	--
6	--	--	--	--	--	--	--	--	--	--	--

Figure 279 OTA channel scanner with NTN



No	Frequency (MHz)	PCI *NTN (Grp,Sctr)	Channel Power (dBm)	PLMN *NTN (MCC/MNC)	RSSI (dBm)	RSRP (dBm)	RSRQ (dB)	S-SS RSRP (dBm)	P-SS RSRP (dBm)	Time Error (µs)	Freq Error (ppm)	RS SII (dB
1	879.00	174 (58,0)	-43.24	450 / 5	-45.29	-66.28	-4.56	-69.94	-69.79	-0.20	0.040	15.6
2	889.00	410 (136,2)	-37.28	450 / 6	-40.72	-63.90	-6.63	-64.85	-64.98	-2.99	0.030	16.3
3	--	--	--	--	--	--	--	--	--	--	--	--
4	--	--	--	--	--	--	--	--	--	--	--	--
5	--	--	--	--	--	--	--	--	--	--	--	--
6	--	--	--	--	--	--	--	--	--	--	--	--

Figure 280 LTE/LTE-A FDD OTA channel scanner with frequency error

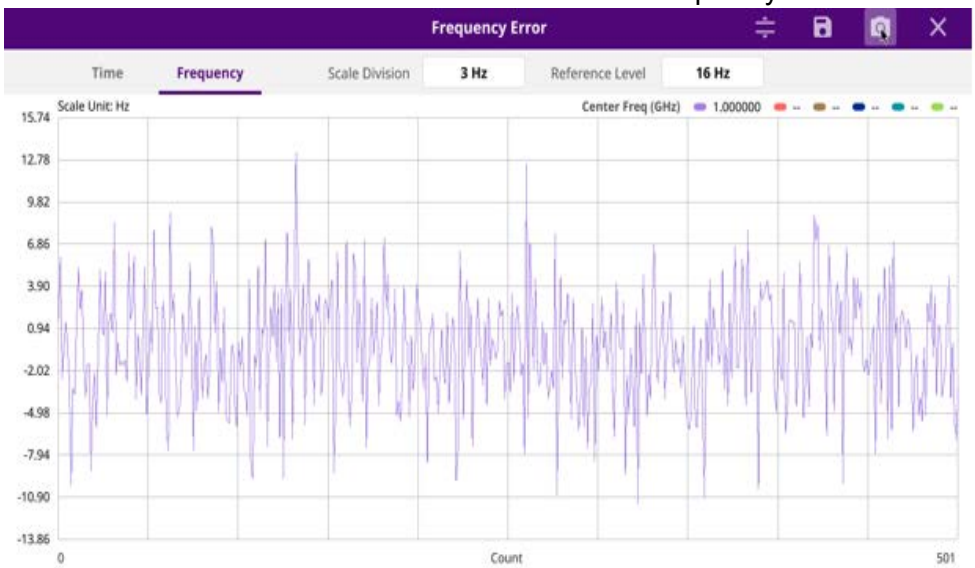
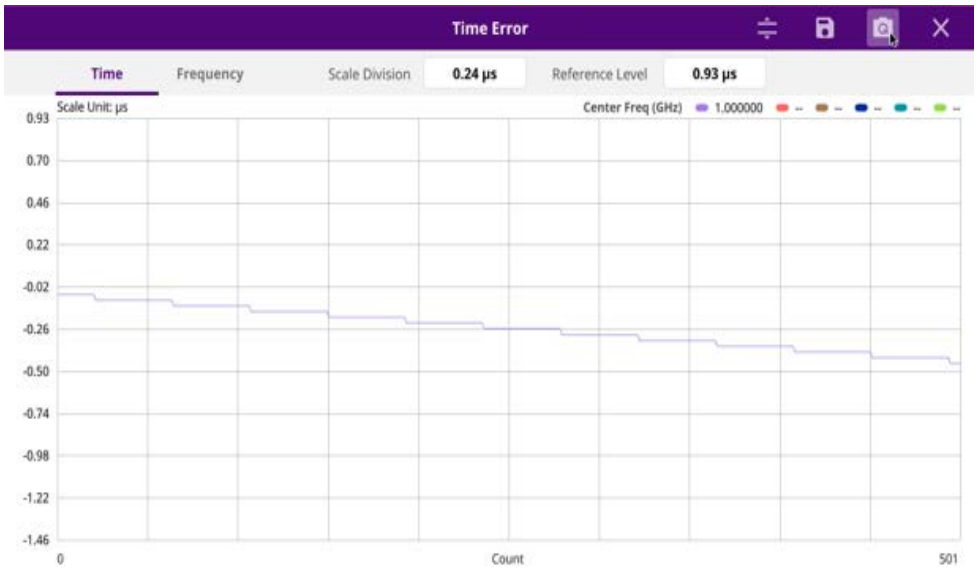


Figure 281 LTE/LTE-A FDD OTA channel scanner with time error



Using icons

You can tap the **Magnifier** icon to check the frequency or time error. You can also perform the following operation using the icons.

Icon	Description
	**Auto Scale**: You can set the scale automatically.
	**Save as CSV**: You can assign file name using the on-screen keyboard and apply the changes. This will let you save your measurement file internally.
	**Quick Save**: You can save current measurement screen as it is.
	**Close**: You can close the screen you are seeing now.

OTA ID scanner

The LTE mobile receives signals from multiple base stations, all of which share the same spectrum and are present at the same time. Each base station has unique scrambling code assigned to the particular base station and it differentiates its signal from other base stations in the area.

The ID Scanner shows key parameters such as RSRP (Reference Signal Received Power) and RSRQ (Reference Signal Received Quality) that predict the downlink coverage quickly. RSRPs from entire cells help to rank between the different cells as

input for handover and cell reselection decisions. RSRQ provides additional information when RSRP is not sufficient to make a reliable handover or cell reselection decision.

Setting measure setup

After configuring the spectrum measurement in "Configuring spectrum measurements" on page 25, you can set the measure setup to continue your measurement. The measurement settings can be saved and recalled as a file by selecting File Type as Setup and load the file onto the instrument using the **Save/Load** icons on the side bar.

To set measure setup

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap to switch **PLMN/BW Decoding** to **On** or **Off**.

When enabled, PLMN/BW Decoding decodes LTE broadcast messages (such as MIB and SIB) to identify the serving cell and determine the operating bandwidth. They are displayed at the top left of the measurement table.

3 Tap **Bandwidth** and select the value from the following choices: **1.4 MHz**, **3 MHz**, **5 MHz**, **10 MHz**, **15 MHz** or **20 MHz**.

4 Tap the **MIMO** and select **2x2** or **4x4 Hz** to select the number of antenna ports.

5 To select the Cyclic Prefix, tap **Cyclic Prefix** and select **Normal** or **Extended**.

6 *Optional.* The **NTN Configuration** box appears only if the ONA-SP-LTE-NTN license is available.

a Tap to turn **NTN On**.

b Tap **NTN Configuration**.

c Tap MCC and MNC and input the required values.

d Tap the **Done** button.

e If NTN cannot be found using the PLMN (MCC/MNC) information:

- Set **Apply Test** to **On** (green).
- Input the required NTN PCI from 1 to 20.

f Tap the **Done** button to complete the NTN configuration.

7 *Optional.* Tap **Limit** > **PCI Dominance**. Once tapped On, you can set the value using the on-screen keyboard.

If the PCI dominance is on, you can judge pass (green) or fail (red) with colors based on the limit you have set. For example, if it becomes smaller than the threshold, the fail indicator (red) can be identified in the PCI column of the result table and the top right corner of the instrument at the same time.

8 *Optional*. Tap the **Save** hot key on the side bar and select the save option from the choices available for your measurement mode.

Figure 282 shows an example of OTA LTE/LTE-A FDD ID scanner measurement.

Figure 282 LTE/LTE-A FDD OTA ID scanner measurement



MCC/MNC 450 / 6 (South Korea / LG U+) Cell Identity 51780623

No	PCI (Grp,Sctr)	RSRP (dBm)	RSRQ (dB)	P-SS SNR (dB)	RS SINR (dB)	S-SS RSSI (dBm)	P-SS RSRP (dBm)	S-SS RSRP (dBm)	S-SS Ec/Io (dB)	Time Error (µs)	Frequency Error (ppm)
1	410 (136,2)	-74.93	-7.88	39.54	7.56	-55.14	-71.97	-73.06	-0.95	-0.03	0.001
2	225 (75,0)	-89.20	-20.30	25.27	-6.03	-69.41	-83.84	-87.34	-12.41	-0.13	-1.124
3	--	--	--	--	--	--	--	--	--	--	--
4	--	--	--	--	--	--	--	--	--	--	--
5	--	--	--	--	--	--	--	--	--	--	--
6	--	--	--	--	--	--	--	--	--	--	--

Figure 283 LTE/LTE-A FDD OTA ID scanner with NTN



No	PCI *NTN (Grp,Sctr)	PLMN *NTN (MCC/MNC)	RSRP (dBm)	RSRQ (dB)	P-SS SNR (dB)	RS SINR (dB)	S-SS RSSI (dBm)	P-SS RSRP (dBm)	S-SS RSRP (dBm)	S-SS Ec/Io (dB)	Time Error (µs)	Frequency Error (ppm
1	410 (136,2)	450 / 6	-63.46	-5.61	38.55	19.04	-45.61	-63.13	-63.54	-0.96	-0.16	0.029
2	225 (75,0)	--	-79.92	-22.15	22.09	-10.48	-62.08	-79.36	-80.00	-16.54	-0.72	-1.124
3	--	--	--	--	--	--	--	--	--	--	--	--
4	--	--	--	--	--	--	--	--	--	--	--	--
5	--	--	--	--	--	--	--	--	--	--	--	--
6	--	--	--	--	--	--	--	--	--	--	--	--

OTA multipath profile

The Multipath Profile enables you to determine RF environmental conditions of testing area. It indicates the amount of power of the dominant pilot signal that is dispersed outside the main correlation peak due to multipath echoes that are expressed in dB. This value should be very small ideally.

The multipath profile is the result of portions of the original broadcast signal arriving at the receiving antenna out of phase. This can be caused by the signal being reflected off objects such as buildings or being refracted through the atmosphere differently from the main signal.

Setting measure setup

After configuring the spectrum measurement in "Configuring spectrum measurements" on page 25, you can set the measure setup to continue your measurement. The measurement settings can be saved and recalled as a file by selecting File Type as Setup and load the file onto the instrument using the **Save/Load** icons on the side bar.

To set measure setup

1. Tap the **Setup** ( ) icon in the side bar.
2. Tap to switch **MIB Decoding** to **On** when you do not know the number of transmitter antennas and Bandwidth or otherwise to **Off**.
3. Tap **Bandwidth** and select the value from the following choices: **1.4 MHz**, **3 MHz**, **5 MHz**, **10 MHz**, **15 MHz** or **20 MHz**.
4. Tap **RS Window Length** and select the RS window option: **2 µs, 4 µs,** or **8 µs**.
5. Tap **RS Window Display** and select between **Default** and **Symmetrical**.

   If you select **Symmetrical**, it will show the symmetrical view for the measurement screen.
6. Tap **Subframe Number** to set the number of subframe using the on-screen keyboard.
7. *Optional.* Tap **Physical Cell ID** and select the type **Manual** or **Auto**.
   - **Auto** lets the instrument detect the Physical Cell ID for the LTE signal automatically.
   - **Manual** sets a specific Physical Cell ID for the LTE signal manually in order to speed up with the synchronization with a BTS.

NOTE
When there are no PSS and SSS signals, set the PCI Cell ID to Manual and input the required PCI number to search CRS.

8. Tap the **MIMO** and select **2x2** or **4x4** to select the number of antenna ports.
9. To select the Cyclic Prefix, tap **Cyclic Prefix** and select **Normal** or **Extended**.

Figure 284 shows an example of LTE/LTE-A FDD OTA multipath profile measurement.

Figure 284 LTE/LTE-A FDD OTA multipath profile measurement



No	Relative Ant0 RS	Delay
1	0.00 dB	0.00 µs
2	-3.26 dB	1.00 µs
3	---	---
4	---	---
5	---	---
6	---	---

No	Relative Ant1 RS	Delay
1	0.00 dB	0.00 µs
2	-3.21 dB	1.00 µs
3	---	---
4	---	---
5	---	---
6	---	---

OTA control channel

DL RS power is the resource element power of Downlink Reference Symbol. The absolute DL RS power is indicated on the BCH. The absolute accuracy is defined as the maximum deviation between the DL RS power indicated on the BCH and the DL RS power at the BS antenna connector.

The OTA Control Channel provides summary of all control channels including RS power trend over time. GPS coordinates (latitude and longitude) will be displayed on the screen if a GPS antenna is connected and locked to the GPS satellites.

Setting measure setup

After configuring the spectrum measurement in “Configuring spectrum measurements” on page 25, you can set the measure setup to continue your measurement. The measurement settings can be saved and recalled as a file by selecting File Type as Setup and load the file onto the instrument using the **Save/Load** icons on the side bar.

To set measure setup

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap to switch **MIB Decoding** to **On** when you do not know the number of transmitter antennas and Bandwidth or otherwise to **Off**.

3 Tap **Bandwidth** and select the value from the following choices: **1.4 MHz**, **3 MHz**, **5 MHz**, **10 MHz**, **15 MHz** or **20 MHz**.

4 Tap **Subframe Number** to set the number of subframe using the on-screen keyboard.



NOTE
For MBMS testing, this subframe number must be either 0 or 5 as these subframes 0 and 5 are not available for MBMS and it must be set to the MBMS transmitted channel's subframe number.

5 *Optional.* Tap **Physical Cell ID** and select the type **Manual** or **Auto**.
- **Auto** lets the instrument detect the Physical Cell ID for the LTE signal automatically.
- **Manual** sets a specific Physical Cell ID for the LTE signal manually in order to speed up with the synchronization with a BTS.



NOTE
When there are no PSS and SSS signals, set the PCI Cell ID to Manual and input the required PCI number to search CRS.

6 Tap the **MIMO** and select **2x2** or **4x4** to select the number of antenna ports.

7 *Optional.* To assign an antenna port number automatically or manually, tap the **Antenna Port** under **Antenna menu** and select the option: **Auto**, **Antenna 0**, **Antenna 1**, **Antenna 2**, or **Antenna 3**.

If the MIMO is set to 2x2, the antenna ports 2 and 3 are disabled.

8 To turn the Multimedia Broadcast Multicast Service (**MBMS**) feature on or off, tap **MBMS** and select **On** or **Off**. For proper MBMS testing, you need to set the **Subframe Number** in the upper right screen with the same PMCH subframe number. If this setting is on, the measurement item MBSFN RS appears in the result table.

9 To set the Multicast Broadcast Single Frequency Network (**MBSFN**) detection automatically or manually for MBMS testing, tap **MBSFN** and select **Auto** or **Manual**.

10 To select the Cyclic Prefix, tap **Cyclic Prefix** and select **Normal** or **Extended**.

11 Tap **Menu** > **Display** and select **EVM** or **Power**.

The screen changes according to the selected option.

To set limit

1 Tap **Menu** > **Limit**.

2 Tap the test items and set the limits depending on your selected measurement mode:

To set the limit for	Select and set
RS EVM	RS0/1/2/3 Limit Mode On/Off, High Limit
P-SS EVM	Test limits On/Off, High Limit

To set the limit for	Select and set
S-SS EVM	Test limits On/Off, High Limit
Frequency Error	Test limits On/Off, High/Low Limit
Time Error	Test limits On/Off, High/Low Limit
Time Alignment Error	Test limits On/Off, High Limit

3 Tap the **Save** icon on the side bar and select the save option from the choices available for your measurement mode.

Figure 285 shows an example of LTE/LTE-A FDD OTA control channel measurement.

Figure 285 LTE/LTE-A FDD OTA control channel measurement



OTA datagram

The OTA Datagram is a time-varying spectral representation that shows how the power of a signal varies with time. The power allocated to the specific resource block will be represented with an amplitude axis (in dBm) and the waterfall diagram will show the trend of past resource block power over certain period. Using a marker function facilitates analysis of accumulated resource block power for data utilization.

Note that this feature is not supported in SPA06MA-O yet.

Setting measure setup

After configuring the spectrum measurement in “Configuring spectrum measurements” on page 25, you can set the measure setup to continue your measurement. The measurement settings can be saved and recalled as a file by selecting File Type as Setup and load the file onto the instrument using the **Save/Load** icons on the side bar.

To set measure setup

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap to switch **MIB Decoding** to **On** when you do not know the number of transmitter antennas and Bandwidth or otherwise to **Off**.

3 Tap **Bandwidth** and select the value from the following choices: **1.4 MHz**, **3 MHz**, **5 MHz**, **10 MHz**, **15 MHz** or **20 MHz**.

4 Tap **Subframe Number** to set the number of subframe using the on-screen keyboard.

5 Tap **Position** to set the number of positions using the on-screen keyboard when **Time Cursor** is set to **On**.

6 *Optional.* Tap **Physical Cell ID** and select the type between **Manual** and **Auto**.
- **Auto** lets the instrument detect the Physical Cell ID for the LTE signal automatically.
- **Manual** sets a specific Physical Cell ID for the LTE signal manually in order to speed up with the synchronization with a BTS.

NOTE
When there are no PSS and SSS signals, set the PCI Cell ID to Manual and input the required PCI number to search CRS.

7 *Optional.* To set the threshold for PDSCH, tap **PDSCH Threshold** and enter a value by using the on-screen keyboard.

8 To set the time cursor at a specific position, tap **Time Cursor** and select **On**.

NOTE
For MBMS testing, this subframe number must be either 0 or 5 as these subframes 0 and 5 are not available for MBMS and it must be set to the MBMS transmitted channel's subframe number.

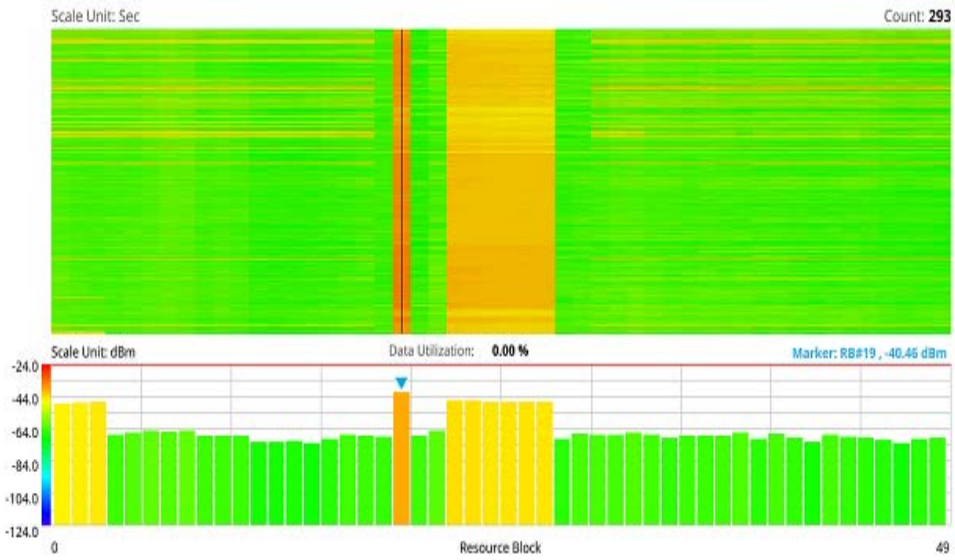
9 To start a new measurement, tap **Reset**.

10 *Optional.* To select the number of antenna ports, tap the **MIMO** and select **2x2** or **4x4.**

11 *Optional.* To select the Cyclic Prefix, tap **Cyclic Prefix** and select **Normal** or **Extended**.

Figure 286 shows an example of LTE/LTE-A FDD OTA datagram measurement.

Figure 286 LTE/LTE-A FDD OTA datagram measurement



OTA route map

LTE route map traces the power level of the strongest LTE signal in terms of RSRP corresponding to a particular time and geographical position and presents it in a geographical map as a measurement point. All the collected measurements can be exported for post-processing purposes, including data of the strongest LTE signal for each measurement point, including its measurement time and geographical location.

Figure 287 shows an example of LTE/LTE-A FDD OTA route map measurement.

Figure 287 OTA route map with LTE/LTE-A FDD analyzer



Figure 288 OTA route map with NTN



Loading a map

To use any features related to maps, you need to download and install the maps on the instrument. The VIAVI JDMapCreator will help you download maps. Make sure the JDMapCreator application on your computer is connected to the instrument via LAN. You can send a map file with a single layer to the instrument directly by using the Send to EQP menu in JDMapCreator. For more information on how to use the JDMapCreator, see the *JDMapCreator 2.0 User Guide*.

To load a map

1. Plug in your USB flash drive that has a map with a file type of .mcfv created in JDMapCreator.
2. Tap the **Load** ( ) icon on the side bar.
3. Navigate to the map file that you want to open.

   The **File Information** pane displays the file properties, including its name, size, type, and date modified.
4. Tap the **Load** button on the screen.
5. Once you have loaded the map, you can also control the map using the following icons on the map.

Table 142 Map icons

Icon	Description
	Tap to go to your current location on the map. Once tapped, a purple icon appears on the map, indicating your current location.
	Tap to switch to the full screen map view.

Table 142 Map icons

Icon	Description
	Tap to zoom in on the map.
	Tap to zoom out on the map.
	Tap and select the area that you want to expand.

The left-most cell-site icon is activated when you import the cell-site information file.

To set measure setup

Before starting the Route Map measurement, you need to set Spectrum measurements displayed on the quick access and display tab. See “Configuring spectrum measurements” on page 25 for more information.

1. If required, connect a GNSS receiver to your instrument for outdoor mapping. Indoor mapping does not necessarily need a GNSS antenna.
2. Tap the Setup ( ) icon on the side bar.
3. Tap to switch **MIB Decoding** to **On** when you do not know the number of transmitter antennas and Bandwidth or otherwise to **Off**.
4. Tap to switch the **Plot Point** to **GNSS**, **Position**, or **Time**.
   a. To collect data/plot points automatically as you move around in a vehicle or outside, select **GNSS**, then tap to switch the **Screen Mode** between **Map** and **Full**.
      - With the **Map** setting, you can view only the collected points that can be seen within the boundary of the loaded map.
      - With the **Full** setting, you can view all the collected points of the route without the loaded map.
   b. To collect data/plot points manually in an indoor layout without a GNSS antenna, select **Position**.
   c. To collect data/plot points based on time, select **Time**.
5. Tap to switch **Plot Item** to **RSRP**, **RSRQ**, **RS SINR**, **S-SS RSSI**, **P-SS RSRP**, **S-SS RSRP**, **S-SS Ec/Io** or **P-SS SNR**.
6. Tap **Bandwidth** and select the value from the following choices: **1.4 MHz**, **3 MHz**, **5 MHz**, **10 MHz**, **15 MHz** or **20 MHz**.

7 Tap to switch **Physical Cell ID** to **Manual** or **Auto**.

– **Auto** lets the instrument detect the Physical Cell ID for the LTE signal automatically

– **Manual** sets a specific Physical Cell ID for the LTE signal manually in order to speed up the synchronization with a BTS.

NOTE
When there are no PSS and SSS signals, set the PCI Cell ID to Manual and input the required PCI number to search CRS.

8 If you set the Physical Cell ID to Manual, tap **Physical Cell ID** and input the value using the on-screen keyboard.

NOTE
The instrument does not automatically save the collected data. It is recommended that you save the result. If not, you will lose all the collected data.

9 *Optional.* The **NTN Configuration** box appears only if the ONA-SP-LTE-NTN license is available.

a Tap to turn **NTN On**.

b Tap **NTN Configuration**.

c Tap MCC and MNC and input the required values.

d Tap the **Done** button.

e If NTN cannot be found using the PLMN (MCC/MNC) information:

- Set **Apply Test** to **On** (green).
- Input the required NTN PCI from 1 to 20.

f Tap the **Done** button to complete the NTN configuration.

To set limit

You can set the thresholds for the two different color indicators, red and blue. The maximum value is the Limit for **Excellent**, and the minimum value is the Limit for **Poor**. See below to check the plot point color based on the Legend Color Table.

1 Tap the rectangle with value before color legend bar on the right panel.

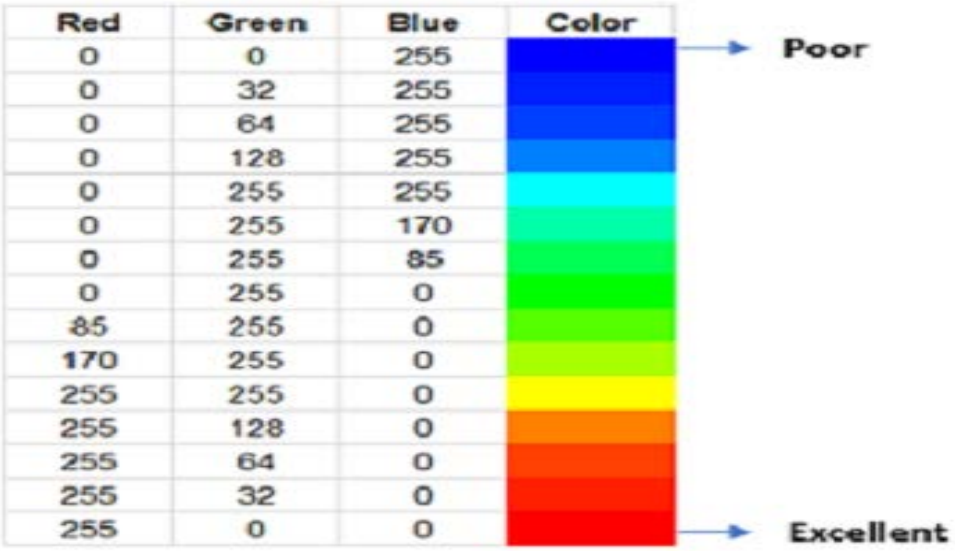
2 Set a value for **Poor** (minimum value) using the on-screen keyboard.

3 Tap the rectangle with value after color legend bar on the right panel.

4 Set a value for **Excellent** (maximum value) using the on-screen keyboard.

Figure 289 shows a legend color table.

Figure 289 Legend color table



Logging data

To use any features related to maps, you need to download and install the maps on the instrument. The VIAVI JDMapCreator will help you download maps. Make sure the JDMapCreator application on your computer is connected to the instrument via LAN. You can send a map file with a single layer to the instrument directly by using the Send to EQP menu in JDMapCreator. For more information on how to use the JDMapCreator, see the *JDMapCreator 2.0 User Guide*.

To log data

1 Follow **steps 1 to 3** in Setting measure setup.

2 Tap the **Testing** button on the right panel of the map to start plotting on the map. When you select a point on the map, a marker appears and the Information window appears on the right panel.

3 Tap the **Stop** ( ) button to stop plotting.

4 Tap the **Pause** button( ) to pause plotting, then the GNSS point cannot be plotted.

5 If you start test and select **Menu** > **Map** > **Plot Point** > **Position**, you can undo by tapping the **Testing** button.

6 If you select the **Stop** button, the Plot Stop pop-up window appears, then tap **Yes**.

7 Tap **Yes** when the Save pop-up window appears and save the logging file to your USB.

Viewing the logging data

To view the logging data

1 Load the saved logging file using the **Load** () icon on the side bar. Make sure the file extension is .gomv.

2 Tap to switch Plot Item to **RSRP**, **RSRQ**, **RS SINR**, **S-SS RSSI**, **P-SS Power**, **S-SS Power**, **S-SS Ec/Io** or **SNR**.

3 Tap the **Apply** button.

The point color of the map changes to the corresponding value, and if there is no detected LTE signal, the point will become gray color.



NOTE
When you load the result file, a pop-up message asking whether you want to load data only or data with map
appears. If the current screen does not display all the loaded data, the screen mode will be automatically changed to Full.

Importing cellsite DB

You can import the site DB by creating the 5G site information form.

To import cellsite DB

1 Create the 5G site information with an excel file as below.

2 Input the two mandatory fields: **Lat (DecDeg)** and **Long (DecDeg)**.

3 Input the **Azimuth** field if you want to check the direction of antenna.

4 Make sure to save the file as (Comma delimited) (*.csv).

5 Copy the file to the USB memory stick and insert it to the **USB A** or **USB B** port of the instrument.

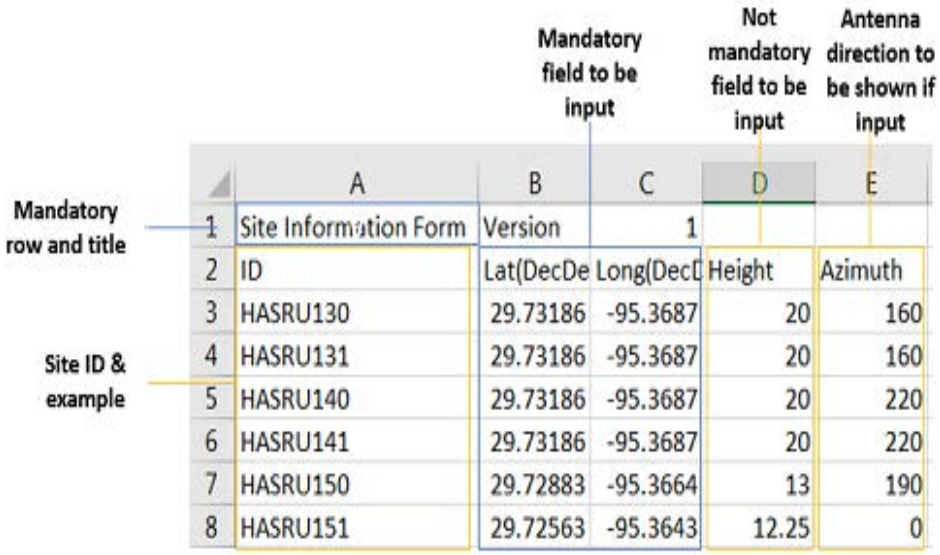
6 Tap the **Load** () icon on the side bar.

7 Import the saved file.

Once the file is loaded, the following cellsite information appears with an icon.

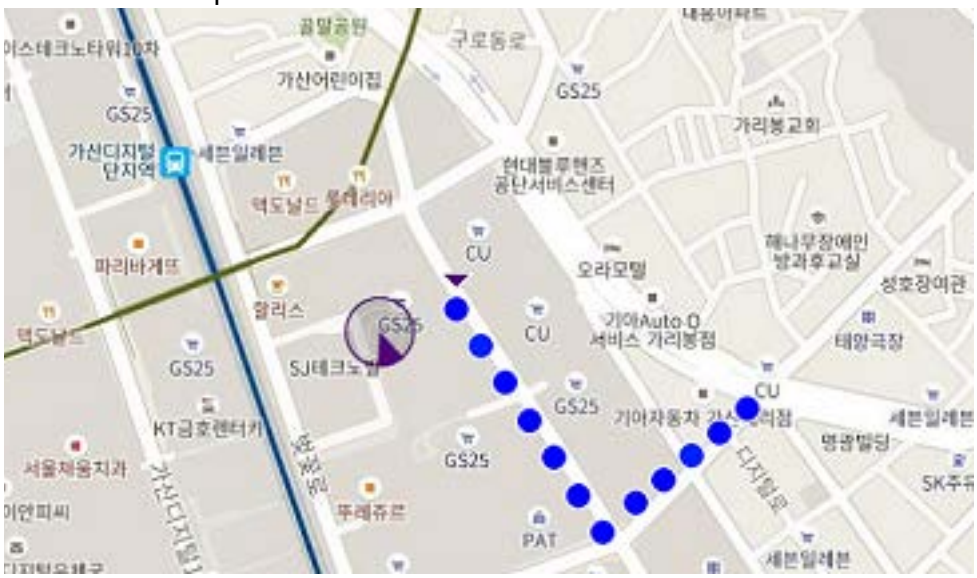
Figure 290 shows an example of an importing cellsite DB.

Figure 290 Importing Cellsite DB



	A	B	C	D	E
1	Site Information Form	Version	1		
2	ID	Lat(DecDe	Long(Dec[	Height	Azimuth
3	HASRU130	29.73186	-95.3687	20	160
4	HASRU131	29.73186	-95.3687	20	160
5	HASRU140	29.73186	-95.3687	20	220
6	HASRU141	29.73186	-95.3687	20	220
7	HASRU150	29.72883	-95.3664	13	190
8	HASRU151	29.72563	-95.3643	12.25	0

Figure 291 Route map measurement with site information screen



NOTE

The purple icon on the map indicates the base station (site) location and the direction of antenna. If the site is beyond the latitude and longitude of the map file, it will show.

Freq/Time/Power variation

Frequency, time, and power variation shows the frequency, time, and power error trend based on the time elapsed.

After configuring the spectrum measurement in “Configuring spectrum measurements” on page 25, you can set the measure setup to continue your measurement. The measurement settings can be saved and recalled as a file by selecting File Type as Setup and load the file onto the instrument using the **Save/Load** icons on the side bar.

To set measure setup

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap to switch **MIB Decoding** to **On** when you do not know the number of transmitter antennas, PHICH ng, and Bandwidth or otherwise to **Off**.

3 Tap **Bandwidth** and select the value from the following choices: **1.4 MHz**, **3 MHz**, **5 MHz**, **10 MHz**, **15 MHz** or **20 MHz**.

4 *Optional.* Tap **Physical Cell ID** and select the type **Manual** or **Auto.**

- **Auto** lets the instrument detect the Physical Cell ID for the LTE signal automatically.
- **Manual** sets the specific Physical Cell ID for the LTE signal manually in order to speed up the synchronization with a BTS.

NOTE
When there are no PSS and SSS signals, set the PCI Cell ID to Manual and input the required PCI number to search CRS.

5 Tap to switch **PCI (Physical Cell ID)** to **Manual** or **Auto**.

6 *Optional.* Tap **CFI** and select the type **Manual** or **Auto**.

- **Auto** lets the instrument set the number of OFDM symbols used for transmitting PDCCHs in a subframe.
- **Manual** sets the number of OFDM symbols manually. The set of OFDM symbols that can be used for PDCCH in a subframe is given by 0, 2, 3 or 4 in 1.4 MHz bandwidth and 1, 2 or 3 in other bandwidths.

7 *Optional.* Tap **PHICH Ng** to set the number of PHICH groups (Ng): **1/6**, **1/2**, **1**, **2**, **E-1/6**, **E-1/2**, **E-1**, or **E-2**.

8 Tap **EVM Detection Mode** and select **Single** or **Combine**.

- **Single**: Testing on one single antenna connected to your instrument with a cable
- **Combine**: Testing on multiple antennas connected to your instrument with a 2x1 or 4x1 combiner or an antenna

9 Tap **Menu > Miscellaneous** and do the following as needed.

- To select the number of antenna ports, tap **MIMO** and select **2x2** or **4x4**. The instrument sets this option to 2x2 by default. A 2x1 or 4x1 RF combiner is also required to be able to test on MIMO channels.
- To turn the Multimedia Broadcast Multicast Service (MBMS) feature on or off, tap to switch **MBMS** and select **On** or **Off**.
- To set the Multicast Broadcast Single Frequency Network (MBSFN) detection automatically or manually for MBMS testing, tap **MBSFN** and select **Auto** or **Manual**. An automatically detected or manually entered MBSFN Number appears on the Top Info.
- To select the cyclic prefix, tap **Cyclic Prefix** and select **Normal** or **Extended**.
- Tap the **PDSCH Modulation Type**, and then select the modulation type option: **Auto**, **QPSK**, **16 QAM**, **64 QAM**, **256 QAM**, **E-TM3.3**, **E-TM3.2**, **E-TM3.1a**, **E-TM3.1**, **E-TM2a**, **E-TM2**, and **E-TM1.2**.
- Tap **PDSCH Threshold** and input the value using the on-screen keyboard.
- Tap **PDCCH Threshold** and input the value using the on-screen keyboard.
- Tap **PDCCH Mode** and select **REG** to calculate EVM based on Resource Element Group or **Average** to calculate EVM after adding up all the PDCCH signals from one subframe.
- Tap to switch **PDSCH Precoding** between **On** and **Off** to enable or disable the PDSCH precoding.

10 Tap **Menu > Antenna**.

- To assign a antenna port number automatically or manually, tap **Antenna Port** and select the option: **Auto**, **Antenna 0**, or **Antenna 1**.



NOTE

If you want to set the reference level and scale, tap **Menu** > **Amp/Scale** > **Reference.** You can set Reference Freq Error Offset, Scale Division (Freq Error), Reference Time Error Offset, Scale Division (Time Error), Reference Level, and Scale Division (Power) on demand using the on-screen keyboard. You can also select the unit on the keyboard.

Figure 292 shows an example of LTE/LTE-A FDD freq/time/power variation by frequency/time.

Figure 292 LTE/LTE-A FDD freq/time/power variation by frequency/time



NOTE

You can tap the Distance box and input the value that you want to compensate for distance. When distance is entered, the time will show the value with distance correction. Make sure the default value for Distance is 0.

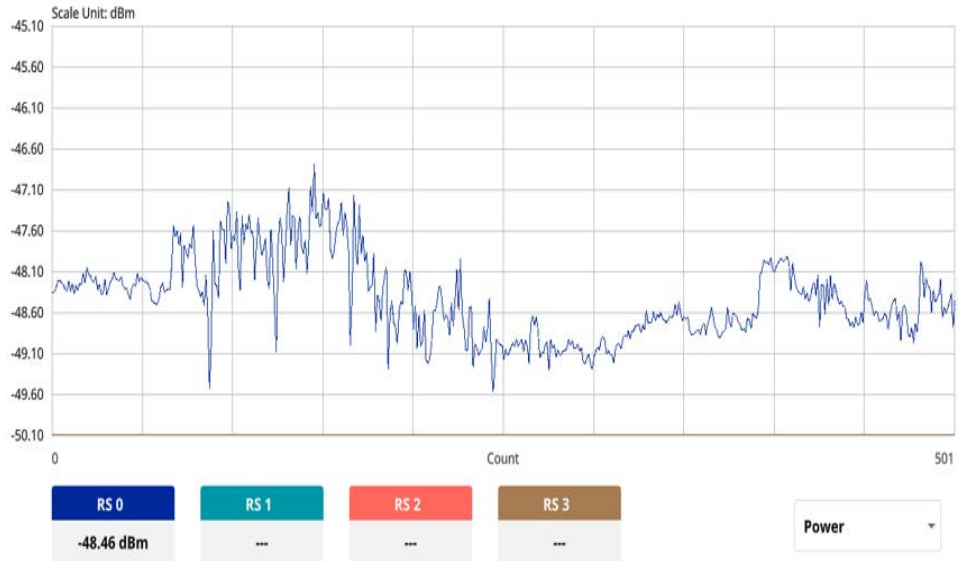
You can see the selected trace being plotted on the chart based on the selection from drop-down menu: Frequency, Time, Frequency/Time, or Power.

NOTE

When you select the Frequency/Time trace to be plotted, the Limit toggle icon will appear in the middle of the measurement screen. Once the Limit menu is turned on, the limit line will be displayed based on your selection of either Frequency or Time.

Figure 293 shows an example of LTE/LTE-A FDD freq/time/power variation by power.

Figure 293 LTE/LTE-A FDD freq/time/power variation by power



Signal analysis

The following sections describe how to perform signal analysis.

Constellation

The constellation is used to observe some aspects of modulation accuracy and can reveal certain fault mechanisms such as I/Q amplitude imbalance or quadrature imbalance. It displays constellation diagram by modulation types.

Setting measure setup

After configuring the spectrum measurement in “Configuring spectrum measurements” on page 25, you can set the measure setup to continue your measurement. The measurement settings can be saved and recalled as a file by selecting File Type as Setup and load the file onto the instrument using the **Save/Load** icons on the side bar.

To set measure setup

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap to switch **MIB Decoding** to **On** when you do not know the number of transmitter antennas, PHICH ng, and Bandwidth or **Off**.

3 Tap **Bandwidth** and select the value from the following choices: **1.4 MHz**, **3 MHz**, **5 MHz**, **10 MHz**, **15 MHz**, or **20 MHz**.

4 Tap **Subframe Number** to set the number of subframe using the on-screen keyboard.

5 *Optional.* Tap **Physical Cell ID** and select the type **Manual** or **Auto**.

– **Auto** lets the instrument detect the Physical Cell ID for the LTE signal automatically.

– **Manual** sets a specific Physical Cell ID for the LTE signal manually in order to speed up with the synchronization with a BTS.

NOTE
When there are no PSS and SSS signals, set the PCI Cell ID to Manual and input the required PCI number to search CRS.

6 *Optional.* Tap **CFI** and select the type **Manual** or **Auto**.

– **Auto** lets the instrument set the number of OFDM symbols used for transmitting PDCCHs in a subframe.

– **Manual** sets the number of OFDM symbols manually.

NOTE
The set of OFDM symbols that can be used for PDCCH in a subframe is given by **0**, **2**, **3** or **4** in 1.4 MHz bandwidth and **1**, **2** or **3** in another bandwidth.

7 *Optional.* Tap **PHICH Ng** to set the number of PHICH groups (Ng): **1/6**, **1/2**, **1**, **2**, **E-1/6**, **E-1/2**, **E-1**, or **E-2**.

8 *Optional.* Tap **Miscellaneous** under **Menu** to do the following as needed.

a To select the number of antenna ports, tap the **MIMO** and select **2x2** or **4x4**.

b To assign an antenna port number automatically or manually, tap **Menu** > **Antenna Port** and select the options from **Auto**, **Antenna 0**, **Antenna 1**, **Antenna 2**, or **Antenna 3**.

If the MIMO is set to 2x2, the antenna ports 2 and 3 are disabled.

c To turn the Multimedia Broadcast Multicast Service (**MBMS**) feature on or off, tap **MBMS** and select **On** or **Off**. For proper MBMS testing, you need to set the **Subframe Number** in the upper right screen with the same PMCH subframe number.

d To set the Multicast Broadcast Single Frequency Network (**MBSFN**) detection automatically or manually for MBMS testing, tap **MBSFN** and select **Auto** or **Manual**.

An automatically detected or manually entered MBSFN ID appears on the screen.

e To select the Cyclic Prefix, tap **Cyclic Prefix** and select **Normal** or **Extended**.

f To set the threshold for PDSCH, tap **PDSCH Threshold** and enter a value by using the on-screen keyboard.

g Tap **PDSCH Modulation Type**, and then select the modulation type option: **Auto, QPSK, 16 QAM, 64 QAM, 256 QAM, E-TM3.3, E-TM3.2, E-TM3.1a, E-TM3.1, E-TM2a, E-TM2, E-TM1.2 or E-TM1.1**

If two or more modulation types are used in a frame, select **Auto**. If the PDSCH uses the same modulation type in a frame or in a subframe, select a specific modulation type to get more accurate EVM.

h Tap **PDSCH Precoding** to set **On** or **Off** to enable or disable the PDSCH precoding.

To set limit

1 Tap **Menu > Limit**.

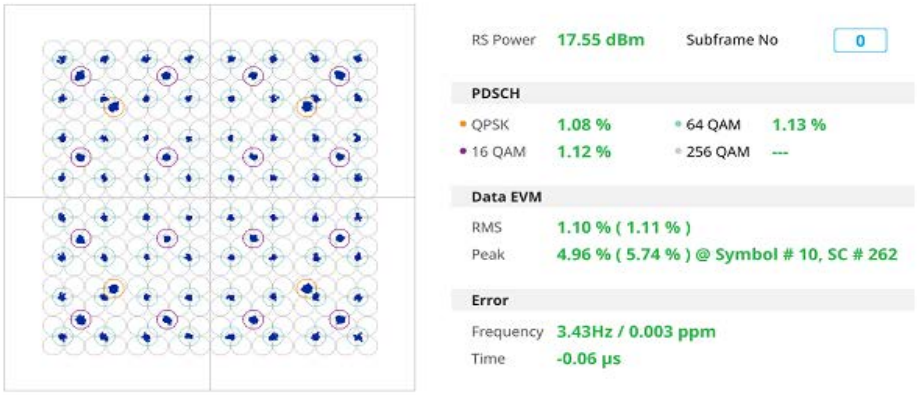
2 Tap the test items and set the limits depending on your selected measurement mode:

To set the limit for	Select and set
Frequency Error	Test limits On/Off, High/Low Limit
PDSCH EVM	Test limits On/Off, High Limit for QPSK/16 QAM/64 QAM/ 256 QAM
PMCH EVM	Test limits On/Off, High Limit for QPSK/16 QAM/64 QAM
Data EVM RMS	Test limits On/Off, High Limit
Data EVM Peak	Test limits On/Off, High Limit
DL RS Power	Test limits On/Off, High/Low Limit
Time Error	Test limits On/Off, High/Low Limit

3 *Optional*: Tap the **Save** hot key on the side bar and select the save option from the choices available for your measurement.

Figure 294 shows an example of LTE/LTE-A FDD constellation measurement.

Figure 294 LTE/LTE-A FDD constellation measurement



Data channel

The Data Channel measures the constellation for the specified resource block as well as the modulation accuracy of each PDSCH at the specified subframe.

Note that this feature is not supported in SPA06MA-O yet.

Setting measure setup

After configuring the spectrum measurement in "Configuring spectrum measurements" on page 25, you can set the measure setup to continue your measurement. The measurement settings can be saved and recalled as a file by selecting File Type as Setup and load the file onto the instrument using the **Save/Load** icons on the side bar.

To set measure setup

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap to switch **MIB Decoding** to **On** when you do not know the number of transmitter antennas, PHICH ng, and Bandwidth or otherwise to **Off**.

3 Tap **Bandwidth** and select the value from the following choices: **1.4 MHz**, **3 MHz**, **5 MHz**, **10 MHz**, **15 MHz**, or **20 MHz**.

4 Tap **Subframe Number** to set the number of subframe using the on-screen keyboard.

NOTE
For MBMS testing, this subframe number must be either 0 or 5 as these subframes 0 and 5 are not available for MBMS and it must be set to the MBMS transmitted channel's subframe number.

5 *Optional.* Tap **Physical Cell ID** and select the type **Manual** or **Auto**.
- **Auto** lets the instrument detect the Physical Cell ID for the LTE signal automatically.
- **Manual** sets a specific Physical Cell ID for the LTE signal manually in order to speed up with the synchronization with a BTS.

NOTE
When there are no PSS and SSS signals, set the PCI Cell ID to Manual and input the required PCI number to search CRS.

6 *Optional.* Tap CFI and select the type **Manual** or **Auto**.
- **Auto** lets the instrument set the number of OFDM symbols used for transmitting PDCCHs in a subframe.
- **Manual** sets the number of OFDM symbols manually.

NOTE
The set of OFDM symbols that can be used for PDCCH in a subframe is given by **0**, **2**, **3** or **4** in 1.4 MHz bandwidth and **1**, **2** or **3** in another bandwidth.

7 *Optional.* Tap **PHICH Ng** to set the number of PHICH groups (Ng): **1/6**, **1/2**, **1**, **2**, **E-1/6**, **E-1/2**, **E-1**, or **E-2**.

8 Tap **Event Hold** and select **On** or **Off** to enable or disable the event hold feature. When enabled, the Reference Line for the PDSCH threshold appears**.** When an event occurs, the measurement is put on hold until you tap the **Hold** icon on the side bar.

9 *Optional.* Tap **Miscellaneous** under **Menu** to do the following as needed.

a To select the number of antenna ports, tap the **MIMO** and select **2x2** or **4x4**.

b To assign an antenna port number automatically or manually, tap **Menu** > **Antenna Port** and select the options from **Auto**, **Antenna 0**, **Antenna 1**, **Antenna 2**, or **Antenna 3**.

If the MIMO is set to 2x2, the antenna ports 2 and 3 are disabled.

c To turn the Multimedia Broadcast Multicast Service (**MBMS**) feature on or off, tap **MBMS** and select **On** or **Off**. For proper MBMS testing, you need to set the **Subframe Number** in the upper right screen with the same PMCH subframe number.

d To set the Multicast Broadcast Single Frequency Network (**MBSFN**) detection automatically or manually for MBMS testing, tap **MBSFN** and select **Auto** or **Manual**.

An automatically detected or manually entered MBSFN ID appears on the screen.

e To select the Cyclic Prefix, tap **Cyclic Prefix** and select **Normal** or **Extended**.

f To set the threshold for PDSCH, tap **PDSCH Threshold** and enter a value by using the on-screen keyboard.

g Tap **PDSCH Modulation Type**, and then select the modulation type option: **Auto, QPSK, 16 QAM, 64 QAM, 256 QAM, E-TM3.3, E-TM3.2, E-TM3.1a, E-TM3.1, E-TM2a, E-TM2, E-TM1.2 or E-TM1.1**

If two or more modulation types are used in a frame, select **Auto**. If the PDSCH uses the same modulation type in a frame or in a subframe, select a specific modulation type to get more accurate EVM.

h Tap **PDSCH Precoding** to set **On** or **Off** to enable or disable the PDSCH precoding.

To set limit

1 Tap **Menu > Limit**.

2 Tap the test items and set the limits depending on your selected measurement mode:

To set the limit for	Select and set
Data EVM RMS	Test limits On/Off, High Limit
Data EVM Peak	Test limits On/Off, High Limit
IQ Origin Offset	Test limits On/Off, High Limit

3 *Optional*: Tap the **Save** hot key on the side bar and select the save option from the choices available for your measurement.

To set marker

1 Tap **Menu > Marker**.

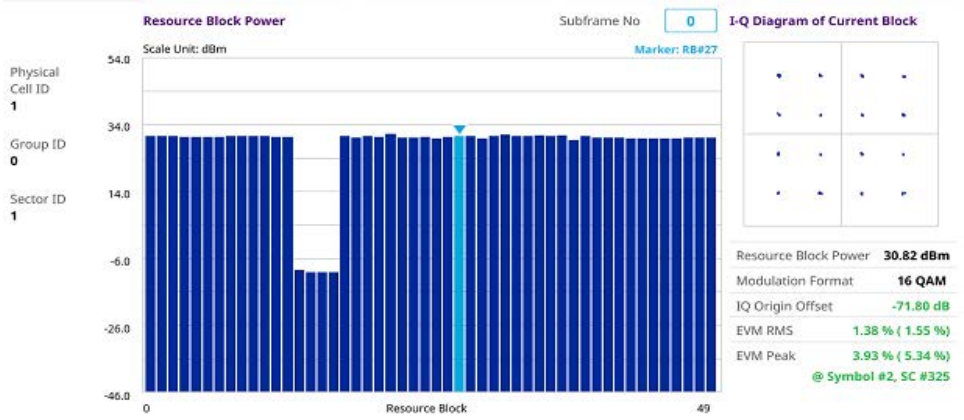
2 Tap **RB Number** to select the resource block to be marked and enter the resource block number using the on-screen keyboard.

The marker appears on the selected resource block.

3 Tap **Marker View** between **On** and **Off** to display of dismiss the result of the selected resource block.

Figure 295 shows an example of LTE/LTE-A FDD data channel measurement.

Figure 295 LTE/LTE-A FDD data channel measurement



Control channel

The Control Channel measures the constellation for the specified control channel as well as modulation accuracy of the control channel at the specified subframe.

Note that this feature is not supported in SPA06MA-O yet.

Setting measure setup

After configuring the spectrum measurement in “Configuring spectrum measurements” on page 25, you can set the measure setup to continue your measurement. The measurement settings can be saved and recalled as a file by selecting File Type as Setup and load the file onto the instrument using the **Save/Load** icons on the side bar.

To set measure setup

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap to switch **MIB Decoding** to **On** when you do not know the number of transmitter antennas, PHICH ng, and Bandwidth or otherwise to **Off**.

3 Tap **Bandwidth** and select the value from the following choices: **1.4 MHz**, **3 MHz**, **5 MHz**, **10 MHz**, **15 MHz**, or **20 MHz**.

4 Tap **Subframe Number** to set the number of subframe using the on-screen keyboard.



NOTE
For MBMS testing, this subframe number must be either 0 or 5 as these subframes 0 and 5 are not available for MBMS and it must be set to the MBMS transmitted channel's subframe number.

5 *Optional.* Tap **Physical Cell ID** and select the type **Manual** or **Auto**.

– **Auto** lets the instrument detect the Physical Cell ID for the LTE signal automatically.

– **Manual** sets a specific Physical Cell ID for the LTE signal manually in order to speed up with the synchronization with a BTS.



NOTE
When there are no PSS and SSS signals, set the PCI Cell ID to Manual and input the required PCI number to search CRS.

6 *Optional.* Tap **CFI** and select the type **Manual** or **Auto**.

– **Auto** lets the instrument set the number of OFDM symbols used for transmitting PDCCHs in a subframe.

– **Manual** sets the number of OFDM symbols manually.



NOTE
The set of OFDM symbols that can be used for PDCCH in a subframe is given by **0**, **2**, **3** or **4** in 1.4 MHz bandwidth and **1**, **2** or **3** in another bandwidth.

7 *Optional.* Tap **PHICH Ng** to set the number of PHICH groups (Ng): **1/6**, **1/2**, **1**, **2**, **E-1/6**, **E-1/2**, **E-1**, or **E-2**.

8 Tap **EVM Detection Mode** and select **Single** or **Combine**.

– **Single**: Testing on one single antenna connected to your ONA-800 series with a cable

– **Combine**: Testing on multiple antennas connected to your ONA-800 series with a cable with a 2x1 or 4x1 combiner or an antenna

9 *Optional.* Tap **Miscellaneous** under **Menu** to do the following as needed.

a To select the number of antenna ports, tap the **MIMO** and select **2x2** or **4x4**.

b To assign an antenna port number automatically or manually, tap **Menu** > **Antenna Port** and select the options from **Auto**, **Antenna 0**, **Antenna 1**, **Antenna 2**, or **Antenna 3**.

If the MIMO is set to 2x2, the antenna ports 2 and 3 are disabled.

c To turn the Multimedia Broadcast Multicast Service (**MBMS**) feature on or off, tap **MBMS** and select **On** or **Off**. For proper MBMS testing, you need to set the **Subframe Number** in the upper right screen with the same PMCH subframe number.

d To set the Multicast Broadcast Single Frequency Network (**MBSFN**) detection automatically or manually for MBMS testing, tap **MBSFN** and select **Auto** or **Manual**.

An automatically detected or manually entered MBSFN ID appears on the screen.

e To select the Cyclic Prefix, tap **Cyclic Prefix** and select **Normal** or **Extended**.

f To set the threshold for PDSCH, tap **PDSCH Threshold** and enter a value by using the on-screen keyboard.

g Tap **PDCCH Mode** to select **REG** to calculate EVM based on Resource Element Group or **Average** to calculate EVM after adding all PDCCH signals from one subframe.

To set limit

1 Tap **Menu > Limit**.

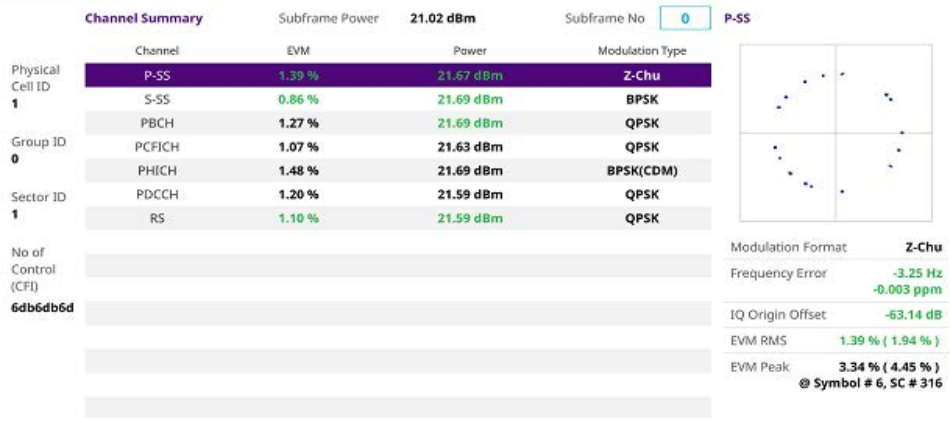
2 Tap the test items and set the limits depending on your selected measurement mode:

To set the limit for	Select and set
Frequency Error	Test limits On/Off, High/Low Limit
RS EVM	Test limits On/Off, High Limit
P-SS EVM	Test limits On/Off, High Limit
S-SS EVM	Test limits On/Off, High Limit
DL RS Power	Test limits On/Off, High/Low Limit
P-SS Power	Test limits On/Off, High/Low Limit
S-SS Power	Test limits On/Off, High/Low Limit
PBCH Power	Test limits On/Off, High/Low Limit
IQ Origin Power	Test limits On/Off, High Limit

3 *Optional*: Tap the **Save** hot key on the side bar and select the save option from the choices available for your measurement.

Figure 296 shows an example of LTE/LTE-A FDD control channel measurement.

Figure 296 LTE/LTE-A FDD control channel measurement



Subframe

The Subframe measures the modulation accuracy of all the data and control channels at the specified subframe (1 ms).

Setting measure setup

After configuring the spectrum measurement in “Configuring spectrum measurements” on page 25, you can set the measure setup to continue your measurement. The measurement settings can be saved and recalled as a file by selecting File Type as Setup and load the file onto the instrument using the **Save/Load** icons on the side bar.

To set measure setup

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap to switch **MIB Decoding** to **On** when you do not know the number of transmitter antennas, PHICH ng, and Bandwidth or otherwise to **Off**.

3 Tap **Bandwidth** and select the value from the following choices: **1.4 MHz**, **3 MHz**, **5 MHz**, **10 MHz**, **15 MHz**, or **20 MHz**.

4 Tap **Subframe Number** to set the number of subframe using the on-screen keyboard.

NOTE
For MBMS testing, this subframe number must be either 0 or 5 as these subframes 0 and 5 are not available for MBMS and it must be set to the MBMS transmitted channel’s subframe number.

5 *Optional.* Tap **Physical Cell ID** and select the type **Manual** or **Auto**.

– **Auto** lets the instrument detect the Physical Cell ID for the LTE signal automatically.

– **Manual** sets a specific Physical Cell ID for the LTE signal manually in order to speed up with the synchronization with a BTS.

NOTE
When there are no PSS and SSS signals, set the PCI Cell ID to Manual and input the required PCI number to search CRS.

6 *Optional.* Tap **CFI** and select the type **Manual** or **Auto**.

– **Auto** lets the instrument set the number of OFDM symbols used for transmitting PDCCHs in a subframe.

– **Manual** sets the number of OFDM symbols manually.

NOTE
The set of OFDM symbols that can be used for PDCCH in a subframe is given by **0**, **2**, **3** or **4** in 1.4 MHz bandwidth and **1**, **2** or **3** in another bandwidth.

7 *Optional.* Tap **PHICH Ng** to set the number of PHICH groups (Ng): **1/6**, **1/2**, **1**, **2**, **E-1/6**, **E-1/2**, **E-1**, or **E-2**.

8 Tap **EVM Detection Mode** and select **Single** or **Combine**.

– **Single**: Testing on one single antenna connected to your ONA-800 series with a cable

– **Combine**: Testing on multiple antennas connected to your ONA-800 series with a cable with a 2x1 or 4x1 combiner or an antenna

9 *Optional.* Tap **Miscellaneous** under **Menu** to do the following as needed.

a To select the number of antenna ports, tap the **MIMO** and select **2x2** or **4x4**.

b To assign an antenna port number automatically or manually, tap **Menu** > **Antenna Port** and select the options from **Auto**, **Antenna 0**, **Antenna 1**, **Antenna 2**, or **Antenna 3**.

If the MIMO is set to 2x2, the antenna ports 2 and 3 are disabled.

c To turn the Multimedia Broadcast Multicast Service (**MBMS**) feature on or off, tap **MBMS** and select **On** or **Off**. For proper MBMS testing, you need to set the **Subframe Number** in the upper right screen with the same PMCH subframe number.

d To set the Multicast Broadcast Single Frequency Network (**MBSFN**) detection automatically or manually for MBMS testing, tap **MBSFN** and select **Auto** or **Manual**.

An automatically detected or manually entered MBSFN ID appears on the screen.

e To select the Cyclic Prefix, tap **Cyclic Prefix** and select **Normal** or **Extended**.

f To set the threshold for PDSCH, tap **PDSCH Threshold** and enter a value by using the on-screen keyboard.

g To set the threshold for PDCCH, tap **PDCCH Threshold** and enter a value by using the on-screen keyboard.

h Tap **PDSCH Modulation Type**, and then select the modulation type option: **Auto, QPSK, 16 QAM, 64 QAM, 256 QAM, E-TM3.3, E-TM3.2, E-TM3.1a, E-TM3.1, E-TM2a, E-TM2, E-TM1.2 or E-TM1.1**

If two or more modulation types are used in a frame, select **Auto**. If the PDSCH uses the same modulation type in a frame or in a subframe, select a specific modulation type to get more accurate EVM.

i Tap **PDCCH Mode** to select **REG** to calculate EVM based on Resource Element Group or **Average** to calculate EVM after adding all PDCCH signals from one subframe.

j Tap **PDSCH Precoding** to set **On** or **Off** to enable or disable the PDSCH precoding.

To set limit

1 Tap **Menu > Limit**.

2 Tap the test items and set the limits depending on your selected measurement mode:

To set the limit for	Select and set
Frequency Error	Test limits On/Off, High/Low Limit
PDSCH EVM	Test limits On/Off, High Limit for QPSK/16 QAM/ 64 QAM/ 256 QAM
Data EVM RMS	Test limits On/Off, High Limit
Data EVM Peak	Test limits On/Off, High Limit
RS EVM	Test limits On/Off, High Limit
P-SS EVM	Test limits On/Off, High Limit
S-SS EVM	Test limits On/Off, High Limit
PMCH EVM	Test limits On/Off, High Limit for QPSK/16 QAM/ 64 QAM
DLRS Power	Test limits On/Off, High/Low Limit
P-SS Power	Test limits On/Off, High/Low Limit
S-SS Power	Test limits On/Off, High/Low Limit
PBCH Power	Test limits On/Off, High/Low Limit

To set the limit for	Select and set
Subframe Power	Test limits On/Off, High/Low Limit
OFDM Symbol Power	Test limits On/Off, High/Low Limit
Time Error	Test limits On/Off, High/Low Limit

3 *Optional*: Tap the **Save** hot key on the side bar and select the save option from the choices available for your measurement.

To set marker

If you turn the Chart View on by tapping the icon next to Channel Summary on the left, you can use maker to place a marker at a specific symbol.

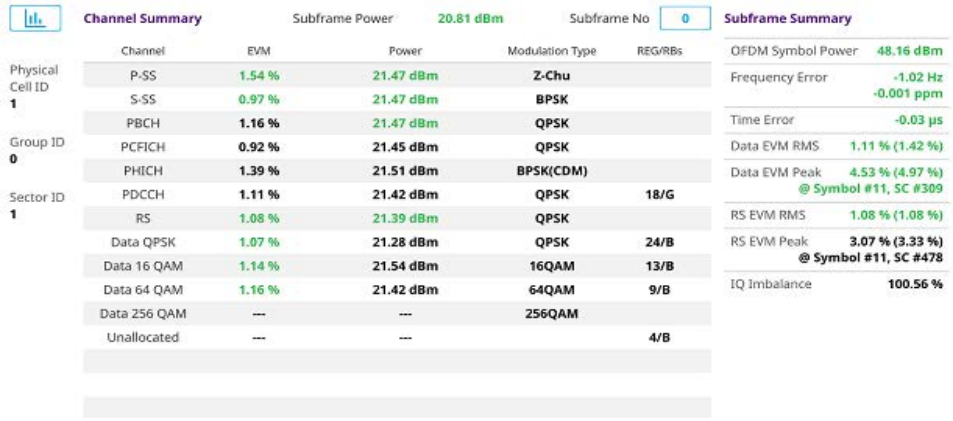
1 Tap **Menu > Marker**.

2 Tap **Marker View** between **On** and **Off** to display or dismiss the marker on the chart.

3 Tap **Symbol** to select the symbol number to which the marker is placed. Enter the value using the on-screen keyboard.

Figure 297 shows an example of LTE/LTE-A FDD subframe measurement.

Figure 297 LTE/LTE-A FDD subframe measurement



NOTE
You can also check the graph chart by tapping the Graph Chart icon next to left Channel Summary.

Time alignment error

In eNode-B supporting Tx Diversity transmission, signals are transmitted from two or more antennas. These signals shall be aligned.
The time alignment error in Tx diversity is specified as the delay between the signals from two antennas at the antenna ports.

Note that this feature is not supported in SPA06MA-O yet.

Setting measure setup

After configuring the spectrum measurement in "Configuring spectrum measurements" on page 25, you can set the measure setup to continue your measurement. The measurement settings can be saved and recalled as a file by selecting File Type as Setup and load the file onto the instrument using the **Save/Load** icons on the side bar.

To set measure setup

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap to switch **MIB Decoding** to **On** when you do not know the number of transmitter antennas, and Bandwidth or otherwise to **Off**.

3 Tap **Bandwidth** and select the value from the following choices: **1.4 MHz**, **3 MHz**, **5 MHz**, **10 MHz**, **15 MHz**, or **20 MHz**.

4 *Optional.* Tap **Physical Cell ID** and select the type **Manual** or **Auto**.

- **Auto** lets the instrument detect the Physical Cell ID for the LTE signal automatically.
- **Manual** sets a specific Physical Cell ID for the LTE signal manually in order to speed up with the synchronization with a BTS.

NOTE
When there are no PSS and SSS signals, set the PCI Cell ID to Manual and input the required PCI number to search CRS.

5 *Optional.* To select the number of antenna ports, tap the **MIMO** and select **2x2** or **4x4**.

6 To assign an antenna port number automatically or manually, tap **Menu** > **Antenna Port** and select the options from **Auto**, **Antenna 0**, **Antenna 1**, **Antenna 2**, or **Antenna 3**.

If the MIMO is set to 2x2, the antenna ports 2 and 3 are disabled.

7 To select the Cyclic Prefix, tap **Cyclic Prefix** and select **Normal** or **Extended**.

To set limit

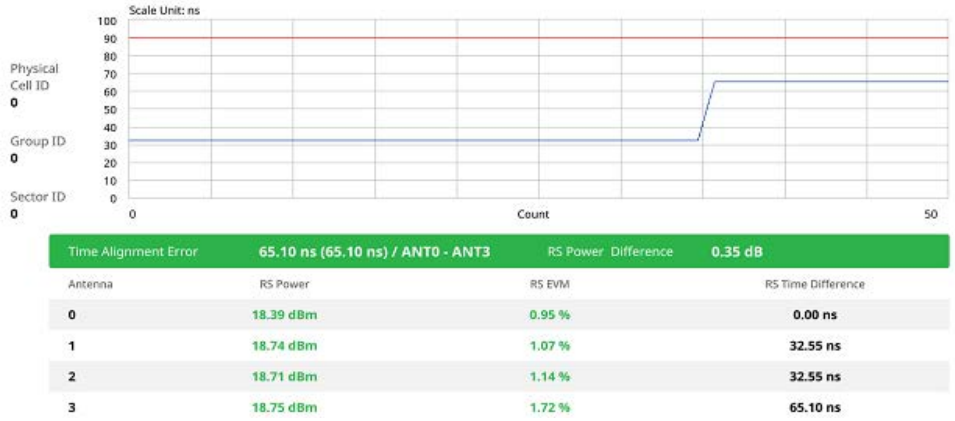
1 Tap **Menu > Limit**.

2 Tap the test items and set the limits depending on your selected measurement mode:

To set the limit for	Select and set
RS EVM	Test limits On/Off, High Limit
DL RS Power	Test limits On/Off, High/Low Limit
MIMO	Test limits On/Off, High Limit

Figure 298 shows an example of LTE/LTE-A FDD time alignment error measurement.

Figure 298 LTE/LTE-A FDD time alignment error measurement



Data allocation map

The Data Allocation Map function represents data allocation as a frame.

Setting measure setup

After configuring the spectrum measurement in “Configuring spectrum measurements” on page 25, you can set the measure setup to continue your measurement. The measurement settings can be saved and recalled as a file by selecting File Type as Setup and load the file onto the instrument using the **Save/Load** icons on the side bar.

To set measure setup

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap to switch **MIB Decoding** to **On** when you do not know the number of transmitter antennas and Bandwidth or otherwise to **Off**.

3 Tap **Bandwidth** and select the value from the following choices: **1.4 MHz**, **3 MHz**, **5 MHz**, **10 MHz**, **15 MHz**, or **20 MHz**.

4 Tap **Subframe Number** to set the number of subframe using the on-screen keyboard.

5 *Optional.* Tap **Physical Cell ID** and select the type **Manual** or **Auto**.

- **Auto** lets the instrument detect the Physical Cell ID for the LTE signal automatically.
- **Manual** sets a specific Physical Cell ID for the LTE signal manually in order to speed up with the synchronization with a BTS.

NOTE
When there are no PSS and SSS signals, set the PCI Cell ID to Manual and input the required PCI number to search CRS.

6 *Optional.* To set the threshold for PDSCH, tap **PDSCH Threshold** and enter a value by using the on-screen keyboard.

7 *Optional.* Tap **Miscellaneous** under **Menu** to do the following as needed.

a To select the number of antenna ports, tap the **MIMO** and select **2x2** or **4x4**.

b To assign an antenna port number automatically or manually, tap **Menu** > **Antenna Port** and select the options from **Auto**, **Antenna 0**, **Antenna 1**, **Antenna 2**, or **Antenna 3**.

If the MIMO is set to 2x2, the antenna ports 2 and 3 are disabled.

c To turn the Multimedia Broadcast Multicast Service (**MBMS**) feature on or off, tap **MBMS** and select **On** or **Off**. For proper MBMS testing, you need to set the **Subframe Number** in the upper right screen with the same PMCH subframe number.

d To set the Multicast Broadcast Single Frequency Network (**MBSFN**) detection automatically or manually for MBMS testing, tap **MBSFN** and select **Auto** or **Manual**.

An automatically detected or manually entered MBSFN ID appears on the screen.

e To select the Cyclic Prefix, tap **Cyclic Prefix** and select **Normal** or **Extended**.

To set display

1 Tap **Menu > Display**.

2 Select the display mode from the choice: **PDSCH**, **PMCH** or **Both.**

To set marker

1 Tap **Menu > Marker**.

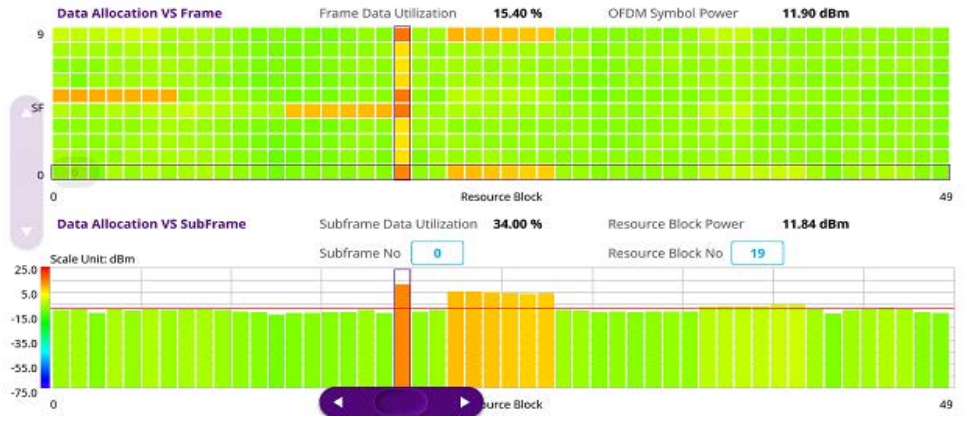
2 Tap the **Marker View** to **On** or **Off** to display or hide the marker on the chart**.**

3 To select the resource block number, tap the **RB Number** and enter a value by using the on-screen keyboard.

4 To select the subframe block number, tap the **Subframe No** and enter a value by using the on-screen keyboard.

Figure 299 shows an example of LTE/LTE-A FDD data allocation map measurement.

Figure 299 LTE/LTE-A FDD data allocation map measurement



Carrier aggregation

The Carrier aggregation enables a maximum of five multiple LTE carriers to be used together in order to provide high data rate required for LTE-Advanced. Component carriers to be aggregated can be intra-band contiguous, intra-band non-contiguous, or inter-band.

The instrument provides carrier aggregation measurements supporting for all the different modes with carrier aggregation bands added to the channel standard.

Note that this feature is not supported in SPA06MA-O yet.

Setting measure setup

After configuring the spectrum measurement in “Configuring spectrum measurements” on page 25, you can set the measure setup to continue your measurement. The measurement settings can be saved and recalled as a file by selecting File Type as Setup and load the file onto the instrument using the **Save/Load** icons on the side bar.

To set measure setup

1. Tap the **Setup** ( ) icon in the side bar.
2. Tap to switch **MIB Decoding** to **On** when you do not know the number of transmitter antennas and Bandwidth or otherwise to **Off**.
3. Tap **CA Configuration** or tap the **Configuration** ( ) icon then the component carrier configuration window appears.
4. Select the number of the component carrier to be set between one and five by tapping the number in **Range** box.
5. Set the Range **On** to set parameters and view the results for the selected component carrier on the screen or **Off** to turn it off.
6. Tap **LAA** (License Assisted Access) and select one among the three options: **2.4 GHz**, **5 GHz**, or **Off**.

7 Set the following parameters as needed: **Center Frequency**, **Channel No**, **Bandwidth**, **Physical Cell ID**, **MBMS**, **MBSFN**, **MIMO**, **Antenna Port**, **CFI, PHICH Ng**, **Cyclic Prefix**, and **PDSCH Modulation Type**.



NOTE
When there are no PSS and SSS signals, set the PCI Cell ID to Manual and input the required PCI number to search CRS.

8 Tap **EVM Detection Mode** and select **Single** or **Combine**.

- **Single**: Testing on one single antenna connected to your ONA-800 series with a cable
- **Combine**: Testing on multiple antennas connected to your ONA-800 series with a cable with a 2x1 or 4x1 combiner or an antenna

9 To select the subframe number to be measured, do one of the following:

a If the **EVM Detection Mode** is set to **Single**, tap **Subframe Number** and set the subframe number.

b If the **EVM Detection Mode** is set to **Combine**, tap **Subframe Number,** and then select 0 or 5.

10 To set the threshold for PDSCH, tap **PDSCH Threshold** and enter a value by using the on-screen keyboard.

11 Tap **PDSCH Precoding** between **On** and **Off** to enable or disable the PDSCH precoding.

To set limit

1 Tap **Menu > Limit**.

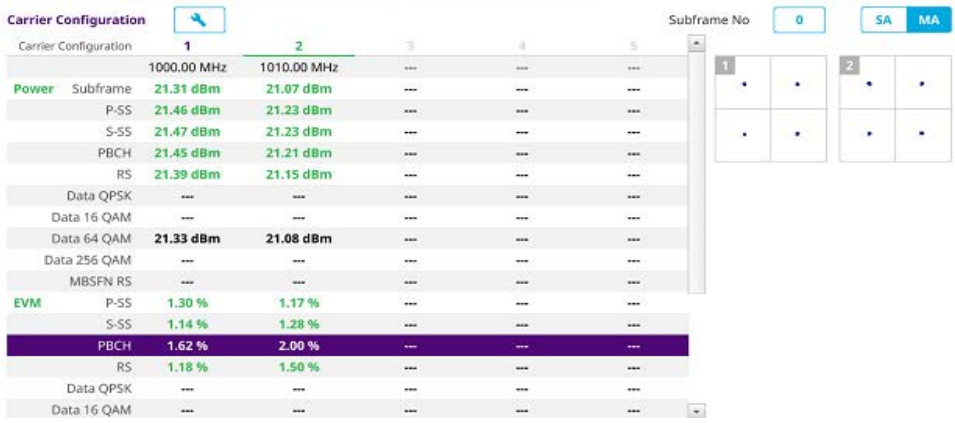
2 Tap the test items and set the limits depending on your selected measurement mode:

To set the limit for	Select and set
Frequency Error	Test limits On/Off, High/Low Limit
PDSCH EVM	Test limits On/Off, High Limit for QPSK/16 QAM/ 64 QAM/ 256 QAM
RS EVM	Test limits On/Off, High Limit
P-SS EVM	Test limits On/Off, High Limit
S-SS EVM	Test limits On/Off, High Limit
PMCH EVM	Test limits On/Off, High Limit for QPSK/16 QAM/ 64 QAM
DL RS Power	Test limits On/Off, High/Low Limit
P-SS Power	Test limits On/Off, High/Low Limit
S-SS Power	Test limits On/Off, High/Low Limit
PBCH Power	Test limits On/Off, High/Low Limit

To set the limit for	Select and set
Subframe Power	Test limits On/Off, High/Low Limit
Channel Power	Test limits On/Off, High/Low Limit
TAE	Test limits On/Off, Intra Count High/Intra Non-Count High/ Inter Band High

Figure 300 shows an example of LTE/LTE-A FDD carrier aggregation measurement.

Figure 300 LTE/LTE-A FDD carrier aggregation measurement



Power vs Time (Frame)

The Power vs. Time (Frame) measures the modulation envelope in the time domain, showing the power of each time slot in a LTE/LTE-A FDD signal.

Setting measure setup

After configuring the spectrum measurement in “Configuring spectrum measurements” on page 25, you can set the measure setup to continue your measurement.

To set measure setup

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap to switch **MIB Decoding** to **On** when you do not know the number of transmitter antennas and Bandwidth or otherwise to **Off**.

3 Tap **Bandwidth** and select the value from the following choices: **1.4 MHz**, **3 MHz**, **5 MHz**, **10 MHz**, **15 MHz**, or **20 MHz**.

4 Tap **Subframe Number** to set the number of subframe using the on-screen keyboard.

5 Tap **Physical Cell ID** and select the type **Manual** or **Auto**.

   a **Auto** lets the instrument detect the Physical Cell ID for the LTE signal automatically.

   b **Manual** sets a specific Physical Cell ID for the LTE signal manually in order to speed up with the synchronization with a BTS.



NOTE
When there are no PSS and SSS signals, set the PCI Cell ID to Manual and input the required PCI number to search CRS.

6 To select the number of antenna ports, tap the **MIMO** and select **2x2** or **4x4**.

7 To assign an antenna port number automatically or manually, tap **Menu** > **Antenna Port** and select the options from **Auto**, **Antenna 0**, **Antenna 1**, **Antenna 2**, or **Antenna 3**.

   If the MIMO is set to 2x2, the antenna ports 2 and 3 are disabled.

8 To select the Cyclic Prefix, tap **Cyclic Prefix** and select **Normal** or **Extended**.

To set limit

1 Tap **Menu > Limit**.

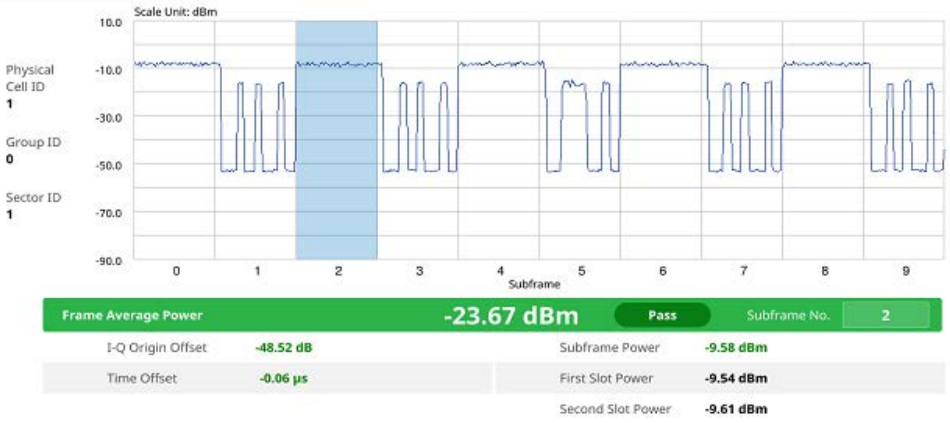
2 Tap the test items and set the limits depending on your selected measurement mode:

To set the limit for	Select and set
Subframe Power	Test limits On/Off, High/Low Limit
Frame Avg Power	Test limits On/Off, High/Low Limit
Time Offset	Test limits On/Off, High/Low Limit
IQ Origin Offset	Test limits On/Off, High Limit

3 *Optional*: Tap the **Save** hot key on the side bar and select the save option from the choices available for your measurement.

Figure 301 shows an example of LTE/LTE-A FDD Power vs Time (Frame) measurement.

Figure 301 LTE/LTE-A FDD Power vs Time (Frame) measurement



NOTE
You can set the Subframe No. from 0 to 9 using the on-screen keyboard.

Online route map

The following sections describe how to perform online route map.

Online OTA route map

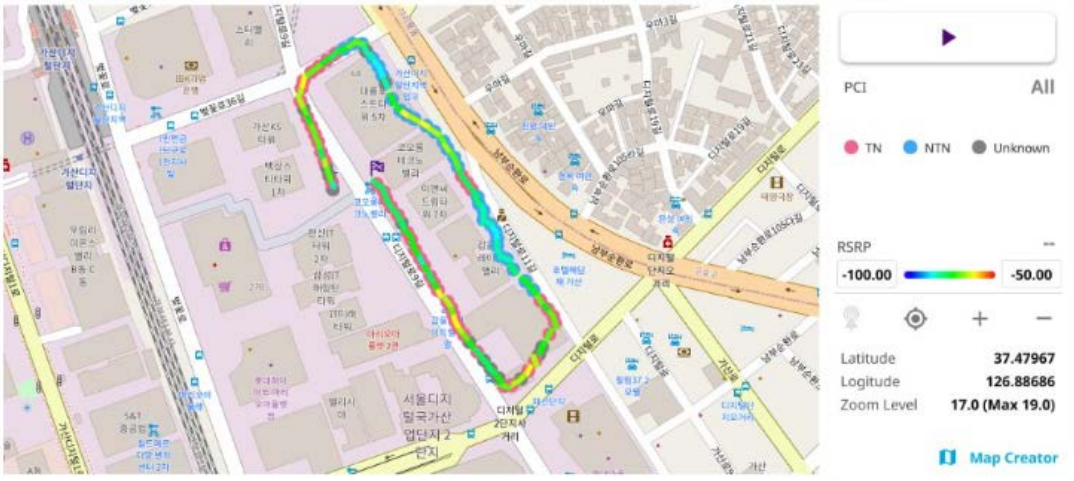
LTE online OTA route map enables you to download a map automatically when connected to the network then you can continue route map measurement using the downloaded map whether you are online or offline. It traces the power level of the strongest LTE signal in terms of RSRP corresponding to a particular time and geographical position and presents it in a geographical map as a measurement point. All the collected measurements can be exported for post-processing purposes, including data of the strongest LTE signal for each measurement point, including its measurement time and geographical location.

Figure 302 shows an example of Online OTA Route Map measurement.

Figure 302 Online OTA Route Map with LTE/LTE-A FDD Signal Analyzer



Figure 303 Online OTA Route Map with NTN



Controlling a map

To control a map

See the following table to control a map.

Table 143 Map control icons

Icon	Description
	Tap to go to your current location on the map. Once tapped, the purple icon appears on the map, indicating your current location.
	Tap to zoom in the map.

Table 143 Map control icons

Icon	Description
	Tap to zoom out the map.

The left-most cell-site icon is activated when you import the cell-site information file.

To set measurement setup

NOTE

Before starting the Route Map measurement, you need to set Spectrum measurements displayed on the quick access and display tab. See “Configuring spectrum measurements” on page 25 for more information.

1 Connect a GNSS receiver to your instrument for outdoor mapping.

2 Tap the **Setup** ( ) icon on the side bar.

3 Tap to switch **MIB Decoding** to **On** when you do not know the number of transmitter antennas and Bandwidth or **Off**.

4 Tap to switch **Plot Item** to **RSRP**, **RSRQ**, **RS SINR**, **S-SS RSSI**, **P-SS RSRP**, **S-SS RSRP**, **S-SS Ec/Io**, or **P-SS SNR**.

5 Tap **Bandwidth** and select the value from the following choices: **1.4 MHz**, **3 MHz**, **5 MHz**, **10 MHz**, **15 MHz** or **20 MHz**.

6 *Optional.* Tap to switch **Physical Cell ID** to **Manual** or **Auto**.

- **Auto** lets the instrument detect the Physical Cell ID for the LTE signal automatically
- **Manual** sets a specific Physical Cell ID for the LTE signal manually in order to speed up the synchronization with a BTS.

NOTE

When there are no PSS and SSS signals, set the PCI Cell ID to Manual and input the required PCI number to search CRS.

NOTE

The instrument does not automatically save the collected data. It is recommended that you save the result. Otherwise, you will lose all the collected data.

7 *Optional.* The **NTN Configuration** box appears only if the ONA-SP-LTE-NTN license is available.

a Tap to turn **NTN On**.

b Tap **NTN Configuration**.

c Tap MCC and MNC and input the required values.

d Tap the **Done** button.

e If NTN cannot be found using the PLMN (MCC/MNC) information:

- Set **Apply Test** to **On** (green).
- Input the required NTN PCI from 1 to 20.
- Tap the **Done** button to complete the NTN configuration.

To set limit

You can set the thresholds for the two different color indicators, red and blue. The maximum value is the Limit for **Excellent**, and the minimum value is the Limit for **Poor**. See below to check the plot point color based on the Legend Color Table.

1 Tap the rectangle with value before color legend bar on the right panel.

2 Set a value for **Poor** (minimum value) using the on-screen keyboard.

3 Tap the rectangle with value after color legend bar on the right panel.

4 Set a value for **Excellent** (maximum value) using the on-screen keyboard.

Figure 304 shows a legend color table.

Figure 304 Legend color table

Red	Green	Blue	Color	
0	0	255		Poor
0	32	255		
0	64	255		
0	128	255		
0	255	255		
0	255	170		
0	255	85		
0	255	0		
85	255	0		
170	255	0		
255	255	0		
255	128	0		
255	64	0		
255	32	0		
255	0	0		Excellent

Logging data

To log data

1. Follow **steps 1 to 3** in Setting measure setup.
2. Tap the **Testing** () button on the right panel of the map to start plotting on the map. When you select a point on the map, a marker appears and the Information window appears on the right panel.
3. Tap the **Stop** () button to stop plotting.
4. Tap the **Pause** button () to pause plotting, then the GNSS point cannot be plotted.
5. If you select the **Stop** button, the Plot Stop pop-up window appears, then tap **Yes**.
6. Tap **Yes** when the Save pop-up window appears and save the logging file to your USB.

Viewing the logging data

To view the logging data

1. Load the saved logging file using the **Load** () icon on the side bar. Make sure the file extension is .orr.
2. Tap to switch **Plot Item** to **RSRP**, **RSRQ**, **RS SINR**, **S-SS RSSI**, **P-SS RSRP**, **S-SS RSRP**, **S-SS Ec/Io**, or **P-SS SNR**.
3. Tap PCI on the left and then the corresponding Beam Index appeared on the right.
4. Tap the **Apply** button.

   The point color of the map changes to the corresponding value, and if there is no detected LTE signal, the point will become gray color.

Importing cellsite DB

You can import the site DB by creating the 5G site information form.

To import cellsite DB

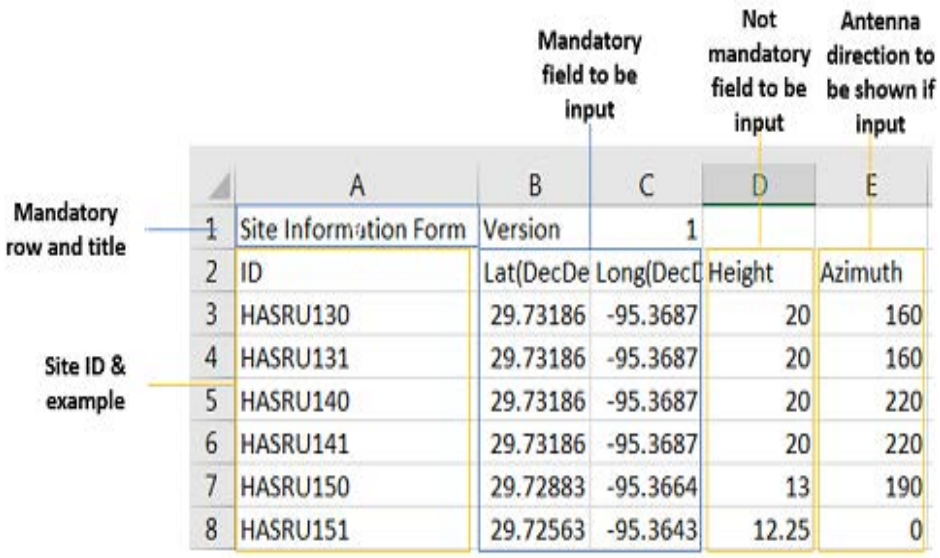
1. Create the 5G site information with an excel file as below.
2. Input the two mandatory fields: **Lat (DecDeg)** and **Long (DecDeg)**.
3. Input the **Azimuth** field if you want to check the direction of antenna.
4. Make sure to save the file as (Comma delimited) (*.csv).
5. Copy the file to the USB memory stick and insert it to the **USB A** or **USB B** port of the instrument.
6. Tap the **Load** () icon on the side bar.

7 Import the saved file.

Once the file is loaded, the following cellsite information appears with an icon.

Figure 305 shows an example of an importing cellsite DB.

Figure 305 Importing Cellsite DB



Creating a map

You can create a map online and continue conducting a route map analysis using the created map even when there is no Ethernet connection.

1 Tap the **Map Creator** button on the right panel at the bottom.

2 Tap the **Search** box and input the location using the on-screen keyboard and select one of the options as required.

3 Tap the **Zoom Level** box to capture the map with corresponding zoom level.

4 Tap the **Capture** button to start capturing the map.

Once the map is captured, the capturing completed pop-up will appear.

5 Select between the two options: Save in the system or Save as file.

6 Tap the **Done** button.

NOTE

If you have unsaved measurement data (map) and start measuring by tapping the Testing button or by tapping another measurement mode, a pop-up window will appear asking whether you will restore the unsaved data or not.

17

Using LTE/LTE-A TDD Analyzer

This chapter describes how to use the LTE/LTE-A TDD Analyzer. Topics covered in this chapter include:

- “Introduction” on page 722
- “Selecting mode and measure” on page 723
- “RF analysis” on page 723
- “OTA analysis” on page 734
- “Signal analysis” on page 755
- “Online route map” on page 777

Introduction

The LTE/LTE-A TDD Analyzer is the optimal portable test solution for installation and maintenance of cellular base stations and cell sites, running with external AC power or battery for the field. Its touch-based user interface has been specifically designed with customized menus and simple calibration procedures, providing service providers with accurate and reliable LTE/LTE-A TDD measurement results.

The LTE/LTE-A TDD Analyzer is the optimal solution to perform following measurements:

- RF Analysis
  - Spectrum
  - Channel Power
  - Occupied Bandwidth
  - Spectrum Emission Mask
  - ACLR
  - Multi-ACLR
  - Spurious Emissions (Not supported in SPA06MA-O yet)
- OTA Analysis
  - OTA Channel Scanner
  - OTA ID Scanner
  - OTA Multipath Profile
  - OTA Control Channel
  - OTA Datagram
  - OTA Route Map
  - Freq/Time/Power Variation
- Signal Analysis
  - Constellation
  - Data Channel (Not supported in SPA06MA-O yet)
  - Control Channel (Not supported in SPA06MA-O yet)
  - Subframe
  - Time Alignment Error (Not supported in SPA06MA-O yet)
  - Data Allocation Map
  - Carrier Aggregation (Not supported in SPA06MA-O yet)
  - Power vs Time (Frame)
  - Power vs Time (Slot)
- Online Route Map Analysis
  - Online Route Map

Selecting mode and measure

The following procedure describes how to start measurement.

To start measurement

1 Tap **LTE/LTE-A TDD Analyzer** on the **MODE** panel.

2 Tap any measurement mode from the following choices:

- **RF Analysis > Spectrum, Channel Power, Occupied Bandwidth, Spectrum Emission Mask, ACLR, Multi-ACLR,** or **Spurious Emissions**
- **OTA Analysis > OTA Channel Scanner, OTA ID Scanner, OTA Multipath Profile, OTA Control Channel, OTA Datagram, OTA Route Map,** or **Freq/Time/Power Variation**
- **Signal Analysis > Constellation, Data Channel, Control Channel, Subframe, Time Alignment Error, Data Allocation Map, Carrier Aggregation, Power vs Time (Frame), Power vs Time (Slot),** or **Power Statistics CCDF**
- **Online Route Map** > **Online OTA Route Map**

RF analysis

The following sections describe how to conduct RF analysis.



You can quickly access the Auto Gain feature by tapping the Auto Gain icon in the top right corner of the measurement screen. If you tap the Auto Gain icon, the following icon appears. + indicates the attenuation increases by 5 each time. - indicates the attenuation decreases by 5 each time. The third one is auto scale and it automatically adjusts scales.You can tap X to exit the Auto Gain feature.

Spectrum

After setting test parameters as described in “Configuring spectrum measurements” on page 25, your measurement is displayed on the screen as like the following example. You can simply change Center Frequency by tapping the icons right below the result chart screen.

To set measure setup

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap **Bandwidth** and select the value from the following choices: **1.4 MHz**, **3 MHz**, **5 MHz**, **10 MHz**, **15 MHz** or **20 MHz**.

3 Tap the **Center Frequency** (Center 1.000 000 000 GHz)icon under the chart screen to set the center frequency using the on-screen keyboard.

4 Tap **Subframe Number** and input the value from 0 to 9 using the on-screen keyboard.

5 Tap to switch **Physical Cell ID** to **Manual** or **Auto**.
- **Auto** lets the instrument detect the Physical Cell ID for the LTE signal automatically
- **Manual** sets a specific Physical Cell ID for the LTE signal manually in order to speed up the synchronization with a BTS.

6 If you set the Physical Cell ID to Manual, tap **Physical Cell ID** and input the value using the on-screen keyboard.

7 *Optional*: Tap the **Save** icon on the side bar and select the save option from the choices available for your measurement mode.

To set trigger

1 Tap the **Menu > Trigger**.

2 Tap **Trigger** and select the options from **Internal**, **External**, or **GNSS**.

3 Tap **Freq. Ref.**(Frequency Reference) to set the clock source.
- **Internal**: Uses a 10 MHz internal clock
- **External**: Uses external 10 MHz, 13 MHz, or 15 MHz clock automatically set by the instrument
- **GNSS**: Uses a built-in GNSS as a frequency and timing source
- **TEM2**: Uses TEM2 pps as a frequency and timing source

  Be aware TEM2 setting is available only when it is connected.

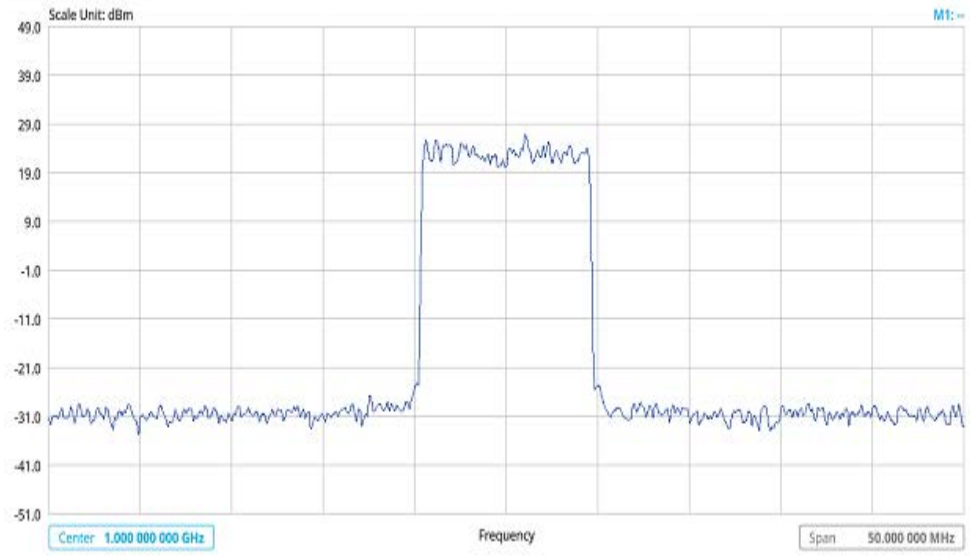


NOTE

Make sure to set Frequency Reference for all measurement mode in LTE-LTE-A TDD Analyzer to sync the proper clock source.

Figure 306 shows an example of an LTE/LTE-A TDD spectrum measurement.

Figure 306 LTE/LTE-A TDD spectrum measurement



Channel power

The Channel Power measurement is a common test used in the wireless industry to measure the total transmitted power of a radio within a defined frequency channel. It acquires a number of points representing the input signal in the time domain, transforms this information into the frequency domain using Fast Fourier Transform (FFT), and then calculates the channel power. The effective resolution bandwidth of the frequency domain trace is proportional to the number of points acquired for the FFT.

The channel power measurement identifies the total RF power and power spectral density (PSD) of the signal in the LTE channel bandwidth.

Setting measure setup

After configuring the spectrum measurement in “Configuring spectrum measurements” on page 25, you can set the measure setup to continue your measurement.

To set measure setup

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap **Bandwidth** and select the value from the following choices: **1.4 MHz**, **3 MHz**, **5 MHz**, **10 MHz**, **15 MHz** or **20 MHz**.
You can also tap the rectangle with value,(Bandwidth 10 MHz) under the chart screen and input the value using the on-screen keyboard.

3 Tap the **Center Frequency** (Center 1.000 000 000 GHz)icon under the chart screen to set the center frequency using the on-screen keyboard.

4 Tap **Subframe Number** and input the value from 0 to 9 using the on-screen keyboard.

5 Tap to switch **Physical Cell ID** to **Manual** or **Auto**.
   – **Auto** lets the instrument detect the Physical Cell ID for the LTE signal automatically
   – **Manual** sets a specific Physical Cell ID for the LTE signal manually in order to speed up the synchronization with a BTS.

6 If you set the Physical Cell ID to Manual, tap **Physical Cell ID** and input the value using the on-screen keyboard.

7 Tap **Menu** > **BW/AVG** > **Average** to set the number of measurements to be averaged using the on-screen keyboard. The input value range is from 1 to 100.

To set limit

1 Tap **Menu > Limit**.

2 Tap to switch the **Test Limits** to **On** or **Off** to enable or disable Pass/Fail indication.

   The result table color for Pass is green, and the result table color for Fail is red.

3 Tap **High Limit** to set the upper threshold using the on-screen keyboard.

4 Tap **Low Limit** to set the lower threshold using the on-screen keyboard.

5 *Optional*: Tap the **Save** hot key on the side bar and select the save option from the choices available for your measurement mode.

Figure 307 shows an example of LTE/LTE-A TDD channel power measurement.

Figure 307 LTE/LTE-A TDD channel power measurement



NOTE
The Channel Power measurement result shows channel power and spectrum density in a user specified channel bandwidth. The peak to average ratio (PAR) is shown at the bottom of the screen as well. The shaded area on the display indicates the channel bandwidth.

Occupied bandwidth

The Occupied Bandwidth measures the percentage of the transmitted power within a specified bandwidth. The percentage is typically 99%.

Setting measure setup

After configuring the spectrum measurement in "Configuring spectrum measurements" on page 25, you can set the measure setup to continue your measurement.

To set measure setup

1. Tap the **Setup** ( ) icon in the side bar.
2. Tap **Bandwidth** and select the value from the following choices: **1.4 MHz**, **3 MHz**, **5 MHz**, **10 MHz**, **15 MHz** or **20 MHz**.

   You can also tap the rectangle with value,(Bandwidth 10 MHz) under the chart screen and input the value using the on-screen keyboard.
3. Tap the **Center Frequency** (Center 1.000 000 000 GHz)icon under the chart screen to set the center frequency using the on-screen keyboard.
4. Tap **Subframe Number** and input the value from 0 to 9 using the on-screen keyboard.
5. Tap to switch **Physical Cell ID** to **Manual** or **Auto**.
   - **Auto** lets the instrument detect the Physical Cell ID for the LTE signal automatically
   - **Manual** sets a specific Physical Cell ID for the LTE signal manually in order to speed up the synchronization with a BTS.
6. If you set the Physical Cell ID to Manual, tap **Physical Cell ID** and input the value using the on-screen keyboard.
7. Tap **Menu** > **BW/AVG** > **Average** to set the number of measurements to be averaged using the on-screen keyboard. The input value range is from 1 to 100.

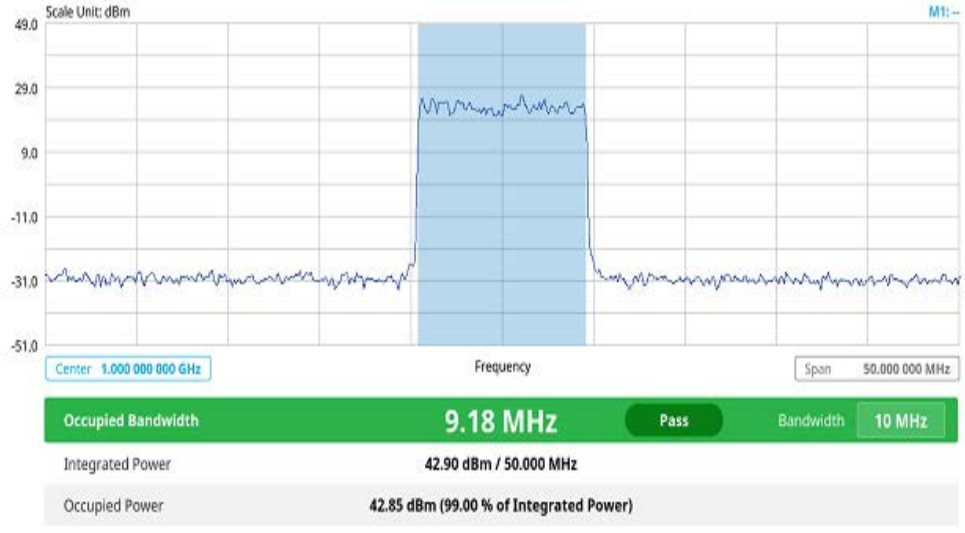
To set limit

1. Tap **Menu > Limit**.
2. Tap to switch the **Test Limits** to **On** or **Off** to enable or disable Pass/Fail indication.

   The result table color for Pass is green, and the result table color for Fail is red.
3. Tap **High Limit** to set the upper threshold using the on-screen keyboard.
4. Tap **Low Limit** to set the lower threshold using the on-screen keyboard.
5. *Optional*: Tap the **Save** hot key on the side bar and select the save option from the choices available for your measurement mode.

Figure 308 shows an example of LTE/LTE-A TDD occupied bandwidth measurement.

Figure 308 LTE/LTE-A TDD occupied bandwidth measurement



NOTE
The Occupied Bandwidth measurement shows both power across the band and power bandwidth in a user specified percentage to determine the amount of spectrum used by a modulated signal. Occupied bandwidth is typically calculated as the bandwidth containing 99% of the transmitted power.

Spectrum emission mask

The Spectrum Emission Mask (SEM) measurement is to identify and determine the power level of out-of-band spurious emission outside the necessary channel bandwidth and modulated signal. It measures the power ratio between in-band and adjacent channels. The instrument indicates either Pass or Fail based on the specified limit of the signal.

Setting measure setup

After configuring the spectrum measurement in “Configuring spectrum measurements” on page 25, you can set the measure setup to continue your measurement. The measurement settings can be saved and recalled as a file by selecting File Type as Setup and load the file onto the instrument using the **Save/Load** icons on the side bar.

To set measure setup

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap **Bandwidth** and select the value from the following choices: **1.4 MHz**, **3 MHz**, **5 MHz**, **10 MHz**, **15 MHz** or **20 MHz**.
You can also tap the rectangle with value,(

) under the chart screen and input the value using the on-screen keyboard.

3 Tap **Mask Type** and select the type from the following choices: **Wide Area BS A**, **Wide Area BS B**, **Local Area BS**, **Home BS**.

4 Tap **Subframe Number** and input the value from 0 to 9 using the on-screen keyboard.

5 *Optional.* Tap to switch **Physical Cell ID** to **Manual** or **Auto**.

- **Auto** lets the instrument detect the Physical Cell ID for the LTE signal automatically
- **Manual** sets a specific Physical Cell ID for the LTE signal manually in order to speed up the synchronization with a BTS.

To set limit

1 Tap **Menu > Limit**.

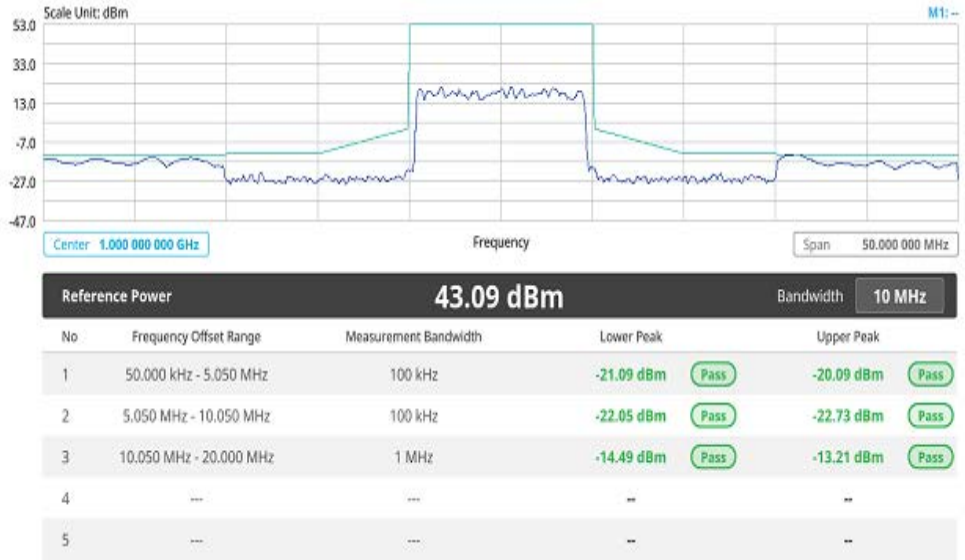
2 Tap to switch the **Test Limits** to **On** or **Off** to enable or disable Pass/Fail indication.

The result table color for Pass is green, and the result table color for Fail is red.

3 *Optional*: Tap the **Save** hot key on the side bar and select the save option from the choices available for your measurement mode.

Figure 309 shows an example of LTE/LTE-A TDD spectrum emission mask measurement.

Figure 309 LTE/LTE-A TDD spectrum emission mask measurement



NOTE
If Lower Peak or Upper Peak indicates Fail, the mask line becomes red.
If the Trace View is set to Off, the Reference Power, Lower Peak, and Upper Peak is not shown. If the Trace View is set to On and the Trace Type is selected other than Clear Write, the Reference Power, Lower Peak, and Upper Peak is shown with value and "*" at the end of the value.

ACLR

The Adjacent Channel Power Ratio (ACPR) designated by the 3GPP LTE/LTE-A specifications as the Adjacent Channel Leakage Power Ratio (ACLR), is the power contained in a specified frequency channel bandwidth relative to the total carrier power. It may also be expressed as a ratio of power spectral densities between the carrier and the specified offset frequency band.

Setting measure setup

After configuring the spectrum measurement in "Configuring spectrum measurements" on page 25, you can set the measure setup to continue your measurement. The measurement settings can be saved and recalled as a file by selecting File Type as Setup and load the file onto the instrument using the **Save/Load** icons on the side bar.

To set measure setup

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap **Bandwidth** and select the value from the following choices: **1.4 MHz**, **3 MHz**, **5 MHz**, **10 MHz**, **15 MHz** or **20 MHz**.

You can also tap the rectangle with value,(

) under the chart screen and input the value using the on-screen keyboard.

3 Tap **Subframe Number** and input the value from 0 to 9 using the on-screen keyboard.

4 *Optional.* Tap to switch **Physical Cell ID** to **Manual** or **Auto**.

- **Auto** lets the instrument detect the Physical Cell ID for the LTE signal automatically
- **Manual** sets a specific Physical Cell ID for the LTE signal manually in order to speed up the synchronization with a BTS.

To set limit

1 Tap **Menu > Limit**.

2 Tap to switch the **Test Limits** to **On** or **Off** to enable or disable Pass/Fail indication.

The result table color for Pass is green, and the result table color for Fail is red.

3 *Optional*: Tap the **Save** hot key on the side bar and select the save option from the choices available for your measurement mode.

Figure 310 shows an example of LTE/LTE-A TDD ACLR measurement.

Figure 310 LTE/LTE-A TDD ACLR measurement



Multi-ACLR

The Multi-ACLR measurement is used to perform multi-channel ACLR measurements with as many channels as possible. It helps you to measure ACLR in multi-channel transmitting Base Station environment.

Setting measure setup

After configuring the spectrum measurement in “Configuring spectrum measurements” on page 25, you can set the measure setup to continue your measurement. The measurement settings can be saved and recalled as a file by selecting File Type as Setup and load the file onto the instrument using the **Save/Load** icons on the side bar.

To set measure setup

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap **Bandwidth** and select the value from the following choices: **1.4 MHz**, **3 MHz**, **5 MHz**, **10 MHz**, **15 MHz** or **20 MHz**.
You can also tap the rectangle with value,(

) under the chart screen and input the value using the on-screen keyboard.

3 Tap **Lowest Frequency** to set the starting center frequency and enter the value using the on-screen keyboard.

4 Tap **Highest Frequency** to set the stopping center frequency and enter the value using the on-screen keyboard.

5 Tap **Lowest Channel Number** to set the starting channel and enter the value using the on-screen keyboard.

6 Tap **Highest Channel Number** to set the stopping Channel and enter the value using the on-screen keyboard.

7 Tap **Channel Standard** and select and apply the channel standard in the **Band Global** list.

To set limit

1 Tap **Menu > Limit**.

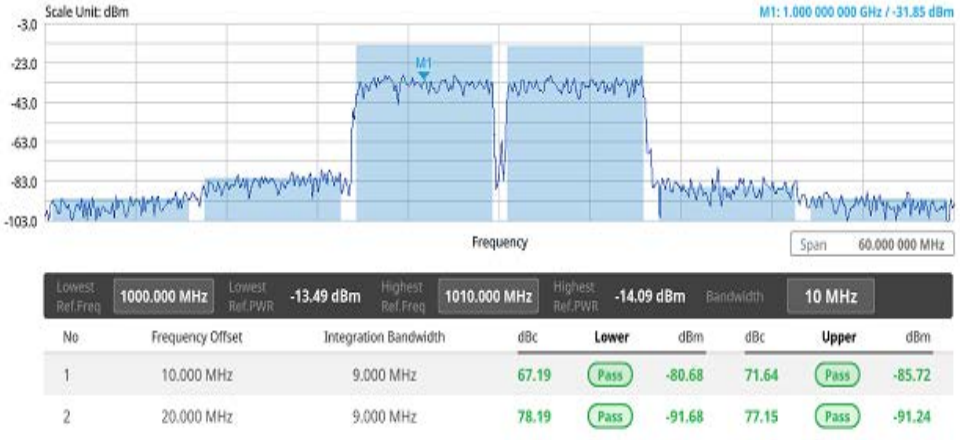
2 Tap to switch the **Test Limits** to **On** or **Off** to enable or disable Pass/Fail indication.

The result table color for Pass is green, and the result table color for Fail is red.

3 *Optional*: Tap the **Save** hot key on the side bar and select the save option from the choices available for your measurement mode.

Figure 311 shows an example of LTE/LTE-A TDD Multi-ACLR measurement.

Figure 311 LTE/LTE-A TDD Multi-ACLR measurement



NOTE
You can set the Lowest Ref. Frequency and Highest Ref. Frequency by tapping the rectangle with value using the on-screen keyboard.

Spurious emissions

The Spurious Emissions measurement is to identify or determine the power level of in-band or out-of-band spurious emissions within the necessary channel bandwidth and modulated signal. The instrument indicates either Pass or Fail based on the specified limit of the signal.

Note that this feature is not supported in SPA06MA-O yet.

Setting measure setup

After configuring the spectrum measurement in “Configuring spectrum measurements”

on page 25, you can set the measure setup to continue your measurement. The measurement settings can be saved and recalled as a file by selecting File Type as Setup and load the file onto the instrument using the **Save/Load** icons on the side bar.

To set measure setup

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap **Configuration** or the **Configuration**( ) icon.

3 Tap **Range** under the chart screen and switch to **On** to display or **Off** to hide the selected range in the result table.

You can select the range number between **1** and **20** to add as a new or change the existing settings.

4 Tap **Start Frequency/Stop Frequency** and enter the value for the selected range using the on-screen keyboard.

5 Tap **Start Limit/Stop Limit** and enter the lower limit/upper limit for Pass/Fail indication.

6 Tap **Attenuation/RBW/VBW** and specify or select the value.

7 Tap **Measurement Type** between **Full** and **Examine**.

The **Examine** mode displays only the selected range while the **Full** mode lets the instrument automatically change the selected range from one another.

8 Tap **Average** on the box of upper screen and enter the value between **1** and **100** to set the number of measurements to be averaged.

You can also access this menu through **Menu > Average** on the side bar.

To set limit

1 Tap **Menu > Limit**.

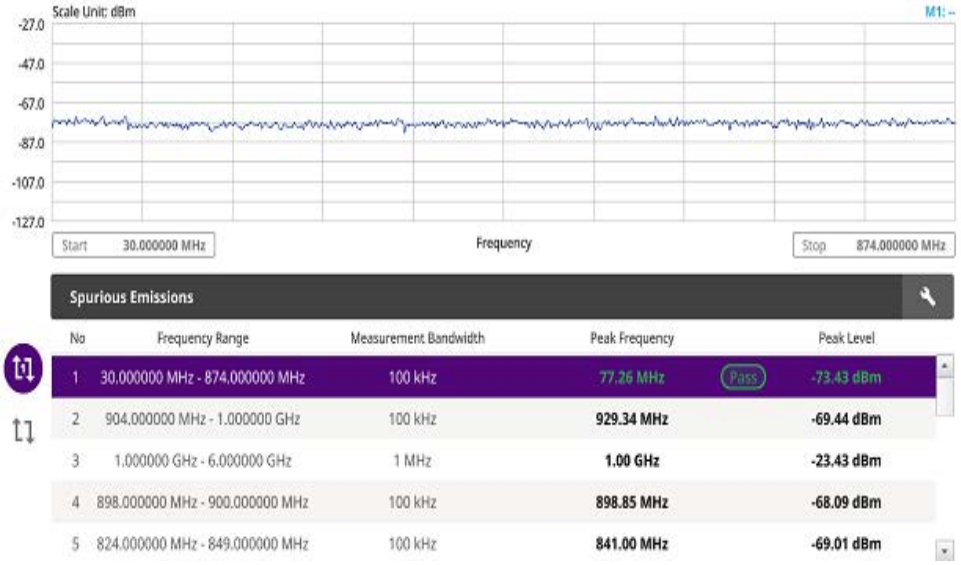
2 Tap to switch the **Test Limits** to **On** or **Off** to enable or disable Pass/Fail indication.

The result table color for Pass is green, and the result table color for Fail is red.

3 *Optional*: Tap the **Save** hot key on the side bar and select the save option from the choices available for your measurement mode.

Figure 312 shows an example of LTE/LTE-A TDD spurious emissions measurement.

Figure 312 LTE/LTE-A TDD spurious emissions measurement



NOTE
You can only set the frequency range and attenuation by tapping the Configuration icon. If you select the first icon next to the Range table above, it only shows the selected range and if you select the second icon next to the Range table, it keeps moving from the first selected range to the final selected range.

OTA analysis

The following sections describe how to perform OTA analysis.

OTA channel scanner

Setting measure setup

After configuring the spectrum measurement in “Configuring spectrum measurements” on page 25, you can set the measure setup to continue your measurement. The measurement settings can be saved and recalled as a file by selecting File Type as Setup and load the file onto the instrument using the **Save/Load** icons on the side bar.

To set measure setup

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap to switch **MIB Decoding** to **On** when you do not know the number of transmitter antennas and Bandwidth or otherwise to **Off**.

3 Tap the **MIMO** and select **2x2** or **4x4** to select the number of antenna ports.

4 Tap **CA Configuration** or tap the **Configuration** () icon.
General Setting and Carrier Setting table appear.

General setting

1 Tap **Trigger** to set **Internal**, **External** or **GNSS** as required.
- **Internal**: when starting a signal processing using the internal reference clock and creating a trigger
- **External**: when starting a signal processing based on the external input trigger
- **GNSS**: When synchronizing the signal processing via the GNSS receiver. If you want to check the time error correctly, set the trigger to GNSS

Carrier setting

1 Tap **Index** to select up to 6 numbers of carriers.

2 Select **Center Frequency** to set the center frequency using the on-screen keyboard.

a If you apply **Center Frequency**, **Channel No**, and **Bandwidth** all at once, tap the **Center Frequency List** () icon and do the following:

i Tap the **Add (+)** icon and input Center Frequency, Channel No, and Bandwidth as required using the on-screen keyboard.

ii Tap the **Apply** button to apply the changes. The screen moves to the Center Frequency List table.

iii Highlight the one of the added lists and tap the **Configuration** icon that appears in gray to change the applied values.

iv Tap the **Delete** icon to delete the selected list(s).



NOTE
You will be able to multi-select the added items and apply them all at once only if the Index number is On. If the Index 1 and 3 are On and you highlight No. 0,3, and 4, the first two highlighted lists, 0 and 3 are applied to each carrier 1 and 3.

3 Select **Channel Standard** to set the channel standard for the selected index using the on-screen keyboard.

4 Select **Channel Number** to set the channel number for the selected index using the on-screen keyboard.

5 Select **Bandwidth** from the following options: **1.4 MHz**, **3 MHz**, **5 MHz**, **10 MHz**, **15 MHz**, or **20 MHz**.

6 Tap the **External Offset** box and input the value using the on-screen keyboard and tap to switch the external offset to **On** (green) or **Off** (gray) as desired.

7 Tap the **Attenuation** box and input the value using the on-screen keyboard if you want to set it manually (**Manual**). Or tap it to set **Auto**.

8 Tap to switch the **Preamp** box **1**, **2**, and **Auto** to **On** (green) or **Off** (gray).

9 Tap the **Add** button to add Index or **Delete** button to delete the selected Index.

10 *Optional.* The **NTN Configuration** box appears only if the ONA-SP-LTE-NTN license is available. See **Figure 266**.

a Tap **Settings** to open the **NTN Configuration** window.

b Tap MCC and MNC and input the required values.

c Tap the **Done** button.

d If NTN cannot be found using the PLMN (MCC/MNC) information:

- Set **Apply Test** to **On** (green).
- Input the required NTN PCI from 1 to 20.
- Tap the **Done** button to complete the NTN configuration.

To set limit

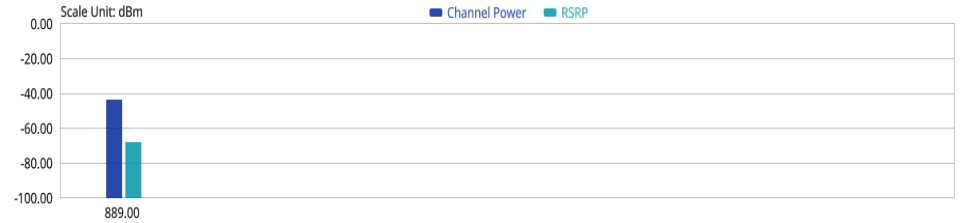
1 Tap **Menu** > **Limit**.

2 Tap to switch **Limit Line** to **On** or **Off**.

3 Tap **Limit Line** and input the value using the on-screen keyboard to enable or disable Pass/Fail indication.

Figure 313 shows an example of OTA LTE/LTE-A TDD channel scanner measurement.

Figure 313 LTE/LTE-A TDD OTA channel scanner measurement



No	Frequency (MHz)	PCI (Grp,Sctr)	Channel Power (dBm)	RSSI (dBm)	RSRP (dBm)	RSRQ (dB)	S-SS RSRP (dBm)	P-SS RSRP (dBm)	Time Error (µs)	Freq Error (ppm)	RS SINR (dB)
1	889.00	410 (136,2)	-43.72	-45.76	-68.15	-5.85	-68.32	-67.78	0.00	0.01	16.87
2	--	--	--	--	--	--	--	--	--	--	--
3	--	--	--	--	--	--	--	--	--	--	--
4	--	--	--	--	--	--	--	--	--	--	--
5	--	--	--	--	--	--	--	--	--	--	--
6	--	--	--	--	--	--	--	--	--	--	--

Figure 314 OTA channel scanner with NTN



No	Frequency (MHz)	PCI *NTN (Grp,Sctr)	Channel Power (dBm)	PLMN *NTN (MCC/MNC)	RSSI (dBm)	RSRP (dBm)	RSRQ (dB)	S-SS RSRP (dBm)	P-SS RSRP (dBm)	Time Error (µs)	Freq Error (ppm)	RS SI (dB
1	879.00	174 (58,0)	-43.24	450 / 5	-45.29	-66.28	-4.56	-69.94	-69.79	-0.20	0.040	15.6
2	889.00	410 (136,2)	-37.28	450 / 6	-40.72	-63.90	-6.63	-64.85	-64.98	-2.99	0.030	16.3
3	--	--	--	--	--	--	--	--	--	--	--	--
4	--	--	--	--	--	--	--	--	--	--	--	--
5	--	--	--	--	--	--	--	--	--	--	--	--
6	--	--	--	--	--	--	--	--	--	--	--	--

Figure 315 LTE/LTE-A TDD OTA channel scanner with frequency error

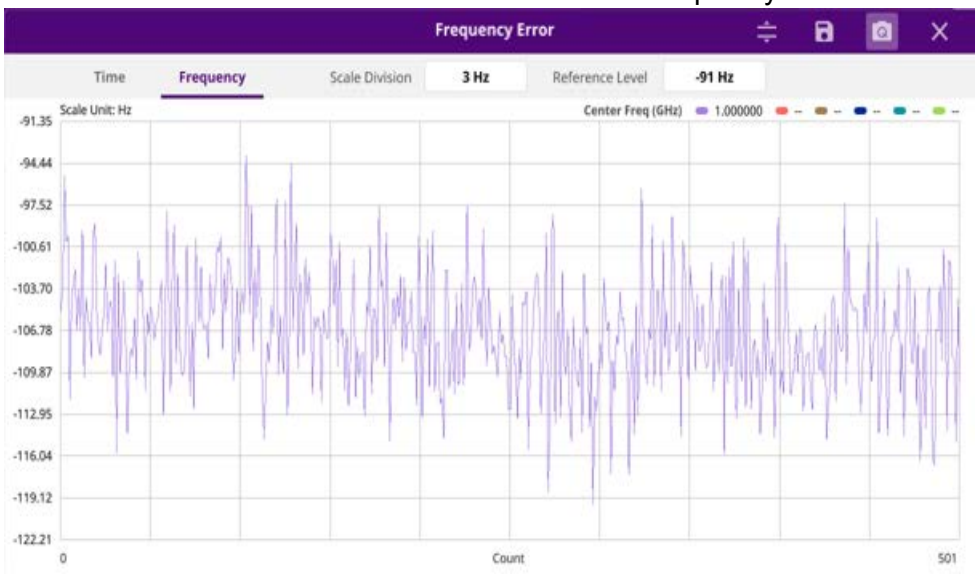
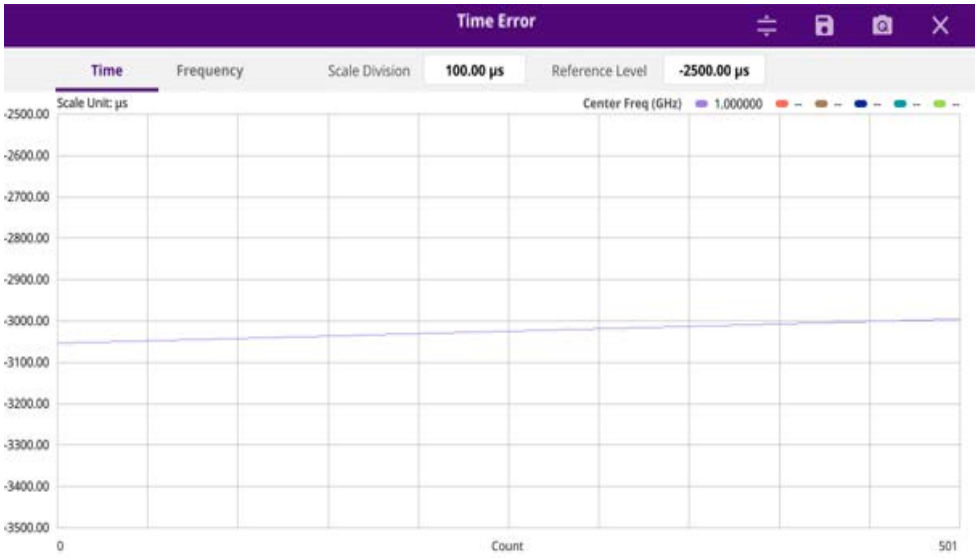


Figure 316 LTE/LTE-A TDD OTA channel scanner with time error



Using icons

You can tap the **Magnifier** icon to check the frequency or time error. You can also perform the following operation using the icons.

Icon	Description
	**Auto Scale**: You can set the scale automatically.
	**Save as CSV**: You can assign file name using the on-screen keyboard and apply the changes. This will let you save your measurement file internally.
	**Quick Save**: You can save current measurement screen as it is.
	**Close**: You can close the screen you are seeing now.

OTA ID Scanner

The LTE mobile receives signals from multiple base stations, all of which share the same spectrum and are present at the same time. Each base station has unique scrambling code assigned to the particular base station and it differentiates its signal from other base stations in the area.

The ID Scanner shows key parameters such as RSRP (Reference Signal Received Power) and RSRQ (Reference Signal Received Quality) that predict the downlink coverage quickly. RSRPs from entire cells help to rank between the different cells as input for handover and cell reselection decisions. RSRQ provides additional information when RSRP is not sufficient to make a reliable handover or cell reselection decision.

Setting measure setup

After configuring the spectrum measurement in “Configuring spectrum measurements” on page 25, you can set the measure setup to continue your measurement. The measurement settings can be saved and recalled as a file by selecting File Type as Setup and load the file onto the instrument using the **Save/Load** icons on the side bar.

To set measure setup

1 Tap the **Setup** () icon in the side bar.

2 Tap to switch **PLMN/BW Decoding** to **On** or **Off**.

When enabled, PLMN/BW Decoding decodes LTE broadcast messages (such as MIB and SIB) to identify the serving cell and determine the operating bandwidth. They are displayed at the top left of the measurement table.

3 Tap **Bandwidth** and select the value from the following choices: **1.4 MHz**, **3 MHz**, **5 MHz**, **10 MHz**, **15 MHz** or **20 MHz**.

4 Tap the **MIMO** and select **2x2** or **4x4** to select the number of antenna ports.

5 To select the Cyclic Prefix, tap **Cyclic Prefix** and select **Normal** or **Extended**.

6 *Optional.* The **NTN Configuration** box appears only if the ONA-SP-LTE-NTN license is available.

a Tap to turn **NTN On**.

b Tap **NTN Configuration**.

c Tap MCC and MNC and input the required values.

d Tap the **Done** button.

e If NTN cannot be found using the PLMN (MCC/MNC) information:

- Set **Apply Test** to **On** (green).
- Input the required NTN PCI from 1 to 20.
- Tap the **Done** button to complete the NTN configuration.

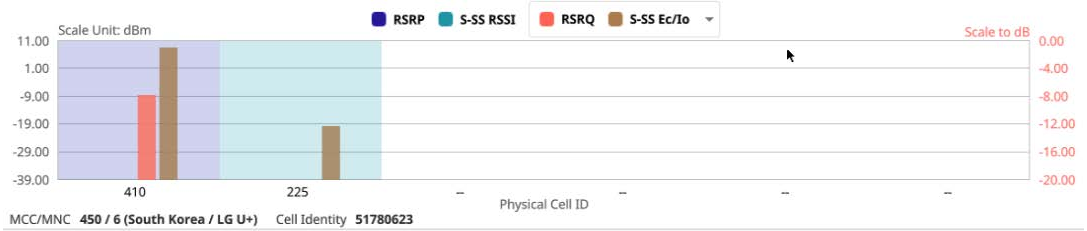
7 *Optional.* Tap **Limit** > **PCI Dominance**. Once tapped On, you can set the value using the on-screen keyboard.

If the PCI dominance is on, you can judge pass (green) or fail (red) with colors based on the limit you have set. For example, if it becomes smaller than the threshold, the fail indicator (red) can be identified in the PCI column of the result table and the top right corner of the instrument at the same time.

8 *Optional*: Tap the **Save** icon on the side bar and select the save option from the choices available for your measurement mode.

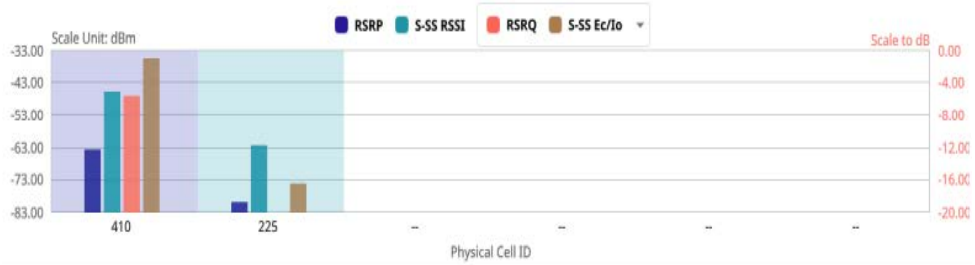
Figure 317 shows an example of OTA LTE/LTE-A TDD ID scanner measurement.

Figure 317 LTE/LTE-A TDD OTA ID scanner measurement



No	PCI (Grp,Sctr)	RSRP (dBm)	RSRQ (dB)	P-SS SNR (dB)	RS SINR (dB)	S-SS RSSI (dBm)	P-SS RSRP (dBm)	S-SS RSRP (dBm)	S-SS Ec/Io (dB)	Time Error (µs)	Frequency Error (ppm)
1	**410 (136,2)**	**-74.93**	**-7.88**	**39.54**	**7.56**	**-55.14**	**-71.97**	**-73.06**	**-0.95**	**-0.03**	**0.001**
2	**225 (75,0)**	**-89.20**	**-20.30**	**25.27**	**-6.03**	**-69.41**	**-83.84**	**-87.34**	**-12.41**	**-0.13**	**-1.124**
3	--	--	--	--	--	--	--	--	--	--	--
4	--	--	--	--	--	--	--	--	--	--	--
5	--	--	--	--	--	--	--	--	--	--	--
6	--	--	--	--	--	--	--	--	--	--	--

Figure 318 LTE/LTE-A TDD OTA ID scanner with NTN



No	PCI *NTN (Grp,Sctr)	PLMN *NTN (MCC/MNC)	RSRP (dBm)	RSRQ (dB)	P-SS SNR (dB)	RS SINR (dB)	S-SS RSSI (dBm)	P-SS RSRP (dBm)	S-SS RSRP (dBm)	S-SS Ec/Io (dB)	Time Error (µs)	Frequency Error (ppm
1	410 (136,2)	450 / 6	-63.46	-5.61	38.55	19.04	-45.61	-63.13	-63.54	-0.96	-0.16	0.029
2	225 (75,0)	--	-79.92	-22.15	22.09	-10.48	-62.08	-79.36	-80.00	-16.54	-0.72	-1.124
3	--	--	--	--	--	--	--	--	--	--	--	--
4	--	--	--	--	--	--	--	--	--	--	--	--
5	--	--	--	--	--	--	--	--	--	--	--	--
6	--	--	--	--	--	--	--	--	--	--	--	--

OTA multipath profile

The Multipath Profile enables you to determine RF environmental conditions of testing area. It indicates the amount of power of the dominant pilot signal that is dispersed outside the main correlation peak due to multipath echoes that are expressed in dB. This value should be very small ideally.

The multipath profile is the result of portions of the original broadcast signal arriving at the receiving antenna out of phase. This can be caused by the signal being reflected off objects such as buildings or being refracted through the atmosphere differently from the main signal.

Setting measure setup

After configuring the spectrum measurement in “Configuring spectrum measurements” on page 25, you can set the measure setup to continue your measurement. The measurement settings can be saved and recalled as a file by selecting File Type as Setup and load the file onto the instrument using the **Save/Load** icons on the side bar.

To set measure setup

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap to switch **MIB Decoding** to **On** when you do not know the number of transmitter antennas and Bandwidth or otherwise to **Off**.

3 Tap **Bandwidth** and select the value from the following choices: **1.4 MHz**, **3 MHz**, **5 MHz**, **10 MHz**, **15 MHz** or **20 MHz**.

4 Tap **RS Window Length** and select the RS window option: **2 µs, 4 µs,** or **8 µs**.

5 Tap **Sync Window Display** and select between **Default** and **Symmetrical**.

If you select **Symmetrical**, it will show the symmetrical view for the measurement screen.

6 Tap **Subframe Number** to set the number of subframe using the on-screen keyboard.

7 *Optional.* Tap **Physical Cell ID** and select the type **Manual** or **Auto**.

– **Auto** lets the instrument detect the Physical Cell ID for the LTE signal automatically.

– **Manual** sets a specific Physical Cell ID for the LTE signal manually in order to speed up with the synchronization with a BTS.

NOTE
When there are no PSS and SSS signals, set the PCI Cell ID to Manual and input the required PCI number to search CRS.

8 Tap the **MIMO** and select **2x2** or **4x4** to select the number of antenna ports.

9 To select the Cyclic Prefix, tap **Cyclic Prefix** and select **Normal** or **Extended**.

Figure 319 shows an example of LTE/LTE-A TDD OTA multipath profile measurement.

Figure 319 LTE/LTE-A TDD OTA multipath profile measurement



OTA control channel

DL RS power is the resource element power of Downlink Reference Symbol. The absolute DL RS power is indicated on the BCH. The absolute accuracy is defined as the maximum deviation between the DL RS power indicated on the BCH and the DL RS power at the BS antenna connector.

The OTA Control Channel provides summary of all control channels including RS power trend over time. GPS coordinates (latitude and longitude) will be displayed on

the screen if a GPS antenna is connected and locked to the GPS satellites.

Setting measure setup

After configuring the spectrum measurement in "Configuring spectrum measurements" on page 25, you can set the measure setup to continue your measurement. The measurement settings can be saved and recalled as a file by selecting File Type as Setup and load the file onto the instrument using the **Save/Load** icons on the side bar.

To set measure setup

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap to switch **MIB Decoding** to **On** when you do not know the number of transmitter antennas and Bandwidth or otherwise to **Off**.

3 Tap **Bandwidth** and select the value from the following choices: **1.4 MHz**, **3 MHz**, **5 MHz**, **10 MHz**, **15 MHz** or **20 MHz**.

4 Tap **Subframe Number** to set the number of subframe using the on-screen keyboard.

NOTE
For MBMS testing, this subframe number must be either 0 nor 5 as these subframes 0 and 5 are not available for MBMS and it must be set to the MBMS transmitted channel's subframe number.

5 *Optional.* Tap **Physical Cell ID** and select the type **Manual** or **Auto**.
- **Auto** lets the instrument detect the Physical Cell ID for the LTE signal automatically.
- **Manual** sets a specific Physical Cell ID for the LTE signal manually in order to speed up with the synchronization with a BTS.

NOTE
When there are no PSS and SSS signals, set the PCI Cell ID to Manual and input the required PCI number to search CRS.

6 Tap the **MIMO** and select **2x2** or **4x4** to select the number of antenna ports.

7 *Optional.* To assign an antenna port number automatically or manually, tap the **Antenna Port** under **Antenna menu** and select the option: **Auto**, **Antenna 0**, **Antenna 1**, **Antenna 2**, or **Antenna 3**.

If the MIMO is set to 2x2, the antenna ports 2 and 3 are disabled.

8 To turn the Multimedia Broadcast Multicast Service (**MBMS**) feature on or off, tap **MBMS** and select **On** or **Off**. For proper MBMS testing, you need to set the **Subframe Number** in the upper right screen with the same PMCH subframe number. If this setting is on, the measurement item MBSFN RS appears in the result table.

9 To set the Multicast Broadcast Single Frequency Network (**MBSFN**) detection automatically or manually for MBMS testing, tap **MBSFN** and select **Auto** or **Manual**.

10 To select the Cyclic Prefix, tap **Cyclic Prefix** and select **Normal** or **Extended**.

11 Tap **Menu** > **Display** and select **EVM** or **Power**.

The screen changes according to the selected option.

To set limit

1 Tap **Menu** > **Limit**.

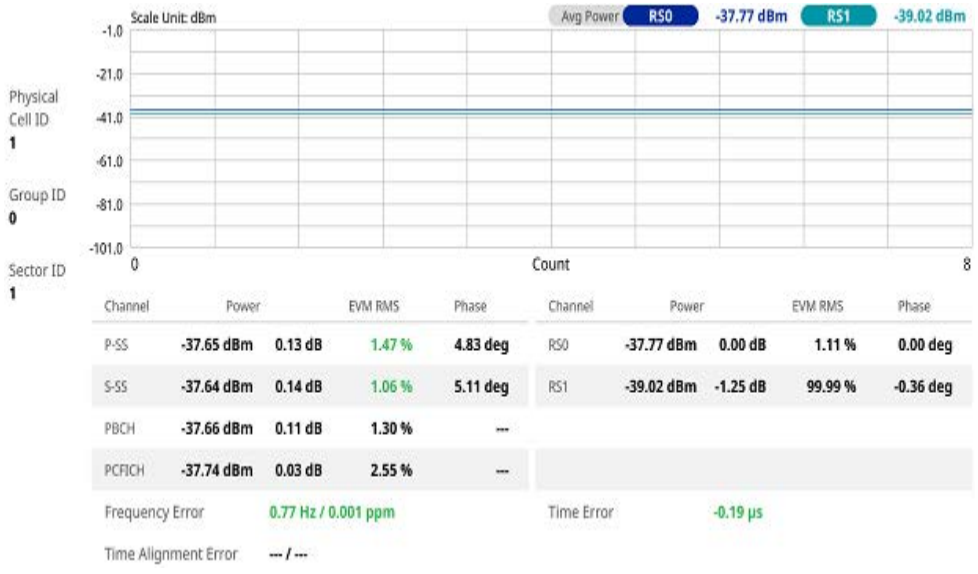
2 Tap the test items and set the limits depending on your selected measurement mode:

To set the limit for	Select and set
RS EVM	RS0/1/2/3 Limit Mode On/Off, High Limit
P-SS EVM	Test limits On/Off, High Limit
S-SS EVM	Test limits On/Off, High Limit
Frequency Error	Test limits On/Off, High/Low Limit
Time Error	Test limits On/Off, High/Low Limit
Time Alignment Error	Test limits On/Off, High Limit

3 Tap the **Save** icon on the side bar and select the save option from the choices available for your measurement mode.

Figure 320 shows an example of LTE/LTE-A TDD OTA control channel measurement.

Figure 320 LTE/LTE-A TDD OTA control channel measurement



OTA datagram

The OTA Datagram is a time-varying spectral representation that shows how the power of a signal varies with time. The power allocated to the specific resource block will be represented with an amplitude axis (in dBm) and the waterfall diagram will show the trend of past resource block power over certain period. Using a marker function facilitates analysis of accumulated resource block power for data utilization.

Note that this feature is not supported in SPA06MA-O yet.

Setting measure setup

After configuring the spectrum measurement in "Configuring spectrum measurements" on page 25, you can set the measure setup to continue your measurement. The measurement settings can be saved and recalled as a file by selecting File Type as Setup and load the file onto the instrument using the **Save/Load** icons on the side bar.

To set measure setup

1 Tap the **Setup** (⚙) icon in the side bar.

2 Tap to switch **MIB Decoding** to **On** when you do not know the number of transmitter antennas and Bandwidth or otherwise to **Off**.

3 Tap **Bandwidth** and select the value from the following choices: **1.4 MHz**, **3 MHz**, **5 MHz**, **10 MHz**, **15 MHz** or **20 MHz**.

4 Tap **Subframe Number** to set the number of subframe using the on-screen keyboard.

5 Tap **Position** to set the number of positions using the on-screen keyboard when **Time Cursor** is set to **On**.

6 *Optional.* Tap **Physical Cell ID** and select the type between **Manual** and **Auto**.
- **Auto** lets the instrument detect the Physical Cell ID for the LTE signal automatically.
- **Manual** sets a specific Physical Cell ID for the LTE signal manually in order to speed up with the synchronization with a BTS.

NOTE
When there are no PSS and SSS signals, set the PCI Cell ID to Manual and input the required PCI number to search CRS.

7 *Optional.* To set the threshold for PDSCH, tap **PDSCH Threshold** and enter a value by using the on-screen keyboard.

8 To set the time cursor at a specific position, tap **Time Cursor** and select **On**.

NOTE
For MBMS testing, this subframe number must be either 0 nor 5 as these subframes 0 and 5 are not available for MBMS and it must be set to the MBMS transmitted channel's subframe number.

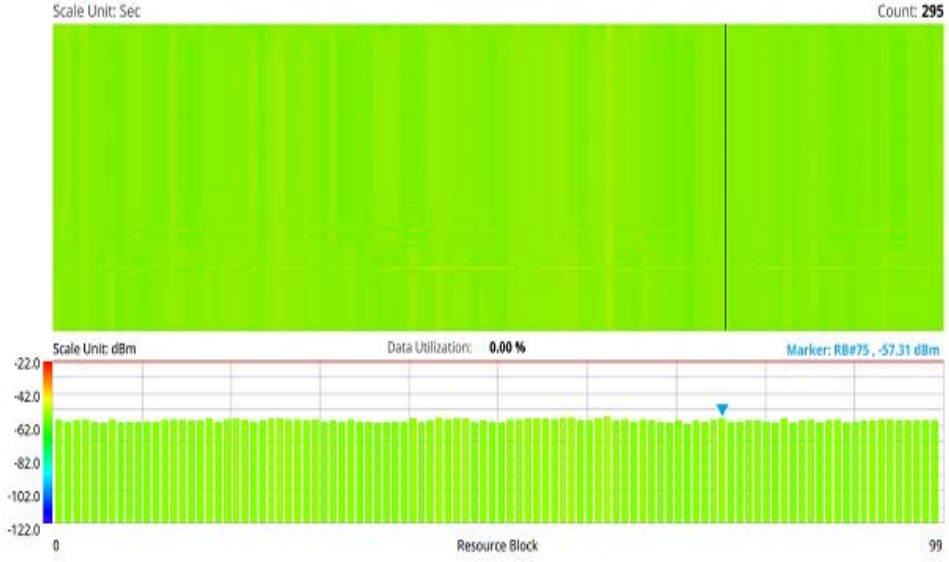
9 To start a new measurement, tap **Reset**.

10 *Optional.* To select the number of antenna ports, tap the **MIMO** and select **2x2** or **4x4.**

11 *Optional.* To select the Cyclic Prefix, tap **Cyclic Prefix** and select **Normal** or **Extended**.

Figure 321 shows an example of LTE/LTE-A TDD OTA datagram measurement.

Figure 321 LTE/LTE-A TDD OTA datagram measurement



OTA route map

LTE route map traces the power level of the strongest LTE signal in terms of RSRP corresponding to a particular time and geographical position and presents it in a geographical map as a measurement point. All the collected measurements can be exported for post-processing purposes, including data of the strongest LTE signal for each measurement point, including its measurement time and geographical location.

Figure 322 shows an example of LTE/LTE-A TDD OTA route map measurement.

Figure 322 OTA route map with LTE/LTE-A TDD Analyzer

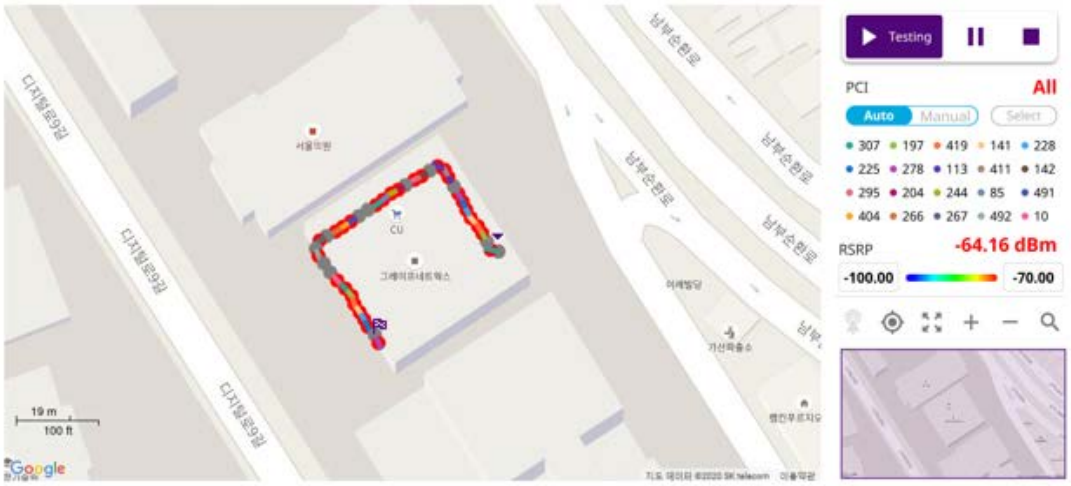


Figure 323 OTA route map with NTN



Loading a map

To use any features related to maps, you need to download and install the maps on the instrument. The VIAVI JDMapCreator will help you download maps. Make sure the JDMapCreator application on your computer is connected to the instrument via LAN. You can send a map file with a single layer to the instrument directly by using the Send to EQP menu in JDMapCreator. For more information on how to use the JDMapCreator, see the *JDMapCreator 2.0 User Guide*.

To load a map

1 Plug in your USB flash drive that has a map with a file type of .mcfv created in JDMapCreator.

2 Tap the **Load** ( ) icon on the side bar.

3 Navigate to the map file that you want to open.

The **File Information** pane displays the file properties, including its name, size, type, and date modified.

4 Tap the **Load** button on the screen.

5 Once you have loaded the map, you can also control the map using the following icons on the map.

Table 144 Map icons

Icon	Description
	Tap to go to your current location on the map. Once tapped, a purple icon appears on the map, indicating your current location.
	Tap to switch to the full screen map view.
	Tap to zoom in on the map.
	Tap to zoom out on the map.
	Tap and select the area that you want to expand.

The left-most cell-site icon is activated when you import the cell-site information file.

To set measurement setup

Before starting the Route Map measurement, you need to set Spectrum measurements displayed on the quick access and display tab. See “Configuring spectrum measurements” on page 25 for more information.

1 If required, connect a GNSS receiver to your instrument for outdoor mapping. Indoor mapping does not necessarily need a GNSS antenna.

2 Tap the **Setup** ( ) icon on the side bar.

3 Tap to switch **MIB Decoding** to **On** when you do not know the number of transmitter antennas and Bandwidth or otherwise to **Off**.

4 Tap to switch the **Plot Point** to **GNSS**, **Position**, or **Time**.

a To collect data/plot points automatically as you move around in a vehicle or outside, select **GNSS**, then tap to switch the **Screen Mode** between **Map** and **Full**.

– With the **Map** setting, you can view only the collected points that can be seen within the boundary of the loaded map.

– With the **Full** setting, you can view all the collected points of the route without the loaded map.

b To collect data/plot points manually in an indoor layout without a GNSS antenna, select **Position**.

c To collect data/plot points based on time, select **Time**.

5 Tap **Bandwidth** and select the value from the following choices: **1.4 MHz**, **3 MHz**, **5 MHz**, **10 MHz**, **15 MHz** or **20 MHz**.

6 Tap to switch **Physical Cell ID** to **Manual** or **Auto**.

– **Auto** lets the instrument detect the Physical Cell ID for the LTE signal automatically

– **Manual** sets a specific Physical Cell ID for the LTE signal manually in order to speed up the synchronization with a BTS.



NOTE
When there are no PSS and SSS signals, set the PCI Cell ID to Manual and input the required PCI number to search CRS.

7 If you set the Physical Cell ID to Manual, tap **Physical Cell ID** and input the value using the on-screen keyboard.

8 *Optional*: Tap the **Save** icon on the side bar and select the save option from the choices available for your measurement mode.



NOTE
The instrument does not automatically save the collected data. It is recommended that you save the result. If not, you will lose all the collected data.

9 *Optional.* The **NTN Configuration** box appears only if the ONA-SP-LTE-NTN license is available.

a Tap to turn **NTN On**.

b Tap **NTN Configuration**.

c Tap MCC and MNC and input the required values.

d Tap the **Done** button.

e If NTN cannot be found using the PLMN (MCC/MNC) information:

- Set **Apply Test** to **On** (green).
- Input the required NTN PCI from 1 to 20.
- Tap the **Done** button to complete the NTN configuration.

To set limit

You can set the thresholds for the two different color indicators, red and blue. The maximum value is the Limit for **Excellent**, and the minimum value is the Limit for **Poor**. See below to check the plot point color based on the Legend Color Table.

1 Tap the rectangle with value before color legend bar on the right panel.

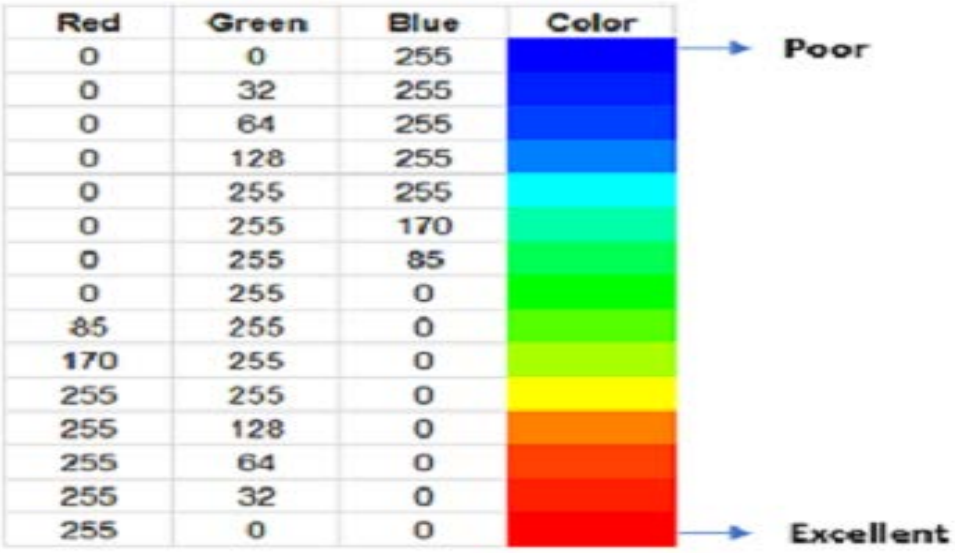
2 Set a value for **Poor** (minimum value) using the on-screen keyboard.

3 Tap the rectangle with value after color legend bar on the right panel.

4 Set a value for **Excellent** (maximum value) using the on-screen keyboard.

Figure 324 shows a legend color table.

Figure 324 Legend color table



Logging data

To use any features related to maps, you need to download and install the maps on the instrument. The VIAVI JDMapCreator will help you download maps. Make sure the JDMapCreator application on your computer is connected to the instrument via LAN. You can send a map file with a single layer to the instrument directly by using the Send to EQP menu in JDMapCreator. For more information on how to use the JDMapCreator, see the *JDMapCreator 2.0 User Guide*.

To log data

1 Follow **steps 1 to 3** in Setting measure setup.

2 Tap the **Testing** button on the right panel of the map to start plotting on the map. When you select a point on the map, a marker appears and the Information window appears on the right panel.

3 Tap the **Stop** ( ) button to stop plotting.

4 Tap the **Pause** button ( ) to pause plotting, then the GNSS point cannot be plotted.

5 If you start test and select **Menu** > **Map** > **Plot Point** > **Position**, you can undo by tapping the **Testing** button.

6 If you select the **Stop** button, the Plot Stop pop-up window appears, then tap **Yes**.

7 Tap **Yes** when the Save pop-up window appears and save the logging file to your USB.

Viewing the logging data

To view the logging data

1 Load the saved logging file using the **Load** ( ) icon on the side bar. Make sure the file extension is .gomv.

2 Tap to switch Plot Item to **RSRP**, **RSRQ**, **RS SINR**, **S-SS RSSI**, **P-SS RSRP**, **S-SS RSRP**, **S-SS Ec/Io** or **P-SS SNR**.

3 Tap the **Apply** button.

The point color of the map changes to the corresponding value, and if there is no detected LTE signal, the point will become gray color.

NOTE
When you load the result file, a pop-up message asking whether you want to load data only or data with map appears. If the current screen does not display all the loaded data, the screen mode will be automatically changed to Full.

Importing cellsite DB

You can import the site DB by creating the 5G site information form.

To import cellsite DB

1 Create the 5G site information with an excel file as below.

2 Input the two mandatory fields: **Lat (DecDeg)** and **Long (DecDeg)**.

3 Input the **Azimuth** field if you want to check the direction of antenna.

4 Make sure to save the file as (Comma delimited) (*.csv).

5 Copy the file to the USB memory stick and insert it to the **USB A** or **USB B** port of the instrument.

6 Tap the **Load** ( ) icon on the side bar.

7 Import the saved file.

Once the file is loaded, the following cellsite information appears with an icon.

Figure 325 shows an example of an importing cellsite DB.

Figure 325 Importing Cellsite DB

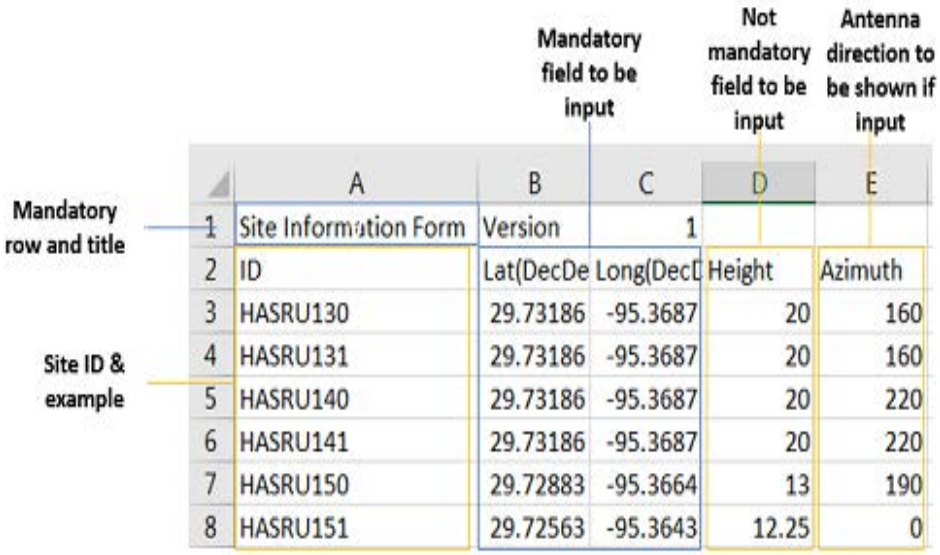
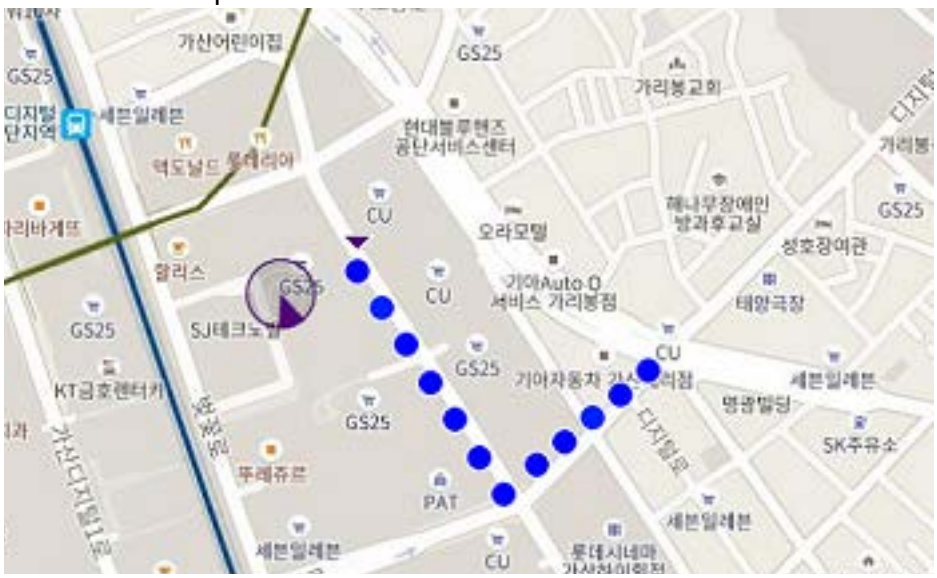


Figure 326 Route map measurement with site information screen



Freq/Time/Power variation

Frequency, time, and power variation shows the frequency, time, and power error trend based on the time elapsed.

After configuring the spectrum measurement in “Configuring spectrum measurements” on page 25, you can set the measure setup to continue your measurement. The measurement settings can be saved and recalled as a file by selecting File Type as Setup and load the file onto the instrument using the **Save/Load** icons on the side bar.

To set measure setup

1 Tap the **Setup** (⚙) icon in the side bar.

2 Tap to switch **MIB Decoding** to **On** when you do not know the number of transmitter antennas, PHICH ng, and Bandwidth or otherwise to **Off**.

3 Tap **Bandwidth** and select the value from the following choices: **1.4 MHz**, **3 MHz**, **5 MHz**, **10 MHz**, **15 MHz** or **20 MHz**.

4 Tap **Subframe Number** and input the value from 0 to 9 using the on-screen keyboard. For MBMS testing, this subframe number must be neither 0 nor 5 as these subframes 0 and 5 are not available for MBMS and it must be set to the MBMS transmitted channel's subframe number.

5 *Optional.* Tap **Physical Cell ID** and select the type **Manual** or **Auto.**

- **Auto** lets the instrument detect the Physical Cell ID for the LTE signal automatically.
- **Manual** sets the specific Physical Cell ID for the LTE signal manually in order to speed up the synchronization with a BTS.



NOTE
When there are no PSS and SSS signals, set the PCI Cell ID to Manual and input the required PCI number to search CRS.

6 Tap to switch **PCI (Physical Cell ID)** to **Manual** or **Auto**.

7 *Optional.* Tap **CFI** and select the type **Manual** or **Auto**.

- **Auto** lets the instrument set the number of OFDM symbols used for transmitting PDCCHs in a subframe.
- **Manual** sets the number of OFDM symbols manually. The set of OFDM symbols that can be used for PDCCH in a subframe is given by 0, 2, 3 or 4 in 1.4 MHz bandwidth and 1, 2 or 3 in other bandwidths.

8 *Optional.* Tap **PHICH Ng** to set the number of PHICH groups (Ng): **1/6**, **1/2**, **1**, **2**, **E-1/6**, **E-1/2**, **E-1**, or **E-2**.

9 Tap **EVM Detection Mode** and select **Single** or **Combine**.

- **Single**: Testing on one single antenna connected to your instrument with a cable
- **Combine**: Testing on multiple antennas connected to your instrument with a 2x1 or 4x1 combiner or an antenna

10 Tap **Menu** > **Miscellaneous** and do the following as needed.

- To select the number of antenna ports, tap **MIMO** and select **2x2** or **4x4**. The instrument sets this option to 2x2 by default. A 2x1 or 4x1 RF combiner is also required to be able to test on MIMO channels.
- To turn the Multimedia Broadcast Multicast Service (MBMS) feature on or off, tap to switch **MBMS** and select **On** or **Off**.
- To set the Multicast Broadcast Single Frequency Network (MBSFN) detection automatically or manually for MBMS testing, tap **MBSFN** and select **Auto** or **Manual**. An automatically detected or manually entered MBSFN Number appears on the Top Info.
- To select the cyclic prefix, tap **Cyclic Prefix** and select **Normal** or **Extended**.
- Tap the **PDSCH Modulation Type**, and then select the modulation type option: **Auto**, **QPSK**, **16 QAM**, **64 QAM**, **256 QAM**, **E-TM3.3**, **E-TM3.2**, **E-TM3.1a**, **E-TM3.1**, **E-TM2a**, **E-TM2**, and **E-TM1.2**.
- Tap **PDSCH Threshold** and input the value using the on-screen keyboard.
- Tap **PDCCH Threshold** and input the value using the on-screen keyboard.
- Tap **PDCCH Mode** and select **REG** to calculate EVM based on Resource Element Group or **Average** to calculate EVM after adding up all the PDCCH signals from one subframe.
- Tap to switch **PDSCH Precoding** between **On** and **Off** to enable or disable the PDSCH precoding.

11 Tap **Menu** > **Antenna**.

- To assign an antenna port number automatically or manually, tap **Antenna Port** and select the option: **Auto**, **Antenna 0**, **Antenna 1**, **Antenna 2**, and **Antenna 3**. If the MIMO is set to 2x2, the antenna ports 2 and 3 are disabled.



NOTE

If you want to set the reference level and scale, tap **Menu** > **Amp/Scale** > **Reference.** You can set Reference Freq Error Offset, Scale Division (Freq Error), Reference Time Error Offset, Scale Division (Time Error), Reference Level, and Scale Division (Power) on demand using the on-screen keyboard. You can also select the unit on the keyboard.

Figure 327 shows an example of LTE/LTE-A TDD freq/time/power variation by frequency/time.

Figure 327 LTE/LTE-A TDD freq/time/power variation by frequency/time



NOTE

You can tap the Distance box and input the value that you want to compensate for distance. When distance is entered, the time will show the value with distance correction. Make sure the default value for Distance is 0.

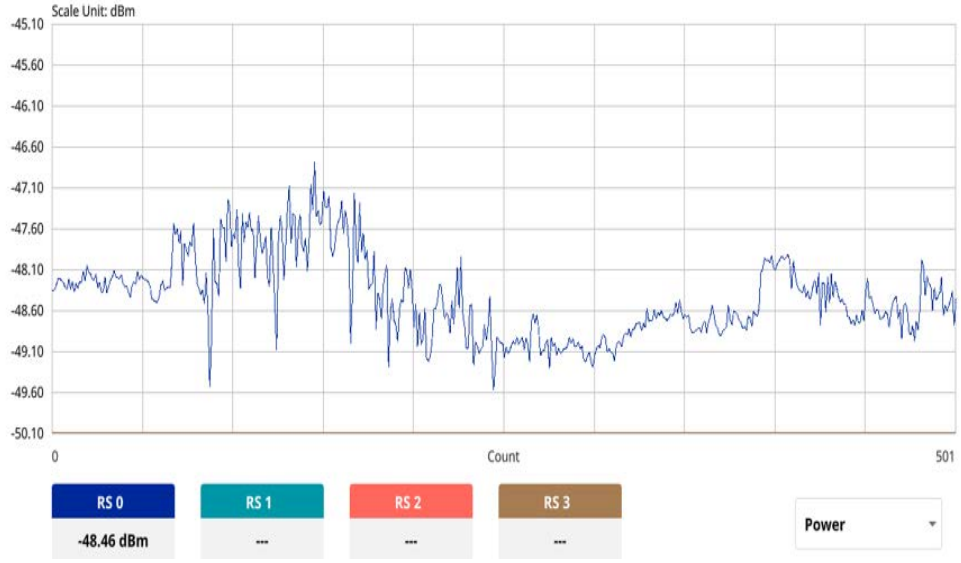
You can see the selected trace being plotted on the chart based on the selection from drop-down menu: Frequency, Time, Frequency/Time, or Power.

NOTE

When you select the Frequency/Time trace to be plotted, the Limit toggle icon will appear in the middle of the measurement screen. Once the Limit menu is turned on, the limit line will be displayed based on your selection of either Frequency or Time.

Figure 328 shows an example of LTE/LTE-A TDD freq/time/power variation by power.

Figure 328 LTE/LTE-A TDD freq/time/power variation by power



Signal analysis

The following section describes how to perform signal analysis.

Constellation

The constellation is used to observe some aspects of modulation accuracy and can reveal certain fault mechanisms such as I/Q amplitude imbalance or quadrature imbalance. It displays constellation diagram by modulation types.

Setting measure setup

After configuring the spectrum measurement in “Configuring spectrum measurements” on page 25, you can set the measure setup to continue your measurement. The measurement settings can be saved and recalled as a file by selecting File Type as Setup and load the file onto the instrument using the **Save/Load** icons on the side bar.

To set measure setup

1. Tap the **Setup** ( ) icon in the side bar.
2. Tap to switch **MIB Decoding** to **On** when you do not know the number of transmitter antennas, PHICH ng, and Bandwidth or otherwise to **Off**.
3. Tap **Bandwidth** and select the value from the following choices: **1.4 MHz**, **3 MHz**, **5 MHz**, **10 MHz**, **15 MHz**, or **20 MHz**.
4. Tap **Subframe Number** to set the number of subframe using the on-screen keyboard.

5 *Optional.* Tap **Physical Cell ID** and select the type **Manual** or **Auto**.

– **Auto** lets the instrument detect the Physical Cell ID for the LTE signal automatically.

– **Manual** sets a specific Physical Cell ID for the LTE signal manually in order to speed up with the synchronization with a BTS.

NOTE
When there are no PSS and SSS signals, set the PCI Cell ID to Manual and input the required PCI number to search CRS.

6 *Optional.* Tap CFI and select the type **Manual** or **Auto**.

– **Auto** lets the instrument set the number of OFDM symbols used for transmitting PDCCHs in a subframe.

– **Manual** sets the number of OFDM symbols manually.

NOTE
The set of OFDM symbols that can be used for PDCCH in a subframe is given by **0**, **2**, **3** or **4** in 1.4 MHz bandwidth and **1**, **2** or **3** in another bandwidth.

7 *Optional.* Tap **PHICH Ng** to set the number of PHICH groups (Ng): **1/6**, **1/2**, **1**, **2**, **E-1/6**, **E-1/2**, **E-1**, or **E-2**.

8 Tap **Uplink-Downlink Config** and select the number of uplink/downlink using the on-screen keyboard.

9 *Optional.* Tap **Miscellaneous** under **Menu** to do the following as needed.

a To select the number of antenna ports, tap the **MIMO** and select **2x2** or **4x4**.

b To assign an antenna port number automatically or manually, tap **Menu** > **Antenna Port** and select the options from **Auto**, **Antenna 0**, **Antenna 1**, **Antenna 2**, or **Antenna 3**.

If the MIMO is set to 2x2, the antenna ports 2 and 3 are disabled.

c To turn the Multimedia Broadcast Multicast Service (**MBMS**) feature on or off, tap **MBMS** and select **On** or **Off**. For proper MBMS testing, you need to set the **Subframe Number** in the upper right screen with the same PMCH subframe number.

d To set the Multicast Broadcast Single Frequency Network (**MBSFN**) detection automatically or manually for MBMS testing, tap **MBSFN** and select **Auto** or **Manual**.

An automatically detected or manually entered MBSFN ID appears on the screen.

e To set the delay, tap **Delay** and enter the value using the on-screen keyboard to set the amount of delay in **µs**.

NOTE
The Delay setting is used only when there is a time offset in the signals to be measured.

f To select the Cyclic Prefix, tap **Cyclic Prefix** and select **Normal** or **Extended**.

g To set the threshold for PDSCH, tap **PDSCH Threshold** and enter a value by using the on-screen keyboard.

h Tap **PDSCH Modulation Type**, and then select the modulation type option: **Auto, QPSK, 16 QAM, 64 QAM, 256 QAM, E-TM3.3, E-TM3.2, E-TM3.1a, E-TM3.1, E-TM2a, E-TM2, E-TM1.2 or E-TM1.1**

If two or more modulation types are used in a frame, select **Auto**. If the PDSCH uses the same modulation type in a frame or in a subframe, select a specific modulation type to get more accurate EVM.

i Tap **PDSCH Precoding** to set **On** or **Off** to enable or disable the PDSCH precoding.

To set limit

1 Tap **Menu > Limit**.

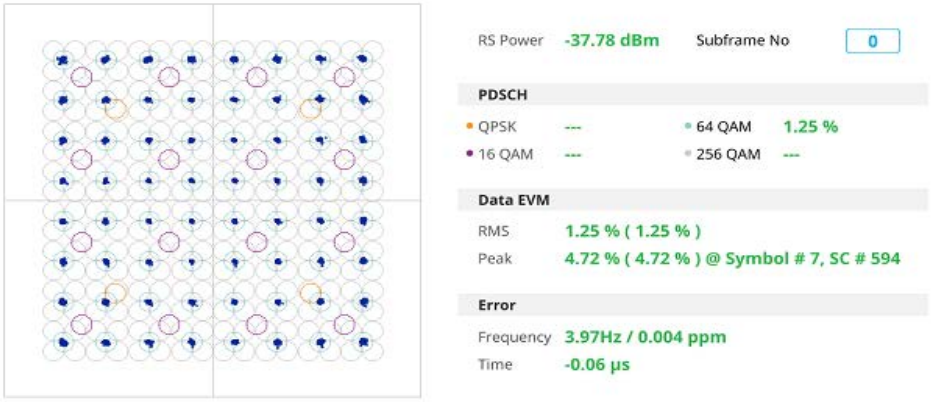
2 Tap the test items and set the limits depending on your selected measurement mode:

To set the limit for	Select and set
Frequency Error	Test limits On/Off, High/Low Limit
PDSCH EVM	Test limits On/Off, High Limit for QPSK/16 QAM/64 QAM/ 256 QAM
PMCH EVM	Test limits On/Off, High Limit for QPSK/16 QAM/64 QAM
Data EVM RMS	Test limits On/Off, High Limit
Data EVM Peak	Test limits On/Off, High Limit
DL RS Power	Test limits On/Off, High/Low Limit
Time Error	Test limits On/Off, High/Low Limit

3 *Optional*: Tap the **Save** hot key on the side bar and select the save option from the choices available for your measurement.

Figure 329 shows an example of LTE/LTE-A TDD constellation measurement.

Figure 329 LTE/LTE-A TDD constellation measurement



Data channel

The Data Channel measures the constellation for the specified resource block as well as the modulation accuracy of each PDSCH at the specified subframe.

Note that this feature is not supported in SPA06MA-O yet.

Setting measure setup

After configuring the spectrum measurement in “Configuring spectrum measurements” on page 25, you can set the measure setup to continue your measurement. The measurement settings can be saved and recalled as a file by selecting File Type as Setup and load the file onto the instrument using the **Save/Load** icons on the side bar.

To set measure setup

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap to switch **MIB Decoding** to **On** when you do not know the number of transmitter antennas, PHICH ng, and Bandwidth or otherwise to **Off**.

3 Tap **Bandwidth** and select the value from the following choices: **1.4 MHz**, **3 MHz**, **5 MHz**, **10 MHz**, **15 MHz**, or **20 MHz**.

4 Tap **Subframe Number** to set the number of subframe using the on-screen keyboard.

NOTE
For MBMS testing, this subframe number must be either 0 nor 5 as these subframes 0 and 5 are not available for MBMS and it must be set to the MBMS transmitted channel’s subframe number.

5 *Optional.* Tap **Physical Cell ID** and select the type **Manual** or **Auto**.

– **Auto** lets the instrument detect the Physical Cell ID for the LTE signal automatically.

– **Manual** sets a specific Physical Cell ID for the LTE signal manually in order to speed up with the synchronization with a BTS.

NOTE
When there are no PSS and SSS signals, set the PCI Cell ID to Manual and input the required PCI number to search CRS.

6 *Optional.* Tap CFI and select the type **Manual** or **Auto**.

– **Auto** lets the instrument set the number of OFDM symbols used for transmitting PDCCHs in a subframe.

– **Manual** sets the number of OFDM symbols manually.

NOTE
The set of OFDM symbols that can be used for PDCCH in a subframe is given by **0**, **2**, **3** or **4** in 1.4 MHz bandwidth and **1**, **2** or **3** in another bandwidth.

7 *Optional.* Tap **PHICH Ng** to set the number of PHICH groups (Ng): **1/6**, **1/2**, **1**, **2**, **E-1/6**, **E-1/2**, **E-1**, or **E-2**.

8 Tap **Event Hold** and select **On** or **Off** to enable or disable the event hold feature. When enabled, the Reference Line for the PDSCH threshold appears**.** When an event occurs, the measurement is put on hold until you tap the **Hold** icon on the side bar.

NOTE
You can view detailed current resource block on the I-Q diagram, particularly in a dynamic field environment.

9 Tap **Uplink-Downlink Config** and select the number of uplink/downlink using the on-screen keyboard.

10 *Optional.* Tap **Miscellaneous** under **Menu** to do the following as needed.

a To select the number of antenna ports, tap the **MIMO** and select **2x2** or **4x4**.

b To assign an antenna port number automatically or manually, tap **Menu** > **Antenna Port** and select the options from **Auto**, **Antenna 0**, **Antenna 1**, **Antenna 2**, or **Antenna 3**.

If the MIMO is set to 2x2, the antenna ports 2 and 3 are disabled.

c To turn the Multimedia Broadcast Multicast Service (**MBMS**) feature on or off, tap **MBMS** and select **On** or **Off**. For proper MBMS testing, you need to set the **Subframe Number** in the upper right screen with the same PMCH subframe number.

d To set the Multicast Broadcast Single Frequency Network (**MBSFN**) detection automatically or manually for MBMS testing, tap **MBSFN** and select **Auto** or **Manual**.

An automatically detected or manually entered MBSFN ID appears on the screen.

e To set the delay, tap **Delay** and enter the value using the on-screen keyboard to set the amount of delay in µs.



NOTE
The Delay setting is used only when there is a time offset in the signals to be measured.

f To select the Cyclic Prefix, tap **Cyclic Prefix** and select **Normal** or **Extended**.

g To set the threshold for PDSCH, tap **PDSCH Threshold** and enter a value by using the on-screen keyboard.

h Tap **PDSCH Modulation Type**, and then select the modulation type option: **Auto, QPSK, 16 QAM, 64 QAM, 256 QAM, E-TM3.3, E-TM3.2, E-TM3.1a, E-TM3.1, E-TM2a, E-TM2, E-TM1.2 or E-TM1.1**

If two or more modulation types are used in a frame, select **Auto**. If the PDSCH uses the same modulation type in a frame or in a subframe, select a specific modulation type to get more accurate EVM.

i Tap **PDSCH Precoding** to set **On** or **Off** to enable or disable the PDSCH precoding.

To set limit

1 Tap **Menu > Limit**.

2 Tap the test items and set the limits depending on your selected measurement mode:

To set the limit for	Select and set
Data EVM RMS	Test limits On/Off, High Limit
Data EVM Peak	Test limits On/Off, High Limit
IQ Origin Offset	Test limits On/Off, High Limit

3 *Optional*: Tap the **Save** hot key on the side bar and select the save option from the choices available for your measurement.

To set marker

1 Tap **Menu > Marker**.

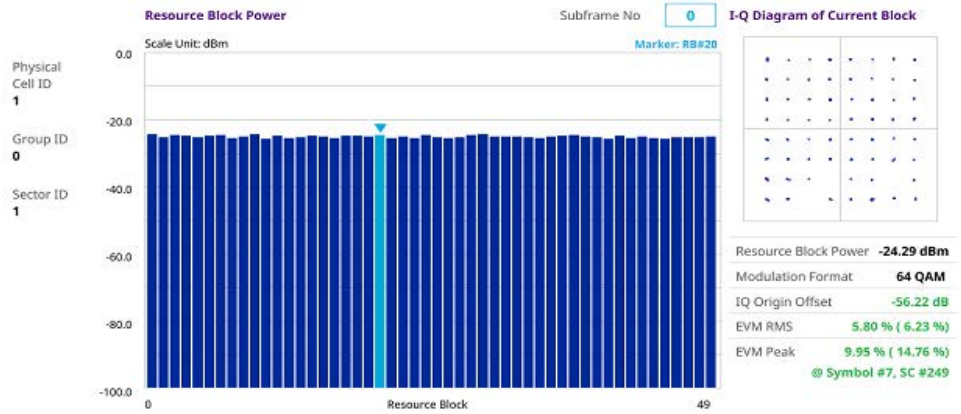
2 Tap **RB Number** to select the resource block to be marked and enter the resource block number using the on-screen keyboard.

The marker appears on the selected resource block.

3 Tap **Marker View** between **On** and **Off** to display or dismiss the result of the selected resource block.

Figure 330 shows an example of LTE/LTE-A TDD data channel measurement.

Figure 330 LTE/LTE-A TDD data channel measurement



Control channel

The Control Channel measures the constellation for the specified control channel as well as modulation accuracy of the control channel at the specified subframe.

Note that this feature is not supported in SPA06MA-O yet.

Setting measure setup

After configuring the spectrum measurement in “Configuring spectrum measurements” on page 25, you can set the measure setup to continue your measurement. The measurement settings can be saved and recalled as a file by selecting File Type as Setup and load the file onto the instrument using the **Save/Load** icons on the side bar.

To set measure setup

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap to switch **MIB Decoding** to **On** when you do not know the number of transmitter antennas, PHICH ng, and Bandwidth or otherwise to **Off**.

3 Tap **Bandwidth** and select the value from the following choices: **1.4 MHz**, **3 MHz**, **5 MHz**, **10 MHz**, **15 MHz**, or **20 MHz**.

4 Tap **Subframe Number** to set the number of subframe using the on-screen keyboard.

NOTE
For MBMS testing, this subframe number must be either 0 nor 5 as these subframes 0 and 5 are not available for MBMS and it must be set to the MBMS transmitted channel’s subframe number.

5 *Optional.* Tap **Physical Cell ID** and select the type **Manual** or **Auto**.

- **Auto** lets the instrument detect the Physical Cell ID for the LTE signal automatically.
- **Manual** sets a specific Physical Cell ID for the LTE signal manually in order to speed up with the synchronization with a BTS.

NOTE
When there are no PSS and SSS signals, set the PCI Cell ID to Manual and input the required PCI number to search CRS.

6 *Optional.* Tap **CFI** and select the type **Manual** or **Auto**.

- **Auto** lets the instrument set the number of OFDM symbols used for transmitting PDCCHs in a subframe.
- **Manual** sets the number of OFDM symbols manually.

NOTE
The set of OFDM symbols that can be used for PDCCH in a subframe is given by **0**, **2**, **3** or **4** in 1.4 MHz bandwidth and **1**, **2** or **3** in another bandwidth.

7 *Optional.* Tap **PHICH Ng** to set the number of PHICH groups (Ng): **1/6**, **1/2**, **1**, **2**, **E-1/6**, **E-1/2**, **E-1**, or **E-2**.

8 Tap **EVM Detection Mode** and select **Single** or **Continue**.

- **Single**: Testing on one single antenna connected to your ONA-800 series with a cable
- **Continue**: Testing on multiple antennas connected to your ONA-800 series with a cable with a 2x1 or 4x1 combiner or an antenna

9 Tap **Uplink-Downlink Config** and select the number of uplink/downlink using the on-screen keyboard.

10 *Optional.* Tap **Miscellaneous** under **Menu** to do the following as needed.

a To select the number of antenna ports, tap the **MIMO** and select **2x2** or **4x4**.

b To assign an antenna port number automatically or manually, tap **Menu** > **Antenna Port** and select the options from **Auto**, **Antenna 0**, **Antenna 1**, **Antenna 2**, or **Antenna 3**.

If the MIMO is set to 2x2, the antenna ports 2 and 3 are disabled.

c To turn the Multimedia Broadcast Multicast Service (**MBMS**) feature on or off, tap **MBMS** and select **On** or **Off**. For proper MBMS testing, you need to set the **Subframe Number** in the upper right screen with the same PMCH subframe number.

d To set the Multicast Broadcast Single Frequency Network (**MBSFN**) detection automatically or manually for MBMS testing, tap **MBSFN** and select **Auto** or **Manual**.

An automatically detected or manually entered MBSFN ID appears on the screen.

e To set the delay, tap **Delay** and enter the value using the on-screen keyboard to set the amount of delay in µs.

NOTE
The Delay setting is used only when there is a time offset in the signals to be measured.

f To select the Cyclic Prefix, tap **Cyclic Prefix** and select **Normal** or **Extended**.

g To set the threshold for PDSCH, tap **PDSCH Threshold** and enter a value by using the on-screen keyboard.

h Tap **PDCCH Mode** to select **REG** to calculate EVM based on Resource Element Group or **Average** to calculate EVM after adding all PDCCH signals from one subframe.

To set limit

1 Tap **Menu > Limit**.

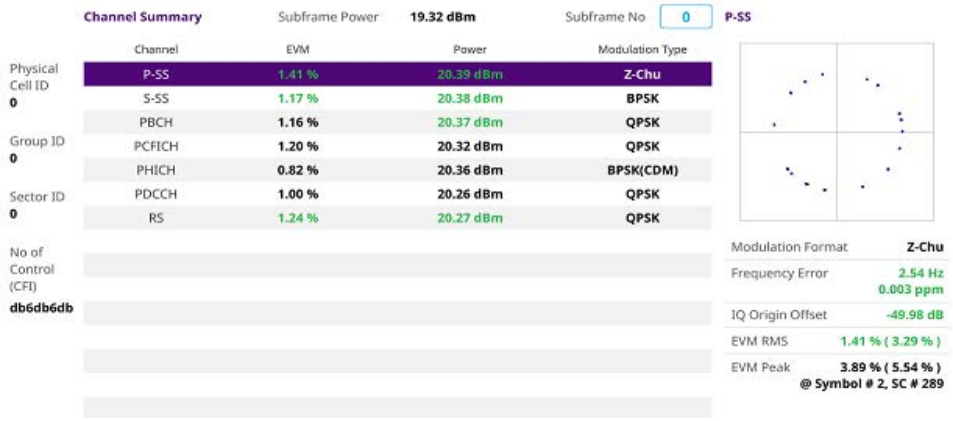
2 Tap the test items and set the limits depending on your selected measurement mode:

To set the limit for	Select and set
Frequency Error	Test limits On/Off, High/Low Limit
RS EVM	Test limits On/Off, High Limit
P-SS EVM	Test limits On/Off, High Limit
S-SS EVM	Test limits On/Off, High Limit
DL RS Power	Test limits On/Off, High/Low Limit
P-SS Power	Test limits On/Off, High/Low Limit
S-SS Power	Test limits On/Off, High/Low Limit
PBCH Power	Test limits On/Off, High/Low Limit
IQ Origin Power	Test limits On/Off, High Limit

3 *Optional*: Tap the **Save** hot key on the side bar and select the save option from the choices available for your measurement.

Figure 331 shows an example of LTE/LTE-A TDD control channel measurement.

Figure 331 LTE/LTE-A TDD control channel measurement



Subframe

The Subframe measures the modulation accuracy of all the data and control channels at the specified subframe (1 ms).

Setting measure setup

After configuring the spectrum measurement in "Configuring spectrum measurements" on page 25, you can set the measure setup to continue your measurement. The measurement settings can be saved and recalled as a file by selecting File Type as Setup and load the file onto the instrument using the **Save/Load** icons on the side bar.

To set measure setup

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap to switch **MIB Decoding** to **On** when you do not know the number of transmitter antennas, PHICH ng, and Bandwidth or otherwise to **Off**.

3 Tap **Bandwidth** and select the value from the following choices: **1.4 MHz**, **3 MHz**, **5 MHz**, **10 MHz**, **15 MHz**, or **20 MHz**.

4 Tap **Subframe Number** to set the number of subframe using the on-screen keyboard.

NOTE
For MBMS testing, this subframe number must be either 0 nor 5 as these subframes 0 and 5 are not available for MBMS and it must be set to the MBMS transmitted channel's subframe number.

5 *Optional.* Tap **Physical Cell ID** and select the type **Manual** or **Auto**.

- **Auto** lets the instrument detect the Physical Cell ID for the LTE signal automatically.
- **Manual** sets a specific Physical Cell ID for the LTE signal manually in order to speed up with the synchronization with a BTS.



NOTE
When there are no PSS and SSS signals, set the PCI Cell ID to Manual and input the required PCI number to search CRS.

6 *Optional.* Tap **CFI** and select the type **Manual** or **Auto**.

- **Auto** lets the instrument set the number of OFDM symbols used for transmitting PDCCHs in a subframe.
- **Manual** sets the number of OFDM symbols manually.



NOTE
The set of OFDM symbols that can be used for PDCCH in a subframe is given by **0**, **2**, **3** or **4** in 1.4 MHz bandwidth and **1**, **2** or **3** in another bandwidth.

7 *Optional.* Tap **PHICH Ng** to set the number of PHICH groups (Ng): **1/6**, **1/2**, **1**, **2**, **E-1/6**, **E-1/2**, **E-1**, or **E-2**.

8 Tap **EVM Detection Mode** and select **Single** or **Continue**.

- **Single**: Testing on one single antenna connected to your ONA-800 series with a cable
- **Continue**: Testing on multiple antennas connected to your ONA-800 series with a cable with a 2x1 or 4x1 combiner or an antenna

9 Tap **Uplink-Downlink Config** and select the number of uplink/downlink using the on-screen keyboard.

10 *Optional.* Tap **Miscellaneous** under **Menu** to do the following as needed.

a To select the number of antenna ports, tap the **MIMO** and select **2x2** or **4x4**.

b To assign an antenna port number automatically or manually, tap **Menu** > **Antenna Port** and select the options from **Auto**, **Antenna 0**, **Antenna 1**, **Antenna 2**, or **Antenna 3**.

If the MIMO is set to 2x2, the antenna ports 2 and 3 are disabled.

c To turn the Multimedia Broadcast Multicast Service (**MBMS**) feature on or off, tap **MBMS** and select **On** or **Off**. For proper MBMS testing, you need to set the **Subframe Number** in the upper right screen with the same PMCH subframe number.

d To set the Multicast Broadcast Single Frequency Network (**MBSFN**) detection automatically or manually for MBMS testing, tap **MBSFN** and select **Auto** or **Manual**.

An automatically detected or manually entered MBSFN ID appears on the screen.

e To set the delay, tap **Delay** and enter the value using the on-screen keyboard to set the amount of delay in µs.

NOTE
The Delay setting is used only when there is a time offset in the signals to be measured.

f To select the Cyclic Prefix, tap **Cyclic Prefix** and select **Normal** or **Extended**.

g To set the threshold for PDSCH, tap **PDSCH Threshold** and enter a value by using the on-screen keyboard.

h To set the threshold for PDCCH, tap **PDCCH Threshold** and enter a value by using the on-screen keyboard.

i Tap **PDSCH Modulation Type**, and then select the modulation type option: **Auto, QPSK, 16 QAM, 64 QAM, 256 QAM, E-TM3.3, E-TM3.2, E-TM3.1a, E-TM3.1, E-TM2a, E-TM2, E-TM1.2 or E-TM1.1**

If two or more modulation types are used in a frame, select **Auto**. If the PDSCH uses the same modulation type in a frame or in a subframe, select a specific modulation type to get more accurate EVM.

j Tap **PDCCH Mode** to select **REG** to calculate EVM based on Resource Element Group or **Average** to calculate EVM after adding all PDCCH signals from one subframe.

k Tap **PDSCH Precoding** to set **On** or **Off** to enable or disable the PDSCH precoding.

To set limit

1 Tap **Menu > Limit**.

2 Tap the test items and set the limits depending on your selected measurement mode:

To set the limit for	Select and set
Frequency Error	Test limits On/Off, High/Low Limit
PDSCH EVM	Test limits On/Off, High Limit for QPSK/16 QAM/ 64 QAM/ 256 QAM
Data EVM RMS	Test limits On/Off, High Limit
Data EVM Peak	Test limits On/Off, High Limit
RS EVM	Test limits On/Off, High Limit
P-SS EVM	Test limits On/Off, High Limit
S-SS EVM	Test limits On/Off, High Limit

To set the limit for	Select and set
PMCH EVM	Test limits On/Off, High Limit for QPSK/16 QAM/ 64 QAM
DLRS Power	Test limits On/Off, High/Low Limit
P-SS Power	Test limits On/Off, High/Low Limit
S-SS Power	Test limits On/Off, High/Low Limit
PBCH Power	Test limits On/Off, High/Low Limit
Subframe Power	Test limits On/Off, High/Low Limit
OFDM Symbol Power	Test limits On/Off, High/Low Limit
Time Error	Test limits On/Off, High/Low Limit

3 *Optional*: Tap the **Save** hot key on the side bar and select the save option from the choices available for your measurement.

To set marker

If you turn the Chart View on by tapping the icon next to Channel Summary on the left, you can use marker to place a marker at a specific symbol.

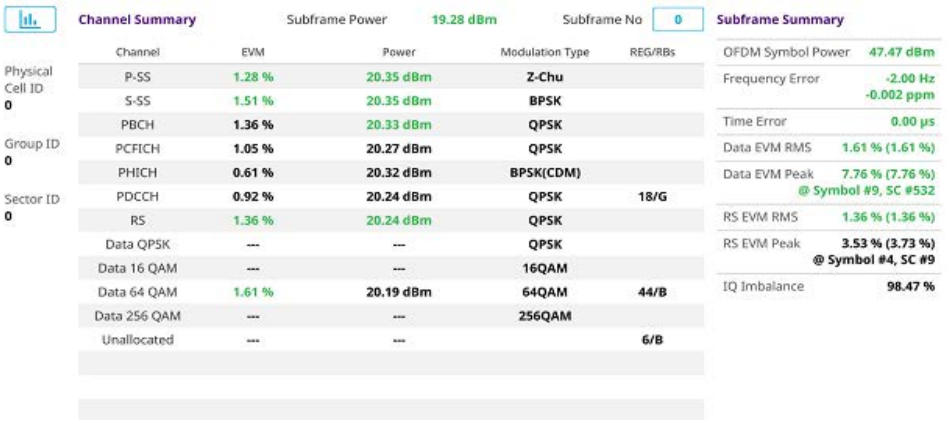
1 Tap **Menu > Marker**.

2 Tap **Marker View** between **On** and **Off** to display or dismiss the marker on the chart.

3 Tap **Symbol** to select the symbol number to which the marker is placed. Enter the value using the on-screen keyboard.

Figure 332 shows an example of LTE/LTE-A TDD subframe measurement.

Figure 332 LTE/LTE-A TDD subframe measurement



NOTE
You can check the Graph Chart by tapping the Graph Chart icon next to Subframe Summary on the left.

Time alignment error

In eNode-B supporting Tx Diversity transmission, signals are transmitted from two or more antennas. These signals shall be aligned.
The time alignment error in Tx diversity is specified as the delay between the signals from two antennas at the antenna ports.

Note that this feature is not supported in SPA06MA-O yet.

Setting measure setup

After configuring the spectrum measurement in "Configuring spectrum measurements" on page 25, you can set the measure setup to continue your measurement. The measurement settings can be saved and recalled as a file by selecting File Type as Setup and load the file onto the instrument using the **Save/Load** icons on the side bar.

To set measure setup

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap to switch **MIB Decoding** to **On** when you do not know the number of transmitter antennas and Bandwidth or **Off**.

3 Tap **Bandwidth** and select the value from the following choices: **1.4 MHz**, **3 MHz**, **5 MHz**, **10 MHz**, **15 MHz**, or **20 MHz**.

4 *Optional.* Tap **Physical Cell ID** and select the type **Manual** or **Auto**.
- **Auto** lets the instrument detect the Physical Cell ID for the LTE signal automatically.
- **Manual** sets a specific Physical Cell ID for the LTE signal manually in order to speed up with the synchronization with a BTS.

NOTE
When there are no PSS and SSS signals, set the PCI Cell ID to Manual and input the required PCI number to search CRS.

5 *Optional.* To select the number of antenna ports, tap the **MIMO** and select **2x2** or **4x4**.

6 To assign an antenna port number automatically or manually, tap **Menu** > **Antenna Port** and select the options from **Auto**, **Antenna 0**, **Antenna 1**, **Antenna 2**, or **Antenna 3**.

If the MIMO is set to 2x2, the antenna ports 2 and 3 are disabled.

7 To set the delay, tap **Delay** and enter the value using the on-screen keyboard to set the amount of delay in µs.

NOTE
The Delay setting is used only when there is a time offset in the signals to be measured.

8 To select the Cyclic Prefix, tap **Cyclic Prefix** and select **Normal** or **Extended**.

To set limit

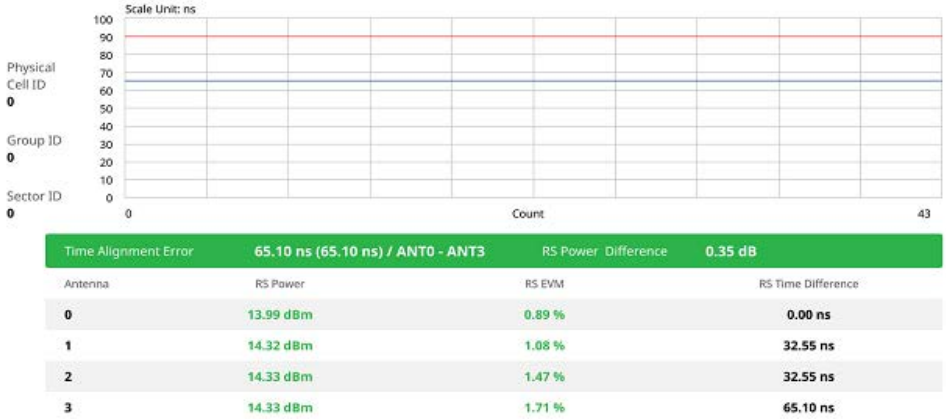
1 Tap **Menu > Limit**.

2 Tap the test items and set the limits depending on your selected measurement mode:

To set the limit for	Select and set
RS EVM	Test limits On/Off, High Limit
DL RS Power	Test limits On/Off, High/Low Limit
MIMO	Test limits On/Off, High Limit

Figure 333 shows an example of LTE/LTE-A TDD time alignment error measurement.

Figure 333 LTE/LTE-A TDD time alignment error measurement



Data allocation map

The Data Allocation Map function represents data allocation as a frame.

Setting measure setup

After configuring the spectrum measurement in “Configuring spectrum measurements” on page 25, you can set the measure setup to continue your measurement. The measurement settings can be saved and recalled as a file by selecting File Type as Setup and load the file onto the instrument using the **Save/Load** icons on the side bar.

To set measure setup

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap to switch **MIB Decoding** to **On** when you do not know the number of transmitter antennas and Bandwidth or otherwise to **Off**.

3 Tap **Bandwidth** and select the value from the following choices: **1.4 MHz**, **3 MHz**, **5 MHz**, **10 MHz**, **15 MHz**, or **20 MHz**.

4 Tap **Subframe Number** to set the number of subframe using the on-screen keyboard.

5 *Optional.* Tap **Physical Cell ID** and select the type **Manual** or **Auto**.

- **Auto** lets the instrument detect the Physical Cell ID for the LTE signal automatically.
- **Manual** sets a specific Physical Cell ID for the LTE signal manually in order to speed up with the synchronization with a BTS.



NOTE
When there are no PSS and SSS signals, set the PCI Cell ID to Manual and input the required PCI number to search CRS.

6 Tap **Uplink-Downlink Config** and select the number of uplink/downlink using the on-screen keyboard.

7 *Optional.* To set the threshold for PDSCH, tap **PDSCH Threshold** and enter a value by using the on-screen keyboard.

8 *Optional.* Tap **Miscellaneous** under **Menu** to do the following as needed.

a To select the number of antenna ports, tap the **MIMO** and select **2x2** or **4x4**.

b To assign an antenna port number automatically or manually, tap **Menu** > **Antenna Port** and select the options from **Auto**, **Antenna 0**, **Antenna 1**, **Antenna 2**, or **Antenna 3**.

If the MIMO is set to 2x2, the antenna ports 2 and 3 are disabled.

c To turn the Multimedia Broadcast Multicast Service (**MBMS**) feature on or off, tap **MBMS** and select **On** or **Off**. For proper MBMS testing, you need to set the **Subframe Number** in the upper right screen with the same PMCH subframe number.

d To set the Multicast Broadcast Single Frequency Network (**MBSFN**) detection automatically or manually for MBMS testing, tap **MBSFN** and select **Auto** or **Manual**.

An automatically detected or manually entered MBSFN ID appears on the screen.

e To select the Cyclic Prefix, tap **Cyclic Prefix** and select **Normal** or **Extended**.

To set display

1 Tap **Menu > Display**.

2 Select the display mode from the choice: **PDSCH**, **PMCH** or **Both.**

To set marker

1 Tap **Menu > Marker**.

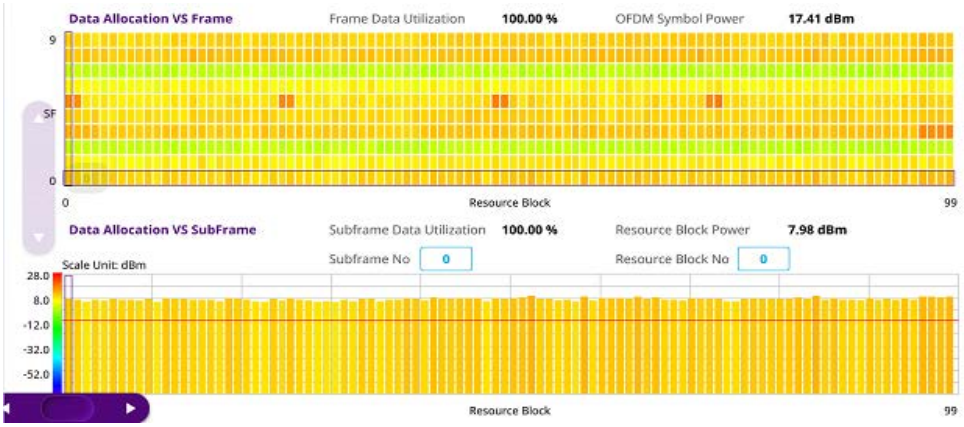
2 Tap the **Marker View** to **On** or **Off** to display or hide the marker on the chart**.**

3 To select the resource block number, tap the **RB Number** and enter a value by using the on-screen keyboard.

4 To select the subframe block number, tap the **Subframe No** and enter a value by using the on-screen keyboard.

Figure 334 shows an example of LTE/LTE-A TDD data allocation map measurement.

Figure 334 LTE/LTE-A TDD data allocation map measurement



Carrier aggregation

The Carrier aggregation enables a maximum of five multiple LTE carriers to be used together in order to provide high data rate required for LTE-Advanced. Component carriers to be aggregated can be intra-band contiguous, intra-band non-contiguous, or inter-band.

The instrument provides carrier aggregation measurements supporting for all the different modes with carrier aggregation bands added to the channel standard.

Note that this feature is not supported in SPA06MA-O yet.

Setting measure setup

After configuring the spectrum measurement in “Configuring spectrum measurements” on page 25, you can set the measure setup to continue your measurement. The measurement settings can be saved and recalled as a file by selecting File Type as Setup and load the file onto the instrument using the **Save/Load** icons on the side bar.

To set measure setup

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap to switch **MIB Decoding** to **On** when you do not know the number of transmitter antennas and Bandwidth or **Off**.

3 Tap **CA Configuration** or tap the **Configuration** ( ) icon then the component carrier configuration window appears.

4 Select the number of the component carrier to be set between one and five by tapping the number in **Range** box.

5 Set the Range **On** to set parameters and view the results for the selected component carrier on the screen or **Off** to turn it off.

6 Tap **LAA** (License Assisted Access) and select one among the three options: **2.4 GHz**, **5 GHz**, or **Off**.

7 Set the following parameters as needed: **Center Frequency**, **Channel No**, **Bandwidth**, **Physical Cell ID**, **MBMS**, **MBSFN**, **MIMO**, **Antenna Port**, **CFI, PHICH Ng**, **Cyclic Prefix**, and **PDSCH Modulation Type**.

NOTE
When there are no PSS and SSS signals, set the PCI Cell ID to Manual and input the required PCI number to search CRS.

a If you apply **Center Frequency**, **Channel No**, and **Bandwidth** all at once, tap the **Center Frequency List** ( ) icon and do the following:

i Tap the **Add (+)** icon and input Center Frequency, Channel No, and Bandwidth as required using the on-screen keyboard.

ii Tap the **Apply** button to apply the changes. The screen moves to the Center Frequency List table.

iii Highlight the one of the added lists and tap the **Configuration** icon that appears in gray to change the applied values.

iv Tap the **Delete** icon to delete the selected list(s).

NOTE
You will be able to multi-select the added items and apply them all at once only if the Range number is On. If the Range 1 and 3 are On and you highlight No. 0,3, and 4, the first two highlighted lists, 0 and 3 are applied to each carrier 1 and 3.

8 Tap **EVM Detection Mode** and select **Single** or **Continue**.

– **Single**: Testing on one single antenna connected to your ONA-800 series with a cable

– **Continue**: Testing on multiple antennas connected to your ONA-800 series with a cable with a 2x1 or 4x1 combiner or an antenna

9 To select the subframe number to be measured, do one of the following:

a If the **EVM Detection Mode** is set to **Single**, tap **Subframe Number** and set the subframe number.

b If the **EVM Detection Mode** is set to **Combine**, tap **Subframe Number,** and then select 0 or 5.

10 To set the threshold for PDSCH, tap **PDSCH Threshold** and enter a value by using the on-screen keyboard.

11 Tap **PDSCH Precoding** between **On** and **Off** to enable or disable the PDSCH precoding.

To set limit

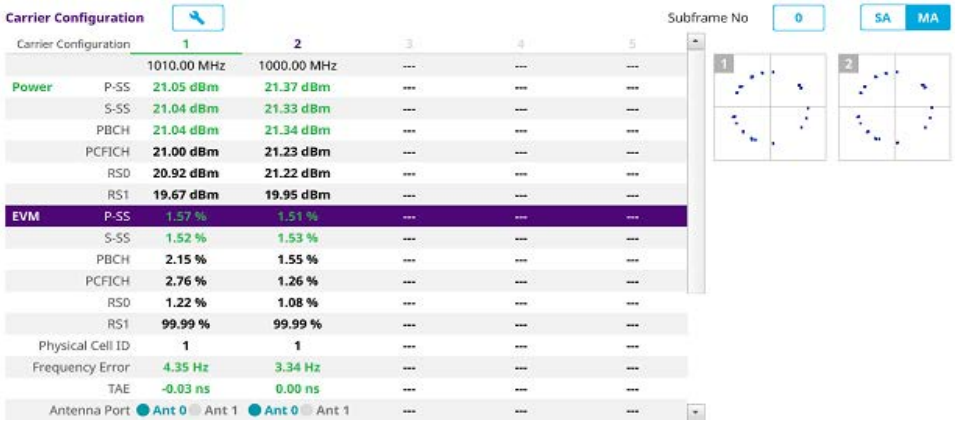
1 Tap **Menu > Limit**.

2 Tap the test items and set the limits depending on your selected measurement mode:

To set the limit for	Select and set
Frequency Error	Test limits On/Off, High/Low Limit
PDSCH EVM	Test limits On/Off, High Limit for QPSK/16 QAM/ 64 QAM/ 256 QAM
RS EVM	Test limits On/Off, High Limit
P-SS EVM	Test limits On/Off, High Limit
S-SS EVM	Test limits On/Off, High Limit
PMCH EVM	Test limits On/Off, High Limit for QPSK/16 QAM/ 64 QAM
DL RS Power	Test limits On/Off, High/Low Limit
P-SS Power	Test limits On/Off, High/Low Limit
S-SS Power	Test limits On/Off, High/Low Limit
PBCH Power	Test limits On/Off, High/Low Limit
Subframe Power	Test limits On/Off, High/Low Limit
Channel Power	Test limits On/Off, High/Low Limit
TAE	Test limits On/Off, Intra Count High/Intra Non-Count High/ Inter Band High

Figure 335 shows an example of LTE/LTE-A TDD carrier aggregation measurement.

Figure 335 LTE/LTE-A TDD carrier aggregation measurement



Power vs Time (Frame)

The Power vs. Time (Frame) measures the modulation envelope in the time domain, showing the power of each time slot in a LTE/LTE-A TDD signal.

Setting measure setup

After configuring the spectrum measurement in "Configuring spectrum measurements" on page 25, you can set the measure setup to continue your measurement. The measurement settings can be saved and recalled as a file by selecting File Type as Setup and load the file onto the instrument using the **Save/Load** icons on the side bar.

To set measure setup

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap to switch **MIB Decoding** to **On** when you do not know the number of transmitter antennas and Bandwidth or otherwise to **Off**.

3 Tap **Bandwidth** and select the value from the following choices: **1.4 MHz**, **3 MHz**, **5 MHz**, **10 MHz**, **15 MHz**, or **20 MHz**.

You can also tap the rectangle with value,(

) under the chart screen and input the value using the on-screen keyboard.

4 Tap **Subframe Number** and input the value from 0 to 9 using the on-screen keyboard.

5 *Optional.* Tap to switch **Physical Cell ID** to **Manual** or **Auto**.

- **Auto** lets the instrument detect the Physical Cell ID for the LTE signal automatically
- **Manual** sets a specific Physical Cell ID for the LTE signal manually in order to speed up the synchronization with a BTS.

NOTE
When there are no PSS and SSS signals, set the PCI Cell ID to Manual and input the required PCI number to search CRS.

6 To select the number of antenna ports, tap the **MIMO** and select **2x2** or **4x4**.

7 To assign an antenna port number automatically or manually, tap the **Antenna Port** under **Antenna menu** and select the option: **Auto**, **Antenna 0**, **Antenna 1**, **Antenna 2**, or **Antenna 3**.

If the MIMO is set to 2x2, the antenna ports 2 and 3 are disabled.

8 Tap **Cyclic Prefix** and select **Normal** or **Extended.**

9 Tap **Delay** and enter a value using the on-screen keyboard to set the amount of delay in **µs.**

10 Tap **Special Subframe** and enter a value using the on-screen keyboard.

To set limit

1 Tap **Menu > Limit**.

2 Tap the test items and set the limits depending on your selected measurement mode:

To set the limit for	Select and set
Subframe Power	Test limits On/Off, High/Low Limit
Frame Avg Power	Test limits On/Off, High/Low Limit
Time Offset	Test limits On/Off, High/Low Limit
IQ Origin Offset	Test limits On/Off, High Limit

3 *Optional*: Tap the **Save** hot key on the side bar and select the save option from the choices available for your measurement.

Figure 336 shows an example of LTE/LTE-A TDD power vs time (Frame) measurement.

Figure 336 LTE/LTE-A TDD power vs time (Frame) measurement



Power vs Time (Slot)

The Power vs. Time (Slot) in LTE/LTE-A TDD Signal Analyzer measures the modulation envelope in the time domain, showing the signal rise and fall shapes of LTE/LTE-A TDD signal.

NOTE
In this measurement, desirable level of the input power is lower than -10 dBm. If the input power to be measured is -10 dBm or higher, it is highly recommended that you use an external attenuator.

Setting measure setup

After configuring the spectrum measurement in "Configuring spectrum measurements" on page 25, you can set the measure setup to continue your measurement. The measurement settings can be saved and recalled as a file by selecting File Type as Setup and load the file onto the instrument using the **Save/Load** icons on the side bar.

To set measure setup

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap to switch **MIB Decoding** to **On** when you do not know the number of transmitter antennas and Bandwidth or otherwise to **Off**.

3 Tap **Bandwidth** and select the value from the following choices: **1.4 MHz**, **3 MHz**, **5 MHz**, **10 MHz**, **15 MHz**, or **20 MHz**.

You can also tap the rectangle with value,(

) under the chart screen and input the value using the on-screen keyboard.

4 Tap **Slot Number** to set the number of slots using the on-screen keyboard.

5 *Optional.* Tap to switch **Physical Cell ID** to **Manual** or **Auto**.

- **Auto** lets the instrument detect the Physical Cell ID for the LTE signal automatically
- **Manual** sets a specific Physical Cell ID for the LTE signal manually in order to speed up the synchronization with a BTS.

NOTE
When there are no PSS and SSS signals, set the PCI Cell ID to Manual and input the required PCI number to search CRS.

6 To select the number of antenna ports, tap the **MIMO** and select **2x2** or **4x4**.

7 To assign an antenna port number automatically or manually, tap the **Antenna Port** under **Antenna menu** and select the option: **Auto**, **Antenna 0**, **Antenna 1**, **Antenna 2**, or **Antenna 3**.

If the MIMO is set to 2x2, the antenna ports 2 and 3 are disabled.

8 Tap **Cyclic Prefix** and select **Normal** or **Extended.**

9 Tap **Delay** and enter a value using the on-screen keyboard to set the amount of delay in **µs.**

NOTE
The Delay setting is used only when there is a time offset in the signals to be measured.

To set limit

1 Tap **Menu > Limit**.

2 Tap the test items and set the limits depending on your selected measurement mode:

To set the limit for	Select and set
Slot Avg Power	Test limits On/Off, High/Low Limit
Off Power	Test limits On/Off, High Limit
Transition Period	Test limits On/Off, High Limit

3 *Optional*: Tap the **Save** hot key on the side bar and select the save option from the choices available for your measurement.

Figure 337 shows an example of LTE/LTE-A TDD power vs time (Slot) measurement.

Figure 337 LTE/LTE-A TDD power vs time (Slot) measurement



Online route map

The following sections describe how to perform online route map.

Online OTA route map

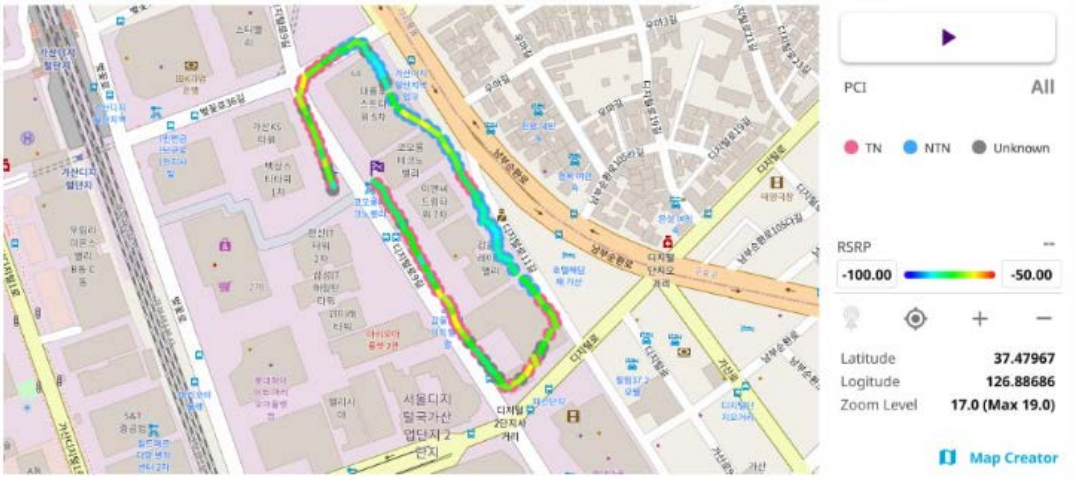
LTE online OTA route map enables you to download a map automatically when connected to the network then you can continue route map measurement using the downloaded map whether you are online or offline. It traces the power level of the strongest LTE signal in terms of RSRP corresponding to a particular time and geographical position and presents it in a geographical map as a measurement point. All the collected measurements can be exported for post-processing purposes, including data of the strongest LTE signal for each measurement point, including its measurement time and geographical location.

Figure 338 shows an example of Online OTA Route Map measurement.

Figure 338 Online OTA Route Map with LTE/LTE-A TDD Signal Analyzer



Figure 339 Online OTA Route Map with NTN



Controlling a map

To control a map

See the following table to control a map.

Table 145 Map control icons

Icon	Description
	Tap to go to your current location on the map. Once tapped, the purple icon appears on the map, indicating your current location.
	Tap to zoom in the map.

Table 145 Map control icons

Icon	Description
	Tap to zoom out the map.

The left-most cell-site icon is activated when you import the cell-site information file.

To set measurement setup

NOTE

Before starting the Route Map measurement, you need to set Spectrum measurements displayed on the quick access and display tab. See “Configuring spectrum measurements” on page 25 for more information.

1 Connect a GNSS receiver to your instrument for outdoor mapping.

2 Tap the **Setup** ( ) icon on the side bar.

3 Tap to switch **MIB Decoding** to **On** when you do not know the number of transmitter antennas and Bandwidth or **Off**.

4 Tap to switch **Plot Item** to **RSRP**, **RSRQ**, **RS SINR**, **S-SS RSSI**, **P-SS RSRP**, **S-SS RSRP**, **S-SS Ec/Io**, or **P-SS SNR**.

5 Tap **Bandwidth** and select the value from the following choices: **1.4 MHz**, **3 MHz**, **5 MHz**, **10 MHz**, **15 MHz** or **20 MHz**.

6 *Optional.* Tap to switch **Physical Cell ID** to **Manual** or **Auto**.

- **Auto** lets the instrument detect the Physical Cell ID for the LTE signal automatically
- **Manual** sets a specific Physical Cell ID for the LTE signal manually in order to speed up the synchronization with a BTS.

NOTE

When there are no PSS and SSS signals, set the PCI Cell ID to Manual and input the required PCI number to search CRS.

NOTE

The instrument does not automatically save the collected data. It is recommended that you save the result. Otherwise, you will lose all the collected data.

7 *Optional.* The **NTN Configuration** box appears only if the ONA-SP-LTE-NTN license is available.

a Tap to turn **NTN On**.

b Tap **NTN Configuration**.

c Tap MCC and MNC and input the required values.

d Tap the **Done** button.

e If NTN cannot be found using the PLMN (MCC/MNC) information:

- Set **Apply Test** to **On** (green).
- Input the required NTN PCI from 1 to 20.
- Tap the **Done** button to complete the NTN configuration.

To set limit

You can set the thresholds for the two different color indicators, red and blue. The maximum value is the Limit for **Excellent**, and the minimum value is the Limit for **Poor**. See below to check the plot point color based on the Legend Color Table.

1 Tap the rectangle with value before color legend bar on the right panel.

2 Set a value for **Poor** (minimum value) using the on-screen keyboard.

3 Tap the rectangle with value after color legend bar on the right panel.

4 Set a value for **Excellent** (maximum value) using the on-screen keyboard.

Figure 340 shows a legend color table.

Figure 340 Legend color table

Red	Green	Blue	Color	
0	0	255		Poor
0	32	255		
0	64	255		
0	128	255		
0	255	255		
0	255	170		
0	255	85		
0	255	0		
85	255	0		
170	255	0		
255	255	0		
255	128	0		
255	64	0		
255	32	0		
255	0	0		Excellent

Logging data

To log data

1. Follow **steps 1 to 3** in Setting measure setup.
2. Tap the **Testing** () button on the right panel of the map to start plotting on the map. When you select a point on the map, a marker appears and the Information window appears on the right panel.
3. Tap the **Stop** () button to stop plotting.
4. Tap the **Pause** button () to pause plotting, then the GNSS point cannot be plotted.
5. If you select the **Stop** button, the Plot Stop pop-up window appears, then tap **Yes**.
6. Tap **Yes** when the Save pop-up window appears and save the logging file to your USB.

Viewing the logging data

To view the logging data

1. Load the saved logging file using the **Load** () icon on the side bar. Make sure the file extension is .orr.
2. Tap to switch **Plot Item** to **RSRP**, **RSRQ**, **RS SINR**, **S-SS RSSI**, **P-SS RSRP**, **S-SS RSRP**, **S-SS Ec/Io**, or **P-SS SNR**.
3. Tap PCI on the left and then the corresponding Beam Index appeared on the right.
4. Tap the **Apply** button.

   The point color of the map changes to the corresponding value, and if there is no detected LTE signal, the point will become gray color.

Importing cellsite DB

You can import the site DB by creating the 5G site information form.

To import cellsite DB

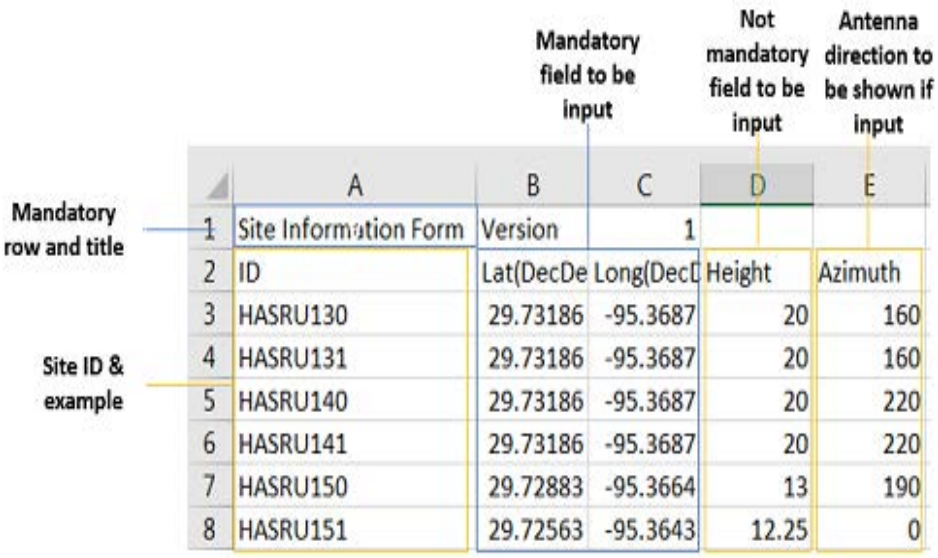
1. Create the 5G site information with an excel file as below.
2. Input the two mandatory fields: **Lat (DecDeg)** and **Long (DecDeg)**.
3. Input the **Azimuth** field if you want to check the direction of antenna.
4. Make sure to save the file as (Comma delimited) (*.csv).
5. Copy the file to the USB memory stick and insert it to the **USB A** or **USB B** port of the instrument.
6. Tap the **Load** () icon on the side bar.

7 Import the saved file.

Once the file is loaded, the following cellsite information appears with an icon.

Figure 341 shows an example of an importing cellsite DB.

Figure 341 Importing Cellsite DB



	A	B	C	D	E
1	Site Information Form	Version	1		
2	ID	Lat(DecDe	Long(Dec[	Height	Azimuth
3	HASRU130	29.73186	-95.3687	20	160
4	HASRU131	29.73186	-95.3687	20	160
5	HASRU140	29.73186	-95.3687	20	220
6	HASRU141	29.73186	-95.3687	20	220
7	HASRU150	29.72883	-95.3664	13	190
8	HASRU151	29.72563	-95.3643	12.25	0

Creating a map

You can create a map online and continue conducting a route map analysis using the created map even when there is no Ethernet connection.

1 Tap the **Map Creator** button on the right panel at the bottom.

2 Tap the **Search** box and input the location using the on-screen keyboard and select one of the options as required.

3 Tap the **Zoom Level** box to capture the map with corresponding zoom level.

4 Tap the **Capture** button to start capturing the map.

Once the map is captured, the capturing completed pop-up will appear.

5 Select between the two options: Save in the system or Save as file.

6 Tap the **Done** button.

NOTE
If you have unsaved measurement data (map) and start measuring by tapping the Testing button or by tapping another measurement mode, a pop-up window will appear asking whether you will restore the unsaved data or not.

18

Using GSM Signal Analyzer

This chapter describes how to use the GSM Analyzer. Topics covered in this chapter include:

- “Introduction” on page 786
- “Connecting cables” on page 786
- “Selecting mode and measure” on page 788
- “RF analysis” on page 788
- “OTA analysis” on page 796
- “Signal analysis” on page 802

Introduction

The Global System for Mobile Communications (GSM) is a digital cellular standard that uses Time Division Multiple Access (TDMA) multiplexing scheme and Gaussian Minimum Shift Keying (GMSK) modulation. The Enhanced Data Rates for GSM Evolution (EDGE) is an enhancement to GSM that promises to deliver multimedia and other broadband applications. It uses TDMA and 3π/8 8PSK (phase shift keying) modulation.

This instrument performs measurements using the methods and limits as defined in the 3GPP TS 51.021 Base Station System (BSS) equipment specification: Radio Aspects V8.9.0 (2003-06) and 3GPP TS 45.005 Radio Transmission and Reception (version 12.5.0, release 12). The Pass/Fail indicator helps you to determine base station performance easily.

This instrument provides the following measurement tools for GSM system:

- RF Analysis
  - Spectrum
  - Channel Power
  - Occupied Bandwidth
  - Spectrum Emission Mask
  - Output RF Spectrum
  - Spurious Emission
- OTA Analysis
  - Channel Scanner
  - Frequency Scanner
  - Custom Scanner
  - Multipath Profile
  - Modulation Analyzer
- Signal Analysis
  - Constellation
  - Power vs Time (Slot)
  - Power vs Time (Frame)

Connecting cables

Direct connection

1 Connect a high power attenuator and a cable to the **RF In port** of the instrument.

Figure 342 shows an example of direct connection.

Figure 342 Direct connection



Indirect connection

1 Connect the **RF Input port** of the instrument and the monitor (test) port of BTS.

Figure 343 shows an example of indirect connection.

Figure 343 Indirect connection



Alert

The maximum power for the RF Input port is +25 dBm (0.316 W) for ONA modules. If the level of the input signal to be measured is greater than this, use a High Power Attenuator to prevent damage when you directly connect the signal to the instrument or connect the signal from the coupling port of a directional coupler.

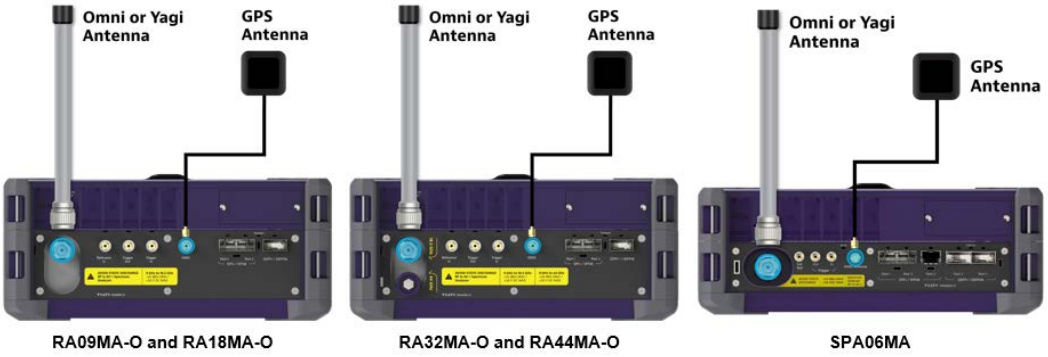
OTA (over the air) connection

1 Connect an Omni/directional RF antenna to the **RF Input port** of the instrument.

2 Connect a GPS antenna to the GPS port of the instrument.

Figure 344 shows an example of OTA connection.

Figure 344 OTA connection



Alert

If the input signal level to be measured is less than 0 dBm, set 0 dB attenuation or turn on the preamp to have better dynamic range for the OTA testing.

Selecting mode and measure

The following procedure describes how to start measurement.

To select mode and measure

1 Tap GSM Signal Analyzer on the MODE panel.

2 Tap any measurement mode from the following choices:

- **RF Analysis > Spectrum**, **Channel Power**, **Occupied Bandwidth**, **Spectrum Emission Mask**, **Output RF Spectrum**, or **Spurious Emission**
- **OTA Analysis > Channel Scanner**, **Frequency Scanner**, **Custom Scanner**, **Multipath Profile**, or **Modulation Analyzer**
- **Signal Analysis > Constellation**, **Power vs Time (Slot)**, or **Power vs Time (Frame)**

RF analysis

The following sections describe how to conduct RF measurements.

Spectrum

Most spectrum measurements of the GSM signal analyzer are also available in Spectrum mode. You can configure the measurements just as in Spectrum mode. For more information, see “Configuring spectrum measurements” on page 25.

Setting measure setup

To set measure setup

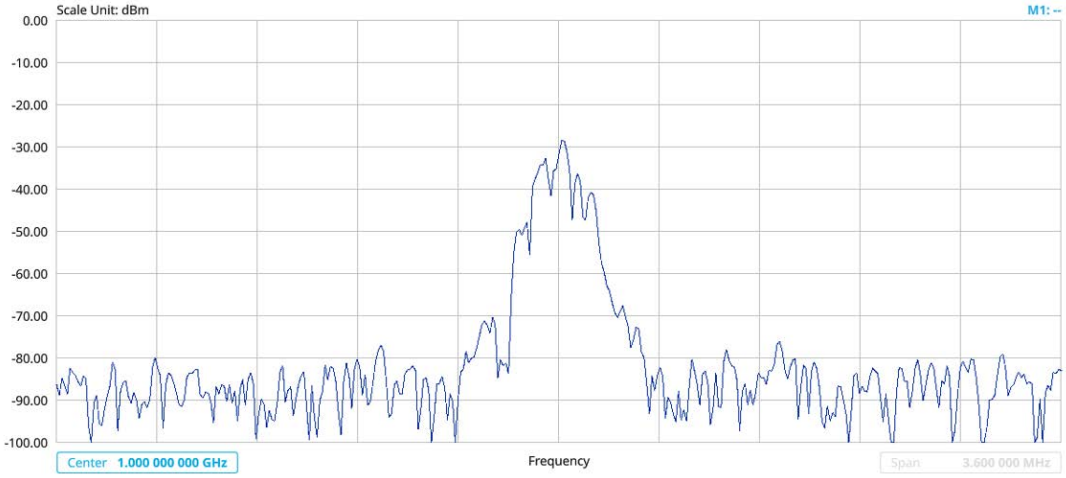
1 Tap the **Setup** ( ) icon on the side bar.

2 Tap **Time Slot** to assign a time slot with which performs RF measurements, and then select your desired time slot number from 0 to 7.

3 Tap **Delay** to set the amount of delay in µs using the on-screen keyboard.

Figure 345 shows an example of spectrum measurement in GSM.

Figure 345 Spectrum measurement in GSM



Channel Power

The Channel Power measures in-channel power for GSM/GPRS and EDGE systems, which use dynamic power control to ensure that each link is maintained with minimum power. It gives two fundamental benefits of keeping overall system interference to a minimum level and of maximizing battery life in the case of mobile stations. It determines the power delivered to the antenna system on the RF channel under test. The instrument acquires a GSM/GPRS or EDGE signal in the time domain. The average power level above the threshold is then computed and displayed.

Setting measure setup

After configuring the spectrum measurement in “Configuring spectrum measurements” on page 25, you can set the measure setup to continue your measurement.

To set measure setup

1 Tap the **Setup** ( ) icon on the side bar.

2 Tap **Time Slot** to assign a time slot with which performs RF measurements, and then select your desired time slot number from 0 to 7.

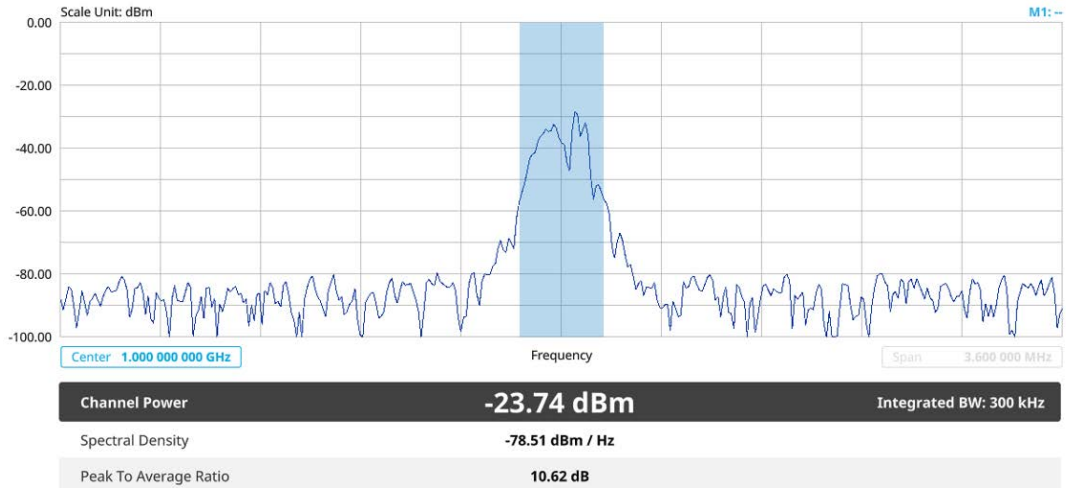
3 Tap **Delay** to set the amount of delay in µs using the on-screen keyboard.

NOTE

The Delay setting is used only when there is a time offset in the signals to be measured.

Figure 346 shows an example of spectrum measurement in GSM.

Figure 346 Channel Power measurement in GSM



Channel power measurement result shows channel power and spectrum density in a user specified channel bandwidth. The peak to average ratio (PAR) is shown at the bottom of the screen as well. The shaded area on the display indicates the channel bandwidth.

To set the limit

1 Tap **Menu > Limit**.

2 Tap to switch the **Test Limits** to **On** or **Off** to enable or disable Pass/Fail indication.

The result table color for Pass is green, and the result table color for Fail is red.

3 Tap **High Limit** to set the upper threshold using the on-screen keyboard.

4 Tap **Low Limit** to set the lower threshold using the on-screen keyboard.

5 *Optional*: Tap the **Save** icon on the side bar and select the save option from the choices available for your measurement mode.

Occupied bandwidth

The Occupied Bandwidth measures the spectrum shape of the carrier. It is defined as the bandwidth, which includes 99% of the transmitted power among total transmitted power.

Setting measure setup

After configuring the spectrum measurement in "Configuring spectrum measurements" on page 25, you can set the measure setup to continue your measurement.

To set measure setup

1 Tap the **Setup** ( ) icon on the side bar.

2 Tap **Time Slot** to assign a time slot with which performs RF measurements, and then select your desired time slot number from 0 to 7.

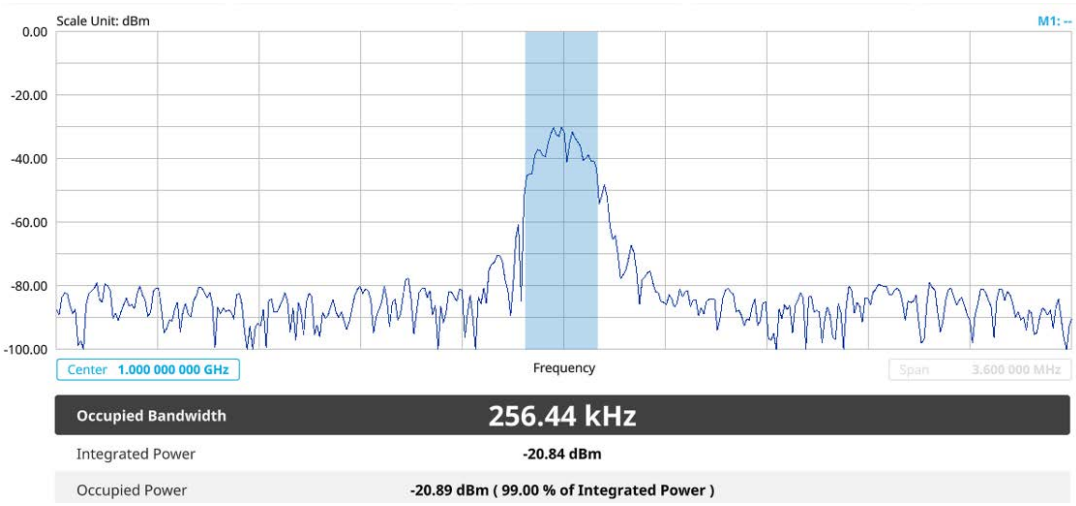
3 Tap **Delay** to set the amount of delay in µs using the on-screen keyboard.

NOTE

The Delay setting is used only when there is a time offset in the signals to be measured.

Figure 347 shows an example of occupied bandwidth measurement in GSM.

Figure 347 Occupied bandwidth measurement in GSM



The Occupied Bandwidth measurement shows both power across the band and power bandwidth in a user specified percentage to determine the amount of spectrum used by a modulated signal. Occupied bandwidth is typically calculated as the bandwidth containing 99% of the transmitted power.

To set the limit

1 Tap **Menu > Limit**.

2 Tap to switch the **Test Limits** to **On** or **Off** to enable or disable Pass/Fail indication.

The result table color for Pass is green, and the result table color for Fail is red.

3 Tap **High Limit** to set the upper threshold using the on-screen keyboard.

4 *Optional*: Tap the **Save** icon on the side bar and select the save option from the choices available for your measurement mode.

Spectrum emission mask

The Spectrum Emission Mask (SEM) measurement is to identify and determine the power level of out-of-band spurious emission outside the necessary channel bandwidth and modulated signal. It measures the power ratio between in-band and adjacent channels. The JD700B series indicates either Pass or Fail based on the specified limit of the signal.

Setting measure setup

After configuring the spectrum measurement in “Configuring spectrum measurements” on page 25, you can set the measure setup to continue your measurement.

To set measure setup

1 Tap the **Setup** ( ) icon on the side bar.

2 Tap **Time Slot** to assign a time slot with which performs RF measurements, and then select your desired time slot number from 0 to 7.

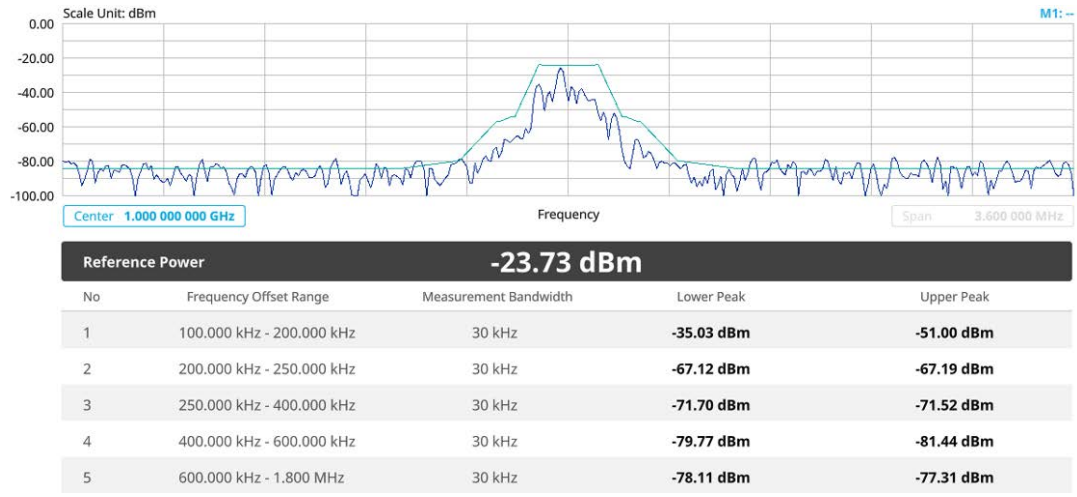
3 Tap **Delay** to set the amount of delay in µs using the on-screen keyboard.

NOTE

The Delay setting is used only when there is a time offset in the signals to be measured.

Figure 348 shows an example of spectrum emission mask measurement in GSM.

Figure 348 Spectrum emission mask measurement in GSM



To set the limit

1 Tap **Menu > Limit**.

2 Tap to switch the **Test Limits** to **On** or **Off** to enable or disable Pass/Fail indication.

The result table color for Pass is green, and the result table color for Fail is red.

3 *Optional*: Tap the **Save** icon on the side bar and select the save option from the choices available for your measurement mode.

Output RF spectrum

The Output RF Spectrum measures power of the output RF modulation spectrum of the carrier at different frequency offsets in different measurement bandwidths. It is used to determine if the output spectrum due to modulation and wideband noise for all supported RF channels meets the requirements specified in 3GPP TS 45.005 and conforms to the specification.

Setting measure setup

After configuring the spectrum measurement in “Configuring spectrum measurements” on page 25, you can set the measure setup to continue your measurement.

To set measure setup

1 Tap the **Setup** ( ) icon on the side bar.

2 Tap **Time Slot** to assign a time slot with which performs RF measurements, and then select your desired time slot number from 0 to 7.

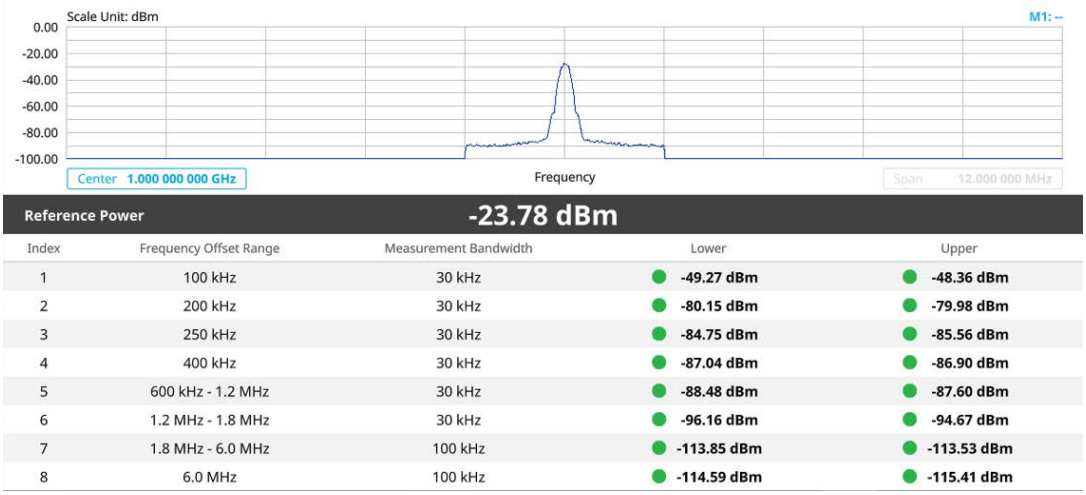
3 Tap **Delay** to set the amount of delay in µs using the on-screen keyboard.

NOTE

The Delay setting is used only when there is a time offset in the signals to be measured.

Figure 349 shows an example of output RF spectrum measurement in GSM.

Figure 349 Output RF spectrum measurement in GSM



Index	Frequency Offset Range	Measurement Bandwidth	Lower	Upper
1	100 kHz	30 kHz	-49.27 dBm	-48.36 dBm
2	200 kHz	30 kHz	-80.15 dBm	-79.98 dBm
3	250 kHz	30 kHz	-84.75 dBm	-85.56 dBm
4	400 kHz	30 kHz	-87.04 dBm	-86.90 dBm
5	600 kHz - 1.2 MHz	30 kHz	-88.48 dBm	-87.60 dBm
6	1.2 MHz - 1.8 MHz	30 kHz	-96.16 dBm	-94.67 dBm
7	1.8 MHz - 6.0 MHz	100 kHz	-113.85 dBm	-113.53 dBm
8	6.0 MHz	100 kHz	-114.59 dBm	-115.41 dBm

To set the limit

1 Tap **Menu > Limit**.

2 Tap to switch the **Test Limits** to **On** or **Off** to enable or disable Pass/Fail indication.

The result table color for Pass is green, and the result table color for Fail is red.

3 *Optional*: Tap the **Save** icon on the side bar and select the save option from the choices available for your measurement mode.

Spurious emissions

The Spurious Emissions measurement is to identify or determine the power level of in-band or out-of-band spurious emissions within the necessary channel bandwidth and modulated signal. The instrument indicates either Pass or Fail based on the specified limit of the signal.

Setting measure setup

After configuring spectrum measurement in “Configuring spectrum measurements” on page 25, you can set the measure setup to continue your measurement. The frequency setting is not used in Spurious Emissions mode. The measurement settings can be saved and recalled as a file by selecting File Type as Setup and load the file onto the instrument using the Save/Load icons on the side bar.

To set measure setup

1 Tap the **Setup** ( ) icon on the side bar.

2 Tap to switch the **Measure Type** to **Full** or **Examine**.

3 Tap **Configuration** to set up the range table and parameters.

a Select **Range** from 1 to 20 and switch each to **On** to display the selected range in the result table, or **Off** to hide it from the table.

b Select **Start Frequency** to specify the start frequency for the selected range using the on-screen keyboard.

c Select **Stop Frequency** to specify the stop frequency for the selected range using the on-screen keyboard.

d Select **Start Limit** and **Stop Limit** to specify the upper limit for Pass/Fail indication using the on-screen keyboard. You can set the threshold line by setting the start/stop limit.

e Select **Attenuation** and specify a value as a multiple of five using the on-screen keyboard.

f Select **RBW** to specify an RBW value using the on-screen keyboard.

g Select **VBW** to specify a VBW value using the on-screen keyboard.

To set limit

1 Tap **Menu > Limit**.

2 Tap to switch the **Test Limits** to **On** or **Off** to enable or disable Pass/Fail indication.

3 *Optional*: Tap the **Save** icon on the side bar and select the save option from the choices available for your measurement mode.

Figure 350 shows a spurious emissions measurement with the spectrum analyzer.

Figure 350 Spurious emissions measurement with spectrum analyzer



NOTE

If you select the first icon next to the Range table above, it only shows the selected range. If you select the second icon next to the Range table, it keeps moving from the first selected range to the final selected range.

OTA analysis

This Over-The-Air (OTA) measurement has channel scanner, frequency scanner, multipath profile, and modulation analyzer screens. The GSM OTA has a function to display channel power and related information up to 128 GSM down link signals. This channel scanner can quickly identify improper power levels that affect network performance. The transmitter performance can be made on a base station from the convenience of your vehicle without taking the base station out of service. It helps you to determine testing area's RF environmental condition with the multipath profile.

Channel Scanner

Setting channel

1. Tap the **Menu** ( ) icon on the side bar, then tap **Channel**.
   The Channel menus appear.
2. To set the standard channel, do the following steps:
   a. Tap **Channel Standard**. The standard channel window appears.
   b. Tap the band to be measured.
   c. Tap the **Apply** button to apply the setting.
3. Tap **Start Channel** to set the starting channel to be scanned and input the required value using the on-screen keyboard.
4. Tap **Channel Step** to set the amount of channel increment in scanning channels and input the required value using the on-screen keyboard.
5. Tap **# of Channels** to set the number of channels to be displayed and input the required value using the on-screen keyboard.

Setting zoom position

You can set the starting channel for the Zoom In Window.

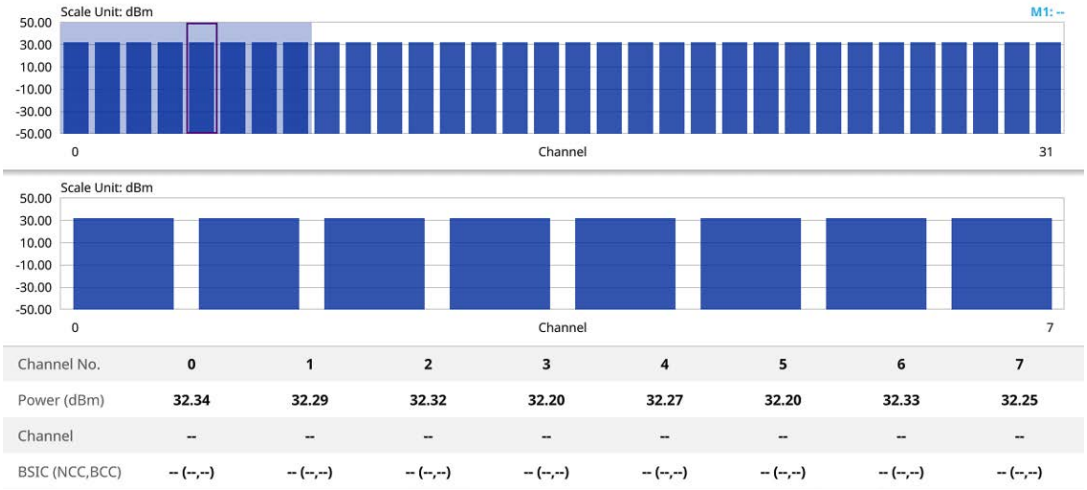
1. Tap the **Setup** ( ) icon on the side bar.
2. Tap **Zoom Position** and input the required value using the on-screen keyboard.

Setting limit

1. Tap **Menu > Limit**.
2. Tap to switch the **Limit Line** to **On** or **Off** to enable or disable Pass/Fail indication.
3. Once the Limit Line is on, enter a required value using the on-screen keyboard.
4. *Optional*: Tap the **Save** icon on the side bar and select the save option from the choices available for your measurement mode.

Figure 351 shows an example of the channel scanner measurement in GSM.

Figure 351 Channel scanner measurement in GSM



Channel No.	0	1	2	3	4	5	6	7
Power (dBm)	32.34	32.29	32.32	32.20	32.27	32.20	32.33	32.25
Channel	--	--	--	--	--	--	--	--
BSIC (NCC,BCC)	-- (--,--)	-- (--,--)	-- (--,--)	-- (--,--)	-- (--,--)	-- (--,--)	-- (--,--)	-- (--,--)

Frequency scanner

Setting frequency

1 Tap the **Menu** (☰) icon on the side bar, then tap **Frequency**.

The Frequency menus appear.

2 Tap **Start Frequency** to set the starting center frequency using the on-screen keyboard.

3 Tap **Frequency Step** to set the amount of frequency increment in scanning channel using the on-screen keyboard.

4 Tap **# of Frequency** to set the number of channels to be displayed in the measurement table using the on-screen keyboard.

Setting zoom position

You can set the starting channel for the Zoom In Window.

1 Tap the **Setup** (⚙) icon on the side bar.

2 Tap **Zoom Position** and input the required value using the on-screen keyboard.

Setting limit

1 Tap **Menu > Limit**.

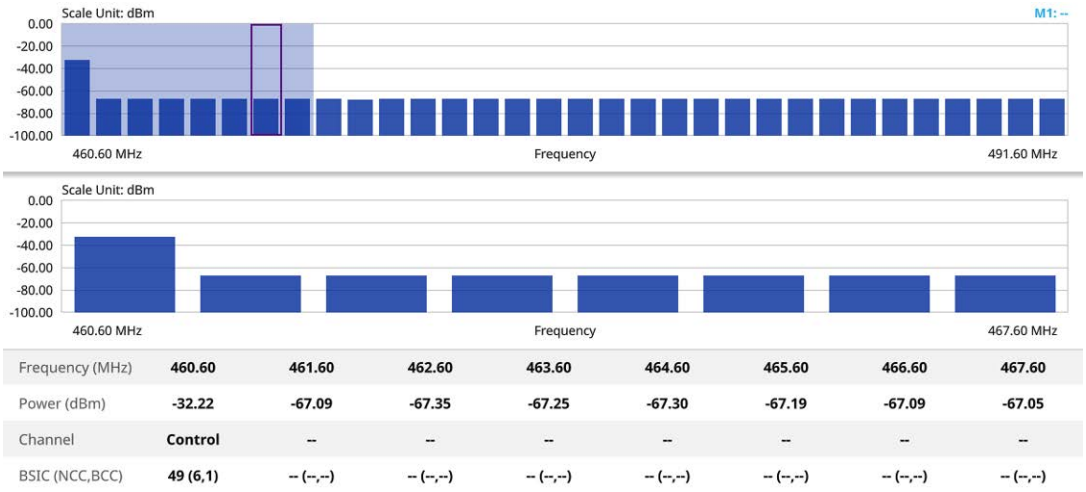
2 Tap to switch the **Limit Line** to **On** or **Off** to enable or disable Pass/Fail indication.

3 Once the Limit Line is on, enter a required value using the on-screen keyboard.

4 *Optional*: Tap the **Save** icon on the side bar and select the save option from the choices available for your measurement mode.

Figure 352 shows an example of the frequency scanner measurement in GSM.

Figure 352 Frequency scanner measurement in GSM



Frequency (MHz)	460.60	461.60	462.60	463.60	464.60	465.60	466.60	467.60
Power (dBm)	-32.22	-67.09	-67.35	-67.25	-67.30	-67.19	-67.09	-67.05
Channel	Control	--	--	--	--	--	--	--
BSIC (NCC,BCC)	49 (6,1)	-- (--,--)	-- (--,--)	-- (--,--)	-- (--,--)	-- (--,--)	-- (--,--)	-- (--,--)

Custom scanner

Setting frequency

To set the channels to be scanned

1 Tap the **Setup** ( ) icon on the side bar.

2 Tap **Configuration** or tap the **Configuration** button on the result table.
The setup table appears as shown in Figure 297.

Figure 353 Setup table



3 Tap **Channel Band** to select the channel band.
The channel standard window appears.

4 Select **Technology** and then select the band to be measured.

5 Tap the **Apply** button to apply the settings.

6 Tap **Index** and select the number from 1 to 20.

7 Tap **Channel No** to set the channel number for the selected index using the on-screen keyboard.
The instrument displays a corresponding center frequency for the channel number.

8 Tap to switch the **Delete** button to **Add** to add more channels to be scanned and repeat steps 6-7.

9 Tap the **X** button to dismiss the channel list window and view the scanning result.

To set the frequencies to be scanned

1 Tap **Index** and select the number from 1 to 20.

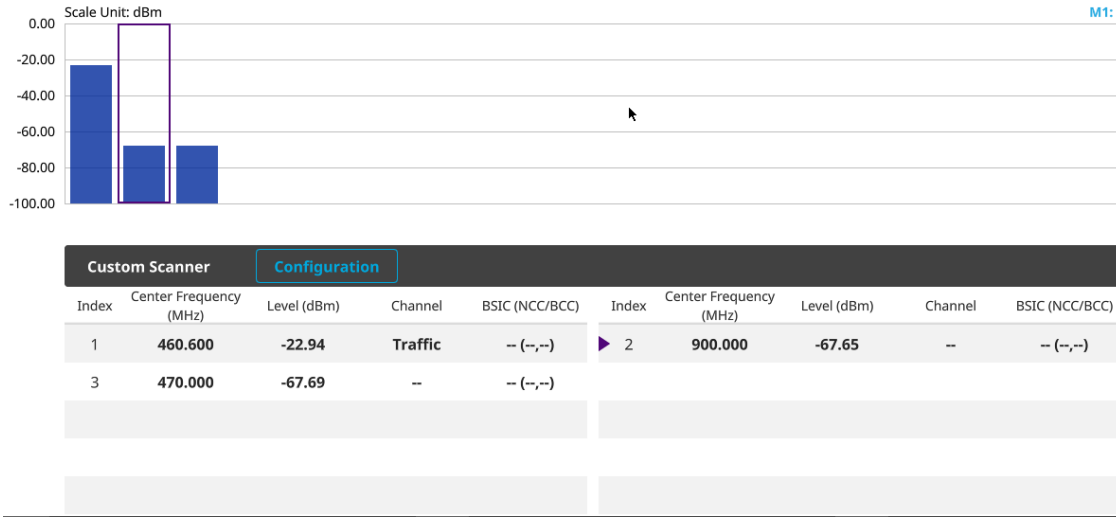
2 Tap **Center Frequency** to set the center frequency for the selected index using the on-screen keyboard.

3 Tap to switch the **Delete** button to **Add** to add more channels to be scanned and repeat steps 1-2.

4 Tap the **X** button to dismiss the channel list window and view the scanning result.

Figure 354 shows an example of the custom scanner measurement in GSM.

Figure 354 Custom scanner measurement in GSM



Multipath profile

The Multipath Profile let you determine RF environmental conditions of testing area. The multipath profile is the result of portions of the original broadcast signal arriving at the receiving antenna out of phase. This can be caused by the signal being reflected off objects such as buildings, or being refracted through the atmosphere differently from the main signal.

Setting measure setup

After configuring the spectrum measurement in “Configuring spectrum measurements” on page 25, you can set the measure setup to continue your measurement. The measurement settings can be saved and recalled as a file by selecting File Type as Setup and load the file onto the instrument using the **Save/Load** icons on the side bar.

To set measure setup

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap **Detect Mode**, and then select the signal standard option: **Auto**, **GMSK**, or **8PSK**.

Auto is set by default. The instrument applies a mask automatically based on the selected mode.

3 Tap **Delay** to set the amount of delay in µs using the on-screen keyboard.

NOTE

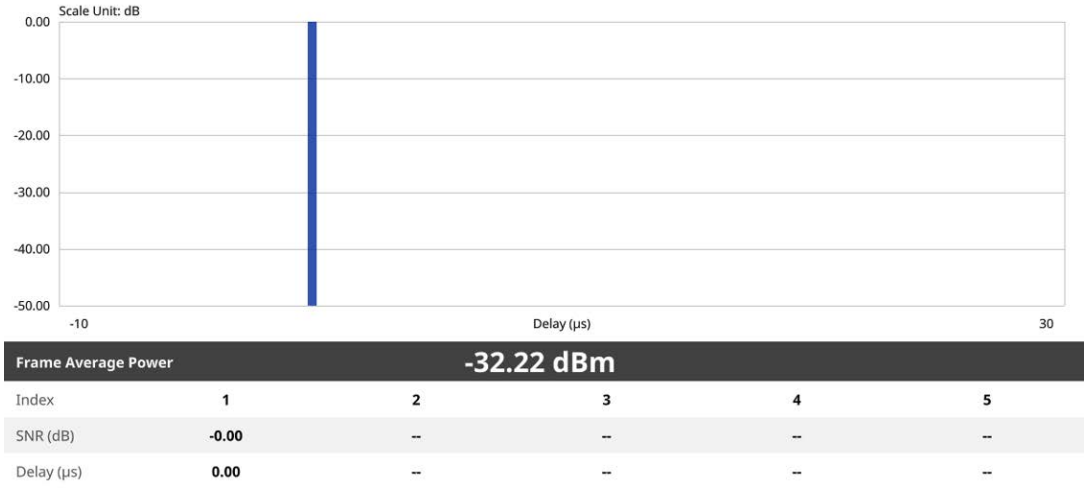
The Delay setting is used only when there is a time offset in the signals to be measured.

4 Tap **TSC/ETSC Sync Window** and select between **Default** and **Symmetrical**.

If you select **Symmetrical**, it will show the symmetrical view for the measurement screen.

Figure 355 shows an example of multipath profile measurement in GSM.

Figure 355 Multipath profile measurement in GSM



Modulation analyzer

Setting measure setup

After configuring the spectrum measurement in “Configuring spectrum measurements” on page 25, you can set the measure setup to continue your measurement. The measurement settings can be saved and recalled as a file by selecting File Type as Setup and load the file onto the instrument using the **Save/Load** icons on the side bar.

To set measure setup

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap **Detect Mode**, and then select the signal standard option: **Auto**, **GMSK**, or **8PSK**.

Auto is set by default. The instrument applies a mask automatically based on the selected mode.

3 Tap **Delay** to set the amount of delay in µs using the on-screen keyboard.

NOTE

The Delay setting is used only when there is a time offset in the signals to be measured.

To set limit

1 Tap **Menu** > **Limit**.

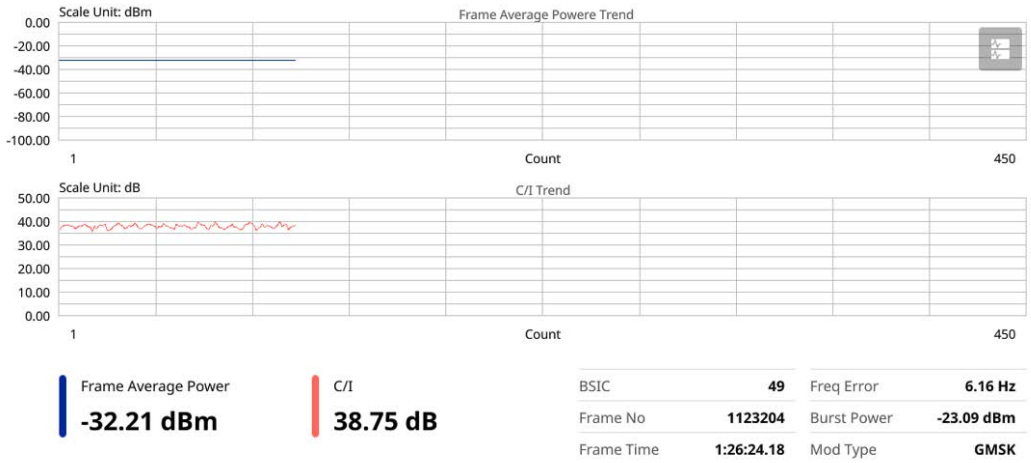
2 Tap the test items and set the limits depending on your selected measurement mode:

To set the limit for	Select and set
Frame average power	High Limit, Low Limit
Frequency error	High Limit, Low Limit
Burst power	High Limit, Low Limit
ACLR	(On/Off only)
Multi-ACLR	(On/Off only)
Spurious emissions	(On/Off only)

3 Tap the **Save** icon on the side bar and select the save option from the choices available for your measurement mode.

Figure 356 shows an example of modulation analyzer profile measurement in GSM.

Figure 356 Modulation analyzer measurement in GSM



Signal analysis

This section describes measurements related to Constellation, Power vs Time (Slot), and Power vs Time (Frame).

Constellation

The Constellation is used to observe some aspects of modulation accuracy and can reveal certain fault mechanisms such as I/Q amplitude imbalance or quadrature imbalance. It displays constellation diagram by modulation types.

Setting measure setup

After configuring the spectrum measurement in “Configuring spectrum measurements” on page 25, you can set the measure setup to continue your measurement. The measurement settings can be saved and recalled as a file by selecting File Type as Setup and load the file onto the instrument using the **Save/Load** icons on the side bar.

to set measure setup

1 Tap the **Setup** ( ) icon in the side bar.

2 Tap **Detect Mode**, and then select the signal standard option: **Auto**, **GMSK**, or **8PSK**.

Auto is set by default. The instrument applies a mask automatically based on the selected mode.

3 Tap to switch **Constellation** to **On** or **Off** to enable or disable the constellation observation**.**

> **NOTE**
> The constellation must be turned on to analyze GMSK and 8PSK signals.

4 Tap **Delay** to set the amount of delay in µs using the on-screen keyboard.

> **NOTE**
> The Delay setting is used only when there is a time offset in the signals to be measured.

To set limit

1 Tap **Menu** > **Limit**.

2 Tap the test items and set the limits depending on your selected measurement mode:

To set the limit for	Select and set
Frequency error	High Limit, Low Limit
Phase error rms	High Limit, Low Limit
Phase error peak	High Limit, Low Limit
Error vector magnitude rms (EVM RMS)	High Limit
Error vector magnitude peak (EVM peak)	High Limit
I/Q origin offset of the I and Q error (magnitude squared) offset from the origin (IQ Origin Offset)	High Limit
Carrier to interference (C/I) ratio (C/I)	Low Limit

3 Tap the **Save** icon on the side bar and select the save option from the choices available for your measurement mode.

Figure 357 shows an example of constellation measurement in GSM.

Figure 357 Constellation measurement (off) in GSM

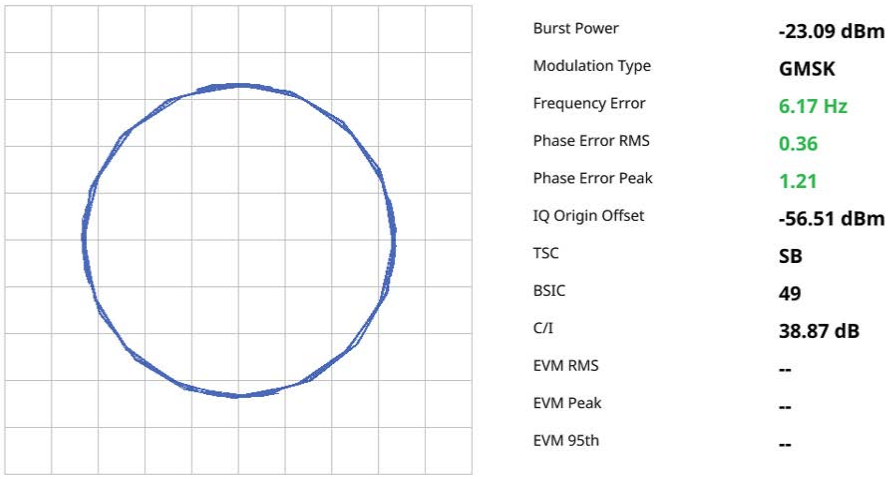


Figure 358 Constellation measurement (on) in GSM

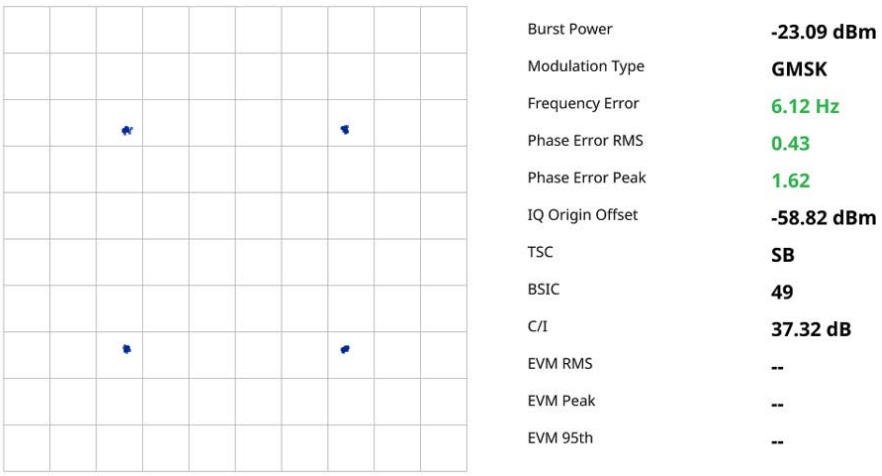
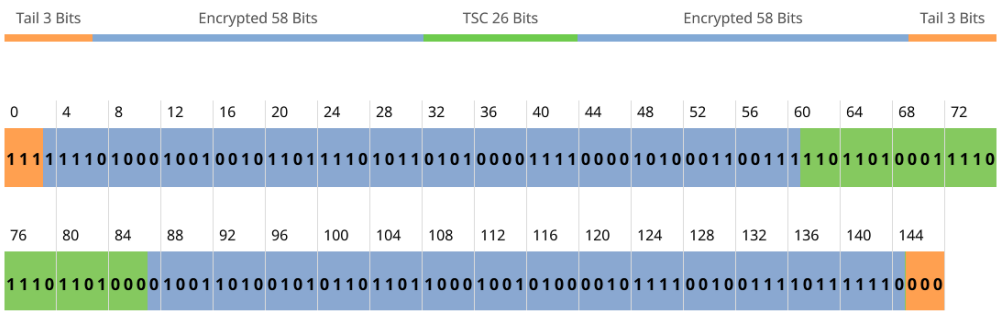


Figure 359 Constellation measurement (Demod Bits to On) in GSM



NOTE

If you go to Menu > Display, and tap to switch the Demod Bits to On, you can check the demodulation bits on the screen as above.

Power vs Time (Slot)

The Power vs. Time measurement measures the mean transmission power during the useful part of GSM bursts and verifies that the power ramp fits within the defined mask. It also lets you view the rise, fall, and useful part of the GSM burst.

This measurement provides masks for both of Base Transceiver Station (BTS) and Mobile Station (MS). The timing masks are referenced to the transition from the bit 13 to the bit 14 of the mid-amble training sequence. For GMSK measurements, the 0 dB reference is determined by measuring the mean transmitted power during the useful part of the burst.

Setting measure setup

After configuring the spectrum measurement in “Configuring spectrum measurements” on page 25, you can set the measure setup to continue your measurement. The measurement settings can be saved and recalled as a file by selecting File Type as Setup and load the file onto the instrument using the **Save/Load** icons on the side bar.

to set measure setup

1. Tap the **Setup** ( ) icon on the side bar.
2. Tap **Time Slot** to assign a time slot with which performs RF measurements, and then select your desired time slot number from 0 to 7.
3. Tap **Detect Mode**, and then select the signal standard option: **Auto**, **GMSK**, or **8PSK**.

   Auto is set by default. The instrument applies a mask automatically based on the selected mode.
4. Tap **Delay** to set the amount of delay in µs using the on-screen keyboard.

NOTE

The Delay setting is used only when there is a time offset in the signals to be measured.

To set the limit

1. Tap **Menu > Limit**.
2. Tap to switch the **Test Limits** to **On** or **Off** to enable or disable Pass/Fail indication.

The result table color for Pass is green, and the result table color for Fail is red.

3 Tap **High Limit** to set the upper threshold using the on-screen keyboard.

4 Tap **Low Limit** to set the lower threshold using the on-screen keyboard.

5 *Optional*: Tap the **Save** icon on the side bar and select the save option from the choices available for your measurement mode.

Figure 360 shows an example of Power vs Time (Slot) measurement in GSM.

Figure 360 Power vs Time (Slot) measurement in GSM



Power vs Time (Frame)

The Power vs. Time measurement measures the mean transmission power during the useful part of GSM bursts and verifies that the power ramp fits within the defined mask. It also lets you view the rise, fall, and useful part of the GSM burst.

This measurement provides masks for both of Base Transceiver Station (BTS) and Mobile Station (MS). The timing masks are referenced to the transition from the bit 13 to the bit 14 of the mid-amble training sequence. For GMSK measurements, the 0 dB reference is determined by measuring the mean transmitted power during the useful part of the burst.

Setting measure setup

After configuring the spectrum measurement in “Configuring spectrum measurements” on page 25, you can set the measure setup to continue your measurement. The measurement settings can be saved and recalled as a file by selecting File Type as Setup and load the file onto the instrument using the **Save/Load** icons on the side bar.

to set measure setup

1 Tap the **Setup** ( ) icon on the side bar.

2 Tap **Time Slot** to assign a time slot with which performs RF measurements, and then select your desired time slot number from 0 to 7.

3 Tap **Detect Mode**, and then select the signal standard option: **Auto**, **GMSK**, or **8PSK**.

Auto is set by default. The instrument applies a mask automatically based on the selected mode.

4 Tap **Delay** to set the amount of delay in µs using the on-screen keyboard.

NOTE

The Delay setting is used only when there is a time offset in the signals to be measured.

To set the limit

1 Tap **Menu > Limit**.

2 Tap to switch the **Test Limits** to **On** or **Off** to enable or disable Pass/Fail indication.

The result table color for Pass is green, and the result table color for Fail is red.

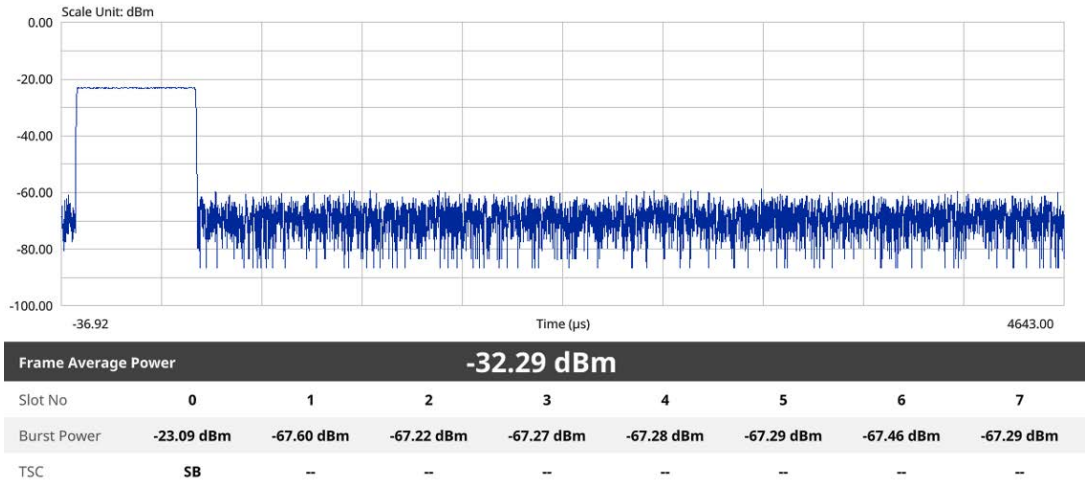
3 Tap **High Limit** to set the upper threshold using the on-screen keyboard.

4 Tap **Low Limit** to set the lower threshold using the on-screen keyboard.

5 *Optional*: Tap the **Save** icon on the side bar and select the save option from the choices available for your measurement mode.

Figure 361 shows an example of Power vs Time (Frame) measurement in GSM.

Figure 361 Power vs Time (Frame) measurement in GSM



19

Channel Scanner

This chapter describes how to use the Channel Scanner. Topics covered in this chapter include:

- “Introduction” on page 810
- “Selecting mode and measure” on page 810
- “Channel scanner” on page 810
- “Frequency scanner” on page 811
- “Custom scanner” on page 812
- “Route map” on page 813
- “Online route map” on page 817

Introduction

A Scanner is a radio receiver that can automatically tune or scan two or more discrete frequencies and multi-channels, indicating when it finds a signal on one of them and then continuing scanning when that frequency goes silent.

You can measure up to 20 channels with this channel scanner. Using existing format-based or custom parameters, you will be able to easily verify improper multi-channel power levels.

Channel Scanner supports N type and K type port selection automatically using top right panel () icon. You will need to connect the RF input port correctly on your instrument based on the frequency range (9 kHz to 18 GHz/9 kHz to 44 GHz).

Selecting mode and measure

The following procedure describes how to start measurement.

To select mode and measure

1 Tap **Channel Scanner** on the **MODE** panel.

2 Tap any measurement mode from the following choices:
- **Channel Scanner** > **Channel Scanner**, **Frequency Scanner, Custom Scanner**, or **Route Map**
- **Online Route Map** > **Online Route Map**

Channel scanner

If you have configured test parameters as described in “Configuring spectrum measurements” on page 25, continue to set measure setup.

To set measure setup

1 Tap the **Menu** (☰) icon on the side bar, then tap **Channel**.
The Channel menus appear.

2 Tap **Channel Standard** to select the standard channel.
The channel standard window appears.
   a Select **Technology** and then select the band to be measured.

3 Tap **Link** to switch it to **Uplink** or **Downlink**.

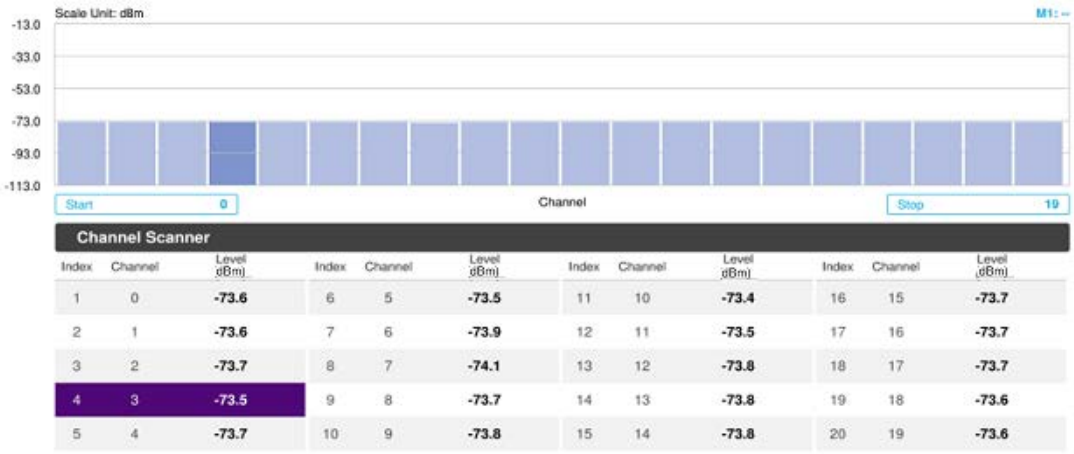
4 Tap **Start Channel** to set the starting channel using the on-screen keyboard.

5 Tap **Channel Step** to set the amount of channel increment in scanning channel using the on-screen keyboard.

6 Tap **Integration BW** and input a value using the on-screen keyboard.

7 Tap **# of Channels** to set the number of channels to be displayed in the measurement table using the on-screen keyboard.

Figure 362 Channel scanner measurement



Index	Channel	Level (dBm)	Index	Channel	Level (dBm)	Index	Channel	Level (dBm)	Index	Channel	Level (dBm)
1	0	-73.6	6	5	-73.5	11	10	-73.4	16	15	-73.7
2	1	-73.6	7	6	-73.9	12	11	-73.5	17	16	-73.7
3	2	-73.7	8	7	-74.1	13	12	-73.8	18	17	-73.7
4	3	-73.5	9	8	-73.7	14	13	-73.8	19	18	-73.6
5	4	-73.7	10	9	-73.8	15	14	-73.8	20	19	-73.6

NOTE

You can go to **Menu** > **Limit** to analyze your measurements with limit line using the on-screen keyboard and the channel limit turning channel limit table On or Off.

You can go to **Menu** > **Marker** to analyze your measurements with markers. See “Using marker” on page 41 for more information.

Frequency scanner

If you have configured test parameters as described in “Configuring spectrum measurements” on page 25, continue to set measure setup.

To set measure setup

1 Tap the **Menu** (☰) icon on the side bar, then tap **Frequency**.

The Frequency menus appear.

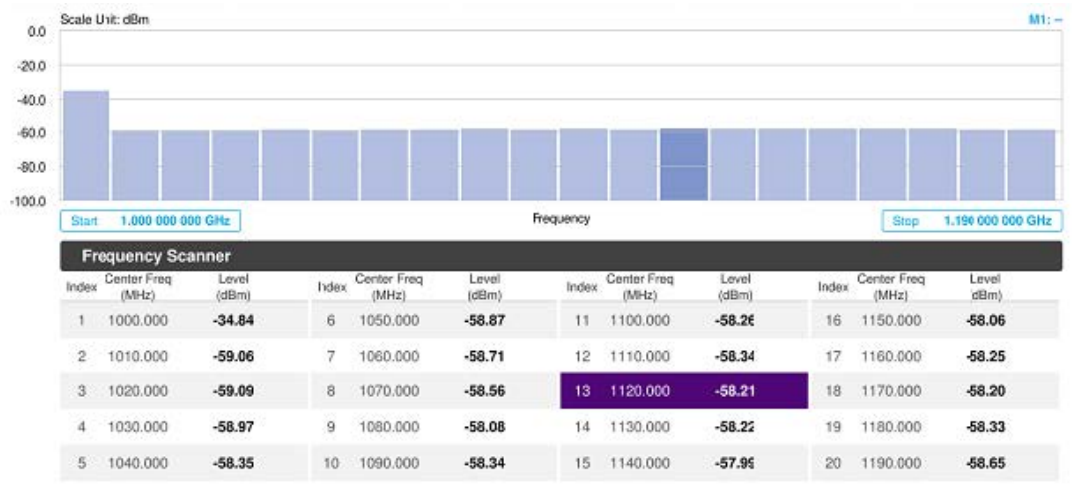
2 Tap **Start Frequency** to set the starting center frequency using the on-screen keyboard.

3 Tap **Frequency Step** to set the amount of frequency increment in scanning channel using the on-screen keyboard.

4 Tap **Integration BW** and input a value using the on-screen keyboard.

5 Tap **# of Frequency** to set the number of channels to be displayed in the measurement table using the on-screen keyboard.

Figure 363 Frequency scanner measurement



NOTE

You can go to **Menu** > **Limit** to analyze your measurements with limit line using the on-screen keyboard and the channel limit turning channel limit table On or Off.

You can go to **Menu** > **Marker** to analyze your measurements with markers. See “Using marker” on page 41 for more information.

Custom scanner

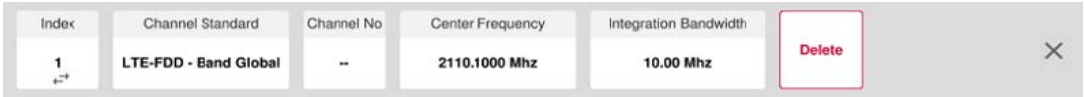
If you have configured test parameters as described in “Configuring spectrum measurements” on page 25, continue to set measure setup.

To set the channels to be scanned

1 Tap the **Setup** ( ) icon on the side bar.

2 Tap **Configuration** or tap the **Edit** icon on the result table.
The setup table appears as shown in Figure 116.

Figure 364 Setup table



3 Tap **Channel Standard** to select the standard channel.
The channel standard window appears.

4 Select **Technology** and then select the band to be measured.

5 Tap the **Apply** button to apply the settings.

6 Tap **Link** to switch it to **Uplink** or **Downlink**.

7 Tap **Index** and select the number from 1 to 20.

8 Tap **Channel No** to set the channel number for the selected index using the on-screen keyboard.

The instrument displays a corresponding center frequency for the channel number.

9 Tap **Integration BW** and input a value for the selected index using the on-screen keyboard.

10 Tap to switch the **Delete** button to **Add** to add more channels to be scanned and repeat steps 7-9.

11 Tap the **X** button to dismiss the channel list window and view the scanning result.

To set the frequencies to be scanned

1 Tap **Index** and select the number from 1 to 20.

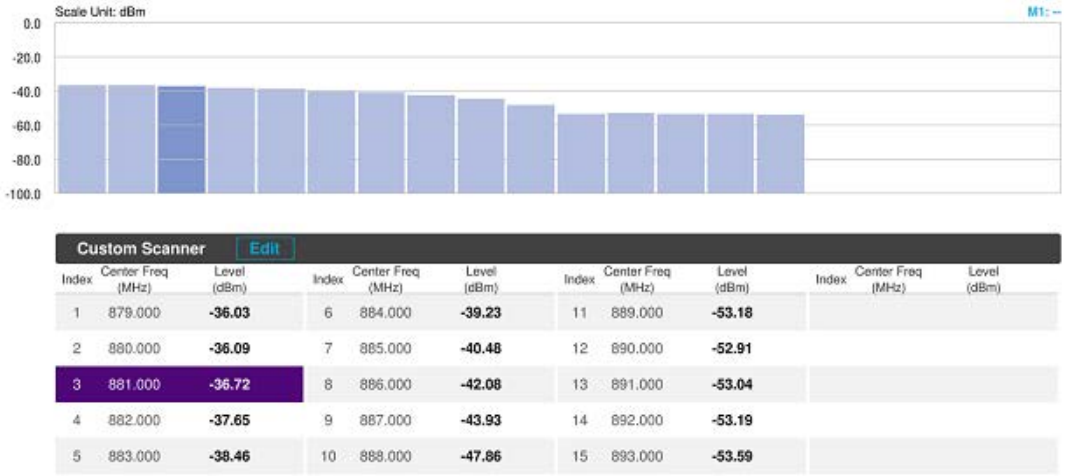
2 Tap **Center Frequency** to set the center frequency for the selected index using the on-screen keyboard.

3 Tap **Integration BW** and input a value for the selected index using the on-screen keyboard.

4 Tap to switch the **Delete** button to **Add** to add more channels to be scanned and repeat steps 1-3.

5 Tap the **X** button to dismiss the channel list window and view the scanning result.

Figure 365 Custom scanner measurement



Route map

Channel Scanner route map traces the power level of the channel power and corresponding to a particular time and geographical position and presents it in a geographical map as a measurement point. All the collected measurements can be exported for post-processing purposes, including data of the eight strongest beams for each measurement point, including its measurement time and geographical location.

Figure 366 shows an example of the Route Map.

Figure 366 Route Map with Channel Scanner



Loading a map

To use any features related to maps, you need to download and install the maps on the instrument. The VIAVI JDMapCreator will help you download maps. Make sure the JDMapCreator application on your computer is connected to the instrument via LAN. You can send a map file with a single layer to the instrument directly by using the Send to EQP menu in JDMapCreator. For more information on how to use the JDMapCreator, see the *JDMapCreator 2.0 User Guide*.

To load a map

1. Plug in your USB flash drive that has a map with a file type of .mcfv created in JDMapCreator.
2. Tap the **Load** icon on the side bar.
3. Navigate to the map file that you want to open.

   The **File Information** pane displays the file properties, including its name, size, type, and date modified.
4. Tap the **Load** button on the screen.
5. Once you have loaded the map, you can also control the map using the following icons on the map.
6. The left-most Cellsite icon is activated when you import the cellsite information file.

Table 146 Map icons

Icon	Description
	Tap to go to your current location on the map. Once tapped, a purple icon appears on the map, indicating your current location.

Table 146 Map icons

Icon	Description
	Tap to switch to the full screen map view.
	Tap to zoom in on the map.
	Tap to zoom out on the map.
	Tap and select the area that you want to expand.

To set measurement setup

Before starting the Route Map measurement, you need to set Spectrum measurements displayed on the quick access and display tab. See “Configuring spectrum measurements” on page 25 for more information.

1. If required, connect a GNSS receiver to your instrument for outdoor mapping. Indoor mapping does not necessarily need a GNSS antenna.
2. Tap the **Cancel** or **Apply** button when **Display** pop-up window appears.
3. Tap the **Setup** ( ) icon on the side bar.
4. Tap to switch the **Plot Point** to **GNSS**, **Position**, or **Time**.
   - **a** To collect data/plot points automatically as you move around in a vehicle or outside, select **GNSS**, then tap to switch the **Screen Mode** between **Map** and **Full**. With the **Map** setting, you can view only the collected points that can be seen within the boundary of the loaded map. With the **Full** setting, you can view all the collected points of the route without the loaded map.
   - **b** To collect data/plot points manually in an indoor layout without a GNSS antenna, select **Position**.
   - **c** To collect data/plot points based on time, select **Time**.

5 Tap **Configuration** to continue with setup appeared in the setup table.

- **a** Tap the number to switch the Index number. You can select up to 20 index numbers.
- **b** Tap to switch the **Link** to **Uplink** or **Downlink**.
- **c** Tap **Channel Standard** and select the required channel standard.
- **d** Tap **Channel Number** and input the required channel number using the on-screen keyboard.
- **e** Tap **Center frequency** and input the required value using the on-screen keyboard.
- **f** Tap **Integrated Bandwidth** and input the required value using the on-screen keyboard.
- **g** Tap the **Add** button to apply the settings.

6 Tap the **Start** button on the right panel of the map to start plotting for the Position or Time setting.

7 Touch directly on the screen and tap to collect data and plot points on the loaded map. For the Position setting, you can change the direction of the route with screen touch. For the Time setting, when you first touch screen a purple triangle appears on the point and the "Number of n" appears in the bottom left of the map. The instrument interpolates points in between two points on a straight dotted line. The max count is 2560, and the time interval is 0.5 s.

8 Tap the **Pause** button to pause plotting. The **Pause** button turns blue and GNSS cannot be plotted.

9 Tap to switch **Plot** to **Stop** to stop plotting.

10 Tap **Menu** > **Sweep** and set the **Sweep Mode** to **Single** or **Continue**, or tap **Sweep Once** to perform a single sweep.

11 If you start testing and select **Setup > Plot Point > Position**, you can undo by tapping the **Start** button.

12 If you select the **Stop** button, the **Plot Stop** popup window appears.



NOTE

The instrument does not automatically save the collected data. It is recommended that you save the result. If not, you will lose all the collected data.

To set limit

You can set the thresholds for the two different color indicators. The maximum value is the Limit for **Excellent**, and the minimum value is the Limit for **Poor**. See below to check the plot point color based on the Legend Color Table.

1 Tap the rectangle with value before color legend bar on the right panel.

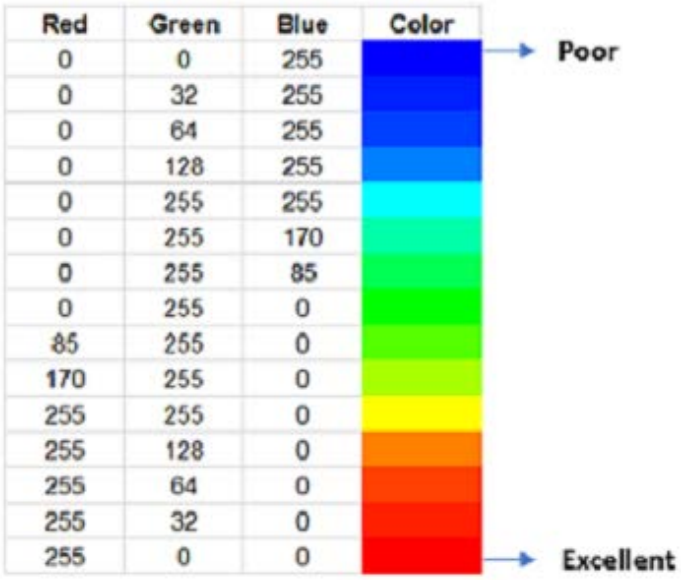
2 Set a value for **Poor** (minimum value) using the on-screen keyboard.

3 Tap the rectangle with value after color legend bar on the right panel.

4 Set a value for **Excellent** (maximum value) using the on-screen keyboard.

Figure 367 shows a legend color table.

Figure 367 Legend color table



NOTE

When you tap the **Start** (Testing) button, the corresponding channel power will show on the measurement screen.

Online route map

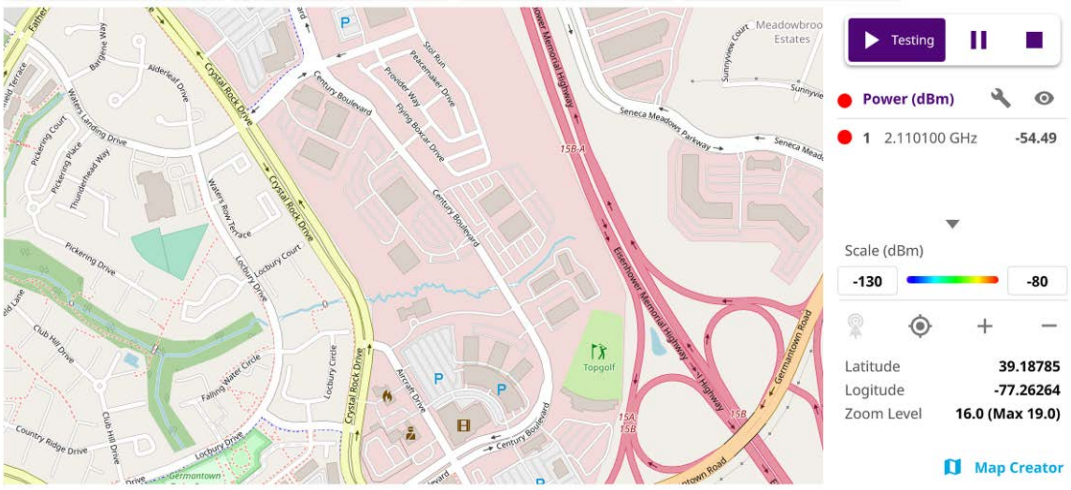
The following sections describe how to perform online route map.

Online route map

Channel Scanner online route map enables you to download a map automatically when connected to the network then you can continue route map measurement using the downloaded map whether you are online or offline.

Figure 368 shows an example of Online Route Map measurement.

Figure 368 Online Route Map with Channel Scanner



Controlling a map

To control a map

See the following table to control a map.

Table 147 Map control icons

Icon	Description
	Tap to go to your current location on the map. Once tapped, the purple icon appears on the map, indicating your current location.
	Tap to zoom in the map.
	Tap to zoom out the map.

The left-most cell-site icon is activated when you import the cell-site information file.

To set measurement setup

Before starting the Route Map measurement, you need to set Spectrum measurements displayed on the quick access and display tab. See “Configuring spectrum measurements” on page 25 for more information.

1 If required, connect a GNSS receiver to your instrument for outdoor mapping.

2 Tap the **Cancel** or **Apply** button when **Display** pop-up window appears.

3 Tap the **Setup** ( ) icon on the side bar.

4 Tap **Configuration** to continue with setup appeared in the setup table.

   a Tap the number to switch the Index number. You can select up to 20 index numbers.

   b Tap to switch the **Link** to **Uplink** or **Downlink**.

   c Tap **Channel Standard** and select the required channel standard.

   d Tap **Channel Number** and input the required channel number using the on-screen keyboard.

   e Tap **Center frequency** and input the required value using the on-screen keyboard.

   f Tap **Integrated Bandwidth** and input the required value using the on-screen keyboard.

   g Tap the **Add** button to apply the settings.

5 Tap the **X** button to finish settings.

6 Tap the **Start** button on the right panel of the map to start plotting

7 Tap the **Pause** button to pause plotting. The **Pause** button turns blue and GNSS cannot be plotted.

8 Tap to switch **Plot** to **Stop** to stop plotting.

NOTE

The instrument does not automatically save the collected data. It is recommended that you save the result. If not, you will lose all the collected data.

To set limit

You can set the thresholds for the two different color indicators, red and blue. The maximum value is the Limit for **Excellent**, and the minimum value is the Limit for **Poor**. See below to check the plot point color based on the Legend Color Table.

1 Tap the rectangle with value before color legend bar on the right panel.

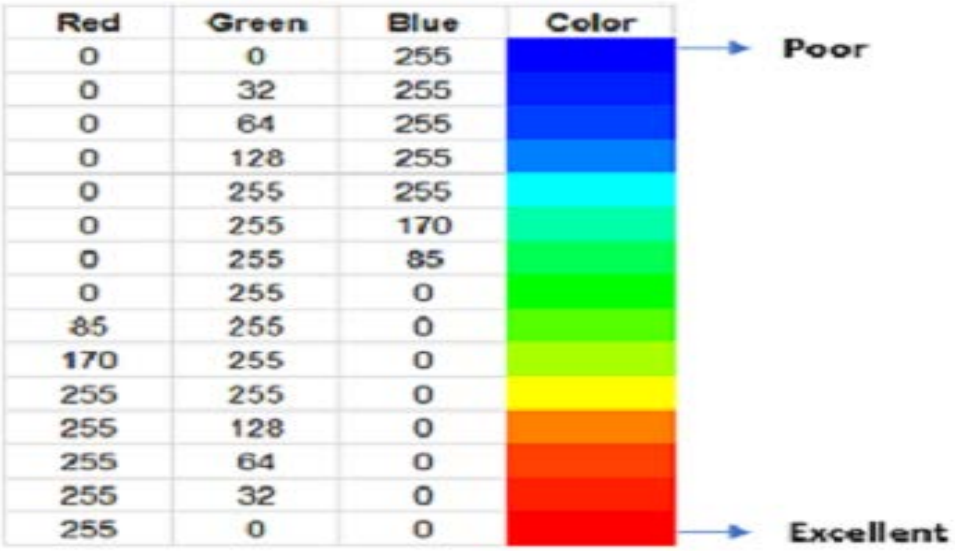
2 Set a value for **Poor** (minimum value) using the on-screen keyboard.

3 Tap the rectangle with value after color legend bar on the right panel.

4 Set a value for **Excellent** (maximum value) using the on-screen keyboard.

Figure 369 shows a legend color table.

Figure 369 Legend color table



Logging data

To log data

1. Follow **steps 1 to 3** in Setting measure setup.
2. Tap the **Testing** ( ) button on the right panel of the map to start plotting on the map. When you select a point on the map, a marker appears and the Information window appears on the right panel.
3. Tap the **Stop** ( ) button to stop plotting.
4. Tap the **Pause** button ( ) to pause plotting, then the GNSS point cannot be plotted.
5. If you select the **Stop** button, the Plot Stop pop-up window appears, then tap **Yes**.
6. Tap **Yes** when the Save pop-up window appears and save the logging file to your USB.

Viewing the logging data

To view the logging data

1. Load the saved logging file using the **Load** ( ) icon on the side bar. Make sure the file extension is .orr.
2. Tap the **Load** button in the file information window.

Importing cellsite DB

You can import the site DB by creating the 5G site information form.

To import cellsite DB

1 Create the 5G site information with an excel file as below.

2 Input the two mandatory fields: **Lat (DecDeg)** and **Long (DecDeg)**.

3 Input the **Azimuth** field if you want to check the direction of antenna.

4 Make sure to save the file as (Comma delimited) (*.csv).

5 Copy the file to the USB memory stick and insert it to the **USB A** or **USB B** port of the instrument.

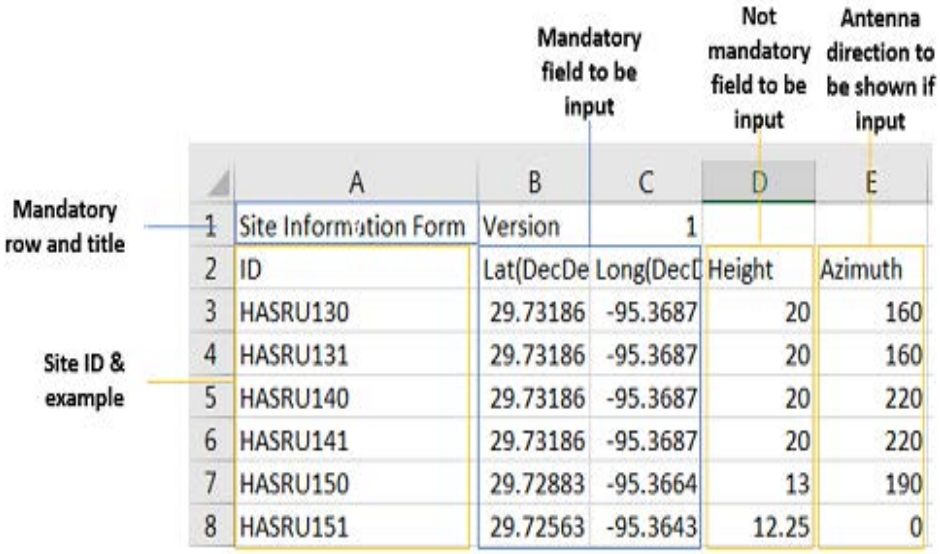
6 Tap the **Load** ( ) icon on the side bar.

7 Import the saved file.

Once the file is loaded, the following cellsite information appears with an icon.

Figure 370 shows an example of an importing cellsite DB.

Figure 370 Importing Cellsite DB



Creating a map

You can create a map online and continue conducting a route map analysis using the created map even when there is no Ethernet connection.

1 Tap the **Map Creator** button on the right panel at the bottom.

2 Tap the **Search** box and input the location using the on-screen keyboard and select one of the options as required.

3 Tap the **Zoom Level** box to capture the map with corresponding zoom level.

4 Tap the **Capture** button to start capturing the map.

Once the map is captured, the capturing completed pop-up will appear.

5 Select between the two options: Save in the system or Save as file.

6 Tap the **Done** button.



NOTE
If you have unsaved measurement data (map) and start measuring by tapping the Testing button or by tapping another measurement mode, a pop-up window will appear asking whether you will restore the unsaved data or not.

20

Using O-RAN

This chapter describes how to use O-RAN. Topics covered in this chapter include:

- “Introduction” on page 824
- “Selecting mode and measure” on page 824
- “Optical BERT” on page 824

Introduction

O-RAN (Open Radio Access Network) enables interoperability between different vendors' equipment by using open and standardized interfaces. Users apply O-RAN when testing or deploying radio access networks that must integrate hardware and software from multiple sources.

O-RAN supports the following measurement:

- Optical BERT

Selecting mode and measure

The following procedure describes how to start measurement.

To select mode and measure

1 Tap **O-RAN** on the **MODE** panel.

2 Tap the measurement mode from the following choice:
   – **Optical Test > Optical BERT** (Available only when the following license(s) are installed: ONA-SP-OB10G and ONA-SP-OB25G)

Optical BERT

The Optical BERT (Bit Error Rate Test) is used to verify the quality and reliability of optical transmission links by checking for bit errors during data transmission.

The Optical BERT is useful for detecting signal impairments in optical fibers and components. It helps ensure link stability and performance before deployment. The test also assists in troubleshooting by locating potential error sources. In addition, it validates compliance with optical network standards.

To set measure setup

Configure the required items before starting optical BERT.

1 Tap the **Setup** ( ) icon on the side bar or tap the **Configuration** icon at the bottom right corner of the screen.

2 Tap **BER Threshold** and select the required option.

   It defines the maximum acceptable Bit Error Rate (BER) for a test. If the measured BER exceeds the threshold, the test is considered failed and **Bit Error Rate** on the Test Results pane turns red.

3 Tap **Test Duration** to set the required test time using the on-screen keyboard.

To conduct optical BERT

The optical BERT feature is available with the ONA-SP-OB10G and ONA-SP-OB25G licenses.

1 Ensure that the fiber optic cable is connected to SFP/SFP+ Port 1 and SFP/SFP+ Port 2 as shown in the figure displayed at the top left of the screen.

2 Tap **Link Rate** and select the desired option from the drop-down menu.

3 Tap 'Rx Optic Limit On' to input High Limit and Low Limit as required.

4 Tap ‘Laser On’ to get the correct signal.

5 Tap the **Testing** icon located at the bottom center of the screen.

6 The right pane of the screen displays the optical test results and port information.

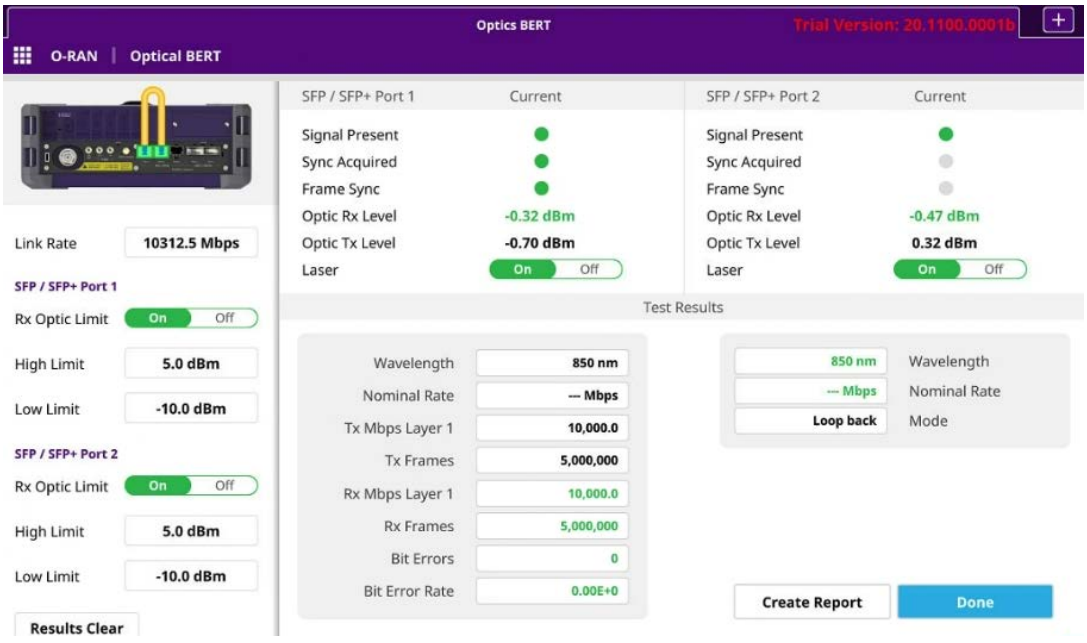
7 Tap the **Create Report** button to save the result in pdf file.

8 Tap the **Done** button to complete the test.

9 *Optional.* Tap the **Results Clear** button to clear the current measurement result.

Figure 371 shows an example of the optical BERT.

Figure 371 O-RAN Optical BERT



21

Optics Testing and Parameters

This chapter provides information about Optics Testing. Topics covered include:

- “Optics Self-Test” on page 828
- “I2C Peek/Poke” on page 829

Optics Self-Test

The Optics Self-Test is available at all base rates corresponding to Ethernet line rates. The purpose is to troubleshoot or sample test pluggable optics.

Running the Optics Self-Test

The following procedure describes how to run the Optics Self-Test.

To run the Optic Self-Test

1. Connect an optical cable between the interface input and output ports.
2. Use the Test Menu screen to select the **Optics Self-Test** application for the interface you are testing.
3. On the next screen you have three configuration options, each with a **Go** button:
   - Edit Previous Configuration
   - Load Configuration from a Profile
   - Start a New Configuration (reset to defaults)

   Select an option by clicking the **Go** button next to it.
4. On the next screen, specify the following:
   - Test Duration. If you set test duration to User Defined, you can define your value in minutes or seconds.
   - BER Threshold. For Ethernet rates with an FEC, there is a BER Threshold Type selection of Pre-FEC (default) or Post-FEC.



NOTE:

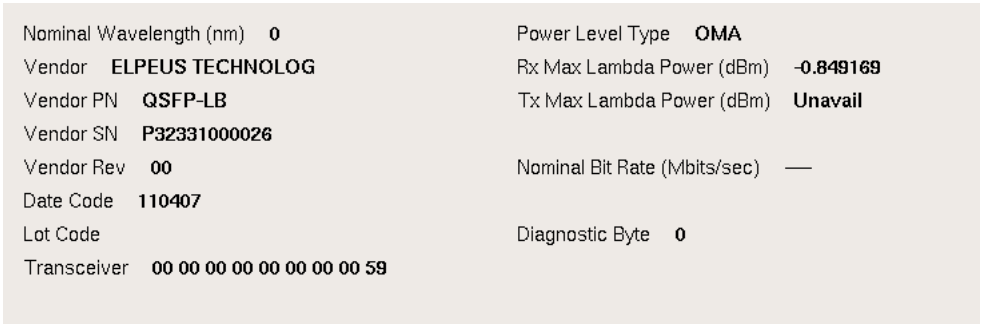
The recommended test times are calculated using BER theory based on the following:

- confidence level (CL) set to 95%
- the user-defined BER threshold
- the duration depends on the line rate selected from the applications menu

   - **Stop on Error.** If enabled, the test stops immediately upon discovery of an out-of-parameter result.
   - Once you have configured your test, you can create a saved profile by clicking the blue **Save Profiles** link. Afterwards you can load these profiles by pressing the **Go To** button and clicking **Configure** to return to the earlier test configuration screen where you can restart the tests.
   - At 25GE with RS-FEC, there is a configuration called 'BER Threshold Type' which can be set to pre-FEC or post-FEC.
5. On the next Report Info screen, either:
   - go to the Job Manager menu under System to use Job Manager.
   - Fill out all entries and press **Next**.

6 On the Run Test screen, start your test by clicking the test button. The results overview appears on the left pane.

7 *Optional*. To verify the specifics of the optic being tested, select the  symbol next to the graphic of the transceiver. A list of specifications (including the SN) similar to the following will appear.



Select the **Back** button to return to the test.

8 Click **Next** to proceed to the Report screen.

Generating Reports

1 After the Optics Self-Test has concluded, select the **Next** arrow at the bottom of the screen.

The Report screen appears.

2 Select the report format in the **Format** pane.

3 To view the report without saving it, select the **View Report button**.

4 To save a report, do the following:

a Enter the filename of the report to be saved. File names of other saved reports are accessible via the **Select** button after the File Name box.

b Click the **Create Report button**. If the **View Report after Creation** check box was checked, the report appears. If not checked, a message appears confirming that the report was saved. Select **OK.**

c If checked, the **Include message log** box will add a message log to the report.

5 If **Job Manager** was activated, the generated report will be available in the report section of the Job Manager application. The reference information lists the Serial Number, Optics type and Vendor.

6 A summary Job Manager report can be generated to provide the summary of all the cable and optics tests performed.

I²C Peek/Poke

I²C Peek/Poke functionality allows you to read (peek) or write (poke) to SFP or QSFP devices via an I2C interface. For CMIS devices, the CMIS process is used.

For Peek and Poke, the following can be entered as decimal numbers:

- Page Select
- Register Address



NOTE

Typically these values from SFF or CMIS documentation are in decimal. The ONA-800 uses hexadecimal values.

For Poke, the poke value is also a hexadecimal value typically mapping to individual bits for each register.

A peek or poke success result is available; 1 indicates success.

In addition, there is a full register dump file which gets updated with each application launch or when a pluggable device gets reseated. This file gets automatically generate in the bert/reports directory with the following name:

- For SFP devices: SFP_RegisterDump.txt
- For QSFP devices: QSFP_RegisterDump.txt
- For QSFP-DD devices: QSFPDD_RegisterDump.txt

22

Ethernet Testing

This section provides information on testing Ethernet services.

- “About Ethernet testing” on page 832
- “Layer 2 testing” on page 835
- “Layer 3 testing” on page 850
- “Capturing packets for analysis” on page 859
- “Loopback testing” on page 867
- “Inserting errors” on page 867
- “Inserting alarms” on page 868
- “Measuring round trip delay or packet jitter” on page 868

About Ethernet testing

The SPA06MA-O can be used to provision Ethernet, verify end-to-end connectivity, and analyze link performance by simulating different traffic conditions.

Features and capabilities

Features and capabilities include the following when testing an Ethernet service. Several results are provided at the physical, PCS, RS-FEC, and MAC layers:

- 100 Gigabit Ethernet with no FEC — Measure Ethernet/MAC layer traffic.
- 25 Gigabit Ethernet with or without RS(528,514) — Measure pre-FEC and post FEC performance using Ethernet/MAC layer traffic.
- 10 Gigabit Ethernet LAN —Measure Ethernet/MAC layer traffic.
- 1 Gigabit Ethernet LAN —Measure Ethernet/MAC layer traffic.
- RS-FEC — The instrument can transmit correctable or uncorrectable RS-FEC errors, and then measure post-FEC performance on the Ethernet/MAC layer using frame loss ratio measurements. The measurements are provided in a dedicated RS-FEC statistics result category.
- BER testing —You can verify circuit performance by sending BERT patterns over switched (layer 2) and unswitched (layer 1) networks.
- Layer 3 testing
- Class of Service testing —You can verify circuit performance using the Acterna payload pattern to obtain throughput, latency, real-time frame loss, and packet jitter results.
- VLAN and Q-in-Q testing —You can configure, transmit, and analyze traffic carrying SVLAN and CVLAN tags per IEEE 802.1ad to verify that your network can support and prioritize traffic for multiple customers without conflicts. Support of up to four levels of VLAN tags is provided.

  For details, see “Configuring Q-in-Q traffic” on page 839.

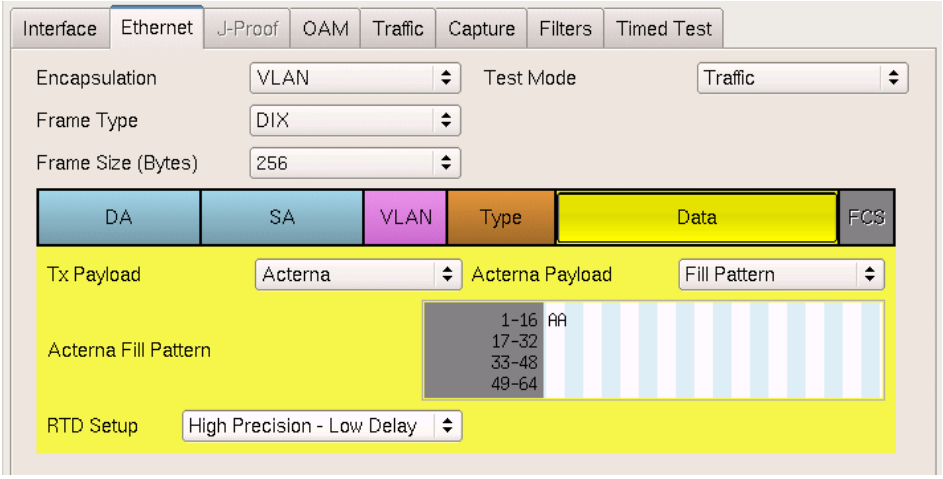
Understanding the graphical user interface

When you configure your module for testing, graphical displays of Ethernet frames are provided on the setup tabs for the application you selected. You can specify frame characteristics for transmitted and filtered traffic by selecting the corresponding field on the graphic, and then entering the value for transmitted or filtered traffic. Colored fields can be edited; fields in gray can not be modified.

Frame settings

Figure 372 illustrates the frame settings for a layer 2 traffic test, with the Data field selected.

Figure 372 Frame Settings



Adjusting the frequency of transmitted optical signals

You can adjust the frequency of transmitted optical signals in increments of 1 PPM or higher.

To adjust the frequency

1. If you haven't already done so, use the Test Menu or Favorites screen to select the test application for the interface you are testing.
2. Connect the module to the circuit.
3. Select the **Laser** button.
4. Select the Laser action bar, and then do one of the following:
   - To increase the frequency by 1 PPM, press Freq Offset +1.
   - To decrease the frequency by 1 PPM, press Freq Offset -1.
   - You increase or decrease the frequency up to 150 PPM.
5. On the transmitting unit, observe the values for the following results in the Interface result group, Signal category:
   - `Tx Freq Max Deviation (ppm)`
   - `Tx Frequency Deviation (ppm)`
6. On the receiving unit, verify that the values for the following results match the transmitted frequency values.
   - `Rx Freq Max Deviation (ppm)`
   - `Rx Frequency Deviation (ppm)`

The frequency was adjusted.

Enabling automatic traffic transmission

You can optionally set up Ethernet test applications to generate and transmit traffic automatically whenever you turn the laser on.

Prerequisites for traffic transmission

If you enable automatic traffic generated, traffic is transmitted after the following occurs:

- You turn the laser ON (using the Laser ON action button).
- A signal is acquired.
- Synchronization is acquired.
- A link is established.

As always, you can turn traffic off at any time using the **Stop Traffic** action button.

Issues to consider

Consider the following issues and behavior before enabling automatic traffic generation:

- **Changing setups while tests are running.** Your unit is designed to handle traffic transmission appropriately when you change key setups while a test is running. In some instances, if you change key setups while running a test, traffic stops temporarily (as a result of the changed setup), and then starts again. In other instances, changing a setup stops traffic entirely until you actively start it again.

  This is still the case when automatic traffic generation is enabled. If you change a setup that causes the unit to stop transmitting traffic entirely, you must actively start it again by pressing the **Start Traffic** action button.
- **loopback testing.** Ensure that your unit is not placed in loopback mode by verifying that the LLB action button is gray. If you intend to issue a command to loop up another unit, make certain automatic traffic generation is not enabled on the far end unit. If it is not disabled, the far end unit will not respond to the loop up command.

Enabling the feature

To enable automatic traffic generation

1 Using the Test menu, launch the test application for the optical interface you are about to test.

2 Select the Setup soft key, and then do the following:

   a Select the Interface tab.

   b Select the Physical Layer sub-tab.

   c Set **Auto-start traffic when laser turned on** to **Yes**.

Traffic will be transmitted after you turn the laser on and the criteria listed in "Prerequisites for traffic transmission" on page 834 is satisfied.

Layer 2 testing

Using the instrument, you can transmit, monitor, and analyze layer 2 Ethernet traffic. Step-by-step instructions are provided in this section for the following:

- "Specifying interface settings" on page 835
- "Specifying Ethernet frame settings" on page 835
- "Specifying traffic load settings" on page 845
- "Transmitting and analyzing layer 2 traffic" on page 849



NOTE:

If during the course of testing you change the frame length (or settings that impact the calculated frame length) while the unit is already transmitting traffic, the unit resets your test results, but some residual frames of the old length may be counted because they are already in the traffic stream.

Specifying interface settings

Before you transmit traffic, you can specify interface settings which specify the source of the reference Signal Clock"

- **Internal** - where synchronization with incoming signal is not necessary (default).
- **Recovered** - from timing signals embedded in incoming signal (Sync-E).
- **External -** stable reference signal input into connectors on the interface panel.

Specifying Ethernet frame settings

Before you transmit traffic, you can specify the frame characteristics of the traffic, such as encapsulation (VLAN, Q-in-Q, up to four stacked VLAN), and payload (Acterna test frames or BERT patterns).

Things to consider

Consider the following before specifying the settings:

- Changing BERT patterns or payload type. In order for a BERT analysis to be reliable, the test configuration must not change for the entire duration of the test. Changing any part of the configuration, including the pattern or source of the frames being analyzed (including changes in loopback) may result in momentary BERT bit errors and a pattern sync loss detected by the receiver after the traffic resumes.

  If you do experience bit errors and sync losses after changing the test configuration (including initiating loop up) and starting traffic, press the Restart soft key to clear the initial burst of errors. If you no longer make configuration changes, you can stop and start traffic without experiencing extraneous bit errors or sync losses. If you continue to see BERT bit errors after performing a test restart, this indicates a problem with the circuit under test.

Specifying the settings

To specify Ethernet frame settings

1 If you haven't already done so, use the Test Menu or Favorite screen to select the test application for the interface you are testing.

2 Select the **Setup** key, and then select the **Ethernet** tab.

3 In **Encapsulation**, select one of the following:

- **None**. If you do not want to encapsulate transmitted frames, select **None**.
- **VLAN.** If you want to transmit VLAN tagged frames, select VLAN, and then refer to "Configuring VLAN tagged traffic" on page 838.
- **Q-in-Q.** If you want to transmit VLAN stacked (Q-in-Q) frames, select **Q-in-Q**, and then refer to "Configuring Q-in-Q traffic" on page 839.
- **Stacked VLAN.** If you want to transmit stacked VLAN frames, select **Stacked VLAN**, and then refer to "Configuring VLAN tagged traffic" on page 838. Up to four levels of VLAN tags are provided.

4 In Test Mode, specify the category of testing being done:

- **Traffic**. Standard mode that transmits unicast frames that satisfy the receiving unit's filter criteria.

5 In Frame Type, specify the type of frame you are transmitting, for example DIX or 802.3.

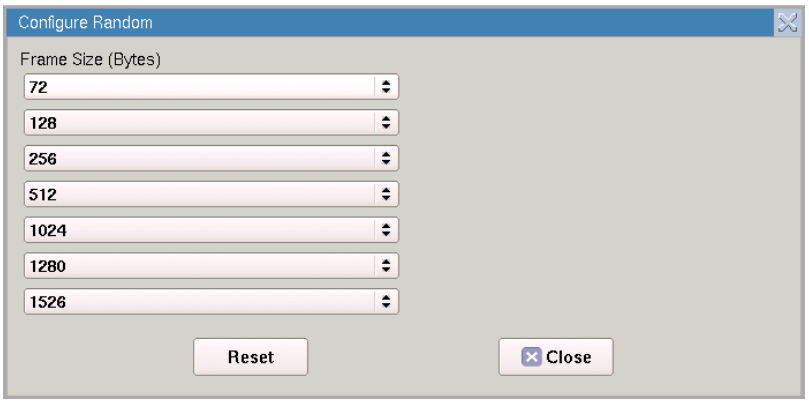
6 If you selected a layer 2 application, in **Frame Size (Bytes)**, select one of the IEEE recommended frame lengths, Random, EMIX or enter a specific Jumbo or User Defined frame length. Frame sizes up to 16,000 bytes can be used.

7 If you selected **VLAN, Q-in-Q,** or **Stacked VLAN** encapsulation, all IEEE recommended frame lengths will be increased in size by 4 bytes for each VLAN tag selected.

If you selected Random or EMIX, use the **Configure** button to specify user-defined random frame sizes, including Jumbo, or select Reset to transmit frames of randomly generated sizes based on the seven RFC 2544 frame length recommendations. EMIX also adds the EMIX Cycle Length field that controls how many

frame entries are sent, in order, before cycling back to the first frame entry and repeating. To define the number of frame entries, enter a number between 1 and 8.

Figure 373 Configure Random Frame Size



– If you are configuring layer 2 traffic, use the graphical display of a frame to specify the following:

Table 148

Frame Label	Setting	Value
DA	Destination Type	Select the type corresponding to the Destination Address that will be inserted in the transmit frames: – **Unicast.** If you select Unicast, the least significant bit of the leftmost byte in the MAC address is forced to 0. – **Multicast.** If you select Multicast, the least significant bit of the leftmost byte in the MAC address is forced to 1. – **Broadcast** If you select Broadcast, the MAC address is automatically FFFFFFFFFFFF.
	Destination MAC	If you specified Unicast or Multicast as the destination type, enter the destination address using a 6 byte hexadecimal format.
	Loop Type	Select one of the following: – **Unicast.** The unit will issue a unicast message and loop-up the device with the Destination MAC address that you specified. – **Broadcast.** The unit will issue a broadcast hello message, and will then send a unicast loop-ip to the first device on the circuit that responds to the hello.

Table 148

Frame Label	Setting	Value
SA	Source Type	Select **Factory Default** or **User Defined**.
	User MAC	If you specified User Defined, enter the unicast source MAC address using a 6 byte hexadecimal format.
	Auto Increment MAC	If you would like the unit to automatically increment the MAC address carried in each frame by one, select **Yes**.
	# MACs in Sequence	If you indicated that you would like the unit to increment the MAC addresses, specify the number of MACs in the sequence. The addresses will be assigned in succession, and will repeat after the number specified for the sequence is complete.
	Disable OoS Results	If you indicated that you would like the unit to increment the mac addresses, any results from out of sequence result (lost frames) will show “N/A” in the results display.
Type	EtherType	If Tx Payload is Acterna, specify the desired Ethertype value from 0x0600-0xFFF. Received ATP frames must have the same ethernet type to be recognized as Acterna Test Packets.
Data	TX Payload	Select from- – **Acterna.** To transmit frames that contain a sequence number and time stamp so that lost frames, round trip delay, and jitter can be calculated, select **Acterna**. – **Acterna Fill Pattern**- these may be filled with any hexadecimal bytes, up to a total of 64 bytes. **For 10GE, the fill pattern is 1 byte.** – **BERT.** To transmit frames with payloads filled with the BERT pattern you specify, select **BERT**, and then select a pattern. – The pseudo-random patterns continue from one frame into the next. The fixed patterns, if available, restart each frame, such that the frame will always start with the beginning of the pattern.

8 If you need to specify other settings for the test, select the appropriate tab; otherwise, press **Results** to return to the Main screen.

The frame settings for transmitted traffic are specified.

Configuring VLAN tagged traffic

To configure VLAN tagged traffic

1 After selecting VLAN as your encapsulation, on the graphic of the frame, select **VLAN**

2 Enter the VLAN ID transmitted in the VLAN ID field in a decimal format ranging from 0 to 4095.

3 In User Priority, select the priority (0 to 7) from the drop-down menu.

4 If you are configuring traffic for a layer 2 application, return to "Specifying Ethernet frame settings".

VLAN settings are specified.

Configuring Q-in-Q traffic

To configure Q-in-Q traffic

1 After selecting **Q-in-Q** as your encapsulation, on the graphic of the frame, select SVLAN, and then specify the SVLAN ID, SVLAN User Priority, DEI Bit, and SVLAN TPID for the service provider.

2 Select CVLAN, and then specify the VLAN ID and User Priority for the customer's traffic.

3 Return to "Specifying Ethernet frame settings" for details on specifying the remaining settings.

Q-in-Q settings are specified.

Configuring stacked VLAN traffic

To configure stacked VLAN traffic

1 After selecting **Stacked VLAN** as your encapsulation, on the graphic of the frame, select VLAN Stack, and then specify the stack depth (number of VLANs).

2 For each VLAN, specify the **SVLAN ID**, **SVLAN User Priority**, **DEI Bit,** and **SVLAN TPID** for the service provider. You can now specify a User Defined TPID if you choose to.

3 Select **CVLAN**, and then specify the **VLAN ID** and **User Priority** for the customer's traffic.

4 Return to "Specifying Ethernet frame settings" for details on specifying the remaining settings.

Stacked VLAN settings are specified.

Specifying Ethernet Filter settings

Before transmitting traffic, you can specify settings that indicate the expected received payload and determine which frames or packets will pass through the filter and be counted in the test result categories for filtered traffic. For example, you can set up the

filter to observe results for all traffic sent to a specific destination address. The filter settings may also impact other results.



NOTE

During Layer 2 BER testing, incoming frames must pass the filter to be analyzed from a BERT pattern. Local loopback is also only performed on frames that pass the filter. Use the filter to analyze BERT frames when non-test frames are present, such as spanning tree frames.

To specify Ethernet filter settings

1. If you haven't already done so, use the Test Menu or Favorite screen to select the test application for the interface you are testing.
2. Select the **Setup** key, and then select the **Filters** tab. By default, a summary of all applicable filter settings appears (Ethernet, IP, and TCP/UDP).
3. In the panel on the left side of the tab, select **Basic**, then set the Filter Mode to **Detailed**.
4. To specify layer 2 filter settings, in the panel on the left side of the tab, select Ethernet, then do the following:
   - **a** If you want to filter traffic based on the type of encapsulation used, specify the following values:

Setting	Value
Encapsulation	Select one of the following: – **None.** The instrument will analyze unencapsulated traffic. – **VLAN**. The instrument will analyze only VLAN encapsulated traffic for the parameters you specify. – **Q-in-Q**. The instrument will analyze only Q-in-Q encapsulated traffic for the parameters you specify. – **Stacked VLAN**. The instrument will analyze only stacked VLAN encapsulated traffic for the parameters you specify. – **Don’t Care.** The instrument will analyze traffic satisfying all other filter criteria regardless of encapsulation.
VLAN	If you specified VLAN as the encapsulation type, on the graphic display of the frame, select VLAN and then specify the VLAN ID carried in the filtered traffic.
User Priority	If you specified VLAN as the encapsulation type and you want to filter for traffic with a specific user priority, specify the priority or select **Don’t Care**.

   - **b** In the Frame Type, specify one of the following:

Frame Type	Description
DIX	To analyze DIX frames only, select DIX**.**

Frame Type	Description
EtherType	If you specified DIX as the frame type, specify the Ethertype by selecting the Type field on the graphic of the frame. If you do not specify the EtherType, the module will filter the traffic for DIX frames with the currently specified EtherType value.
802.3	To analyze 802.3 frames only, select 802.3.
Data Length (bytes)	If you specified 802.3 as the frame type, specify the data length by selecting the Length field on the graphic of the frame. If you do not specify the length, the module will filter the traffic for 802.3 frames with the currently specified length.
Don't Care	If you want to analyze both DIX and 802.3 VLAN or Q-in-Q encapsulated traffic, select Don't Care. You must specify a frame type if you are filtering encapsulated traffic.

Filtering traffic using Q-in-Q criteria

If your instrument is configured to transmit Q-in-Q encapsulated traffic, you can filter received traffic using Q-in-Q criteria.

To filter traffic using Q-in-Q criteria

1. If you haven't already done so, use the Test Menu or Favorites screen to select the layer 2 or layer 3 test application for the interface you are testing.
2. Select the Setup soft key, and then select the Ethernet tab. Verify that Q-in-Q is specified as the encapsulation.

3 Select the Filters tab. In the panel on the left side of the tab, select Ethernet, then specify the following:

a On the graphic of the frame, select **SVLAN** and specify the following:

Setting	Value
SVLAN ID	Specify the SVLAN ID carried in the filtered traffic.
SVLAN User Priority	If you want to filter traffic for a specific user priority, specify the priority; otherwise select **Don't Care**.
SVLAN DEI Bit	If you want to filter traffic for a specific DEI Bit, specify the bit value; otherwise select **Don't Care**.
SVLAN TPID (hex)	Specify the TPID carried in the filtered traffic. If you are transmitting traffic with a user defined TPID, your instrument will automatically use the TPID that you specified in the User SVLAN TPID (hex) field. **NOTE**: If you want to filter on a user-defined TPID, you must also enter that TPID on the RX Payload/TPID setup page.

b On the graphic of the frame, select CVLAN and specify the following:

Table 149

Setting	Value
Specify VLAN ID	If you specified Q-in-Q as the encapsulation type, and you want to filter traffic for a specific CVLAN, select **Yes**; otherwise, select **Don't Care**.
VLAN ID	If you specified Q-in-Q as the encapsulation type and indicated you want to filter traffic for a particular CVLAN, specify the VLAN ID carried in the filtered traffic.
User Priority	If you specified Q-in-Q as the encapsulation type, and you indicated that you want to filter traffic for a partic- ular CVLAN, specify the User Priority carried in the filtered traffic.

4 If you want to analyze/detect frames carrying User Defined SVLAN TPID as Q-in-Q traffic, you have to specify the expected User Defined TPID value(s) on the **Filters->Rx->TPID** page. The TPID values on this page are used to recognize Q-in-Q traffic with User Defined TPID. If you want to analyze/detect Q-in-Q traffic carrying the same TPID that you specified for transmitted traffic, check the box for Use Tx User SVLAN TPID.

5 If you need to specify other settings for the test, select the appropriate tab; otherwise, press **Results** to return to the Main screen.

The Q-in-Q filter settings are specified.

Filtering traffic using stacked VLAN criteria

If your instrument is configured to transmit stacked VLAN encapsulated traffic, you can filter received traffic using stacked VLAN criteria.

To filter traffic using stacked VLAN criteria

1 If you haven't already done so, use the Test Menu to select the layer 2 test application for the interface you are testing.

2 Select **Setup**, and then select the **Ethernet** tab. Verify that Stacked VLAN is specified as the encapsulation.

3 Select the **Filters** tab. In the panel on the left side of the tab, select **Ethernet**, then specify the following:

a On the graphic of the frame, select **SVLAN**, and then specify the following:

Setting	Value
SVLAN ID	Specify the SVLAN ID carried in the filtered traffic.
SVLAN User Priority	If you want to filter traffic for a specific user priority, specify the priority; otherwise, select **Don't Care**.
SVLAN DEI Bit	If you want to filter traffic for a specific DEI Bit, specify the bit value; otherwise, select **Don't Care**.
SVLAN TPID (hex)	Specify the TPID carried in the filtered traffic. If you are transmitting traffic with a user defined TPID, your instrument will automatically use the TPID that you specified in the User SVLAN TPID (hex) field.

b On the graphic of the frame, select **CVLAN**, and then specify the following:

Setting	Value
Specify VLAN ID	If you specified stacked VLAN as the encapsulation type, and you want to filter traffic for a specific CVLAN, select **Yes**; otherwise, select **Don't Care**.
VLAN ID	If you specified stacked VLAN as the encapsulation type, and you specified indicated that you want to filter traffic for a particular CVLAN, specify the VLAN ID carried in the filtered traffic.
User Priority	If you specified stacked VLAN as the encapsulation type, and you specified indicated that you want to filter traffic for a particular CVLAN, specify the User Priority carried in the filtered traffic.

4 If you want to analyze/detect frames carrying User Defined SVLAN TPID as Stacked VLAN traffic, you have to specify the expected User Defined TPID value(s) on the Filters->Rx->TPID page. The TPID values on this page are used

to recognize Stacked VLAN traffic with User Defined TPID. If you want to analyze/detect Stacked VLAN traffic carrying the same TPID that you specified for transmitted traffic, check the box for Use Tx User SVLAN TPID.

5 If you need to specify other settings for the test, select the appropriate tab; otherwise, press **Results** to return to the Main screen.

The stacked VLAN filter settings are specified.

Filtering traffic using payload criteria

You can filter traffic using payload criteria, or you can turn payload analysis off entirely.

To specify payload filter settings

1 In the panel on the left side of the tab, select **Rx Payload**, then specify the following:

Setting	Value
Payload Analysis	Specify one of the following: – **Off.** If you want the module to monitor and analyze live Ethernet traffic by suppressing lost frames (LF) or BERT errors in their associated result counts and as triggers for LEDs during payload analysis, select Off. – **On.** If you want to analyze traffic carrying a particular BERT pattern, select On.
Use Tx BERT settings	Specify one of the following: – If you want the module to monitor and analyze traffic carrying a different BERT pattern than the one specified for transmitted traffic, clear the box. – If you want to analyze traffic carrying the same BERT pattern carried in transmitted traffic, check the box.
Rx Payload (Payload Analysis On, and Use Tx BERT settings un-checked)	Specify **Acterna** or **BERT**.
Rx BERT Pattern Payload Analysis On, and Use Tx BERT settings un-checked)	If you unchecked Use Tx BERT settings, specify the BERT pattern carried in the filtered traffic.

Payload filter criteria is specified.

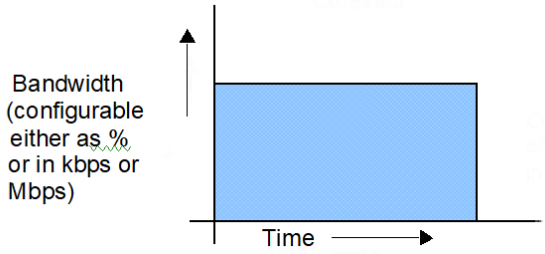
Specifying traffic load settings

Before transmitting traffic, you can specify the type of traffic load the unit will transmit (Constant, Bursty or Ramp). The settings vary depending on the type of load. When configuring a load, you can specify the bandwidth of the transmitted traffic in 0.001% increments.

Transmitting a constant load

With a **constant** load, the module transmits frames continuously with a fixed bandwidth utilization. You can specify the load as a percent or a bit rate. See Figure 374.

Figure 374 Constant traffic



When you setup a constant traffic load, if you are running a standard Ethernet application, you can specify the bandwidth as a percentage of the line rate (%BW) or at a specific bit rate. The bit rate can be specified in Gbps.

To configure the module to transmit a constant load of traffic

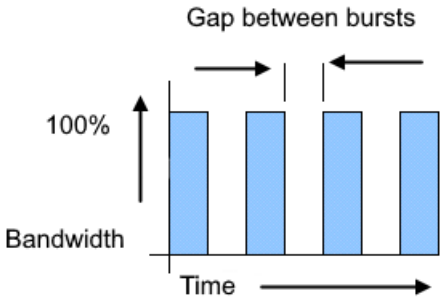
1. If you haven't already done so, use the Test Menu to select the test application for the interface you are testing.
2. Select the **Setup** key, and then select the Traffic tab.
3. In Load Type, select **Constant**.
4. In Load Unit:
   - **a** select one of the following:
     - **Percent**. If you select Percent, in **Load %**, enter the duty cycle as a percentage.
     - **Bit Rate**. If you select Bit Rate, in **Load (Mbps)** or Load **(kbps)** enter the bit rate in Mbps or kbps.
     - **Frames Per Second**.
   - **b** Select the **Allow flooding** check box to transmit a true 100% load in those circuits that you are certain can handle the signal.
5. If you need to specify other settings for the test, select the appropriate tab; otherwise, press **Results** to return to the Main screen.

The module is configured to transmit a constant rate of traffic.

Transmitting a bursty load

With a **bursty** load, the module transmits frames at 100% bandwidth for a specific time interval, followed by no frame transmissions during the specified gap interval. See Figure 375.

Figure 375 Bursty traffic



When you configure bursty traffic, if you are running a standard Ethernet application, you can specify the burst load as a percentage of the duty cycle, or by specifying the burst and gap intervals in units of time, bytes and Information Rate (IR). If you specify the burst load as a percentage of the duty cycle, and then specify the number of frames per burst, the module automatically calculates the burst gap.

To configure the module to transmit bursts of traffic

1. If you haven't already done so, use the Test Menu or Quick Launch screen to select the test application for the interface you are testing.
2. Select the **Setup** soft key, and then select the Traffic tab.
3. In Load Type, select **Burst**.
4. In Load Unit, select one of the following:
   - **Bytes and Information Rate**. Proceed to step 5.
   - **Burst Time and Information Rate**. Proceed to step 5.
   - **Gap Time and Information Rate**. Proceed to step 5.
   - **Bytes and Gap Time**. Proceed to step 5.
   - **Burst Time and Gap Time**. Proceed to step 5.
   - **Frames and Duty Cycle**. Proceed to step 6.

5 If you selected any of the combinations of Time, Rates and Byte, the following parameters may need to be set:



NOTE:

Values may be automatically normalized (rounded to nearest appropriate values) from values entered.

a **Information Rate**. Enter the average throughput rate in Mbps up to the maximum rate of the interface (layer 2 only).

b **Burst KBytes**. Enter the number of Kbytes of data desired to be transmitted in each burst of traffic.

c **Burst Time**. Enter the amount of time that each burst of traffic should be transmitted (will round to the nearest frame transmit time).

d **Time Unit**. Select unit for time entry - sec, msec, usec or nsec.

e **Gap/Idle Time**. Enter the amount of time between each burst. The valid range for this setting adjusts depending on the Burst Time that is entered, to ensure that the duty cycle is at least 1% in 0.001% intervals (will round to the nearest 0.001%).

The following parameters may be displayed as a result of the above selections:

f **Bit Rate (calculated)**. Bits/Time Unit from Burst average throughput rate (will round down to the nearest frame size).

g **Actual KBytes (calculated)**. Actual value of bytes/burst. Values above the line rate can not be entered.

6 If you selected Frames and Duty Cycle as the load unit, set the following:

a **Duty Cycle (%)**. **Enter** the percentage of the line rate (the duty cycle) during which traffic will be transmitted in the burst, from 0.001 - 100%.

b **Frames/Burst Time**. Select a predefined value, or User-Defined, for the number of frames that are to be included in each burst.

c **User Burst Size**. If User-Defined is specified for Frames/Burst, define the User Burst size, 1- 65535 frames.

7 Specify the burst type for the traffic:

– **Fixed**. Sends a fixed number of bursts and then stops. If you select Fixed, enter the number of bursts.

– **Continuous**. Sends bursts continuously.

8 If you need to specify other settings for the test, select the appropriate tab; otherwise, press **Results** to return to the Main screen.

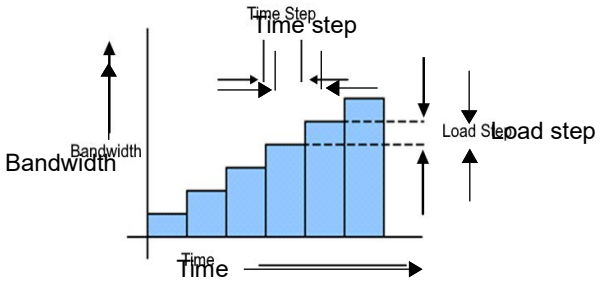
The module is configured to transmit bursts of traffic.

Transmitting a ramped load

With a **ramped** load, the module automatically increases the load by a percentage of bandwidth (specified as the load step) at a particular time interval (specified as the time

step). The process is repeated, allowing you to easily verify the maximum throughput of a link. See Figure 376.

Figure 376 Ramped traffic



You can also specify criteria to tell the module to stop ramping if an error (or errors) occurs in a load step.

To configure the module to transmit a ramped load of traffic

1 If you haven't already done so, use the Test Menu to select the test application for the interface you are testing.

2 Select the **Setup** soft key, and then select the Traffic tab.

3 In Load Type, select **Ramp**, and then specify the following settings:

   a **Time Step (sec)**. Enter the time step in seconds.

   b **Load Step.** Enter the load step as a percentage of the total bandwidth.

4 *Optional*. If you want to stop the ramp from incrementing when certain errors occur, under Stop Load Increments, specify the following:

   – **Errored Frames**. If you want to stop incrementing the load if FCS errored frames are detected, select **Yes**, and then enter the number of errored frames that must be detected to stop the ramp.

   – **Dropped Frames**. If you want to stop incrementing the load if dropped frames are detected, select **Yes**, and then enter the number of dropped frames that must be detected to stop the ramp.



NOTE:

Acterna frames carry a sequence number which the unit uses to determine whether frames were dropped; therefore, you must configure your unit to transmit an Acterna payload, turn payload analysis on, and loop the far-end device back to the traffic originating unit.

5 If you need to specify other settings for the test, select the appropriate tab; otherwise, press **Results** to return to the Main screen.

The module is configured to transmit ramped traffic.

Transmitting and analyzing layer 2 traffic

Before you transmit layer 2 traffic, you must specify:

- Interface settings (see “Specifying interface settings” on page 835).
- Frame characteristics for the transmitted traffic (see “Specifying Ethernet frame settings” on page 835).
- Traffic load settings (see “Specifying traffic load settings” on page 845).

After you specify the layer 2 settings, you are ready to transmit and analyze the layer 2 traffic.



NOTE: Layer 2 BERT testing

Layer 2 BERT patterns carried in a BERT payload are not compatible with BERT patterns carried in an ATP payload. When testing using two instruments, be certain to configure both using the same payload type and BERT pattern.

To transmit and analyze layer 2 traffic

1. If you haven’t already done so, use the Test Menu screen to select the test application for the interface you are testing.
2. Select the **Setup** soft key, and then select the Interface tab to specify settings that control the Ethernet interface (see “Specifying interface settings” on page 835).
3. Select the **Ethernet** tab to specify settings that define the frame characteristics of the transmitted traffic (see “Specifying Ethernet frame settings” on page 835).
4. Select the **Ethernet Filter** tab to specify settings that filter the received traffic based on specified frame characteristics (see “Specifying Ethernet frame settings” on page 835).
5. Select the **Traffic** tab to specify the type of load the unit will transmit (see “Specifying traffic load settings” on page 845).
6. Press **Results** to return to the Main screen.
7. Connect the module to the circuit.
8. If you are testing an optical interface, select the **Laser** button.
9. Select **Start Traffic** to transmit traffic over the circuit.
10. Verify that the green Signal Present, Sync Acquired, and Link Active LEDs are illuminated.
11. At a minimum, observe the summary, link statistics and counts, filter statistics and counts, error statistics, and layer 2 BERT statistics results.

You have analyzed layer 2 traffic.

LBM (Y.1731)

Traffic can be generated up to the line rate using **Test Mode LBM** on the **Ethernet** tab; this is available in the Layer 2 multiple streams application. In this mode, the application generates LBM frames that contain ATP as payload for analysis. A third-party device, typically a router, is expected to loop this traffic back toward the traffic generating test unit as LBR frames; the LBR frame ATP payload can then be analyzed.

Layer 3 testing

Using the instrument, you can transmit, monitor, and analyze layer 3 IPv4 or IPv6 traffic. Step-by-step instructions are provided in this section for the following:

Specifying L3 interface settings

You can specify interface settings before you transmit traffic. Specification of the interface settings is similar for Layer 2, 3, and 4 applications. An explanation of these settings can be found at “Specifying interface settings” on page 835.

Specifying the data mode and link initialization settings

Before transmitting Layer 3 traffic, you must provide the appropriate link initialization settings.

To specify the data mode and initialization settings

1. If you haven’t already done so, use the Test Menu to select the test application for the interface you are testing.
2. Select the **Setup** key, and then select the **Ethernet** tab.
3. In Encapsulation, select one of the following:
   - **None**. If you do not want to encapsulate transmitted traffic, select **None**.
   - **VLAN.** If you want to transmit VLAN tagged frames, select VLAN, and then refer to “Configuring VLAN tagged traffic” on page 838.
   - **Q-in-Q.** If you want to transmit VLAN stacked (Q-in-Q) frames, select **Q-in-Q**, and then refer to “Configuring Q-in-Q traffic” on page 839.
   - **Stacked VLAN.** If you want to transmit stacked VLAN frames, select **Stacked VLAN**, and then refer to “Configuring VLAN tagged traffic” on page 838. Up to four levels of VLAN tags are provided.
4. If you want the unit to issue an ARP request to determine the destination MAC address of the instrument’s link partner, in ARP mode, select **Enabled**; otherwise, select **Disabled**, and then be certain to manually specify the destination MAC address, (see “Specifying Ethernet frame settings” on page 835).

If you enabled ARP, and you only want to respond to ARP requests from devices on the same VLAN specified for transmitted traffic, select **Match VLAN ID(s)**.

NOTE: If you need your unit to respond to ARP requests from other devices (for example, a second test instrument on the circuit), be certain to enable ARP.

5 In Frame Type, specify **DIX** or **802.3**.

6 In Length Type, indicate whether you want to specify the length as a frame size or as a packet length.

- **Frame Size.** If you select Frame Size, select a pre-defined size, or select User Defined or Jumbo, and then specify the size. The calculated packet length (in bytes) appears to the right of the field.
- **Packet Length.** . If you select Packet Length, select a pre-defined length, or select User Defined or Jumbo and then specify the length. The calculated frame size (in bytes) appears to the right of the field.

7 If you want to specify a source address for the traffic, select **SA**, and then specify the following:

- **Source MAC Address.** Select Factory Default or User Defined.
- **User MAC Address.** If you specified User Defined, enter the source MAC address using a 6 byte hexadecimal format.

8 Select the **Filter** tab, and then specify the Ethernet filter settings for the destination type, source type, and encapsulation.

Specifying transmitted IPv4 packet settings

Before you transmit layer 3 IPV4 traffic, you can specify the IP characteristics of the traffic, such as the IP address, the type of payload, and the type of service.

To specify transmitted IPv4 packet settings

1 If you have not already done so, use the Test Menu to select the layer 3 test application for the interface you are testing.

2 Select the **Setup** soft key, and the select the **IP** tab.

3 In Length Type, indicate whether you want to specify the length as a frame size or as a packet length.

- **Frame Size.** If you select Frame Size, you must specify the size on the Ethernet tab, then return to the IP tab to specify the remaining settings.
- **Packet Length.** If you select Packet Length, select a pre-defined length, or select User Defined or Jumbo and then specify the length. The calculated frame size (in bytes) appears to the right of the field.

4 On the illustration of the IP packet, select the **TOS/DSCP** field, and then do the following to indicate how the packet should be prioritized during the transmission:

- In Type, select **TOS** or **DSCP**.
- Specify the TOS or DSCP value. DSCP values are shown as code points with their decimal values in ( ) following. For example: EF(46).

5 Select the **TTL** field, and then specify maximum number of hops to travel before the packet is dropped.

6 Select the **Source/Destination Address** field, and then specify the Source IP Type, Source IP, Default Gateway, Subnet Mask and Destination IP.

A ping button is available.

7 Select the Data field, and then do the following:

– If you want to transmit packets with a time stamp and sequence number, select **Acterna**.

NOTE:

You must select an Acterna payload to measure round trip delay and count lost packets.

– If you want to populate the payload by repeating a specific pattern of bytes, select **Fill Byte**, type the byte value using a 1 byte hexadecimal format.

8 If you need to specify the other settings for the test, select the appropriate tab; otherwise, press **Results** to return to the Main screen.

The transmitted IPv4 packet settings are specified.

Specifying IPv4 filter settings

Before transmitting layer 3 IPv4 traffic, you can optionally specify settings that indicate the expected received payload and determine which packets will pass through the receive filter and be counted in the test result categories for filtered IP traffic. The settings may also impact other results.

To specify received IPv4 packet settings

1 If you haven't already done so, use the Test Menu to select the IPv4 test application for the interface you are testing.

2 Select the **Setup** key, and then select the **Filters** tab.

3 In the panel on the left side of the tab, select **Basic**, then set the Filter Mode to **Detailed**.

4 Specify the Ethernet filter settings. See "Specifying Ethernet Filter settings" on page 839.

5 To specify layer 3 filter settings, in the panel on the left side of the tab, select **IP**.

6 Set the IP Filter to **Enable**, then do the following:

a If you are running an application in Monitor mode, in **IP Version**, select IPv4.

b In **Address Filter**, select one of the following:

Single Direction. To pass through the filter, traffic must satisfy the source and destination address criteria you specified for the filter to be reflected in the L3 Filter Counts and L3 Filter Stats result categories.

Either Direction. The filter will not care which direction the traffic is coming from; therefore, the source address carried in the filtered traffic can be the source address of the near-end unit or port, or the source address of the far end unit or port. Traffic from either source will be reflected in the L3 Filter Counts and L3 Filter Stats result categories.

c On the illustration of the IP packet, select the **TOS/DSCP**, **Protocol**, **Source IP**, or **Destination IP** field, and then enter the filter criteria. This is the criteria that must be carried in the analyzed (filtered) traffic. For descriptions of each of these settings, see "Specifying transmitted IPv4 packet settings" on page 851.

7 If you want the module to monitor and analyze live Ethernet traffic, in the panel on the left side of the tab, select **Rx Payload**, then turn Payload Analysis Off. The instrument will suppress lost frames (LF) in their associated result counts and as triggers for LEDs.

8 If you need to specify other settings for the test, select the appropriate tab; otherwise, press **Results** to return to the Main screen.

The filter settings for IPv4 packets are specified.

Specifying transmitted IPv6 packet settings

Before you transmit layer 3 IPv6 traffic, you can specify the IP characteristics of the traffic, such as the source type and default gateway.

To specify transmitted IPv6 packet settings

1 If you haven't already done so, use the Test Menu or Quick Launch screen to select the layer 3 or layer 4 IPv6 test application for the interface you are testing.

2 Select the **Setup** soft key, and then select the **IP** tab.

3 In Length Type, indicate whether you want to specify the length as a frame size or as a packet length.

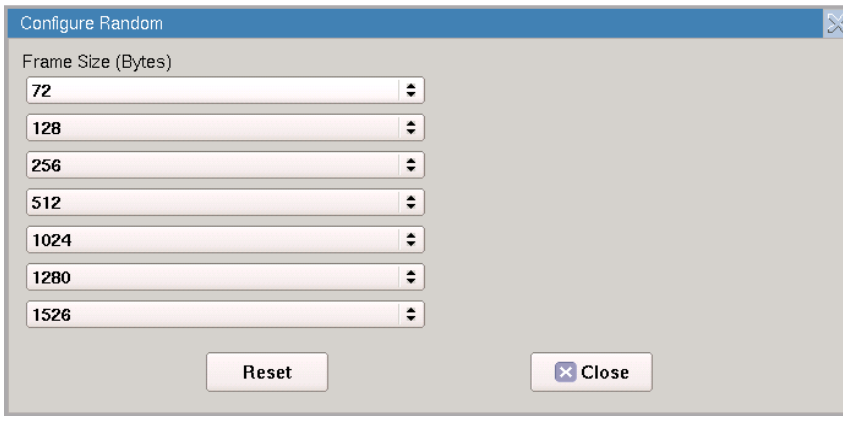
– **Frame Size.** If you select Frame Size, you must specify the size on the Ethernet tab, then return to the IP tab to specify the remaining settings.

– **Packet Length.** If you select Packet Length, select a pre-defined length, or select User Defined, Jumbo, or Random and then specify the length. The calculated frame size (in bytes) appears to the right of the field.

If you selected Random or EMIX, use the **Configure** button to specify user-defined random frame sizes, including Jumbo, or select Reset to transmit frames of randomly generated sizes based on the seven RFC 2544 frame length recommendations. EMIX also adds the EMIX Cycle Length field that

controls how many frame entries are sent, in order, before cycling back to the first frame entry and repeating. To define the number of frame entries, enter a number between 1 and 8.

Figure 377 Configure Random Frame Size



4 On the illustration of the IP packet, select the **Traffic Class** field, and then specify a number representing the traffic class using a hexadecimal format ranging from 0x0 to 0xFF.

5 Select the **Flow Label** field. If you are certain the routers on the circuit support flow labels for traffic prioritization, specify the flow label using a hexadecimal format ranging from 0x0 to 0xFFFFF; otherwise, use the default (0x0).

6 Select the **Next Header** field, then specify the code representing the type of data carried in the next header in the packet using a hexadecimal format ranging from 0x0 to 0xFF.

7 Select the **Hop Limit** field, then specify the time after which a packet can be deleted by any device on a circuit as a number of hops. The default Hop Limit setting is 64 hops.

8 Select the **Source Address** field, then select one of the following:

- **Stateful.** Select Stateful if you want to obtain the required global, default gateway, and DNS server addresses from a DHCPv6 server.
- **Stateless.** Select Stateless if you know that routers on the network allow stateless configuration. When you use Stateless configuration, the instrument generates a tentative link-local address, and then performs Duplicate Address Detection to verify that the address isn't already used. If DAD is successful, the instrument then obtains a subnet prefix from the router to build the required global address.
- **Manual.** Select Manual if you want to specify the source link-local address, global address, subnet prefix length, and default gateway.

9 Select the **Destination Address** field, and then specify the destination address for the traffic.

10 Select the Data field, and then do the following:

- If you want to transmit packets with a time stamp and sequence number, select **Acterna**.

Indicate whether you want the payload to carry a BERT pattern, or a Fill-Byte pattern, then specify the pattern.

– If you are measuring round trip delay on a 10 Gigabit circuit, in RTD Setup, indicate whether you want to measure delay with a high degree of precision, or a low degree of precision. In most instances, you should select **High Precision - Low Delay**.

  NOTE: You must select an Acterna payload to measure round trip delay and count lost packets.

– If you want to populate the payload by repeating a specific pattern of bytes, select **Fill Byte**, type the byte value using a 1 byte hexadecimal format, and then specify the **Protocol**.

11 If you need to specify other settings for the test, select the appropriate tab; otherwise, press **Results** to return to the Main screen.

The transmitted IPv6 packet settings are specified.

Specifying IPv6 filter settings

Before transmitting layer 3 IPv6 traffic, you can optionally specify settings that indicate the expected received payload and determine which packets will pass through the receive filter and be counted in the test result categories for filtered IPv6 traffic. The settings may also impact other results.

To specify received IPv6 packet settings

1 If you haven't already done so, use the Test Menu or Quick Launch screen to select the IPv6 test application for the interface you are testing.

2 Select the **Setup** soft key, and then select the **Filters** tab.

3 In the panel on the left side of the tab, select **Basic**, then set the Filter Mode to **Detailed**.

4 Specify the Ethernet filter settings. See "Specifying Ethernet Filter settings" on page 839.

5 To specify layer 3 filter settings, in the panel on the left side of the tab, select **IP**.

6 Set the IP Filter to **Enable**, then do the following:

a If you are running an application in Monitor mode, in **IP Version**, select IPv6.

b In **Address Filter**, select one of the following:

Single Direction. To pass through the filter, traffic must satisfy the source and destination address criteria you specified for the filter to be reflected in the L3 Filter Counts and L3 Filter Stats result categories.

Either Direction. The filter will not care which direction the traffic is coming from; therefore, the source address carried in the filtered traffic can be the source address of the near-end unit or port, or the source address of the far end unit or port. Traffic from either source will be reflected in the L3 Filter Counts and L3 Filter Stats result categories.

c On the illustration of the IP packet, select the **Traffic Class**, **Next Header**, **Source Address**, or **Destination Address** field, and then enter the filter criteria. This is the criteria that must be carried in the analyzed (filtered) traffic. For descriptions of each of these settings, see "Specifying transmitted IPv6 packet settings" on page 853.

7 If you want the module to monitor and analyze live Ethernet traffic, in the panel on the left side of the tab, select **Rx Payload**, then turn Payload Analysis Off. The instrument will suppress lost frames (LF) in their associated result counts and as triggers for LEDs.

8 If you need to specify other settings for the test, select the appropriate tab; otherwise, press **Results** to return to the Main screen.

The filter settings for IPv6 packets are specified.

IPv6 Ping testing

IPv6 ping is available on the ONA-800 in the IPv6 test application.

Using the instrument, you can verify connectivity with another layer 3 or IP device by sending ping request packets to the device. If responsive, the device responds to the ping request with a ping reply or with another message indicating the reason no ping reply was sent.

Ping testing tells you if the destination device is reachable, how long it took the ping to travel to the destination device and back, and if ping packets were dropped or lost along the way.

Before you transmit ping request packets, you must specify:

- Interface settings (see "Specifying interface settings" on page 835)
- Ethernet Frame settings (see "Specifying Ethernet frame settings" on page 835)



NOTE

Jumbo packets are only supported for DIX traffic (the 802.3 specification does not support jumbo packets).

Jumbo frames are also not supported when the instrument is configure to transmit fast ping packets.

- IP Settings (see "Specifying IP settings for Ping testing" on page 857)

After you specify the ping settings, you are ready to transmit ping request packets.

NOTE

When transmitting ping packets with the with ping Response Time set to Throttled, your instrument automatically inserts a delay, The delay is reflected in the corresponding test results within the Ping and Delay categories.

Specifying IP settings for Ping testing

Before you transmit ping request packets, you can specify settings indicating the source of the IP address (static or assigned by a DHCP server), the destination type (IP address or host name), and attributes of the ping request packets (type, size, type of service, and time to live.

The following procedure describes how to specify IP settings.

To specify IP settings

1. Select the **Setup** soft key, select the **Ethernet** tab, and then specify the Ethernet frame settings (see “Specifying Ethernet frame settings” on page 835.)
2. Select the **IP** tab.
3. In Source Type, select one of the following:
   - **Manual**: To manually assign an IP address as the source address for the traffic, select **Static IP**, and then type the address, subnet mask, and default gateway in the corresponding fields.
   - **Stateful**: Stateful auto-configuration requires a DHCPv6 service.
   - **Stateless**: Allows the client device to self-configure its IPv6 address and routing based on router advertisements.
4. In DNS Type, select manual or auto.
5. In Destination Type, select IP Address or Host Name, and then type the destination IP address or the host name for the ping.
6. Specify the following settings:
   a. In Ping Type, indicate whether you want to transmit a **Single** ping packet, **Multiple** ping packets, a **Continuous** stream of ping packets, or a **Fast** stream of ping packets. If you specify Multiple, enter the number of packets to transmit.

      NOTE

      The rate at which the instruments sends pings depends on the Ping Response Time Setting. Throttled introduces a delay after receiving a response.

   b. In Packet Size (Bytes), enter the size of the ping request packet or packets.
   c. Make selections for the Traffic Class, Flow Label, and Hop Limit fields.

7 If you need to specify other settings for the test, select the appropriate tab; otherwise, press **Results** to return to the Main screen.

The IP settings for ping testing are specified.

Transmitting ping request packets

After specifying the interface, frame, and IP settings, you can transmit ping request packets to verify connectivity.

To transmit ping packets

1 Use the Test Menu to select the layer 3 Ping test application for the interface you are testing.

2 Select the **Setup** soft key, and then select the Interface tab to specify settings that control the Ethernet interface (see “Specifying interface settings” on page 835).

3 Select the **Ethernet Frame** tab to specify settings that define the frame characteristics of the transmitted traffic, and then select the **IP** tab to specify settings that characterize the ping packets (see “Specifying IP settings for Ping testing” on page 857).

4 Press **Results** to return to the Main screen.

5 Connect the module to the circuit.

6 If you are testing an optical interface, select the **Laser** button.

7 Verify that the green Signal Present, Sync Acquired, and Link Active LEDs are illuminated.

8 On the Main screen, select the **Ping** button to transmit the packet or packets.

9 At a minimum, observe the ping and IP configuration status test results.

You have transmitted ping request packets.

Transmitting and analyzing IP traffic

Before you transmit layer 3 IP traffic, you must specify:

- Interface settings (see “Specifying interface settings” on page 835).
- IP characteristics of the transmitted traffic (see “Specifying transmitted IPv4 packet settings” on page 851).
- Traffic load settings (see “Specifying traffic load settings” on page 845).

After you configure the layer 3 IP settings, and you either manually specify the destination device’s MAC address or the unit determines the address using ARP, you are ready to transmit traffic over the link.

To transmit and analyze IP traffic

1. Use the Test Menu to select the layer 3 IP traffic terminate test application for the interface you are testing.
2. Select the **Setup** soft key, and then select the Interface tab to specify settings that control the Ethernet interface (see “Specifying interface settings” on page 835).
3. Specify settings that define the Ethernet frame and the IP packet characteristics of the transmitted traffic (see “Specifying transmitted IPv4 packet settings” on page 851).
4. Select the **Setup** soft key, and then select the **Ethernet filter** tab to specify the Ethernet filter settings. See “Specifying Ethernet Filter settings” on page 839.
5. Select the **Traffic** tab to specify the type of load the unit will transmit (see “Specifying traffic load settings” on page 845).
6. Press **Results** to return to the Main screen.
7. Connect the module to the circuit.
8. Select the **Laser** button.
9. Select **Start Traffic** (for constant or bursty loads) or **Start Ramp** (for ramped loads) to transmit traffic over the circuit.
10. Verify that the green Signal Present, Sync Acquired, Link Active, and IP Packet Detect LEDs are illuminated.
11. At a minimum, observe the summary, layer 2 and 3 link counts and statistics, layer 2 and 3 filter counts and statistics, layer 3 configuration status, and error statistics.

You have analyzed IP traffic.

Capturing packets for analysis

If your instrument is configured and optioned to do so, you can use it to capture transmitted and received packets, save it on the instrument or to an external USB key, and then either send the packets to another technician for analysis, or analyze it yourself using the Wireshark® protocol analyzer.



NOTE

The term “packets” is used interchangeably with “frames” throughout the following section, and represents any of the layer 2 or layer 3 datagrams.

You can capture packets when running any of the Ethernet applications.

What is captured?

All received traffic (test traffic, control plane traffic, and live traffic) that satisfies the user-specified criteria on the Filter setup tab can be captured for all supported interfaces.

Only control plane traffic for transmitted traffic is captured. The scope (extent) of the control plane traffic captured depends on:

- The bandwidth remaining after received traffic captured
- The bandwidth of the transmitted control plane traffic.

Test Traffic

Test traffic is the traffic generated and transmitted by your test instrument carrying an ATP or BERT payload. Test traffic can be captured when it is transmitted, looped back and then captured when it is received, or it can be captured when received from a transmitting instrument on the far end.

You can capture received test traffic for all supported interfaces.

Control plane traffic

Control plane traffic is traffic used to establish a connection with another network element or instrument, request information from the element, or to verify connectivity with the element. Examples of control plane traffic include ARP packets, Ping packets, and software application layer datagrams, such as HTTP, TCP/UDP, or FTP control packets.

You can capture transmitted and received control traffic from all supported interfaces.

How is the capture buffer filled?

You can control how your instrument handles the packets when the buffer becomes full. The instrument can stop capturing packets entirely, or it can wrap (overwrite) the oldest packets in the buffer with new captured packets in 1 MB increments.

After capturing packets to the buffer, you can save them to a PCAP (packet capture) file, which can optionally be compressed using gzip for efficient storage.

Why use frame slicing?

When you configure your instrument to capture packets, you can tell the instrument to capture only the first 64, 128, or 256 bytes of each packet. This allows you to analyze the most important data carried in the packet headers (at the beginning of the packets), and to capture and store more packets in the buffer.

Understanding the Capture toolbar

The buttons on the Capture toolbar start and stop the capture process, save the packets in the capture buffer to the internal USB drive or external drive, or launch Wireshark®.

Figure 381 shows the Capture toolbar.

Figure 378 Capture toolbar



The **%Buffer Full** gauge shows the percentage of the available buffer capacity that is used.

When you capture traffic at a high bandwidth or specify a small buffer size, if you configure the capture to wrap (overwrite) the oldest packets in the buffer with new captured packets in 1 MB increments, the buffer gauge may appear to move erratically.

If you do not wrap the packets the capture process may stop very soon after it is started as the buffer reaches capacity quickly. This is expected behavior.

Specifying filter settings

If you specify filter settings when configuring the application, the settings determine which traffic is captured to the buffer.

Transmitted control plane frames are always captured to the buffer.

To specify filter settings before capturing frames

1. If you have not already done so, use the **Test Menu** or **Quick Launch** screen to select the test application for the interface you are testing.
2. Select the **Setup** soft key, then select the **Filters tab.**

   By default, a summary of all currently configured filter settings appear (Ethernet and IP)
3. If you want to clear the filters to specify new settings for the capture process, select **Clear All Filters**.
4. If you launched a layer 2 application, the panel of the left of the tab displays the **Summary** and **Ethernet** selections. If you launched a layer 3 application, the panel displays the **Summary**, **Basic**, **Ethernet**, and **IP** selections.

   Either:

   a For a layer 2 application, select Ethernet, then specify the settings that capture the received traffic that you want to analyze, as described in “Specifying Ethernet Filter settings” on page 839.

   b For a layer 3 application specifying basic filter information, select **Basic**, then specify the **Traffic Type** and **Address Type** carried in the received traffic you want to capture.

   c For a layer 3 application specifying detailed filter information, select **Basic** then set the **Filter Mode** to Detailed.

Use the Ethernet and IP selections in the pane on the left to display the filter settings for your particular test, then specify the settings that capture the received traffic that you want to analyze. See “Specifying Ethernet Filter settings” on page 839, “Specifying IPv4 filter settings” on page 852, or “Specifying IPv6 filter settings” on page 855.

The filter settings are specified for the capture.

Capturing packets

Capturing packets involves launching and configuring an Ethernet application, specifying the capture settings, and specifying the filter settings. If you are capturing received traffic only, you can start the capture process immediately.



NOTE

Configuring the capture for a large buffer (for example, 256 MB) with small packets (for example, 46 byte ping packets), it will take a long time to fill the buffer. Configuring the capture for a small buffer with large packets will take less time.

To capture packet on the instrument

1. Launch an Ethernet application.
2. Select the **Setup** soft key, then do one of the following:
   - Specify the settings required to filter received traffic for the type you want to capture and analyze.
   - Clear all of the filters to capture all received traffic. See “Specifying filter settings” on page 872 for more information.
3. Select the **Capture** setup tab, then configure the following settings:

Setting	Description
Capture Buffer Size (MB)	Specify a capture buffer size in a 1 MB increments.
Capture frame slicing	Select to capture the first 64, 128, or 256 bytes of each frame (and ignore the rest of the frame; otherwise, select None to capture the entire frame.
When capture buffer is filled	If you want to overwrite the oldest packets with new packets when the buffer becomes full, select Wrap Capture; otherwise, select Stop Capture.

4. Select the **Results** soft key to return to the **Main** screen.
5. If you are capturing transmitted or looped traffic, select **Start Traffic**.

6 Select the **Capture** toolbar, then do the following:

   a Select **Start Capture**. A message appears in the message bar indicating that the capture has started. The **Action** key states Capture Started.

   b If you want to capture packets that show how the traffic is impacted by various events, use the buttons on the **Actions**, **Errors**, and **Fault Signaling** tool bars to insert the events into the transmitted traffic stream.

7 If you want to manually stop capturing packets, select the **Capture Started** action key.

   Packets are captured and stored temporarily in the capture buffer. A count of the number of packets processed is provided in the **Ethernet** result group in the **Capture** category.

Capturing packets based on a trigger

When troubleshooting problems that occur intermittently or inconsistently, the trigger feature allows capture to begin based on a given event. For this scenario, the filters are used as trigger.

To trigger with Filters or FCS Errors

1 Press the **Setup** soft key.

2 Set **Use Filters as** to Trigger.

3 Specify a post-trigger size. This is the amount of data, in MB, to capture after the trigger event occurs.

4 Either:

   – Select **Trigger On Filters** to use settings from the Filters tab as a trigger and continue to Step 5.

   – Select **FCS Error** to trigger on the first FCS error received and skip to Step 8.

5 Select the **Filters** tab, then in the panel on the left side, select **Summary**.

6 Select the **Clear all Filters** button to clear any current filter settings.

7 Select the filter properties that match the traffic criteria you want to include in the capture.

8 Select the **Results** soft key to return to the Main screen.

9 Select the **Capture** toolbar, then select **Start Capture**. A message appears in the message bar indicating that the capture has started and the action key states Capture Started.

The capture begins when the trigger even occurs, which is when the data matches the Filter criteria or FCS Error. Captured packets are stored temporarily in the capture

buffer until saved to a file. A count of the number of packets processed and packets captured is provided in the **Ethernet** result group in the **Capture** category.

NOTE

When capturing packets based on a trigger, the capture buffer saves in wrap-around mode, in which the oldest packets are overwritten with new packets when the buffer becomes full, until the trigger condition is met.

Saving or exporting captured packets

After capturing packets, you can save the packets in the buffer to the internal disk, or export it to an external USB drive. You can save the entire buffer, or you can indicate that you want to save part of the buffer. You can also optionally turn on zip compression.

You can also optionally import a pcap file from an external USB drive to analyze it on your unit.

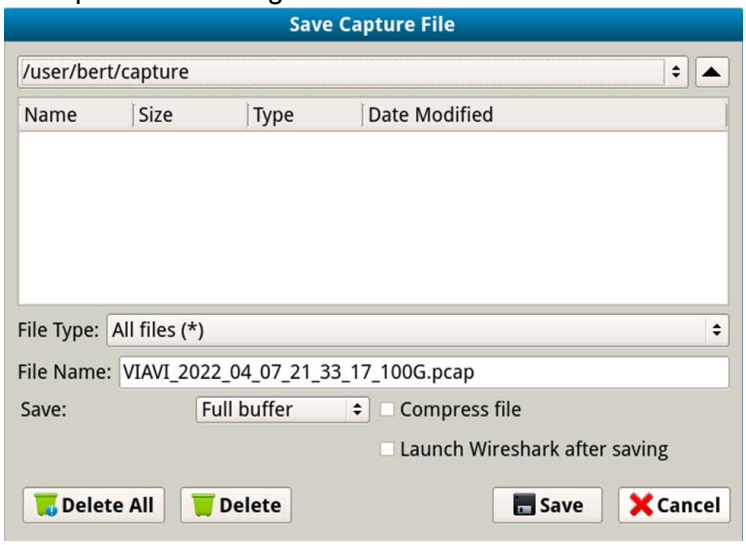
To save the packets in the capture buffer

1 Capture the packets, as described in "Capturing packets" on page 862 and "Capturing packets based on a trigger" on page 874.

2 Select **Save Capture Buffer**.

The Save Capture File dialog box appears, as shown in Figure 379.

Figure 379 Save Capture File dialog box



3 At the top of the dialog box, select one of the following:

To	Select
Save the captured packets to the internal USB drive	/user/bert/capture

To	Select
Save the captured packets to an external USB drive	/user/bert/usbflash

4 Configure the following:

Setting	Description
File Type	To see all files stored in the location specified in Step 3, select **All Files**. Otherwise, select PCAP files to view only the captured files.
File Name	To specify a filename instead of accepting the default, type the name using the popup keypad. You do not have to specify the .pcap file extension, as the instrument will do so automatically.
Save	Select one of the following: To save all of the packets in the buffer, select **Full Buffer**. To save only some packets in the buffer, select **Partial Buffer**.
From	If you indicated that you only want to save part of the buffer by selecting Partial Buffer, specify one of the following: Start of buffer End of buffer
Amount	If you indicated that you only want to save part of the buffer by selecting Partial Buffer, specify one of the following: The number of MB to save The percentage of the buffer to save
Compress File	By default, the instrument does not compress the file. Select this setting to save the packets in a compressed format (.gz).
Launch Wireshark after saving	Select this setting to launch Wireshark® immediately after saving the packets.

5 Select the **Save** button at the bottom of the dialog box.

A box appears above the Main screen showing the percentage of the buffer that has been saved. When the buffer is saved, the box closes. If you indicated that you wanted Wireshark® to launch immediately after saving the buffer, the Wireshark® application appears.

The packets in the capture buffer are saved or exported.

ALERT

You will lose the entire contents of the capture buffer if you launch a new application on the port that you are capturing packets on, or if you turn your instrument OFF. To ensure that the packets are stored, save the capture buffer before changing applications or turning the instrument OFF.

Analyzing the packets using Wireshark®

After saving the packets in the capture buffer to a PCAP file, you can analyze the packets in detail on the instrument using the Wireshark® protocol analyzer.

Files exceeding 16 MB should not be analyzed on the instrument. Large files should be exported for analysis on another device. If you attempt to analyze a file with more than 50,000 packets, the instrument will alert you that the file should be exported for files exceeding 16 MB should not be analyzed on the instrument.

IMPORTANT: Wireshark® Support

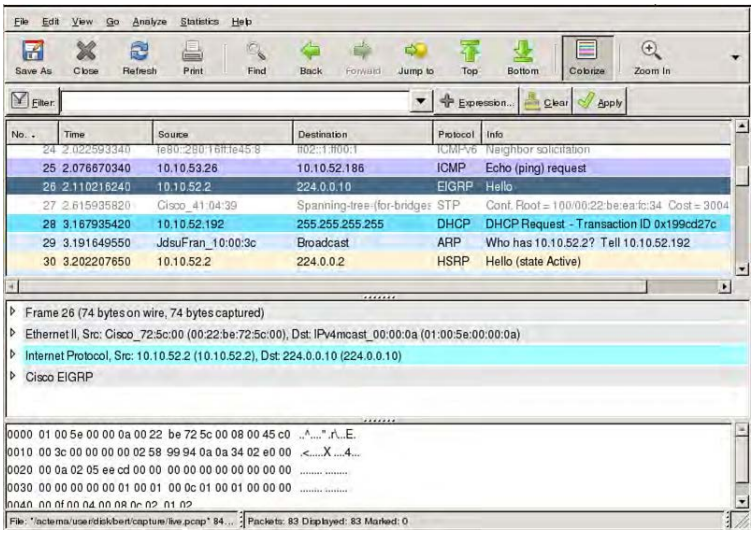
VIAVI distributes Wireshark® under the GNU General Public License, version 2. It is not a VIAVI product. For technical support, go to the product website at www.wireshark.org.

To analyze captured packets

1. On the Capture toolbar, select the Wireshark action key. The Open Capture File dialog box appears.
2. Navigate to and select the file you want to analyze.

   The Wireshark® splash screen appears, then a small dialog box appears while the application loads the packets in the file you selected.
3. After the packets are loaded, a screen similar to the one shown in Figure 380 appears.

Figure 380 Sample Wireshark® screen



4 Use the controls at the top of the screen to locate and evaluate the packets. For technical support and product documentation, go to www.wireshark.org.

You are analyzing captured packets.

Loopback testing

Loopback testing allows you to transmit traffic from one VIAVI Ethernet test set, and then loop the traffic back through a second unit on the far end of a circuit. For details, refer to Chapter 22 “ Ethernet Testing”.

Inserting errors

Action buttons on the Main screen allow you to insert errors and pause frames into the traffic stream. If you turn on a particular error insertion rate, the error insertion continues even after you restart a test or change the test configuration.

To insert errors

1 Using the Test Menu, select the terminate test application for the signal, rate, and payload you are testing.

2 When inserting errors, select one of the following error types:

– RS-FEC Corr. CW

– RS-FEC Uncorr. CW

3 Specify the Insertion Style (**Single**, **Burst**, **Rate**, or **Continuous**).

– If you specified Burst, specify the number of errors in the burst.

– If you specified Rate, select a rate.

– Select **OK.**

4 Press the **Error Insert** button.

5 At a minimum, observe the summary, layer 2 link counts and statistics, error statistics, and event log.

If you are inserting errors at a particular rate, the associated button turns yellow. To stop insertion, press the corresponding button again. Error insertion stops, and the associated button turns gray.

Inserting alarms

You can insert multiple types of alarms simultaneously.

To insert alarms or faults

1 Using the Test Menu, select the terminate test application for the signal, rate, and payload you are testing.

2 Connect a cable from the appropriate TX connector to the network's RECEIVE access connector.

3 Select the **Laser** button.

4 Select an alarm type.

5 For alarms that apply to multi-lane applications, specify the number of the lane in which the alarm is to be inserted or select **All**.

6 Press the **Alarm Insert** button.

The module inserts an alarm or defect, and the button turns yellow.

To stop insertion (Multiple alarms)

- Press the **Alarm Insert** button again.

Alarm insertion stops, and the button turns gray.

Test results associated with the alarm appear in the Status result category.

Measuring round trip delay or packet jitter

You can measure round trip delay or packet jitter by transmitting an Acterna payload. The Acterna payload carries frames with timestamps, enabling the instrument to calculate the delay and jitter. To measure round trip delay, you must use a loopback configuration.

You can measure packet jitter (the difference in one-way-delay as experienced by a series of packets) using either a loopback or an end-to-end configuration. When measuring packet jitter, your unit must receive three or more Acterna frames or packets before measurement begins.

To measure round trip delay or packet jitter

1 Use the Test Menu to do one of the following:
   – Select the layer 2 or layer 3 traffic terminate test application for the interface you are testing.

2 Select the **Setup** soft key, and then do the following:
   – With a layer 2 traffic application, select the Ethernet setup tab.
   – Select the DATA field to specify that transmitted frames will carry an Acterna payload.

3 If you need to specify other settings for the test, select the appropriate tab; otherwise, press **Results** to return to the Main screen.

4 Connect the module to the circuit.

5 If you are testing an optical interface, select the **Laser** button.

6 Verify that the green Signal Present, Sync Acquired, and Link Active LEDs are illuminated.

7 At a minimum, observe the delay and jitter test results in the Ethernet L2 Link Stats.

Round trip delay and packet jitter are measured.

Measuring Peak IFG

You can use two instruments or ports in an end-to-end configuration, or one port to a loopback point to measure the Peak InterFrame Gap (IFG). This measurement determines the service disruption time typically resulting from a link switchover on a network.



NOTE

VIAVI recommends sending traffic at constant line rate (100%) for the most accurate measurement.

By default (as per Ethernet standards), a port typically stops transmitting traffic when a fault or alarm is detected on the receive path. For Peak IFG, it is recommended you decouple Tx and Rx on the test port, such that the transmitter will ignore the state of the receiver; the default setting is Couple.

The Peak IFG function measures the longest IFG during a test. Before measuring a service disruption event, it is recommended that you click the Reset Peak IFG Result button on the Peak IFG panel at the bottom of the main screen. This is also where the Tx and Rx couple/decouple settings are found.



NOTE

Decoupling Tx and Rx is only applicable to the Peak IFG function. For any other measurements or analysis, set to Couple (default). This meets the standard Ethernet requirements.

To measure Peak IFG

1 Using the Test Menu, select the layer 2 or layer 3 traffic terminate test application at the Ethernet rate to use.
   – If using 1 port to a loopback, this is done on that single port.
   – If using 2 ports, both should run the same application; one will transmit traffic while the other will measure the Peak IFG time.

2 Connect to the network under test. Blinking LEDs on the connector panels indicate which connectors to use for your test.

3 Set the Traffic Rate on the transmitter port from the **Setup > Traffic** tab. It is recommended to set
   – **Load Unit** to percent
   – **Load%** to 100%
   – **Allow flooding** enabled.

4 On the transmitting port, ensure the **Setup > Laser** button is set to enabled

5 On the receiving port which can be the same or different as the transmitting port depending on the set up, verify that the green Signal Present, Sync Acquired, and Link Active LEDs are illuminated.

6 On the transmitting port, Start traffic under the **Actions** tab.



NOTE

You can eliminate this step by selecting ‘Auto-start traffic when laser turned on under **Results > Interface > Physical Layer**.

7 On the receiving port that will measure the Peak IFG:
   a Go to **Results**.
   b In the **Peak IFG** tab at the bottom of the screen, set **Tx and Rx** to decouple.

8 Click the **Reset Peak IFG Result** button to clear the PEAK IFG time.

9 Set a result pane to **Ethernet > L2 Link Stats** and scroll to the bottom to see the Peak IFG value. This should be a fairly small value.

10 Initiate the protection switching mechanism in the network under test

11 Observe the **Peak InterFrame Gap** result in **Ethernet > L2 Link Stats**

12 Repeat 8 to 11 for each additional measurement required.

Peak IFG time has been measured.

Capturing packets for analysis

If your instrument is configured and optioned to do so, you can use it to capture transmitted and received packets, save it on the instrument or to an external USB key,

and then either send the packets to another technician for analysis, or analyze it yourself using the Wireshark® protocol analyzer.



NOTE

The term “packets” is used interchangeably with “frames” throughout the following section, and represents any of the layer 2 or layer 3 datagrams.

You can capture packets when running any of the Ethernet applications.

What is captured?

All received traffic (test traffic, control plane traffic, and live traffic) that satisfies the user-specified criteria on the Filter setup tab can be captured for all supported interfaces.

Only control plane traffic for transmitted traffic is captured. The scope (extent) of the control plane traffic captured depends on:

- The bandwidth remaining after received traffic captured
- The bandwidth of the transmitted control plane traffic.

Test Traffic

Test traffic is the traffic generated and transmitted by your test instrument carrying an ATP or BERT payload. Test traffic can be captured when it is transmitted, looped back and then captured when it is received, or it can be captured when received from a transmitting instrument on the far end.

You can capture received test traffic for all supported interfaces.

Control plane traffic

Control plane traffic is traffic used to establish a connection with another network element or instrument, request information from the element, or to verify connectivity with the element. Examples of control plane traffic include ARP packets, Ping packets, and software application layer datagrams, such as HTTP, TCP/UDP, or FTP control packets.

You can capture transmitted and received control traffic from all supported interfaces.

How is the capture buffer filled?

You can control how your instrument handles the packets when the buffer becomes full. The instrument can stop capturing packets entirely, or it can wrap (overwrite) the oldest packets in the buffer with new captured packets in 1 MB increments.

After capturing packets to the buffer, you can save them to a PCAP (packet capture) file, which can optionally be compressed using gzip for efficient storage.

Why use frame slicing?

When you configure your instrument to capture packets, you can tell the instrument to capture only the first 64, 128, or 256 bytes of each packet. This allows you to analyze the most important data carried in the packet headers (at the beginning of the packets), and to capture and store more packets in the buffer.

Understanding the Capture toolbar

The buttons on the Capture toolbar start and stop the capture process, save the packets in the capture buffer to the internal USB drive or external drive, or launch Wireshark®.

Figure 381 shows the Capture toolbar.

Figure 381 Capture toolbar



The **%Buffer Full** gauge shows the percentage of the available buffer capacity that is used.

When you capture traffic at a high bandwidth or specify a small buffer size, if you configure the capture to wrap (overwrite) the oldest packets in the buffer with new captured packets in 1 MB increments, the buffer gauge may appear to move erratically. If you do not wrap the packets the capture process may stop very soon after it is started as the buffer reaches capacity quickly. This is expected behavior.

Specifying filter settings

If you specify filter settings when configuring the application, the settings determine which traffic is captured to the buffer.

Transmitted control plane frames are always captured to the buffer.

To specify filter settings before capturing frames

1. If you have not already done so, use the **Test Menu** or **Quick Launch** screen to select the test application for the interface you are testing.
2. Select the **Setup** soft key, then select the **Filters tab.**

   By default, a summary of all currently configured filter settings appear (Ethernet, IP, and TCP/UDP.)
3. If you want to clear the filters to specify new settings for the capture process, select **Clear All Filters**.

4 If you launched a layer 2 application, the panel of the left of the tab displays the summary and Ethernet selections. If you launched a layer 3 application, the panel displays the Summary, Basic, Ethernet, and IP selections.

Either:

a For a layer 2 application, select Ethernet, then specify the settings that capture the received traffic that you want to analyze, as described in "Specifying Ethernet Filter settings" on page 839.

b For a layer 3 application specifying basic filter information, select **Basic**, then specify the **Traffic Type** and **Address Type** carried in the received traffic you want to capture.

c For a layer 3 application specifying detailed filter information, select **Basic** then set the filter mode to Detailed.

Use the Ethernet, IP, and TCP/UDP selections in the pane on the left to display the filter settings for your particular test, then specify the settings that capture the received traffic that you want to analyze. See "Specifying Ethernet Filter settings" on page 839, "Specifying IPv4 filter settings" on page 852, or "Specifying IPv6 filter settings" on page 855.

The filter settings are specified for the capture.

Capturing packets

Capturing packets involves launching and configuring an Ethernet application, specifying the capture settings, and specifying the filter settings. If you are capturing received traffic only, you can start the capture process immediately.



NOTE

Configuring the capture for a large buffer (for example, 256 MB) with small packets (for example, 46 byte ping packets), it will take a long time to fill the buffer. Configuring the capture for a small buffer with large packets will take less time.

To capture packet on the instrument

1 Launch an Ethernet application.

2 Select the **Setup** soft key, then do one of the following:

– Specify the settings required to filter received traffic for the type you want to capture and analyze.

– Clear all of the filters to capture all received traffic. See "Specifying filter settings" on page 872 for more information.

3 Select the Capture setup tab, then configure the following settings:

4 Select the Results soft key to return to the Main screen.

5 If you are capturing transmitted or looped traffic, select Start Traffic.

6 Select the Capture toolbar, then do the following:

   a Select Start Capture. A message appears in the message bar indicating that the capture has started. The Action key states Capture Started.

   b If you want to capture packets that show how the traffic is impacted by various events, use the buttons on the **Actions**, **Errors**, and **Fault Signaling** tool bars to insert the events into the transmitted traffic stream.

7 If you want to manually stop capturing packets, select the **Capture Started** action key.

   Packets are captured and stored temporarily in the capture buffer. A count of the number of packets processed is provided in the **Ethernet** result group in the **Capture** category.

Capturing packets based on a trigger

When troubleshooting problems that occur intermittently or inconsistently, the trigger feature allows capture to begin based on a given event. For this scenario, the filters are used as trigger.

To trigger with Filters or FCS Errors

1 Press the **Setup** soft key.

2 Set **Use Filters as** to Trigger.

3 Specify a post-trigger size. This is the amount of data, in MB, to capture after the trigger event occurs.

4 Either:
   – Select Trigger On Filters to use settings from the Filters tab as a trigger and continue to Step 5.
   – Select FCS Error to trigger on the first FCS error received and skip to Step 8.

5 Select the **Filters** tab, then in the panel on the left side, select **Summary**.

6 Select the **Clear all Filters** button to clear any current filter settings.

7 Select the filter properties that match the traffic criteria you want to include in the capture.

8 Select the **Results** soft key to return to the Main screen.

9 Select the **Capture** toolbar, then select **Start Capture**. A message appears in the message bar indicating that the capture has started and the action key states Capture Started.

The capture begins when the trigger even occurs, which is when the data matches the Filter criteria or FCS Error. Captured packets are stored temporarily in the capture

buffer until saved to a file. A count of the number of packets processed and packets captured is provided in the **Ethernet** result group in the **Capture** category.



NOTE

When capturing packets based on a trigger, the capture buffer saves in wrap-around mode, in which the oldest packets are overwritten with new packets when the buffer becomes full, until the trigger condition is met.

Saving or exporting captured packets

After capturing packets, you can save the packets in the buffer to the internal disk, or export it to an external USB drive. You can save the entire buffer, or you can indicate that you want to save part of the buffer. You can also optionally turn on zip compression.

You can also optionally import a pcap file from an external USB drive to analyze it on your unit.

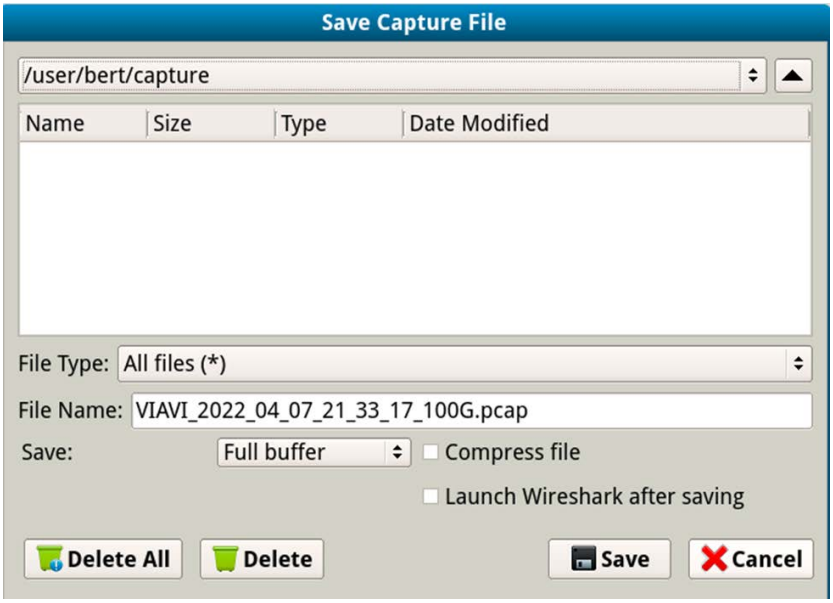
To save the packets in the capture buffer

1 Capture the packets, as described in “Capturing packets” on page 873 and “Capturing packets based on a trigger” on page 874.

2 Select **Save Capture Buffer**.

The Save Capture File dialog box appears, as shown in Figure 382.

Figure 382 Save Capture File dialog box



3 At the top of the dialog box, select one of the following:

To	Select
Save the captured packets to the internal USB drive	/user/bert/capture
Save the captured packets to an external USB drive	/user/bert/usbflash

4 Configure the following:

Setting	Description
File Type	To see all files stored in the location specified in Step 3, select **All Files**. Otherwise, select PCAP files to view only the captured files.
File Name	To specify a filename instead of accepting the default, type the name using the popup keypad. You do not have to specify the .pcap file extension, as the instrument will do so automatically.
Save	Select one of the following: To save all of the packets in the buffer, select **Full Buffer**. To save only some packets in the buffer, select **Partial Buffer**.

Setting	Description
From	If you indicated that you only want to save part of the buffer by selecting Partial Buffer, specify one of the following: Start of buffer End of buffer
Amount	If you indicated that you only want to save part of the buffer by selecting Partial Buffer, specify one of the following: The number of MB to save The percentage of the buffer to save
Compress File	By default, the instrument does not compress the file. Select this setting to save the packets in a compressed format (.gz).
Launch Wireshark after saving	Select this setting to launch Wireshark® immediately after saving the packets.

5 Select the **Save** button at the bottom of the dialog box.

A box appears above the Main screen showing the percentage of the buffer that has been saved. When the buffer is saved, the box closes. If you indicated that you wanted Wireshark® to launch immediately after saving the buffer, the Wireshark® application appears.

The packets in the capture buffer are saved or exported.



ALERT

You will lose the entire contents of the capture buffer if you launch a new application on the port that you are capturing packets on, or if you turn your instrument OFF. To ensure that the packets are stored, save the capture buffer before changing applications or turning the instrument OFF.

Analyzing the packets using Wireshark®

After saving the packets in the capture buffer to a PCAP file, you can analyze the packets in detail on the instrument using the Wireshark® protocol analyzer.

Files exceeding 16 MB should not be analyzed on the instrument. Large files should be exported for analysis on another device. If you attempt to analyze a file with more than 50,000 packets, the instrument will alert you that the file should be exported for analysis.

Files exceeding 16 MB should not be analyzed on the instrument.

IMPORTANT: Wireshark® Support

VIAVI distributes Wireshark® under the GNU General Public License, version 2. It is not a VIAVI product. For technical support, go to the product website at www.wireshark.org.

To analyze captured packets

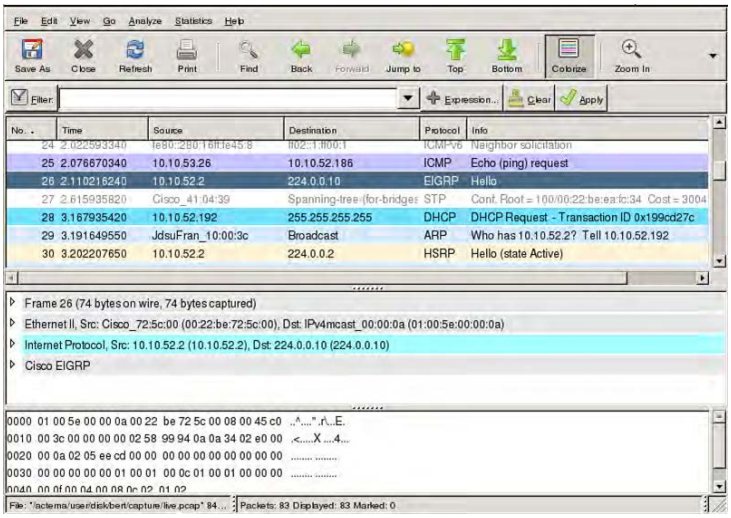
1 On the Capture toolbar, select the Wireshark action key. The Open Capture File dialog box appears.

2 Navigate to and select the file you want to analyze.

The Wireshark® splash screen appears, then a small dialog box appears while the application loads the packets in the file you selected.

3 After the packets are loaded, a screen similar to the one shown in figure appears.

Figure 383 Sample Wireshark® screen



4 Use the controls at the top of the screen to locate and evaluate the packets. For technical support and product documentation, go to www.wireshark.org.

You are analyzing captured packets.

23

PTP/IEEE 1588v2 Testing

This chapter provides information on testing during the turn-up or installation of PTP links or when troubleshooting an active link. Topics in this chapter include:

- “About IEEE 1588 PTP testing” on page 880
- “Analyzing PTP traffic” on page 881

About IEEE 1588 PTP testing

Due to growing wireless traffic volume, xhaul networks are being deployed. In order to ensure accuracy and that inter-cell handoffs are manageable, every base transmission station in the network needs to be able to trace its frequency synchronization back to a primary reference clock. Without synchronization, the mobile devices lose lock which can adversely affect voice and data services or result in dropped calls.

Precision time protocol (PTP) is an industry-standard protocol that enables the precise transfer of frequency and time to synchronize clocks over packet-based Ethernet networks, and is based on IEEE 1588. The PTP protocol specifies master and slave clocks. It synchronizes the PTP local slave clock on each PTP network device with a PTP system Grandmaster clock. PTP distributes the timing at layer 2 or 4 using timestamps embedded within an Ethernet frame or IP/UDP packet; thus, PTP can be transported over native Ethernet or any transport that supports IP/UDP.

If your instrument is optioned to do so, it can be configured as either a slave or a master device in a PTP system. The measurement of the relative stability of this system is the Packet Delay Variation (PDV).

Features and capabilities

If configured and optioned to do so, you can use your instrument during the turn-up or installation of PTP links or to troubleshoot an active link by doing the following:

- Verifying that the link can support PTP
- Verifying that the PTP Master is reachable and can be communicated with
- Verifying that PTP timing messages are received
- Reviewing packet delay variation (PDV) measurements in microseconds
- Measuring master-to-slave and slave-to-master delay
- Measuring and recording T1 - T4 timestamps
- Measuring T1, T4, and two-way constant time errors (cTE) in microseconds.

PTP/1588 test applications

If your instrument is optioned to do so, this release supports the PTP/1588 applications listed in Table 150.

Table 150 PTP/1588 applications

Interface	Application	Test Mode
10 GigE LAN	Layer 2 PTP/1588	Terminate
	Layer 4 PTP/1588 (IPV6)	Terminate
25GigE	Layer 2 PTP/1588	Terminate
	Layer 4 PTP/1588 (IPV6)	Terminate

Optional time sources

In systems where PDV results indicate the need for greater stability, you can use a GNSS Time of Day and 1PPS signal to generate timestamps and provide a reference to a Grandmaster clock. You can also determine the difference between the timestamps of a PTP slave and the timestamps that are provided by an optional, attached GNSS receiver.

An optional Timing Expansion (TEM) Module is also available for the ONA-800 which provides a GNSS receiver and supports more precise PTP measurements. For details concerning the TEM Module, see the *Timing Expansion Module User Manual* that ships with the module.

Wander Analysis of TIE, MTIE, and TDEV data on your instrument requires a highly stable timing reference; therefore, a GNSS receiver or the optional TEM Module must be connected to your instrument before generating the data, calculating results, and then analyzing the results.

Connecting a TEM Module

The optional TEM supplies the 1PPS and the ToD signal that are required to generate PTP timestamps. Instructions for connecting the TEM are provided in the *User Manual* that ships with the module.

The ONA-800 has an internal GNSS receiver that can be used when the TEM is not available.

Before testing, verify that the optional TEM and your instrument are synchronized.

- Verify that the appropriate LEDs on the TEM are flashing or steadily on.
- Verify that the TOD Sync and 1PPS LEDs on the instrument are on.

To ensure maximum accuracy and stability, follow the guidelines regarding preparation time and hold-over stability included in the documentation shipped with the optional TEM.

Analyzing PTP traffic

You can use the instrument to send, receive, and analyze traffic to troubleshoot a PTP link.

To transmit and analyze PTP traffic

1 If you haven't already done so, use the Test Menu or Quick Launch screen to select the PTP/1588 application for the interface you are testing. Refer to Table 150 on page 880 for a list of applications.

2 Select the **PTP** tab, then specify the following settings:

Table 151 PTP Settings

Setting	Description
Mode	Specifies master or slave mode.
PTP Layer	Specifies the encapsulation for PTP. – Layer 2 – Layer 4 IPv6
Address Mode	In Slave mode, specifies the type of message: – Multicast: PTP message (announce, sync and delay request) rates configured on Master. – Unicast: PTP message rates configured on Slave. **NOTE**: If you select Unicast, you can optionally disable the transmission of unicast signaling messages by selecting Disable Signaling.
Domain	Specifies the domain number that is using PTP. The domain is a logical grouping of clocks that synchronize to each other using PTP.
Use 01-80-C2-00-00-0E Destination MAC	If you selected Multicast as your address mode, select this option to ensure that a non-forwardable MAC address is used (01-80-C2-00-00-0E).
Ignore Flags	Ignore Unicast flags in Slave Multicast mode, as per G.827.1.
Sync Type	In Master mode, indicates that the synchronization type is 2 Step. For 10GigE LAN Layer 2/Layer 4 PTP/1588 applications, you can configure the Sync Type to 1 Step or 2 Step.
Master IP Address	If testing layer 4 in slave mode, and the address mode is unicast, enter the IP destination address of the master.
Scope	If testing layer 4 PTP/1588 IPv6, choose the Scope type of either the Local Link or Global.
Master MAC Address	If testing layer 2 in slave mode, and the address mode is unicast, enter the MAC destination address of the master.
Encapsulation	Specify the encapsulation: VLAN, Q-in-Q or None. – If Encapsulation is set to VLAN, specify the ID and priority for the VLAN. – If Encapsulation is set to Q-in-Q, specify the SVLAN ID and SVLAN TPID.
TOS Type	If testing layer 4, specify the TOS type: TOS or DSCP.
TOS	If TOS type is TOS, specify the TOS code.
DSCP	If TOS type is DSCP, specify the DSCP code. DSCP values are shown as code points with their decimal values following in ( ). For example, EF(46).
Message Interval	Specifies the message interval.

Table 151 PTP Settings

Setting	Description
Announce Rx Timeout	If in Slave mode, specify the amount of time that has to pass without receipt of an announce message to trigger a Timeout event.
Query	If testing in the Slave mode and using unicast address mode, specifies the rate at which unicast signaling messages are transmitted.
Announce	Specify the announce message rate - the rate at which announce messages are transmitted. **NOTE:** When using multicast address mode, the announce rate must match for the Master and Slave. Although the Master controls the rate, the Slave must use the same rate, otherwise timeouts occur.
Lease Duration	If testing in the Slave mode and using unicast address mode, specifies the unicast lease duration, in seconds.
Sync	Specify the sync message rate - the rate at which sync messages are transmitted.
Delay Request	Specify the delay request message rate - the rate at which delay request messages are transmitted.
Always configure clock attributes manually.	In Master mode, selecting this option allows for the following setups to be configured independently of timing source.
Priority 1	In Master mode, specify the priority 1 value - the priority is used in the execution of the best master clock algorithm.
Priority 2	In Master mode, specify the priority 2 value - the priority is used in the execution of the best master clock algorithm.
Class	Specify the clock class - the traceability of the time and frequency distributed by the grandmaster clock.
Time Source	Specify the source of time used by the grandmaster clock.
Clock Accuracy	Specify the estimated accuracy of the grandmaster clock.
UTC Offset (s)	Specify the difference in seconds between International Atomic Time (TAI) and Coordinated Universal Time (UTC).
Frequency Traceable	Specify if the frequency determining the timescale is traceable to a primary reference.
Time Traceable	Specify if the timescale and UTC offset are traceable to a primary reference.
PTP Layer	Specifies the encapsulation for the PTP: Layer 2 Layer 4 IPv6

3 Select the **Thresholds** tab, then enable and specify the packet delay variation (PDV) thresholds for the PTP traffic to be analyzed in microseconds (us). Available thresholds are:

- Sync PDV Max (us)
- Delay Request PDV Max (us)
- Floor Packet Measurement. If enabled, opens the following pane:



Window Duration (in seconds). The amount of time to collect packets for each measurement window.

Cluster Range (in microseconds). Adding this value to the measured Floor Packet Delay Minimum defines the upper bound for a floor packet.

FPP Limit (%). This value defines the Pass/Fail threshold for the test. If the FPP (%) for any measurement window is less than the configured FPP Limit then the test will fail.

Window Spacing.

Jumping Window: collects packets for the configured Window Duration and then calculates the Floor Packet Measurement results. Each received packet is included in the results for only a single measurement window.

Sliding Window: Each received packet causes the oldest packet measurement to be discarded and new Floor Packet Measurement results to be calculated. Each received packet is included in the results for many measurement windows.

Settling Time (in seconds). The amount of time to wait before collecting and calculating Floor Packet Measurement results.

Message Type. This control defines whether Floor Packet Measurements are based on Sync or Delay Request messages.

4 If testing Layer 4 IPv6, select the Port Addresses tab and select the Layer 3 Source Address Type method for IPv6:

- **Manual**: Select Manual if you want to specify the source link-local address, global address, subnet prefix length, and default gateway.
- **Stateful**: Select Stateful if you want to obtain the required global, default gateway, and DNS server addresses from a DHCPv6 server
- **Stateless**: Select Stateless if you know that routers on the network allow stateless configuration.

  When you use Stateless configuration, the instrument generates a tentative link-local address, and then performs Duplicate Address Detection (DAD) to verify that the address isn't already used. If DAD is successful, the instrument then obtains a subnet prefix from the router to build the required global address

5 Press **Results** to return to the Main screen.

6 Connect the instrument to the circuit.

7 If you are testing an optical interface, select the **Laser** button.

8 Select the **Start PTP session** button.

9 Verify that the green Signal Present and Link Active LEDs are illuminated.

10 Observe the PTP Link Stats and PTP Link Counts. In particular, review the Constant Time Error and Time Error results.



NOTE:

The PTP session will be terminated if a loop down request is received. If you wish to save the test results, do so before looping down.

You have analyzed PTP traffic.

24

Automated Testing Using Workflows

This section provides information on using the automated scripting programs that are available, depending on the how the unit is equipped and configured. Topics in this chapter include:

- “Launching an automated test” on page 888
- “Automated RFC 2544 tests” on page 889
- “About the Y.1564 SAMComplete test” on page 907
- “5G NR Discovery” on page 916
- “Automated VLAN tests” on page 917
- “Saving automated test report data” on page 918

Launching an automated test

There are two ways to launch automated test scripts from the Test Select application and the automated script in which it is to be run.

- Directly from the Select Test menu, for example by choosing Ethernet, then the line rate, then the automated test RFC 2544, and then the layer L2 Traffic.
- From within a base application, such as “10GigE>Layer 2 Traffic> Term”, specifying the automated test to be run by a soft key on the right side of the interface, or by a button inside the Toolkit which is opened by the Toolkit softkey. Note that all toolkit functions are also provided in the Tools menu (depending on your model, accessed from the menu bar along the top of the interface, or from the Tools icon in the lower-left corner.)

In most cases, the relevant configuration settings are available within the automated test, but if the base application configuration must be changed before running the automated test, use option 2 above to launch the base application, then make the necessary configuration changes, then launch the automated test. You may also use the ‘Load Test…’ menu choice to configure the base application from a Saved Test file before starting the automated test.

To launch from the Select Test menu

1. From the Select Test application tree, select the technology and interface desired. All the applications available for the current configuration of the unit will be displayed.
2. Select the automated script from the top levels of the tree, then the specific test desired. The automated script is launched.

To launch for later use

1. Select the technology and interface desired. All the applications available for the current configuration of the unit will be displayed.
2. Select the base application (from the lower part of the application tree) and then initiate the desired automated script using the on-screen soft key on the right side of the interface.

   The automated script will be launched, ready to be configured.



NOTE:

The Quick Launch window displays previously run and/or saved configurations of applications. Automated scripts launched simultaneously with base applications are fully identified with the script.

To launch from a running application

1. If you haven’t already done so, use the Test Menu or Quick Launch screen to select the appropriate application.
2. Connect the modules on the near-end and the far end to the circuit.

3 Select the **Laser** button to turn the laser on.

4 On both modules, verify that the green Signal Present, Sync Acquired, and Link Active LEDs are illuminated.

5 On the Main screen, do one of the following:

- If you are running the RFC 2544 test, press the **Enhanced RFC 2544 Test** soft key, and proceed to "Configuring the Enhanced RFC 2544 tests" on page 898.
- If you are running the automated multiple Ethernet service verification SAMComplete test, press the **SAMComplete** soft key, and proceed to "About the Y.1564 SAMComplete test" on page 907.

The automated test is launched.

Automated Test Availability

Table 152 lists the available automated tests for each application.

Table 152 Automated Tests

Automated Test	Application
QuickCheck	Ethernet – Layer 2 Traffic – Layer 3 Traffic (IPv4)
Enhanced RFC 2544 Test	Ethernet – Layer 2 Traffic – Layer 3 Traffic (IPv4)
SAMComplete (Y.1564)	Ethernet – Layer 2 Traffic – Layer 3 Traffic (IPv4)
5G NR	Ethernet Layer 3 Traffic (IPv6)
VLAN	Ethernet – Layer 2 Traffic – Layer 3 Traffic (IPv4)

ALERT: CORRUPTED RESULTS

Pressing Restart during a test could corrupt the results. To ensure accurate script results, wait for the script to complete before pressing Restart.

Automated RFC 2544 tests

You can use the instrument to run tests that automate the procedures recommended in RFC 2544 for Ethernet. The tests prompt you to select key parameters for throughput,

round trip delay, frame loss rate, and back to back frame tests, run the tests, and then automatically generates a report file of results for the tests and a log file detailing the progress of the script. The generated report file includes the test results in tabular and graphical formats.

The following topics are discussed in this section:

- "Features and capabilities" on page 890
- "About loopbacks" on page 891
- "QuickCheck" on page 891
- "Throughput test" on page 892
- "Latency (RTD) test" on page 894
- "Packet Jitter test" on page 895
- "Frame Loss test" on page 896
- "Back to Back Frames test (Burst test)" on page 896
- "Optimizing the test time" on page 897
- "Importing and exporting RFC config files" on page 897
- "Configuring the Enhanced RFC 2544 tests" on page 898
- "Specifying the external test settings" on page 899
- "Setting Connection parameters" on page 899
- "Test selection" on page 902
- "Running Enhanced RFC 2544 tests" on page 904

Features and capabilities

The instrument supports the following features when running the RFC 2544 tests:

- Support for Ethernet line rate
- QuickCheck—Before running the Enhanced RFC 2544 test, you can run the QuickCheck application to verify that the local and remote instruments are configured properly to bring up the link, establish the link, establish a loopback, and then verify that the link can support 100% traffic utilization. There is also an extended Layer 2 traffic test useful for quick turn-ups.
- Graphical output of key results. When running the tests, frame loss, throughput, and latency (round trip delay) results are displayed graphically in their own result categories.
- Status bar. A status bar is also provided that lets you know how far the test has progressed, and provides an estimate of the time remaining to run the test.
- Report output. You can save the test results to a user-named file in PDF, XML, or TXT format.
- Enhanced test. You can run the Enhanced RFC 2544 test to run a symmetrical test.
- Exporting and importing of configurations for the Enhanced RFC test.
- The Enhanced RFC tests supports round-trip delay (RTD).

About loopbacks

During the automated tests, the instrument checks for a loopback. It could be one of the following types:

Active loop — the destination has responded to a loop command.

Hard loop — the source and destination addresses are the same for both the returned frames and the outgoing frames.

Permanent loop — the source and destination addresses are switched in the returned frames.

QuickCheck

The QuickCheck application is used to verify that the local and remote instruments are configured properly to bring up the link, establish the link, establish a loopback, and then verify that the link can support 100% traffic utilization. QuickCheck can be launched stand-alone or used integrated into the RFC 2544 or SAMComplete scripts.

There are a number of ways in which the QuickCheck test may be initiated:

- launch QuickCheck directly from the Test menu
- relaunch Quick-Check from an underlying L2 traffic application via the Quick-Check button on the right side of the screen.
- the original simple verification that the local and remote instruments are configured properly to bring up the link accessed through the QuickCheck button in the tool kit.
- an extended Layer 2 Turnup test
- an automatic initiation of the full RFC 2544 test upon completion of the QuickCheck test link verification utilizing maximum throughput rates determined by the QuickCheck test

These options can be run in combination or separately.



NOTE:

After specifying settings for QuickCheck in the standalone QuickCheck test (from the Test menu), you may return to the main app if desired, but you should not change any settings or you must change them back before re-entering QuickCheck. Running the test with settings different than originally set may result in some unexpected errors or failures. To restore test defaults, select restore test to defaults or manually restore any settings that were changed.

Understanding the QuickCheck stages

At each of the three stages of the QuickCheck application, the instrument automatically performs certain actions. Some actions must occur before others can take place. For example, the local port must be up before a loopback can take place.

Local Port

If application for an optical circuit indicates that the local port is down, (indicated by a red **Not Connected** button), verify that the laser is ON on both near and far end instruments. If the application is for an electrical circuit, verify that frame sync and link LEDs are illuminated on both instruments.

Auto-negotiation

Auto-negotiation can not take place until the physical link is established. If at any time during this phase the link or frame synchronization is lost, the instrument will alert the user, and will then restart the application automatically. There is no auto-negotiation at rates above 1GigE.

Remote Loop (traffic test mode)

A remote loop up can not take place until the physical link is established. For 10GigE, a far-end LLB is required.

Basic Load Test

The load test can not take place until a remote loop is established or detected. If a loop is in place, the near end instrument automatically transmits a full load of traffic (100% at the selected line rate) using the frame size that was specified for the application. The instrument then calculates the average layer 2 bandwidth utilization, and displays it as a percentage.

Test at configured Max Bandwidth

With this option selected, the RFC 2544 test will automatically be run upon completion of the QuickCheck test using the Max Bandwidth setting pre-configured on the Setup-All Tests tab.

Layer 2 Quick Test

The Layer 2 Quick Test extended test option operates in the symmetric, loopback mode. The test can be configured to set the length of time the test is to be run and to configure the CIR in the RFC 2544 settings with a percentage of the Throughput value detected. The default value will be 100% (i.e. CIR will be 100% of the QuickCheck Throughput).

Throughput test

The throughput test is used to determine the highest possible bandwidth at which no frames are lost.

VIAVI zeroing-in method

The VIAVI zeroing-in method functions as follows:

Attempting Phase

- The test starts transmitting traffic at the Maximum Bandwidth, then waits 3 seconds.
- The test does a restart, then waits 5 seconds.
- The test calculates the average layer 2 bandwidth utilized (L2 Avg. % Util).
- If the Bandwidth Accuracy is 1% and the L2 Avg. % Util is less than 99.98%, the throughput is the integer value of the measurement. Otherwise, throughput is 100%.
- If the Bandwidth Accuracy is .1% or .01%:
  - The test increases the load 3% over the L2 Avg. % Util measured above.
- If the Bandwidth Accuracy is .1% or .01%:
  - Start traffic at the rate calculated above
  - Wait 3 seconds
  - Do a test restart
  - Wait 5 seconds
  - Get the L2 Avg. % Util

For .1% accuracy, Throughput is calculated as:

- The (integer value of L2 Avg.)% Util * 10 divided by 10

For .01% accuracy, Throughput is calculated as:

- The (integer value of L2 Avg.)% Util * 100 divided by 100



NOTE

The minimal throughput values for mismatched (asynchronous) rates are 100K to 10G. Anything below 100k (such as 10k) that comes into a 10G unit will not be detected because it is below the threshold granularity supported. (0.001% of 10G = 100k)

Verifying Phase

The load is set to the calculated throughput value, and transmitted for the Throughput Duration time. If the frame loss tolerance is exceeded, instructions are provided for testing the link manually for intermittent problems, and the test is aborted.

Throughput test results

The following results are reported for every frame length selected.

Cfg Length (Mbps)

The bit rate for transmitted traffic (expressed in Mbps) at which no frames were lost for a particular frame length.

Measured Rate (Mbps)

The measured bit rate (expressed in Mbps) at which no frames were lost for a particular frame length.

Measured Rate (%)

The bit rate (expressed as a percentage of the line rate) at which no frames were lost for a particular frame length.

Measured Rate (frms/sec)

The peak frame rate (expressed in frames per second) at which no frames were lost for a particular frame length.

Pause Detected

These results are also reported when you run the Latency and Packet Jitter tests.



NOTE:
If QuickCheck is not performed, the report may show loop type achieved.

Pass/fail threshold

You can configure the test to optionally indicate whether the Throughput test passed or failed. To do so, you specify the bandwidth for the Throughput Pass Threshold. If the highest rate at which frames are not lost is equal to or exceeds the threshold, the test indicates that the test passed for each transmitted frame length. If it falls below the threshold, the test indicates that the test failed.

Latency (RTD) test

If the Latency test is a desired part of the test, the Throughput test must also be run.

About the latency test

The Latency test transmits traffic at a specified percentage of the bandwidth at which no frames were lost (as determined during the Throughput test) for each frame length you selected. The average delay is then measured after transmitting traffic for each frame length for the period of time that you specified as the Latency (RTD) Trial Duration.The test measures delay for each trial (specified as the Number of Latency (RTD) Trials), and each measurement is then added to a running total. After all of the

trials are complete, the running total is divided by the number of trials to come up with a total trial average.

If the Throughput test reached the lowest bandwidth limit without ever successfully receiving all transmitted frames (in other words, it lost frames), the average delay will also be unavailable. Unavailable measurements are not included in the total trial average.

Pass/fail threshold

You can configure the test to optionally indicate whether the Latency test passed or failed. To do so, you specify the Latency (RTD) Pass Threshold. If the total trial average for measured average delay is equal to or less than the threshold, the test indicates that the test passed for each transmitted frame length. If it exceeds the threshold, the test indicates that the test failed.

Packet Jitter test

If you intend to run the Packet Jitter test as part of the test, you must also run the Throughput test.

About the Packet Jitter test

The Packet Jitter test transmits traffic at the maximum bandwidth at which no frames were lost (determined using the Throughput test) for each frame length you selected. The packet jitter is then measured after transmitting traffic for each frame length for the period of time that you specified as the Packet Jitter Trial Duration.

The test measures the average packet jitter and maximum packet jitter for each trial (specified as the Number of Packet Jitter Trials), and then each measurement is added to a running total. After all of the trials are complete, the running total is divided by the number of trials to come up with a total trial average measurement.

If the Throughput test reached the lowest bandwidth limit without ever successfully receiving all transmitted frames (in other words, it lost frames), the packet jitter measurements will also be unavailable. Unavailable average or maximum average measurements are not included in the total trial average.

Packet Jitter test results

Packet Jitter results are presented statistically.

Pass/fail threshold

You can configure the test to optionally indicate whether the Packet Jitter test passed or failed. To do so, you specify the Packet Jitter Pass Threshold. For each frame length you selected, the test compares the average packet jitter for the trial to the value that you specified as the threshold. If the average packet jitter is less than or equal to that

specified for the threshold, the test indicates that the test passed. If it exceeds the threshold, the test indicates that the test failed.

Frame Loss test

The Frame Lost test measures bandwidth until no frames are lost.

About the frame loss test

For each frame length you select, beginning at the maximum test bandwidth you specified, the instrument transmits traffic for the amount of time you specified as the Frame Loss Trial Duration. If frames are lost during that time frame, the instrument reduces the transmitted bandwidth by the amount you specified as the Frame Loss Bandwidth Granularity, and then transmits the traffic at the reduced bandwidth.

The test decreases the transmitted bandwidth accordingly until either no frames are lost during the duration specified, or the transmitted bandwidth reaches the lowest bandwidth limit (specified as the Frame Loss Bandwidth Granularity).

If the instrument succeeds in transmitting frames without losing any at a particular bandwidth, it then reduces the bandwidth one more time (by the granularity amount). If no frames are lost, the test stops. If frames are lost, the instrument starts the entire process over again until two successive trials occur without losing frames.

Frame Loss test results

Frame Loss results are presented in a tabular format, illustrating the frame loss rate versus the percent of the bandwidth.

Back to Back Frames test (Burst test)

This test determines the maximum back to back burst size supported by the network under test. Upstream and downstream back to back (burst size) tests can now be run concurrently (rather than sequentially).

About the Back to Back Frames test

Using the frame length and other settings such as the frame type and encapsulation, the instrument calculates the burst size required to transmit back to back frames for the duration that you specify as the Back to Back Max Trial Time. It then transmits the burst of frames over the circuit. If the number of frames transmitted carrying an Acterna payload does not equal the number of received frames carrying an Acterna payload (indicating that frames were lost during the transmission), the instrument goes through the stages described for the Throughput test (see “Throughput test” on page 892) until no frames are lost, or until the number of frames per burst from the last successful burst exceeds the Back to Back Frames Granularity by a 1 frame burst.

The test counts the number of frames received for each trial (specified as the Number of Back to Back Frame Trials), and each count is added to a running total. After all of the trials are complete, the running total is divided by the number of trials to come up with a total trial average count. The test then uses this count to calculate the average amount of time a burst can be transmitted before a frame is dropped.

Back to Back test results

Back to Back test results are presented in a table.

Optimizing the test time

When you configure an Enhanced RFC test in symmetric mode, you can optimize the time it takes to run the test time by doing the following:

- Ensure that the duration time for the Throughput, Packet Jitter, and Latency (RTD) tests is the same.
- Ensure that the number of trials for the Latency (RTD) and Packet Jitter tests is “1” (one trial only).

If you configure the test in this manner, all three tests (Throughput, Latency, and Packet Jitter) will be run simultaneously. If the duration times vary, or if you indicate that you want to run more than one trial, each test will be executed in succession. As a result, the test will take longer to complete.

In addition to the duration time and number of trial settings, you can control the bandwidth transmitted during the course of the test.

- If you select Top Down, the test transmits traffic at the maximum bandwidth specified, and then *decreases* the bandwidth for each trial by the granularity you specify until you reach the minimum bandwidth specified.
- If you select Bottom Up, the test transmits traffic at the minimum bandwidth specified, and then *increases* the bandwidth for each trial by the granularity you specify until you reach the maximum bandwidth specified.

Importing and exporting RFC config files

The instrument allows importing and exporting of configuration files. This allows consistent testing configurations which yield more reliable test results. You will need a USB stick for transferring the files.

To export a RFC configuration

1. Verify that you have a USB stick inserted into the instrument.
2. After specifying the settings for your Enhanced RFC test, save the configuration.
3. Exit the test.
4. From the Tools menu, select **Export to USB**, and then **Saved Test Config**.

5 Locate the `*.expert_rfc` file or files you wish to export. Click on the file to select it (click again to clear it).

6 Do one of the following:

- If exporting multiple files and you wish to zip them before exporting, click the **Zip selected files as** box and specify a file name for the resulting .tar file, and then click **Zip &Export**.
- If exporting files without zipping or are exporting a single file, Click **Export**.

The files are copied to the USB stick.

To import a RFC configuration

1 Verify that you have a USB stick inserted into the instrument.

2 From the Tools menu, select **Import from USB**, and then **Saved Test Config**.

3 Locate the file or files you wish to import. Click on the file to select it (click again to clear it).

4 Do one of the following:

- If importing a zipped file, click **Unzip& Import**.
- If importing one or more files that are not compressed, click **Import Test**.

The files are copied to the instrument's file directory. The next time you launch the test, the imported configuration(s) appear in the configuration list.

Initiating the Enhanced RFC2544 Test

There are two ways to initiate the RFC2544 test using the on screen softkey.

- Select the base application and then initiate the RFC2544 test using the on screen soft key.
- Select the RFC2544 implementation for the technology and interface you want to use.

The first option will be necessary if you have "No Configurations" saved where you can load the parameters of the test to be run. Alternatively, if you are coming back to run of a saved configuration (or modify an existing profile), you can select the direct initiation of the automatic script, load the existing profile and start testing. For more information see "Launching an automated test" on page 888.

Configuring the Enhanced RFC 2544 tests

Before running these tests, it's important to understand which settings need to be specified externally (outside of the automated test screens), and how to navigate through the screens and menus presented when you run the tests.

Specifying the external test settings

The automated tests allow you to specify most required settings; however, certain settings need to be specified outside of the automated test screens (using the procedures listed in Table 153.)

Table 153 RFC 2544 Setup Tab Settings

Layer/Setting	To specify, see....
Ethernet Layer 2 – Frame Type – Destination Type – Ether Type – Unit Identifier	"Specifying Ethernet frame settings" on page 835 "Specifying interface settings" on page 835
Layer 3	"Specifying Ethernet frame settings" on page 835 "Specifying IPv4 filter settings" on page 852

To specify the external test settings

1 Select the **Setup** soft key, and then do the following:
   – If you are running the test with layer 2 Ethernet traffic, select the Ethernet tab to specify settings that define the frame characteristics of the transmitted traffic, such as an 802.3 frame type, or a VLAN ID and priority (see "Specifying Ethernet frame settings" on page 835).
   – If you are running the test with layer 3 Ethernet (IP) traffic, select the Ethernet tab to enable or disable ARM, and then select the UP tab to specify settings that define the packet characteristics of the transmitted traffic, such as the destination IP address.

2 Verify the following settings:
   – Payload analysis is ON for your current test application. You can not run the RFC 2544 test when the module is configured to analyze live traffic.
   – The module is not configured to run a timed test. You can not run the RFC 2544 test during a timed test.

3 Select the **Results** soft key to return to the Main screen.

The external settings are specified.

Setting Connection parameters

Before running any of the RFC2544 automated tests, the connection parameters must be defined so the local and remote units can link.

Configuration methods

Upon initiation of the RFC2544 Automated configuration, the user is given the option of defining all parameters manually or restoring a configuration from a previously saved file. In either case any parameter may be modified prior to running the tests.

Retrieving configuration from previously saved file

1. To select a configuration currently saved on the unit, select the **Go** button (right green arrow) after “Load Configuration from Profile”.
2. After selecting one of the files on the left side of the page, the configured scripts that comprise the profile will be shown checked. To prevent any portion of the saved configuration from loading, clear any of the activated sections. Any portion of the test may be configured after the saved file is loaded.
3. Select the **Load Profile** button. The test will be configured as saved and if the connect data is detailed in the file, the unit will attempt to establish that connection.
4. If a desired configuration is not found, select the **Skip Load Profiles** button (right green arrow). Go to step 2 of “Manually configuring all parameters” on page 900.

Manually configuring all parameters

1. To manually configure the tests to be run, from the main menu, select the **Go** button (right green arrow) after Configure Test Settings Manually.
2. The first Connection parameters screen describes the Symmetry of the connection to be established.
   a. Select the Throughput.
      - **Symmetric** - same parameters for up and downstream connections
      - **Asymmetric** - different up and downstream parameters
      - **Unidirectional** - only testing one direction, up or downstream

   b. Depending on the symmetry selected, define the Measurement Direction.
      - **Loopback** - Traffic is generated locally and measurements are taken locally.
      - **Downstream and Upstream** - Traffic is generated locally and remotely and measurements are taken in each direction.

      Select **Next** (the green arrow).
3. For all symmetry schema, except loop back, the Connection parameters pertaining to the local and remote instrument must be defined.
   a. The first screen specifies the local settings. These parameters are Frame Type, and IP Settings - Source IP, Gateway and Subnet Mask.

      Other optional settings are accessed via the **Advanced Ethernet Settings** button. They are Source MAC, ARP Mode, Data Mode, and Source IP type.

When all local settings have been specified, select **Next** (the green arrow).

b The Remote configuration screen defines the number of VLANs and the Destination IP.

- To verify the Destination instrument is available, select the **Ping** button.
- To establish the connection with the remote instrument, select the **Connect to Remote** button.

If the test is being configured for future use and/or the remote instrument is not available, to continue with the configuration, select the **Skip Connect** right arrow button.

4 The next set of parameters to be defined pertain to network configuration. Depending upon the symmetry scheme selected, screens defining the following will appear in sequence.

Unit	Parameter	Options
Layer 2	Frame Type	DIX 802.3
	Encapsulation	NONE VLAN Q-in-Q Stacked VLAN
	Source IP	User entry
	Default Gateway	User entry
	Subnet Mask	User entry
	Advanced	Source MAC Auto-Increment Address (L2 only) ARP Mode (L3, L4) Source IP type (L3, L4)
Layer 3 (L3 & L4 applications only)	IP Prioritization	NONE TOS DSCP PPPoE
	TOS	User entry
Layer 4 applica-tions only)	Traffic Mode	TCP UDP
	Source Service Type	Select from list
	Source Port	User entry
	Destination Service Type	Select from list
	Destination Port	User entry

Test selection

After all connection parameters have been defined, the user is able to select which tests are to be included in the automated sequence. In addition to the standard RFC 2544 tests: Throughput, Latency, Frame Loss, and Back to Back, additional tests are included for Packet Jitter, Burst and Extended Load.

Choosing tests to be included

1 Upon opting to select which tests to run, the test screen appears.

The Enhanced RFC tests include Throughput, Latency, Frame Loss, Back to Back, Buffer Credit and Buffer Credit Throughput.

2 Select the tests that are to be included in the Enhanced RFC 2544 automated test by checking the box in front of the tests desired. Note that some tests will be unavailable with certain connections or in combinations with other tests.

When all desired tests have been chosen, select **Next** (the green arrow).

3 Depending upon which test(s) have been selected there are a number of parameters that must be set to define the results.

a On the Utilization screen, the **Bandwidth Unit** and the **Max Bandwidth** can be selected.

To choose whether the bandwidth units used for the tests are chosen from **Layer 1** or **Layer 2**, make the selection in the Bandwidth Unit drop-down box. Then enter the **Max Bandwidth (in Mbps)** in the entry box (Upstream and/or Downstream for non-symmetric test).



NOTE:

The load value cannot be set to a value that cannot be measured on the other side due to an imbalanced line rate.

To further refine the Utilization configuration, select **Set advanced Utilization settings**. Select **Back** to return to previous screen.

Select **Next** (the green arrow).

b On the Frame Lengths screen, select the number of frame lengths to be tested by checking the appropriate number of boxes and then entering a value for each checked Upstream and/or Downstream Frame length to be tested.

Select **Next** (the green arrow).

c On the Throughput Test screen, select whether the RFC 2544 Standard or JDSU Enhanced version of the test is to be used for the **Zeroing-in Process** and the level of **Measurement Accuracy**.

To further refine the Zeroing-in Process configuration, select **Set advanced Throughput Latency measurement settings** and then specify the **Latency Bandwidth** or **Configure Max Bandwidth per Frame Size**. Select **Back** to return to the previous screen.

d On the Frame Loss Test screen, select the test procedure to be used.

RFC 2544. Transmits traffic at the maximum bandwidth, and then decreases the bandwidth for each trial by the granularity you specify. The test ends after two successive trials with no frames lost. This procedure also requires specification of **Bandwidth Granularity** in Mbps**.**

Top Down. Transmits traffic at the maximum bandwidth specified in the **Test Range** setting, and then decreases the bandwidth for each trial by the **Number of Steps** specified until the minimum bandwidth is reached for the specified Test Range.

Bottom Up. Transmits traffic at the minimum bandwidth specified in the **Test Range** setting, and then increases the bandwidth for each trial by the **Number of Steps** specified until the maximum bandwidth is reached for the specified Test Range.

To further refine the frame loss configuration, select **Set advanced Frame Loss measurement settings** and then choose whether to **Measure Latency** or **Measure Packet Jitter** by selecting their checkbox. Select **Back** to return to previous screen.

Select **Next** (the green arrow).

e For the Back to Back Test screen, define the **Max Duration** (Upstream and/or Downstream for non-symmetric test) of each test and **Burst Granularity** in kB.

To further refine the Back to Back test, select **Set advanced Back to Back settings** and then choose the **Ignore Pause Frames** checkbox. Select **Back** to return to previous screen.

f For the Burst Test screen, select the Burst Test Type - either **Committed Burst Size**, **CBS Policing (MEF 34)** or **Burst Hunt** and the **CBS (in kB)** (Upstream and/or Downstream for non-symmetric test), **CBS Duration** and **Burst Sizes (kB**) (Upstream and/or Downstream for non-symmetric test) depending on which Burst test type is chosen.

g For the Extended Load test screen, enter **Throughput Scaling (%)** and **Frame Length** values.

Select **Next** (the green arrow).**Next** (the green arrow).

When the individual tests have been configured, select **Next** (the green arrow).

4 The overall test control configuration items need to be set.

a On the Test Duration screen, specify whether all tests are to have common durations or are individual tests to have their durations specified separately by selecting **Yes** or **No** radio button.

If Yes is chosen specify the **Durations** and the **Number of Trials**.

Select **Next** (the green arrow).

b On the Test Thresholds screen, specify whether **Pass/Fail** indications are to be shown for individual tests and what is the pass/fail **Threshold** value (Upstream and/or Downstream for non-symmetric test) for each test.

When the overall test control configuration items have been set, select **Next** (the green arrow).

5 The RFC 2544 test has been completely configured.

a If it is not desired to save this configuration profile, at this time, go to step 6.

b To save the profile of this configuration, specify the filename under which it is to be saved by entering the desired filename in the **File Name** box. To discover the name of previously saved files click on **Select**.

To preserve the configuration so it won't be changed by future users, select the **Save as read-only** checkbox.

When all file attributes have been set, select the **Save Profiles** button. and then select **OK** to return to the previous screen.

Select **Next** (the green arrow).

6 The Run/Edit screen appears.

Do one of the following:

– To return to the beginning and modify the current configuration, select the **Go** arrow after "Change Configuration". Go to "Manually configuring all parameters" on page 900.

– To load a previously saved set of configuration parameters, select the **Go** arrow after "Load Configuration from a Profile". Go to "Retrieving configuration from previously saved file" on page 900.

– To run the test, as configured, select the **Go** arrow after "Run Tests". The Run QuickCheck screen appears. Go to "Running Enhanced RFC 2544 tests" on page 904

Running Enhanced RFC 2544 tests

After configuration has been completed, the Enhanced RFC 2544 tests can be run.

The first test to be run is the QuickCheck test. The QuickCheck application uses the configured parameters for the connection to either run a bi-directional test or establish a loopback to verify that the link can support 100% traffic utilization allowing the other tests to be run effectively.

The balance of the tests will run without any user intervention necessary after initiation.

Initiating QuickCheck test

1 The QuickCheck screen appears. Notes appear on the left side of the screen indicating the current settings to be used for the test. If different settings are desired for throughput and Frame parameters, click the **Not what you wanted?** link.

- **a** Select the **Test using configured RFC 2544 Max Bandwidth** or **Use the Measured Throughput measurement as the RFC2544 Max Bandwidth** check boxes and/ or enter a new frame size value via the pop-up keypad.
- **b** When configured for layer 2 loopback test, you can select **VLAN Discovery**. This mode will transmit a burst of VLAN frames to automatically discover test instruments on the network.
- **c** When configured for a loopback test, you can select **Maximum Frame Search**. When selected after a successful loop detection, bursts of various frame sizes will be transmitted in order to determine the largest frame size you network can support.
- **d** Select **Back** to return to previous screen.

2 To initiate the QuickCheck test, press the **Start** button.

3 Observe the network diagram. The following occurs:

- **a** For both end running terminate application - The instrument indicates that it is waiting for a link, then connecting the link, and provides the status of the auto-negotiation capabilities.
- **b** The instrument checks for a hardware loop. If a hardware loop is not found, we check for a permanent loop. If a permanent loop is not found, the instrument declares “No Loop Found”

4 The instrument moves on to transmit traffic over the link at 100% of the line rate to verify the link’s ability to support a full load of traffic. If the test is successful, the button under Measured Throughput displays the expected throughput (Up and Down if appropriate).

Green graphics on the screen indicate that an action was successful, yellow indicates an action is currently taking place (for example, connecting the local port to the link), and red indicates that an action failed (for example, the remote loop failed).

When QuickCheck has reported acceptable results, select **Next** (the green arrow).

Initiating Enhanced RFC 2544

The RFC 2544 testing status screen keeps the user informed of the progress and the success or failure of the tests while they are running. A key of status indicators is available on the screen for easy reference.

1 To initiate the test sequence, select the **Run Test** button.

The time remaining displays in the top tab, and each test scheduled will be displayed with its current status.

NOTE:

To switch between the test and the Setup panel on the user interface, click the **Go To** button at the top of the screen and then click the **Results** button in the dialog. This function is intended allow you to verify the settings. Note that the RFC2544 button is yellow to indicate it has been launched. You should not change the settings during a test, as you may get undesired results. To return to the test, click the RFC2544 button.

2 When the tests have completed, select the **Next** (the green arrow).

The Test Complete page appears. Do one of the following:

– To create a report of the results of the test that just completed, select the **Go** arrow on the “Create Report” line. Go to step 3.

– To repeat the test that just ran, select the **Go** arrow on the “Repeat Test” line. Go back to “Running Enhanced RFC 2544 tests” on page 904.

– To reconfigure the test and then run it again, select the **Go** arrow on the “Change Configuration and Rerun Test” line. Go to step 2 of “Manually configuring all parameters” on page 900.

– To view detailed results of the performance achieved during the test, select the **Go** arrow on the “View Detailed Results” line.

The detailed results are presented on a sequence of windows that vary depending upon the steps in the test that were selected to be run.

On the last page of the results select the right-pointing green arrow. Go to step 3.

3 The report info screen will display.

This screen allows the user to enter information about the test environment which will be added to the report.

This information includes:

- Customer Name
- Technician ID
- Test Location
- Work Order
- Comments/Notes
- Custom Logo (from memory)

NOTE:

This screen is also associated with VIAVI’s Job Manager functionality, which enables you to run tests based on a documented test plan. You can also save multiple tests in one resulting report file.

4 After all the desired data is entered into the entry boxes, select **Next** (the green arrow).

5 The Report window appears. Do the following:

a Select the format in which the report is to be saved by selecting the radio button in Format pane.

b Specify the filename of the report.To review the filenames of other, currently saved reports on the unit, select the Select button.

c You may view saved reports by selecting the **View Report** button.

d To show a copy of the current report after saving it, check the **View report after creation** checkbox. The report will automatically load into the appropriate reader (if available) depending upon the format in which it has been saved.

e To include the message log with the report, select the Include Message log check box.

f When ready to save the report, select the **Create Report** button. After it has been saved (and viewed), select the right-pointing green arrow.

6 The post-report/results window appears.

All options available on this window are described in step 2 with the exception of the “Exit RFC 2544 test”.

To exit the RFC 2544 test application, select the **Go** arrow after “Exit RFC 2544 test”.

7 The Exit window appears. Do one of the following:

– To exit to the base application, retaining all setups from the RFC2544 test, select the Exit to Results button.

– To restore the configuration setups to their default values when leaving the application, check the box **Restore Setups on Exit**. To completely exit the Enhanced RFC 2544 application, select **Exit.**

– To return to the previous window, select **Cancel**.

The Enhanced RFC 2544 test has been run.

About the Y.1564 SAMComplete test

This test is a multi-stream test based on ITU-T Y.1564 that performs a two-phase test. First, the test verifies whether each Ethernet service is properly configured. Second, multiple Ethernet service instances are verified simultaneously, each meeting its assigned Committed Information Rate (CIR). All services are transmitted at CIR and must pass all SLA parameters (FDV, FTD, RTD and Availability).

The following topics are discussed in this section:

- “Initiating the SAMComplete test” on page 908
- “Configuring SAMComplete test settings” on page 909
- “Choosing SAMComplete tests” on page 914
- “Running SAMComplete tests” on page 914

Initiating the SAMComplete test

SAMComplete functionality is standard on all units and all Ethernet line rates are supported. Although all applications do not include SAMComplete functionality, if your instrument is appropriately configured, you can use it to run the SAMComplete test.

There are two ways to initiate the SAMComplete test; both from the Select Test application tree.

- Select the base application and then initiate the SAMComplete test using the on-screen softkey.
- Select the SAMComplete implementation for the technology and interface you want to use.

The first option will be necessary if you have no configurations saved to load the parameters of the test to be run. Alternatively, if you are coming back to run a saved configuration (or modify an existing profile) you can select the direct initiation of SAM Complete, load the existing profile and start testing. For more information see “Launching an automated test” on page 888.

To launch the SAMComplete test (from base application)

1. If you haven’t already done so, use the Test Menu or Quick Launch screen to select the desired application for the circuit you are testing (see “Launching an automated test” on page 888), and connect the instrument to the circuit. For details, refer to the *Getting Started Manual* that shipped with your instrument or upgrade.
2. Select the SAMComplete soft key on the right side of the interface.
3. Go to “Configuring SAMComplete test settings” on page 909

SAMComplete has been launched.

To Launch SAMComplete simultaneously with base application

1. From the Select Test application tree, select the technology and interface desired. All the applications available for the current configuration of the unit will be displayed.
2. Select **Y.1564 SAMComplete** from the tree, then the specific test desired such as Layer 2 Traffic >Term.
3. Go to “Configuring SAMComplete test settings” on page 909.

SAMComplete has been launched.



NOTE:

The Quick Launch window displays previously run and/or saved configurations of applications. Automated scripts launched simultaneously with base applications are fully identified with the script and base application. See *T–BERD/MTS/SC Getting Started Manual* for more information on the Quick Launch window.

Configuring SAMComplete test settings

From the configuration page, the settings can be configured manually, or if a profile has been previously configured and saved, the test settings can be loaded into SAMComplete.



NOTE:

QuickCheck is integrated into SAMComplete.

To configure test settings

To make changes to the existing settings, select the green arrow to the right of Edit Previous Configuration. Go to step 2 on page 910.

To reset all settings to their default values and configure all options yourself, select the green arrow to the right of **Start a New Configuration**. Go to step 2 on page 910.

To load configuration settings set from a previously saved file, select **Go To...** and proceed to **Load Profiles**.

1 The Profile selection window appears.

The filenames of the saved profiles will be listed on the left side of the window and all sections of the currently loaded profile will be listed on the right side of the screen.

Do the following:

a Select a profile from the list whose configuration is to be loaded.



NOTE:

If you load a profile that was configured on another unit, and that profile specified including a logo in the test report, make sure that the .png, .jpg, or .jpeg is in the following folder on your unit:
`/disk/bert/images`

b Check those sections, on the right side of the screen, that are to be loaded into the test. If no profile has yet been selected, the currently configured profile sections will be checked.

Any section not selected will not be configured into the test. Any parameter of the test (checked or not checked) may be reconfigured at a later point in the configuration process.

c Select the **Load Profiles** button to load all checked sections into the test. After profile has successfully loaded select, **OK** and then select **Next** (the green arrow). Go to "Choosing SAMComplete tests" on page 914.



TIPS:

1. Generally, selecting the **Next** button (right green arrow) on each page will advance to the next step you need to do, but if at any time, you need to return to the test configuration, skip to running tests, or review test results, select the **Go To...** button, and then select the step to which you need to return.

2. To save a view of the screen on the unit for future reference, use the camera icon to capture a screenshot.

2 The first Symmetry page appears.

To configure a SAMComplete Test

1 To manually configure the tests to be run, from the main menu, select the **Go** button (right green arrow) after Configure Test Settings Manually.

2 Configure the Symmetry of the connection to be established.

a Select the Throughput.

- **Symmetric** - same parameters for up and downstream connections
- **Asymmetric** - Downstream and Upstream throughputs are different
- **Unidirectional** - Only test the network in one direction.

b Define the Measurement Direction:

- **Loopback** - Traffic is generated locally and measurements are taken locally.
- **Downstream and Upstream** - Traffic is generated locally and remotely and measurements are taken in each direction.

3 Tap **Interface and FEC Settings** to configure Connector and RS-FEC settings.

i Click the applicable sub-tab to see and configure the configuration items.

ii Click **Back** when configuration is finished.

4 Select **Next** (the green arrow) to configure the Local Settings.

5 The Local Network Settings page appears. Do the following:

a Select the **Service Name** for each of the services being configured. This specifies which service you are configuring.

b Select **Configure Triple Play**, if needed. The Triple Play properties screen appears. You can specify the properties for Voice, Data, HDTV and SDTV. Repeat for each of the services defined.

c Select the Layer for bit rate layer definition mode. When L2 is selected, the max value of the Load unit will remain in terms of L1. L2 utilization is affected by frame size and therefore a value may be selected that is greater than can actually be transmitted.

d Choose, from the drop-down list, which encapsulation is desired - **None**, **VLAN**, or **Q-in-Q**.

e For Layer 2 applications, select the frame size from the values in the drop-down box.

f To specify **Source** and **Destination MAC addresses, Loop Type** and **Auto-Incrementing Address** settings, select the **Advanced** link at the lower right side of the window.

g Select the **Next** (the green arrow).

6 The SLA Throughput page appears. Do the following:

a Specify the SLA values. Depending upon the application selected, the SLA Threshold and Throughput can be specified for both the Local and Remote unit.

- **CIR** – Committed Information Rate. The threshold used to indicate the maximum sustained throughput guaranteed by the SLA. If the CIR is 0, the CIR test is skipped. When multiple services are specified and the Enable Aggregate Mode checkbox is not selected, values entered into the **All** line are copied to each service.
- **EIR** – Excess Information Rate. The threshold used to indicate the maximum sustained throughput allowed by the SLA by which a service can exceed the CIR. The throughput between CIR and EIR is not guaranteed. If the EIR is 0, the EIR test is skipped. When multiple services are specified and the Enable Aggregate Mode checkbox is not selected, values entered into the **All** line are copied to each service.
- **Policing** – Selects that policing be applied to the test. All traffic greater than CIR + EIR is removed by the policier. (If the test shows frame loss, the test passes – it indicates the policier is doing its job. If there is no

frame loss even with the overage percentage, the test fails.) When multiple services are specified, selecting the Policing checkbox on the All (or Total) line, selects Policing for all services.

- **Max Load Display** - Calculated from the values of CIR and EIR and changes based upon policing selection, it is the maximum rate of traffic to be generated. (If policing is not selected, Max Load is CIR+EIR. If policing is selected, Max Load is CIR + 1.25xEIR, or when EIR is less than 20% of CIR, Max Load is 1.25xCIR + EIR).
- **M** – Tolerance, or delta, in traffic rate which is allowed to be received above CIR+EIR before declaring a policing failure. For some applications, the desired **M** value is specified on the SLA Throughput page. For Multistream or Truespeed applications, **M** will be entered on a following page labeled “SLA Policing”. Specify the desired value for **M**.

b If it is desired to transmit the burst at a true 100% load, in those circuits that can handle the signal, select **Set Advanced Traffic Settings** and then check the **Allow True 100% traffic** checkbox. Select the left green arrow to return to SLA Throughput screen.

c Select the **Next** (the green arrow).

7 The SLA Burst page appears.(If SLA Policing appears, see discussion of M above, in step a). Do the following:

a Specify whether burst testing will be performed by selecting the radio button next to **Yes** or **No**.

If **No** is selected, go to step 8.

If **Yes** is selected, enter the CBS (in kB) where kB = 1000 bytes.

b Select whether to run the **Committed Burst Size** or the **CBS Policing** test by selecting the radio button next to either.

c To further refine the SLA Burst test, select the **Set Advanced Burst Setting** link.

- If desired, select the **Ignore Pause frames** checkbox.
- If CBS Policing was selected, specify the desired **+%** and **-%** tolerance to specify Pass values from expected.
- Select the **BACK** button (left green arrow) to return to the SLA Burst screen.

d Select **Next** (the green arrow).

8 The SLA Performance page appears.

a Specify the desired Threshold values. Each service may have its own values.

- **Frame Loss Ratio**– The maximum ratio allowed of frames lost to total frames.
- **Frame Delay** – The maximum allowed average OWD delay/latency for all throughput values.
- **Delay Variation** – The maximum allowed frame delay variation for all throughput values.

b Select **Next** (the green arrow).

9 The Test Controls page appears.

a Specify the Service Configuration and Service Performance settings.

- **Number of steps below CIR** – The number of steps, in information rate, needed to reach the CIR.
- The corresponding number of Step Values % CIR appear. The default values will be equal parts, based on the number of steps (for example, if 3 steps are used, each will be 25%). The values can be changed, if required.
- **Step Duration** – The duration, in seconds, that traffic is generated for each step.
- **Test Duration** – The duration, in minutes, that traffic is generated before the service performance test completes.

b To further refine the Test Controls select the **Advanced** button.

% CIR – These will be automatically populated with the equal part values calculated from the Number of Steps below CIR parameter but can be changed to any value between 0 and 100.

c Select the **right green arrow**.

10 The Save Profiles window appears.

Do one of the following:

– If no Profile is to be saved at his time, select the **right-facing green arrow** at the bottom of the window. Go to step 11.

– If it is desired that the configuration be saved to memory (disk or USB), specify the filename. To save somewhere other than the default location, press the **Select** button after the filename to define the directory where it is to be stored.

– If it is desired that subsequent users be restricted from being able modify this profile, check the box **Save as read-only.**

– To save the file to memory, select the **Save Profiles** button. Then select the **OK** button, then select the **right-facing green arrow**.

11 The Run/Edit window appears.

Do one of the following:

– To return to the beginning and modify the current configuration, select the **Go** arrow after “Change Configuration”. Go to step 2 of “To configure test settings” on page 909.

– To load a previously saved set of configuration parameters, select the **Go** arrow after “Load Configuration from a Profile”. Go to step 1 of “To configure test settings” on page 909.

– To run the test, as configured, select the **Go** arrow after “Select and Run Tests”. Go to “Choosing SAMComplete tests” on page 914

SAMComplete has been configured.

Choosing SAMComplete tests

After specifying test settings, you must choose whether to run one or both of the tests: Service Configuration or Service Performance.

To choose the tests

1. On the Select Y.1564 Tests page, select **Enable** if you wish to run the Service Configuration and/or Service Performance tests.
2. If you wish to **include the optional throughput measurement** in the test, check the box to enable the test, and then specify the **Max** throughput allowed.
3. Select **Next** (the green arrow).

   The QuickCheck page appears. Go to "Running SAMComplete tests" on page 914.

Running SAMComplete tests

After choosing the tests, you are ready to run the test.

To run tests

1. From the QuickCheck page, do one of the following:
   - When you configured for layer 2 loopback test, you can select **VLAN Discovery**. This mode will transmit a burst of VLAN frames to automatically discover test instruments on the network.
   - When configured for a loopback test, you can select **Maximum Frame Search**. When selected after a successful loop detection, bursts of various frame sizes will be transmitted in order to determine the largest frame size you network can support.
   - Select the **Start** button.

   The QuickCheck test, using the source and destination data entered, verifies that the connections detailed in the test setup are functioning as needed for the proper operation of the test. As QuickCheck is completing its analysis of the circuit, graphics along the top of the page provide a visual indication of the circuit structure and its suitability for the selected test.

   If a remote device is necessary, QuickCheck first checks to see if a connection to the remote device has been established. If it has not, a message is displayed indicating the connection must first be established.

   For loopback tests, QuickCheck tests the Local port for proper operation and then checks for loopback in a remote device. If no remote active loop is detected, it then verifies whether a hard loop is in place.

   After QuickCheck completes, select **Next** (the green arrow). Go to step 2.
   - To skip the QuickCheck test, select the **Skip QuickCheck** button at the bottom of the window.
2. The Run Y.1564 Tests page appears.

There is a display bar for each service under Service Configuration and also for each test verdict under Service Performance. These indicate the status of each test to be run. Please refer to the Test Status Key at the bottom of the page to interpret these display bars.

Do the following:

a If you would like the test to continue when a failure occurs, clear the **Stop on failure** box.

b Select the **Start** button.

The test begins.

As the tests are run, the status display bars will show the results of each test. In each case, you may view detailed results of that test by selecting the “magnifying glass” icon when it appears on the status bar.

While the tests are running, the status panel near the top of the screen displays a blue progress bar and indicates the estimated time remaining to complete the testing.

After the test finishes, the pass/fail results appear (green check mark or red X) on each of the tests. The status panel near the top of the screen displays an overall OK (PASS) or FAIL result

c Once the testing is completed, select **Next** (the green arrow).



NOTE:

To switch between the test and the Setup panel on the user interface, click the **Go To** button at the top of the screen and then click the **Results** button in the dialog. This function is intended allow you to verify the settings. Note that the SAMComplete button is yellow to indicate it has been launched. You should not change the settings during a test, as you may get undesired results. To return to the test, click the SAMComplete button.

3 The Test Complete page appears. Do one of the following:

– To create a report of the results of the test that just completed, select the **Go** arrow on the “Create Report” line. Go to step 4.

– To repeat the test that just ran, select the **Go** arrow on the “Repeat Test” line. Go back to “Choosing SAMComplete tests” on page 914.

– To reconfigure the test and then run it again, select the **Go** arrow on the “Change Configuration and Rerun Test” line. Go to step 2 of “Configuring SAMComplete test settings” on page 909.

– To view detailed results of the performance achieved during the test, select the **Go** arrow on the “View Detailed Results” line.

The detailed results are presented on a sequence of windows that vary depending upon the steps in the test that were selected to be run.

On the last page of the results select the right-pointing green arrow. Go to step 5.

4 The Report window appears. Do the following:

   a Select the items to be included in the report by putting a checkmark in front of the item. Entire groups may be selected or individual items within a group. To expand the group listing to see the individual items, select the “+” in front of the group name.

   b Select the format in which the report is to be saved by selecting the radio button under Format.

   c Specify the filename of the report.

   d You may view saved reports by selecting the **View Report** button.

   e To show a copy of the current report after saving it, check the “View report after creation” checkbox. The report will automatically load into the appropriate reader (if available) depending upon the format in which it has been saved.

   f When ready to save the report, select the Create Report button. After it has been saved (and viewed), select the right-pointing green arrow.

5 The post-report/results window appears.

   All options available on this window are described in step 3 with the exception of the “Exit Y.1564 test”.

   To exit the SAMComplete application, select the **Go** arrow after “Exit Y.1564 test”.

6 The Exit window appears. Do one of the following:

   – To exit to the base application, retaining all setups from the SamComplete test, select the Exit to Results button.

   – To restore the configuration setups to their default values when leaving the application, check the box **Restore Setups on Exit**. To completely exit the SAMComplete application, select **Exit**.

   – To return to the previous window, select **Cancel**.

The SAMComplete test has been run.

5G NR Discovery

You can use 5G NR Discovery to discover key information from a 5G NR device. To begin, select the **5g NR Discovery** option on the appropriate Ethernet interface for your 5G NR device. The supported interfaces are:

- 10 GigE LAN
- 25 GigE

Optionally, select to:

- Enter a **Listening Time (s)** to specify the time used to listen for traffic
- Select to **Save capture file** for the discovery session
- **Reset Link** to reset the link

Press the **Run Test** button. The **5G NR Discovery** test begins and performs the following:

- Initializes and checks the Ethernet link
- Collects and analyzes transmissions from the radio and reports key radio configuration information, including:
  - MAC Address(es)
  - VLAN ID(s)
  - IPv6 Address(es)
  - Network protocols in use
- Attempts communication with the radio on each discovered VLAN and IP address pair.

At the conclusion of the test an option to create a test report is available.

Automated VLAN tests

If your instrument is configured and optioned to do so, you can use it to run the automated VLAN test. This test is used to test a range of VLANs by transmitting and looping back frames for each VLAN in the range for a user-specified test period, and then comparing the number of frames transmitted to the number received. Pass criteria can be specified as No frames lost or Some frames received as meet your needs.

To test a range of VLANs

1. Establish a connection to the network using one of the Ethernet test interfaces. *Do not use the management RJ-45 connector provided on the base unit*.
2. If you haven't already done so, use the Test Menu or Quick Launch screen to select the Traffic Terminate application for the circuit you are testing (see "Launching an automated test" on page 888), and connect the instrument to the circuit. For details, refer to the *Getting Started Manual* that shipped with your instrument or upgrade.
3. Specify the settings required to initialize the link (see "Specifying interface settings" on page 835), and to establish a connection to the network (see "Layer 2 testing" on page 835).
4. To Launch the VLAN scan, select the Toolkit softkey on the lower right of the Results screen. Then select the **VLAN Scan** button. The VLAN Scan Loading intermediate screen appears followed by the VLAN Scan window.
5. Enter the **Duration per ID(s)**. This specifies the length of time (in seconds) for which each VLAN ID will be searched.
6. Enter the **Number of ranges** (the number of ranges of VLAN ID's you want to be searched).
7. Enter **VLAN ID Min** (one for each Range). The minimum value in the range to be searched.

8 Enter **VLAN ID Max** (one for each Range). The maximum value in the range to be searched.

9 To specify the **Frame size**, **Bandwidth** or the **Pass Criteria**, select the A**dvanced VLAN Scan Settings** link on the lower right corner. Select **Back** when complete to return to VLAN Scan window.

10 To run the test, select **Start Test**.

11 A progress bar, and the remaining time to test completion, will appear at the top of the screen. To cancel the test at any time press the **Abort Test** button.

12 When the test is complete, a dialog box appears asking if you would like to save a test report. For details, see “Saving automated test report data” on page 918.

The VLAN test is complete. The report will provide the total number of VLANs tested, the total number of successes, and the total number of failures. It can also optionally include the test progress log that appeared as you were running the test.

Saving automated test report data

When each automated test is complete, a dialog box appears asking if you would like to save a test report. You can optionally append the progress log (the text that appeared while you were running the test) to the end of the report.

To save automated test report data

1 When the report dialog box appears, if you would like to append a progress log to the end of the report, select the option on the dialog box, then reply with **Yes** or **No**. If you select Yes, specify the following:

- The customer’s name.
- Your name.
- Work Order No.
- The test location.
- Any additional comments you might have concerning the test.

Select the right-facing green arrow. The Report screen appears.

2 This screen allows two actions - Generating a report of the most current results or viewing a previously saved report. To generate a new report:

   a Select the radio button for the format desired.

   b Change the default file name, if desired, or click on the Select button to open the report file management screen to find existing file names. To overwrite an existing file, select it from the list and then click the Select button to return to the Report screen.

   c To display the report on the screen after it is generated, check the View report after creation checkbox.

   d To include the message log in the generated report, check the Include message log checkbox.

   e Select the Create Report button.

3 To View previously saved report;

   a Select the create Report Button. The View Report screen appears.

   b from this screen you can see the list of currently saved reports in available locations. To view an existing report, select its filename then, click on View. the report will display on the screen.

   c When finished with the report, select the Exit button to return to the Report screen.

4 When completed with the Reports, select the left-facing green button to re-specify your report or the Exit button.

   The Exit screen appears.

5 To restore the setups to their previous settings, check the Restore Setups on Exit checkbox.

6 To return to the base application, select the Exit button.

7 To return to the Report screen, select the Cancel button.

8 Select **Close** to close the dialog box and return to the Main screen.

The report is saved.

25

Physical specifications

Table 154 Physical specifications

Parameter	Specification
Dimensions	
Height	170 mm (6.7 in)
Width	269 mm (10.6 in)
Depth	41 mm (1.6 in)
Weight	1.4 kg (3.0 lb)
Environment	
Maximum humidity	95% RH non-condensing
Shock and vibration	MIL-PRF-28800F
Drop	MIL-PRF-28800F
Storage temperature	-20 to 60°C (-4 to 140°F)

Radio Analysis
Module User Guide
22145360 R021

Viavi Solutions

North America:	**1.844.GO VIAVI / 1.844.468.4284**
Latin America	**+52 55 5543 6644**
EMEA	**+49 7121 862273**
APAC	**+1 512 201 6534**
All Other Regions:	**viavisolutions.com/contacts**
email	**TAC@viavisolutions.com**

September 2026
English