SPA06MA-O User’s Guide

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SPA06MA-O User’s Guide

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About this User Guide

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

Purpose and scope

This manual is intended to help you use the capabilities of the SPA06MA-O/SPA06MA, and 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
- **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
- **TDD —** Time Division Duplex

Related Information

This is the 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.

Table 2 Symbol conventions (Continued)

	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.
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

1

Overview

This chapter provides a description of the SPA06MA-O. Topics covered in this chapter include:

SPA06MA-O overview

The SPA06MA-O module is equipped with 6 GHz RF and 25 Gbps Optical hardware. SPA06MA is a variant that has 6 GHz RF hardware only.

6 Ghz RF hardware allows:

- Spectrum Analysis from 9 kHz to 6 GHz
- Real-time Spectrum Analysis with up to 100MHz persistent display
- LTE-FDD/TDD and 5G NR OTA Signal Analysis

25 Gbps optical hardware allows:

- RFoCPRI Interference Analysis up to 10.1 Gbps.

Exploring the module

Figure 1 SPA06MA-O module

1	RF Input port	Used as the 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	SMB connector to send 1 PPS clock or 10 ms synchronization signals from an internal timing reference. Digital CMOS Input DC Coupled Input signal requirements: Minimum logic high. 2.4V, Maxi-mum logic high ≥ 3.3V.

4	Trigger In	SMB connector to receive 1PPS clock or 10 ms synchronization signals. Digital CMOS Input DC Coupled Input signal requirements: Minimum logic high. 2.4V, Maximum logic high ≥ 3.3V.
5	GNSS Antenna	SMA connector for GNSS antenna.
6[1] 7[1]	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[1]	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.

1. Not supported on SPA06MA.

Module installation

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

To connect the module to the ONA-800

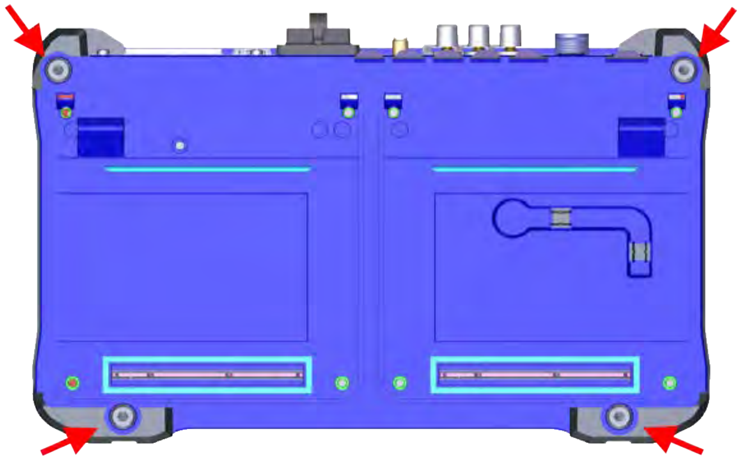
1 Verify that the power is OFF on your ONA-800 and the power adapter is unplugged.

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 2.

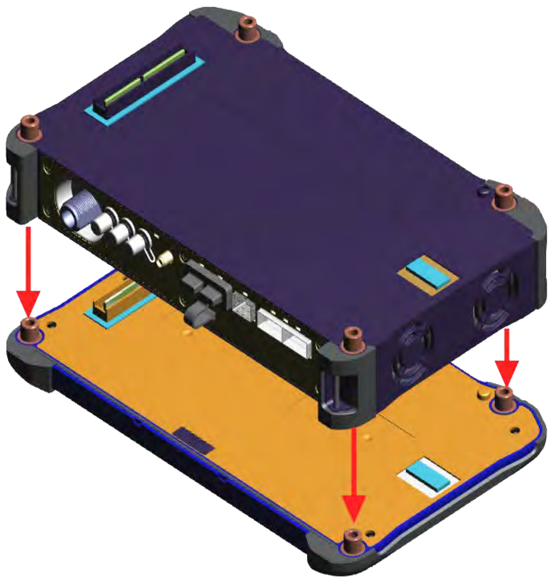
Figure 2 Fastener locations



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 3.

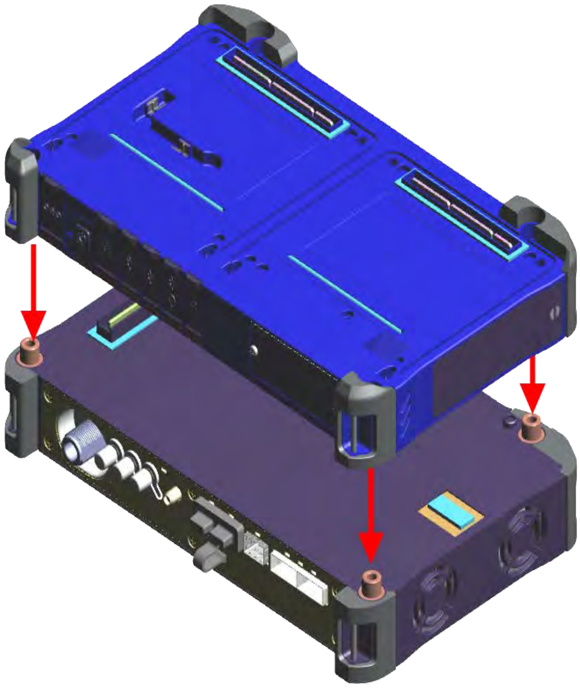
Figure 3 Module to screen alignment



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 4.

Figure 4 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 Spectrum Analyzer

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

Introduction

The advantage of using the Spectrum Analyzer 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 transmitter may interfere with in band signals affecting the spectral integrity.

In these days when 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:

- Spectrum Analysis
  - Sweep Tuned Spectrum
- RF Analysis
  - Channel Power
  - Occupied Bandwidth
  - Spectrum Emission Mask
  - Adjacent Channel Power (ACP)
  - Multi Adjacent Channel Power (multi-ACP)
  - Spurious Emissions
  - Total Harmonic Distortion (THD)
  - Field Strength
- Utility
  - Gated Sweep
  - Route Map

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:

Table 1 Measurement modes

Mode	Measurement
Spectrum Analysis	Sweep Tuned Spectrum
RF Analysis	Channel Power Occupied Bandwidth
	Spectrum Emission Mask
	Adjacent Channel Power
	Multi-Adjacent Channel Power
	Spurious Emissions
	Total Harmonic Distortion
	Field Strength
Utility	Gated Sweep
	Route Map

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, display 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 access 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 2 describes each key function.

Table 2 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. **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. **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. **Access: Menu > Frequency > Frequency Offset**
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. **Access: Menu > Frequency > Span Frequency**
Full Span	Sets the span to full span, showing the full frequency range of the instrument. **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. If you have selected Zero Span, select **Trigger> Free, External, GNSS,** or **Video**. **Access: Menu > Frequency > Last Span**

Table 2 Key Frequency Functions.

Parameter	Description
Last Span	Sets the span to the previous span setting. **Access: Menu > Frequency > Last Span**

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 3 describes each function.

Table 3 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**. **Access: Menu > Channel > Link Uplink/Downlink**
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**

Setting amplitude

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

Table 4 describes each function.

Table 4 Amplitude functions

Parameter	Definition
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**
Attenuation	Tap to set the attenuation value using the on-screen key-board. **Access: Menu > Amp/Scale > Attenuation**
Attenuation Auto/ Couple/Manual	Tap to select the attenuation option from **Auto**, **Manual**, or **Couple**. – **Auto**: sets the input attenuator's level automatically; you must select a lower attenuation. – **Manual**: sets the input attenuation manually up to 55 dB to optimize S/N – **Couple**: couples the input attenuator's level with your ref-erence level setting **Access: Menu > Amp/Scale > Attenuation/Manual**
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**
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**
External Offset Mode On/Off	Tap to turn the external offset mode on or off. **Access: Menu > Amp/Scale > External Offset On/Off**
External Offset	Tap to manually set the external offset value form -120 to 120 using the on-screen keyboard. When you compensate for the external loss, input the negative values. when you compensate for the external gain, input the positive values. **Access: Menu > Amp/Scale > External Offset**

Table 4 Amplitude functions

Parameter	Definition
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**
Auto Scale	Tap to automatically set the reference and attenuation level. 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**

NOTE

It is recommended that you set the Attenuation to Auto in most situations, so that the level of the input attenuator can be set automatically according to your input signal level.

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 5 describes the key functions.

Table 5 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)**

Table 5 BW/AVG functions

Parameter	Description
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 6 provides a VBW/RBW ratio example.

Table 6 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 so 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 7 describes each key function.

Table 7 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**

Table 7 Sweep functions

Parameter	Definition
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 trigger

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

Table 8 describes each function.

Table 8 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 > Trigger > Free**

Table 8 Trigger functions

Parameter	Description
Internal	Select **Internal** to start a sweep using the internal reference clock and creating a trigger. **Access: Menu > Trigger > Internal**
External	Select **External** to start a sweep based on the external input trigger. **Access: Menu > Trigger > External**
GNSS	If you use a GNSS receiver while performing measurements on a base station, you can synchronize the sweep via the GNSS receiver. **Access: Menu > Trigger > GNSS**
Video	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).

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 9 describes the functions.

Table 9 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 “Trace type” on page 17. **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**

Table 9 Trace functions

Parameter	Definition
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 "Trace type" on page 17 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.

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:

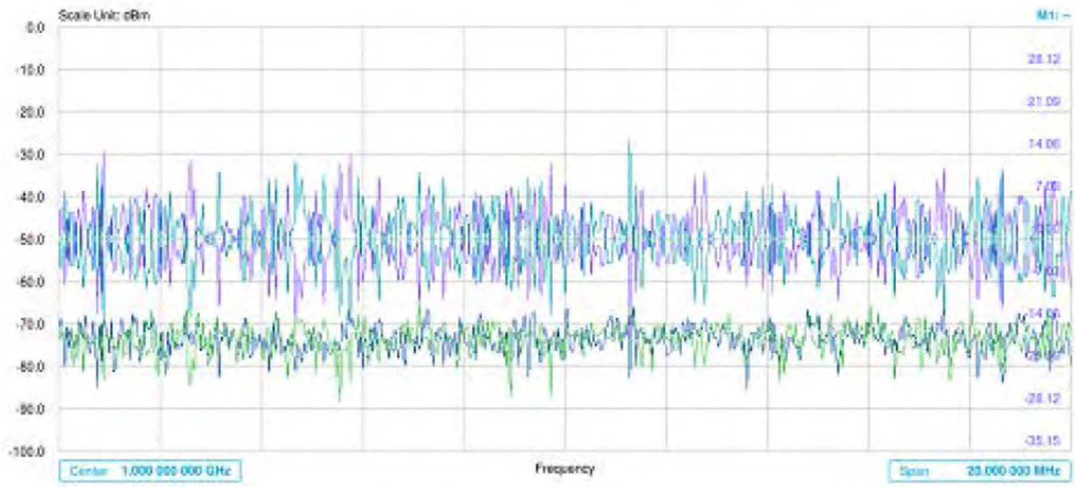
- **Normal**: Displays random noise better than the peak without missing signals.

- **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 5.

Figure 5 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 10 describes each function.

Table 10 Limit functions

Parameter	Description
Display Line	Tap to set values for the reference line using the on-screen keyboard. **Access: Menu > Limit > Display Line**

Table 10 Limit functions

Parameter	Description
Display Line Mode On/Off	Tap to set the **Display 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 display 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 display line does not indicate Pass/Fail. **Access: Menu > Limit > Display Line Mode On/Off**
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 11 describes the parameters displayed for the multi segment line.

Table 11 Multi Segment Line parameters

Parameter	Description
Autoset	Tap to autoset the limit for each segment and display 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**

Table 11 Multi Segment Line parameters

Parameter	Description
Offset Up/Down (dB)	Tap to set the **Offset Up/Down** to move the limit line up or down when the **Display 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 **Display Line Mode** is set to **On** using the on-screen key-board. **Access: Menu > Limit > Multi Segment Line > Offset Left/ Right**
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 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 12 describes the functions.

Table 12 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 marker's 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 stat 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**.

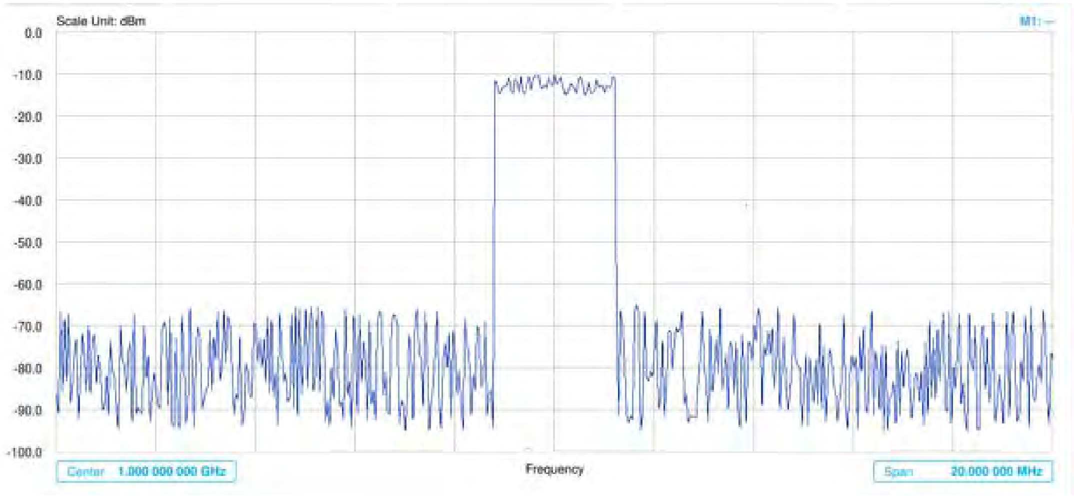
   The selected marker moves to the selected trace.

> **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.

Conducting spectrum measurements

If you have configured test patterns as described in “Configuring spectrum measurements” on page 9, your measurement is displayed on the screen, as shown in Figure 6 on page 23. You can change **Center Frequency** and **Span** by tapping the icons below the result chart screen.

Figure 6 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.

Conducting RF measurements

The following sections describe how to conduct RF measurements.

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 9, 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.

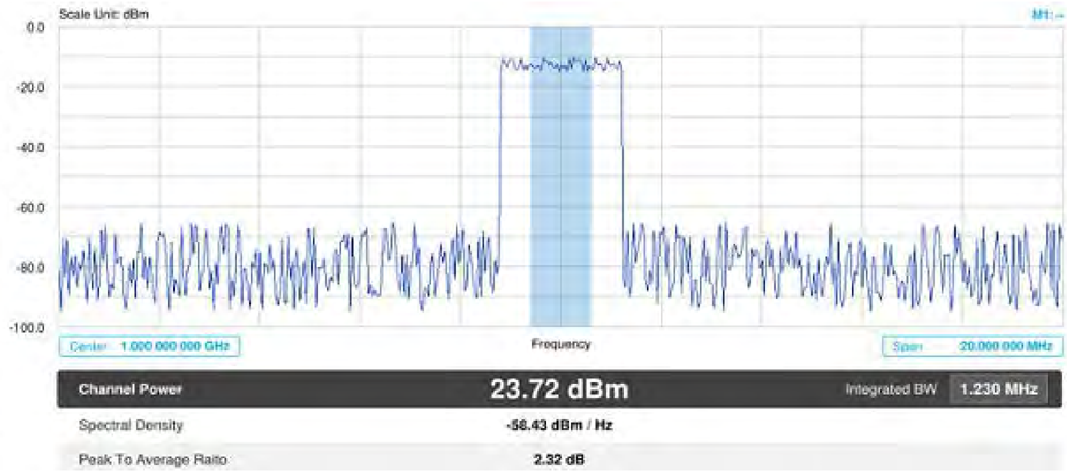
4 Tap **Low Limit** to set the lower threshold using the on-screen keyboard.

5 *Optional*: Tap the **Save** hot key 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 7 shows an example of Channel Power Measurement.

Figure 7 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 with spectrum analyzer

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 9, 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 form 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 ration between in-band and adjacent channels. The instrument indicates either Pass or Fail based on the specified limit of the signal.

Setting measure setup

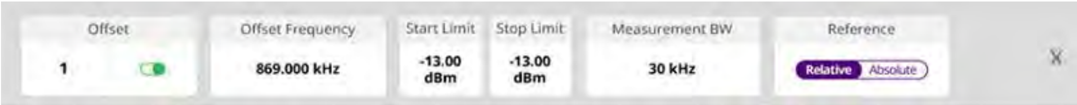
After configuring spectrum measurement as described in “Configuring spectrum measurements” on page 9, you can set the measure setup to continue your measurement. The measurement settings can be saved and recalled as a file by selecting File Type as Setup and load the file onto the instrument using the 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 8.

Figure 8 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

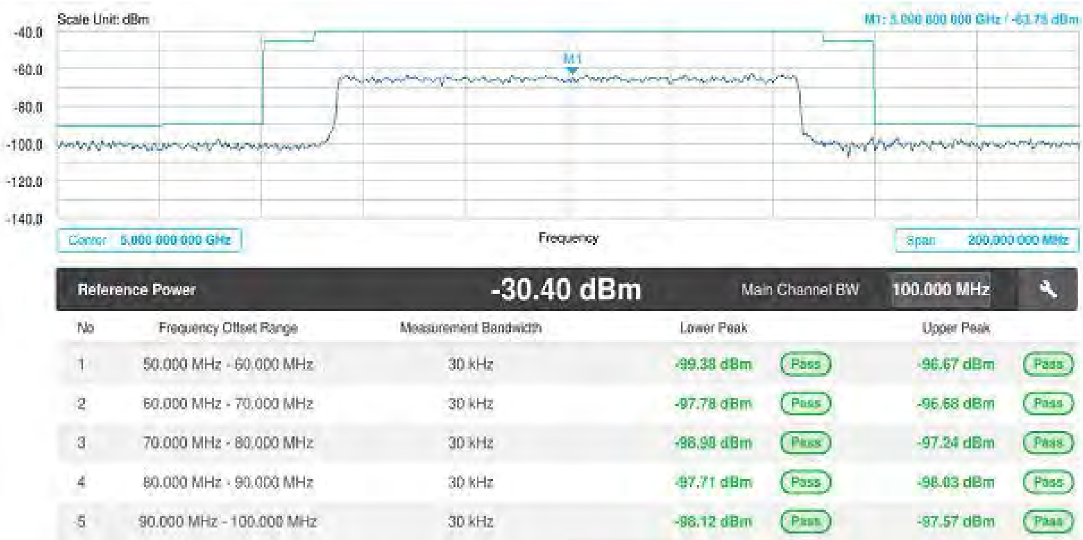
1 Tap **Menu > Limit**.

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 9 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 9, 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 10.

Figure 10 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 11 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 9, 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 sing 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 chard 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 12.

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

Figure 12 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 whit 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 RM is selected when you perform the multi-adjacent channel power measurement.

To set limit

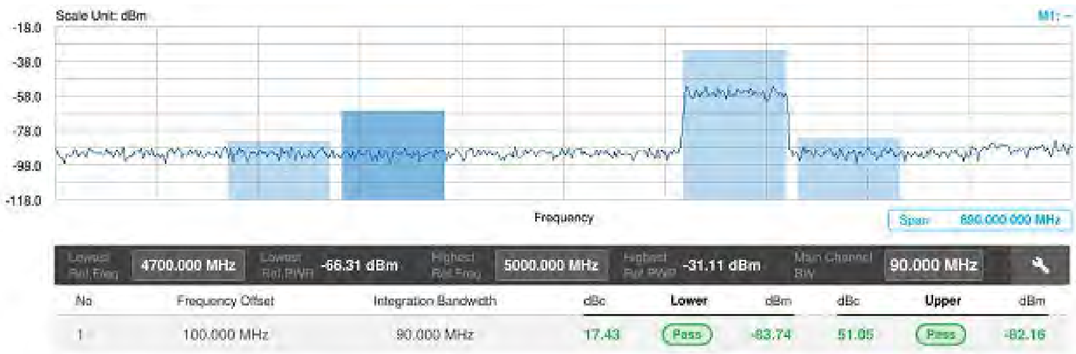
1 Tap **Menu > Limit**.

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 13 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 9, 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 14 shows a spurious emissions measurement with the spectrum analyzer.

Figure 14 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

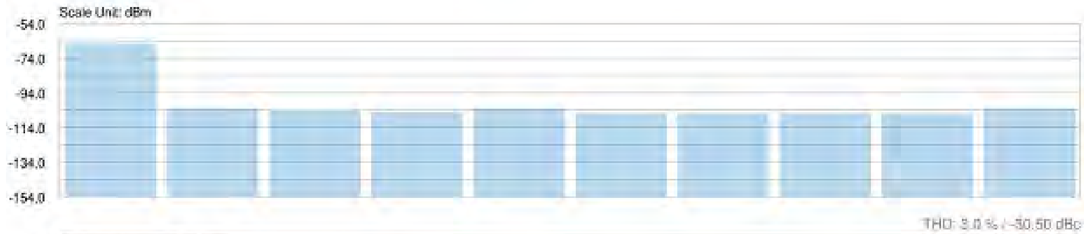
You need to set the fundamental frequency to measure the total harmonic distortion. Once you set up, it will automatically collect the harmonic outputs up to the tenth harmonics from the spectrum analyzer and calculate the corresponding THD value (%) and the distortion attenuation (dB).

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 11 for more information.

Figure 15 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 meter

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 9, you can set the measure setup to continue your measurement.

To set measure setup

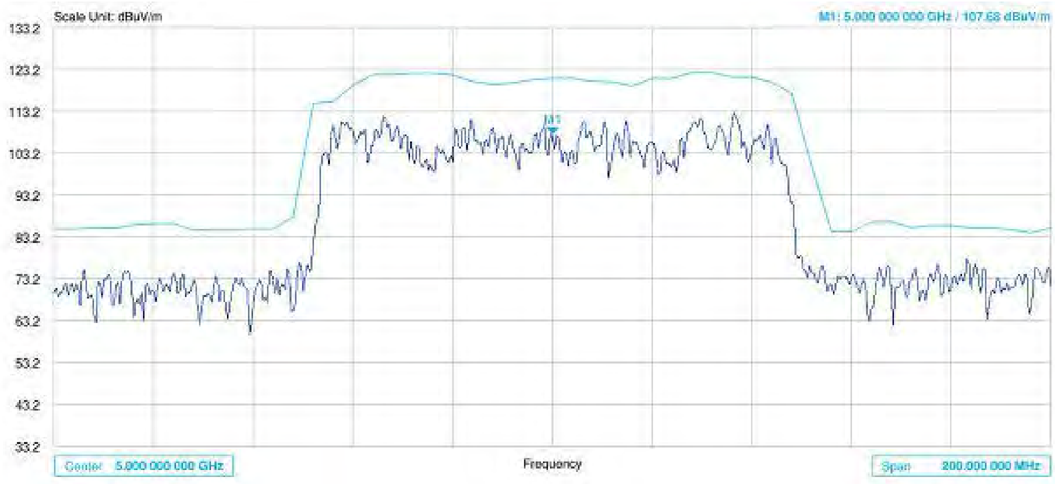
1. Connect an antenna to be used with your instrument.
2. Tap the **Setup** ( ) icon on the side bar.
3. Tap **Antenna List** to select antennas to be used for field strength measurement from the list stored in the instrument.

   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 display 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 18 for more information.

Figure 16 Field strength measurement with spectrum analyzer



Utility

The following sections describe the utility functions of the Spectrum Analyzer.

Gate sweep spectrum

To get appropriate gate sweep spectrum, 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 17 shows the Gate Sweep Spectrum Setup screen.

Figure 17 Gate Sweep Spectrum Setup screen

To set Gate Sweep Spectrum

1. 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.

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

3. 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.

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

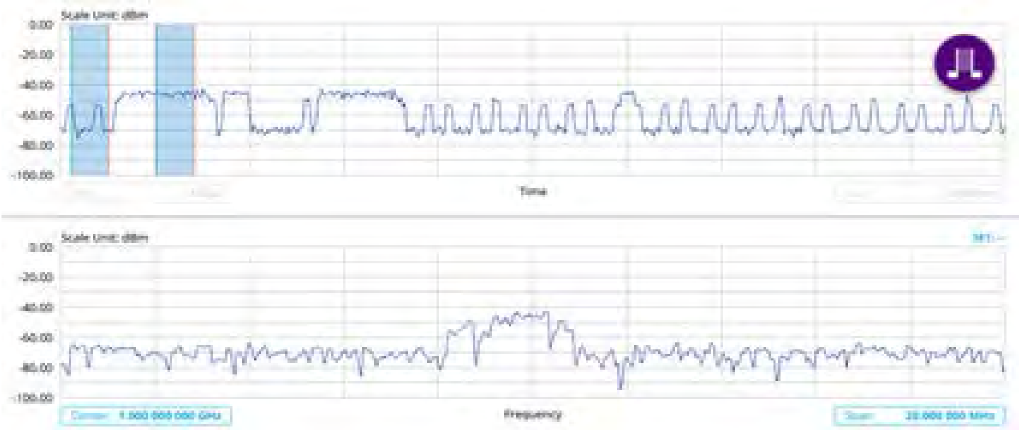
5. Tap **StdSignal** to select a **Standard Signal** from the pop-up list.

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

7. 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 18.

Figure 18 Gate Sweep Spectrum with spectrum analyzer



8 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 pf 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 19 shows an example of the Route Map.

Figure 19 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 .mcf created in JDMapCreator.

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

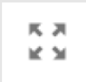
3 Navigate to the map file that you want to open.

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 13 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 9 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 **GPS**, **Position**, or **Time**.

- **a** To collect data/plot points automatically as you move around in a vehicle or outside, select **GPS**, 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 enters 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 **Menu > Limit**.

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

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

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

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

3

Using Interference Analyzer

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

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:

- Spectrum Analysis
  - Spectrum
  - Spectrogram
- Interference Analysis
  - RSSI (Received Signal Strength Indicator)
  - Interference Finder
  - Radar Chart
- Utility
  - Spectrum Replayer
  - PIM Detection Single Carrier
  - PIM Detection Multi Carrier

Using a set of the AntennaAdvisor Handle that holds a broadband directional antenna is mandatory in the Reider 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:

- **Spectrum Analysis > Spectrum** or **Spectrogram**
- **Interference Analysis > RSSI, Interference Finder** or **Radar Chart**
- **Utility > Spectrum Replayer > PIM Detection Single Carrier or PIM Detection Multi Carrier**

> **NOTE**
> You can choose **RF Source On** or **Off** in setup menu after tapping **CAA RF Power On** if you have **RF Source** option in your CAA (Cable and Antenna Analyzer.)

Conducting spectrum measurements

The following sections describe how to conduct spectrum measurements.

Spectrum

Most spectrum measurements of the interference analyzer are also available in Spectrum mode. Using these measurements allows you to located interferences in the frequency spectrum. You can configure the measurements just as in Spectrum mode. For more information, see “Configuring spectrum measurements” on page 9.

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 display line, multi-segment line, and channel limit table. See

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 9, 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.

Interference measurement in spectrogram

The Spectrogram shows a vertical line on the chart when the marker is enabled on the screen. Figure 20 shows the Normal chart view, and Figure 21 shows the Waterfall (3D display) chart view.

Figure 20 Interference measurement in spectrogram- Normal view

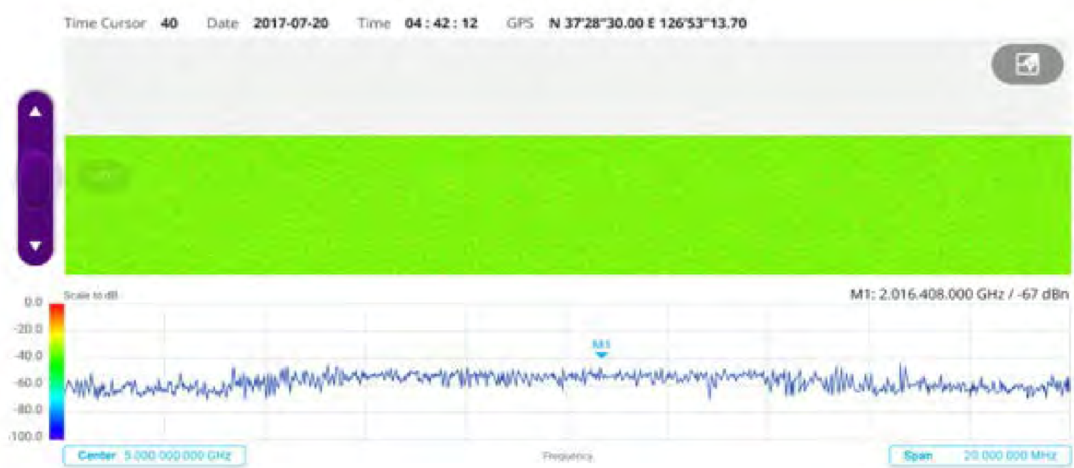
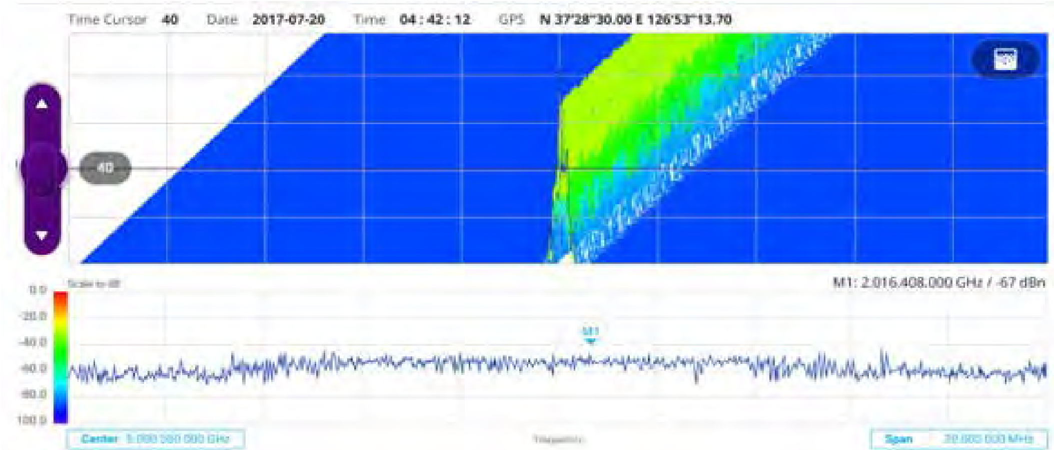


Figure 21 Interference measurement in spectrogram- Waterfall (3D Display) view



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.

Conducting interference measurements

The following sections describe how to conduct interference measurements.

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 9, 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 use the marker position to sound alarm. See “Using marker” on page 20 for more information.

Interference measurement in RSSI

Figure 22 shows an example of interference measurement in RSSI.

Figure 22 Interference measurement in RSSI

You can go to **Menu > Limit** to analyze your measurements with the display line, multi-segment line, and channel limit. See “Setting limit” on page 18 for more information.

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 SPA06MA-O 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 9.

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.

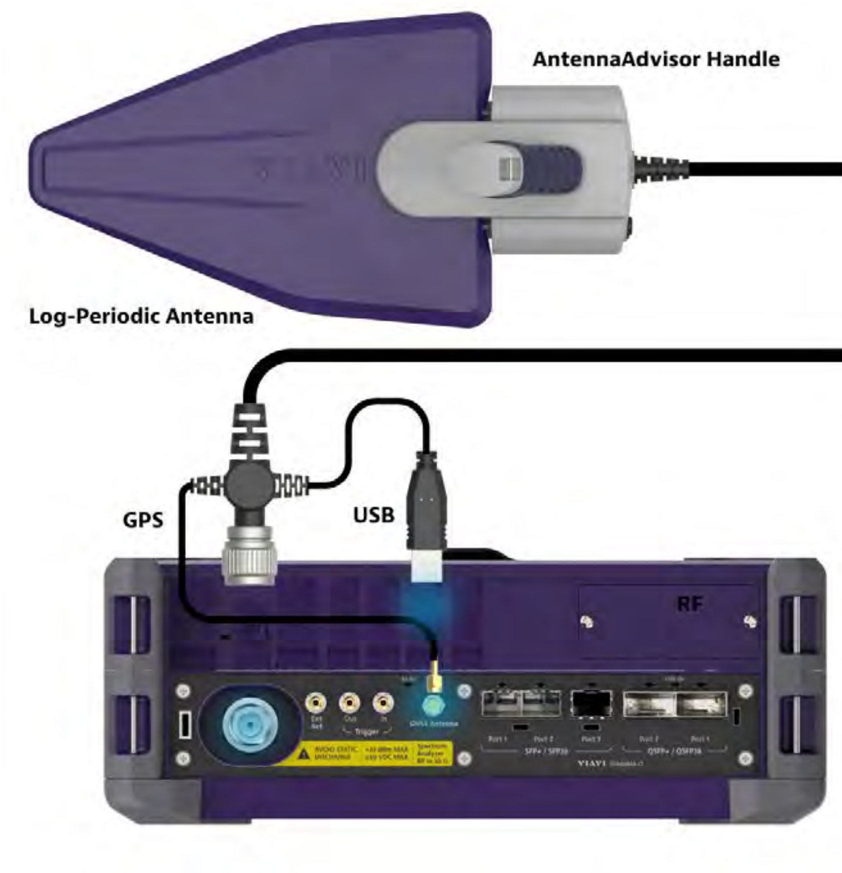
3 Connect the **GNSS SMA** jack of the handle to the **GNSS port** of the instrument. The GNSS status indicator appears on the instrument screen.

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 AntennaAdivsor handle to search more exact directional information. You can use a log periodic antenna or Omni antenna alone as well.

Figure 23 shows an example of an antenna connection.

Figure 23 Antenna connection example



Loading a map

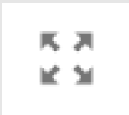
To use any features related to maps, you need to download and install the maps on the instrument. The **VIAVI JDMapCreator** will help you to download maps. Ensure the JDMapCreator application on your computer is connected to the instrument via LAN. You can send a map file with a single layer to the 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 .mcf file type created in JDMap-Creator.
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 14 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.

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.

   Make sure you set three location points so that the straight lines started from the point and can create three intersections.

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 and pan the antenna handle to scan through until you find 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**.

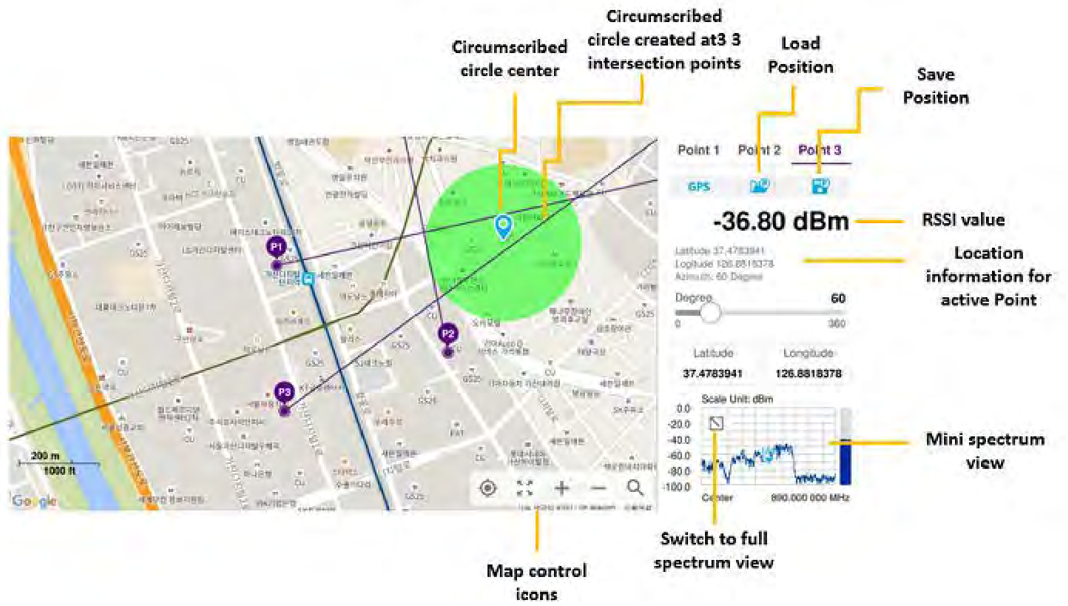
4 Tap the **Screen Mode** to select **Map** or **Full**.

– **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 24 shows an example of the Interference Finder measurement in map view.

Figure 24 Interference Finder measurement in map view



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 f 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 9 for more information.

For information about connecting the antenna, see "Antenna connection" on page 47.

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 .mcf file type created in JDMap-Creator.

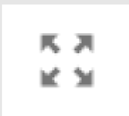
2 Tap the **Load** icon on the side bar,

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 15 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.

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 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 through 360 degrees at your location.

To obtain RSSI 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 Obtain a Persistent RSSI value:

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 panning the antenna horizontally to vary the angle of the direction, repeat pressing the TRIGGER button to obtain at least five points if you want to do the localization.

8 To continuously obtain Persistent RSSI values:

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

b Pan the antenna handle horizontally through the angle of 360 degrees you desire. A beep is sounded repeatedly to let you know that the measurement is continuing and measured values are plotted on the radar chart.

c Release the TRIGGER button to stop the continuous measurement.

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

> **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 to adjust the amplitude scale of the chart.

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 25 shows an example of the Radar Chart. Figure 26 shows an example of the radar chart with localized data.

Figure 25 Radar Chart

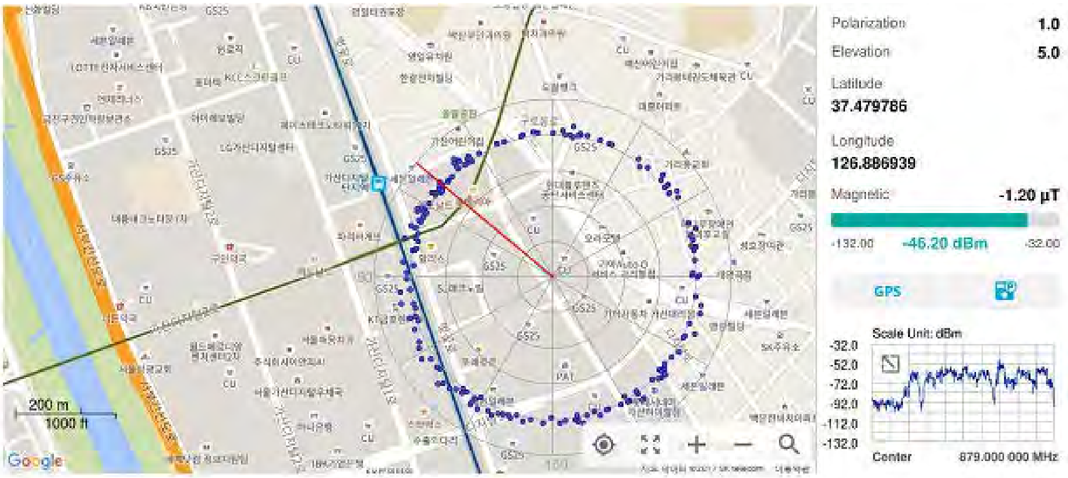


Figure 26 Radar Chart localized

Utility

The following sections describe the utility functions of the instrument.

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 27.

Figure 27 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 **Index Fail** and enter a value by using the on-screen keyboard.

9 *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.

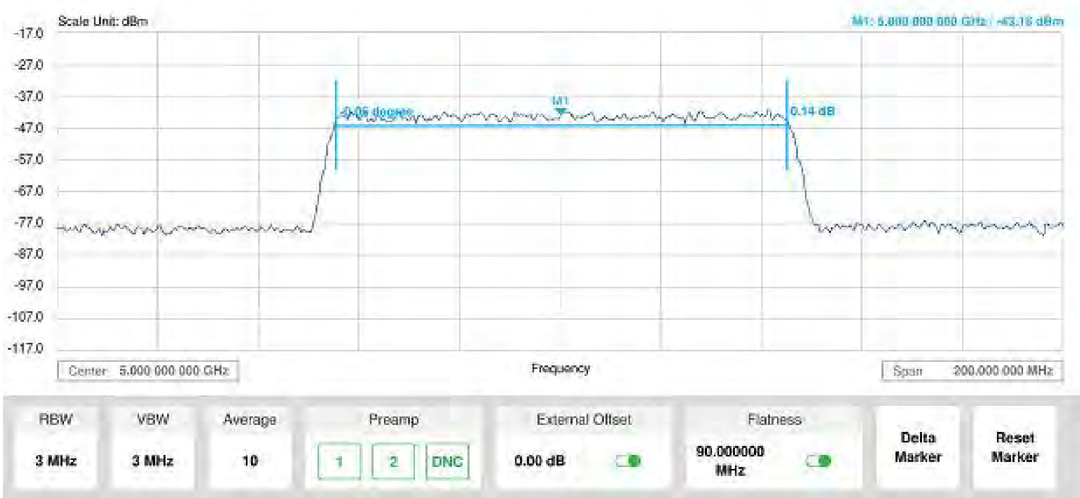
6 Tap **Channel Number** and input a value using the on-screen keyboard.

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 28 shows an example of a single carrier PIM Detection measurement.

Figure 28 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.

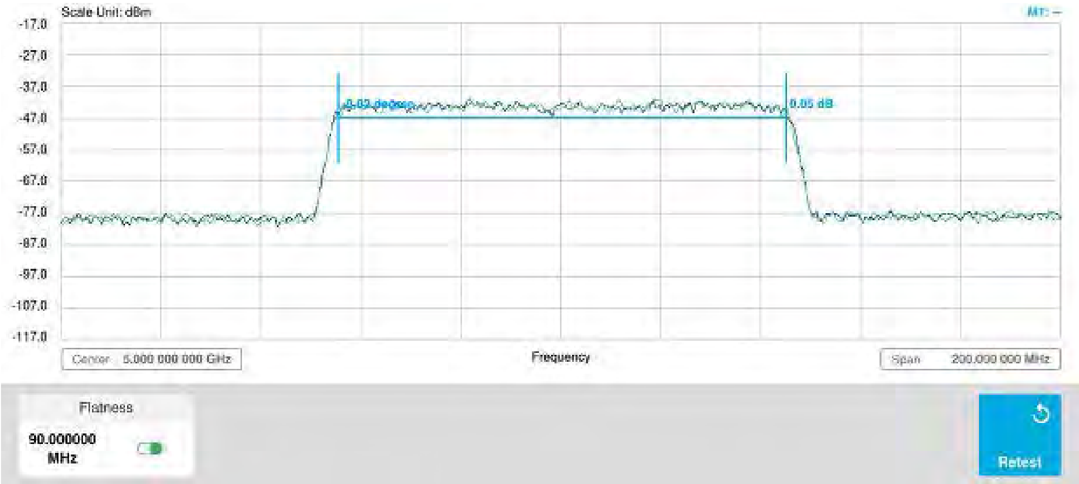
9 Tap the **Continue Step3/4** button on the right edge to continue.

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 29 shows an example of a multi carrier PIM Detection measurement.

Figure 29 PIM detection — multi carrier



4

Using Real-Time Spectrum Analyzer

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

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:

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

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

NOTE

You can choose **RF Source On** or **Off** in setup menu after tapping **CAA RF Power On** if you have **RF Source** option in your CAA (Cable and Antenna Analyzer.)

Conducting spectrum measurements

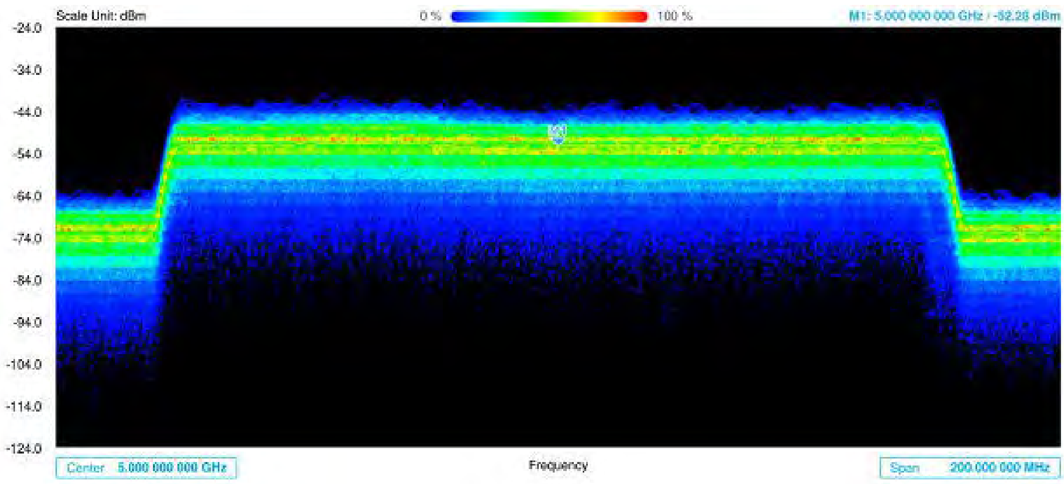
The following sections describe how to conduct spectrum measurements.

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 displays a sample persistent spectrum measurement.

Figure 30 Persistent spectrum measurement



To set measure setup for Sound Indicator

If you have configured test parameters as described in “Configuring spectrum measurements” on page 9, 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

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 **POI**. 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 16 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 Heatmap marker

1 Tap **Menu > Marker**.

The marker setting table appears.

2 Tap **Heatmap**.

The vertical bar and horizontal bar appear. A heatmap 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 heatmap marker or move the vertical bar and horizontal bar.

> **NOTE**
> If you select the heatmap marker, you can only use the Peak Search and Always Peak options. Delta pair is not available. See “Using marker” on page 20 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 heatmap 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.

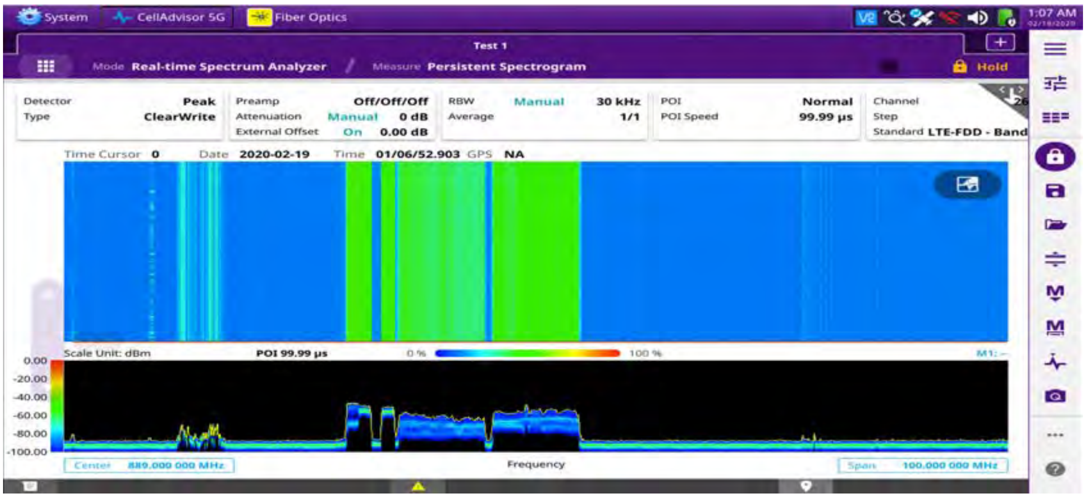
Hit Max represents the maximum number of hits to be converted to colors. If you set it to 90%, the hit matched with 90% or above shows with max colors.

Persistent 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 31 displays a sample persistent spectrogram measurement.

Figure 31 Persistent spectrogram measurement



To set measure setup

After configuring spectrum measurement as described in “Conducting spectrum measurements” on page 62, 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.** 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 17 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 Heatmap marker

1 Tap **Menu > Marker**.

The marker setting table appears.

2 Tap **Heatmap**.

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

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

> **NOTE**
> If you select the heatmap marker, you can only use Peak Search and Always Peak options. Delta pair is not available. See “Using marker” on page 20 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 heatmap 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% if 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 18 for more information.

Conducting interference analysis

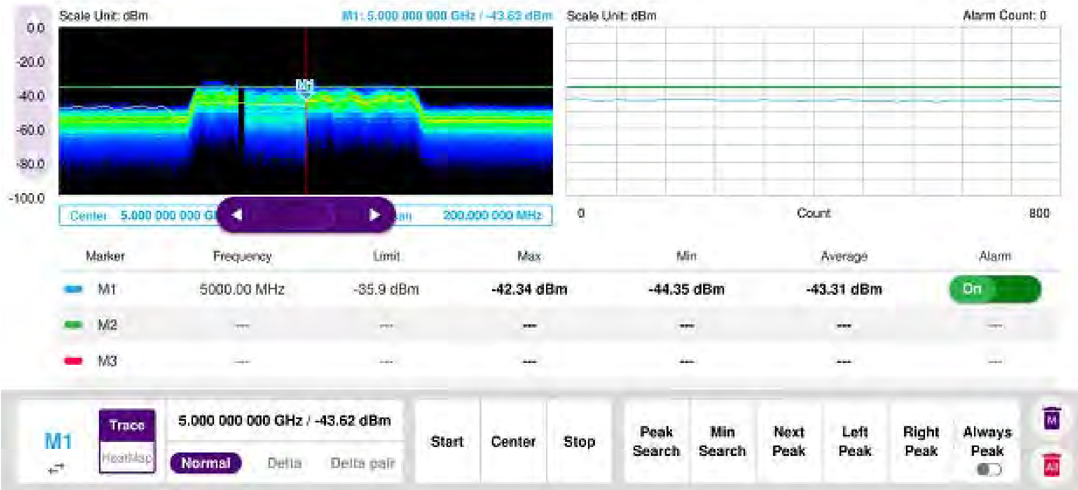
The following sections describe how to conduct interference analysis.

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 displays an example of a Persistent RSSI Measurement.

Figure 32 Persistent RSSI Measurement



After configuring spectrum measurement as described in “Configuring spectrum measurements” on page 9, 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 20 for more information.

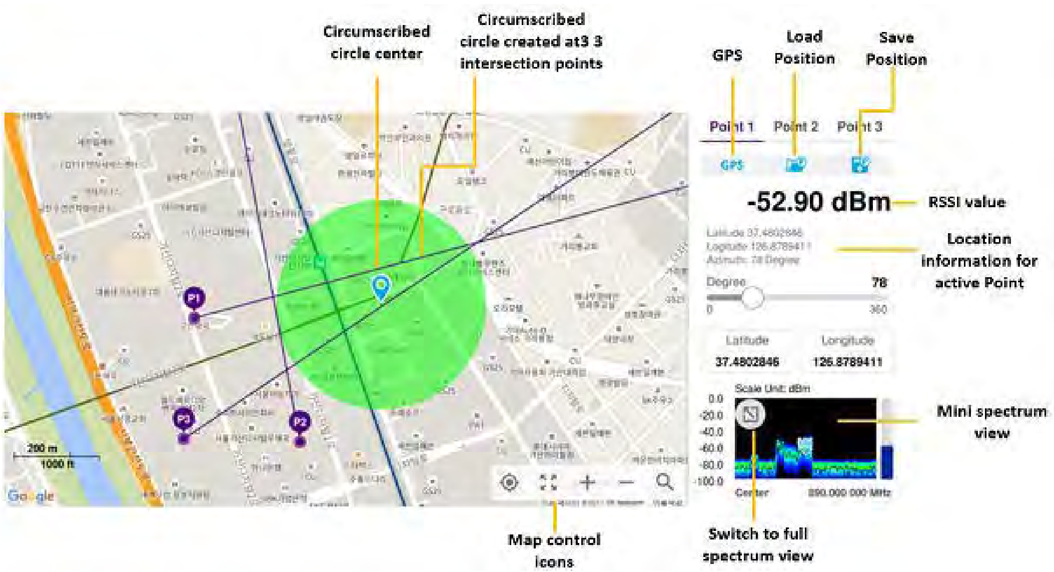
You can go to **Menu > Limit** to analyze your measurements with the display line, multi-segment line, and channel limit. See “Setting limit” on page 18 for more information. Once you tap the vertical move bar and move it up and down, the reference line value changes.

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 inscribes 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 9 for more information. Note that the purpose of the measurement is to monitor the intermittent and transient interfering signals.

Figure 33 shows an example of the Persistent Interference Finder.

Figure 33 Persistent Interference Finder



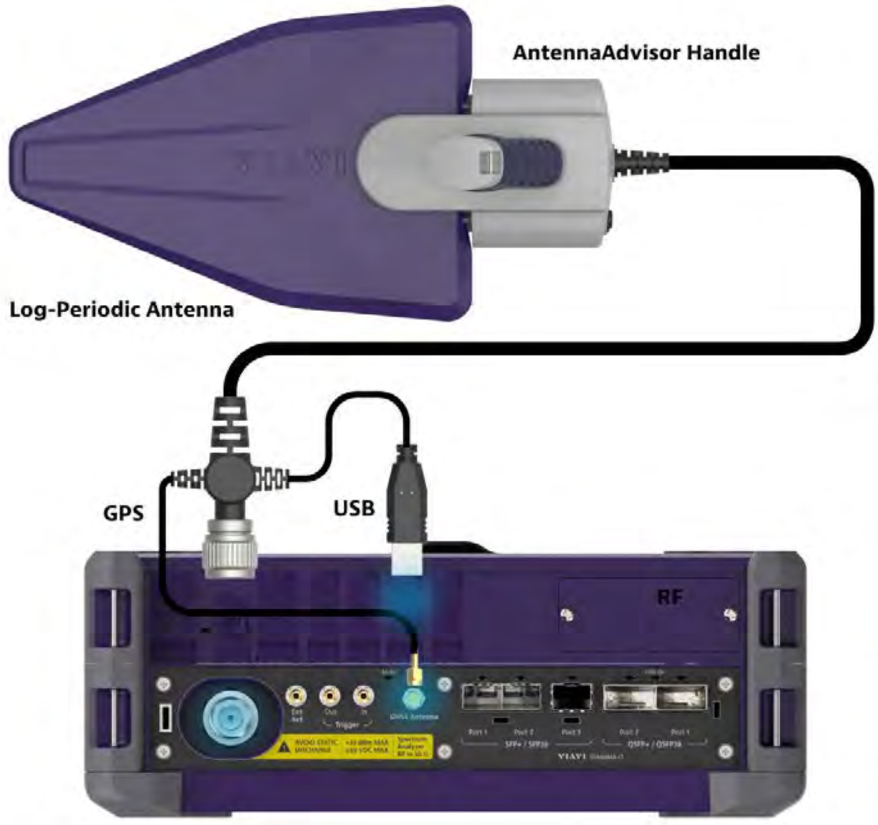
To make full use of the feature available in the map mode, you will need a GNSS receiver and an antenna. For more details, see "Antenna connection" below.

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 34 shows an example of an antenna connection.

Figure 34 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 AntennaAdivsor 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**

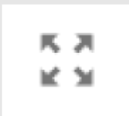
to EQP menu in JDMapCreator. For information about how to use the JDMapCreator, see the *JDMapCreator 2.0 User Guide*.

To load a map

1. Plug in your USB flash drive that has a map file in .mcf file type created in JDMap-Creator.
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 18 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.

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.

   Make sure you set three location points so that the straight lines started from the point and can create three intersections.
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 and pan the antenna handle to scan through until you find 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

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 **POI**. 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 19 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 **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.

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 9 for more information.

For antenna connection, see “Antenna connection” on page 71.

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 .mcf file type created in JDMap-Creator.

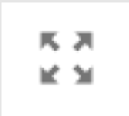
2 Tap the **Load** icon on the side bar,

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 20 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.

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 persistent RSSI 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 through 360 degrees at your location.

To obtain Persistent RSSI 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:
   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 panning the antenna horizontally to vary the angle of the direction, repeat pressing the **TRIGGER** button to obtain at least five points if you want to do the localization.

8 To continuously obtain **Persistent RSSI** values:

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

b Pan the antenna handle horizontally through the angle of 360 degrees you desire. A beep is sounded repeatedly to let you know that the measurement is continuing and measured values are plotted on the radar chart.

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

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

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 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 to adjust the amplitude scale of the chart.

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

Figure 35 Persistent Radar Chart

Figure 36 Persistent Radar Chart — localized

To set measure setup for POI

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 **POI**. 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 21 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.

Utility

The following section describes the utility functions of the device.

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 37.

Figure 37 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 **Index Fail** and enter a value by using the on-screen keyboard.
9. *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.

5

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

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:

- Spectrum Analysis
  - Spectrum
- RF Analysis
  - Channel Power
  - Occupied Bandwidth
  - Spectrum Emission Mask
  - ACLR
  - Multi-ACLR
  - Spurious Emissions
- Power vs Time
  - Power vs Time (Frame)
- Modulation Analysis
  - Constellation
  - Data Channel
  - Control Channel
  - Subframe
  - Frame
  - Time Alignment Error
  - Data Allocation Map
  - Carrier Aggregation
- OTA Analysis
  - OTA Channel Scanner
  - OTA ID Scanner
  - OTA Multipath Profile
  - OTA Control Channel
  - OTA Datagram
  - OTA Route Map
  - Freq/Time/Power Variation
- Miscellaneous
  - Power Statistics CCDF

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:
   - **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)**
   - **Modulation Analysis > Constellation, Data Channel, Control Channel, Subframe, Frame, Time Alignment Error, Data Allocation Map,** or **Carrier Aggregation**
   - **OTA Analysis > OTA Channel Scanner, OTA ID Scanner, OTA Multipath Profile, OTA Control Channel, OTA Route Map,** or **Freq/Time/Power Variation**
   - **Miscellaneous > Power Statistics CCDF**

Conducting spectrum measurement

The following sections describe how to conduct spectrum analysis.

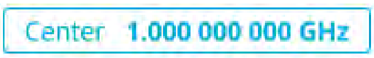
Spectrum

After setting test parameters as described in “Configuring spectrum measurements” on page 9, 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** (

)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 **GPS**.

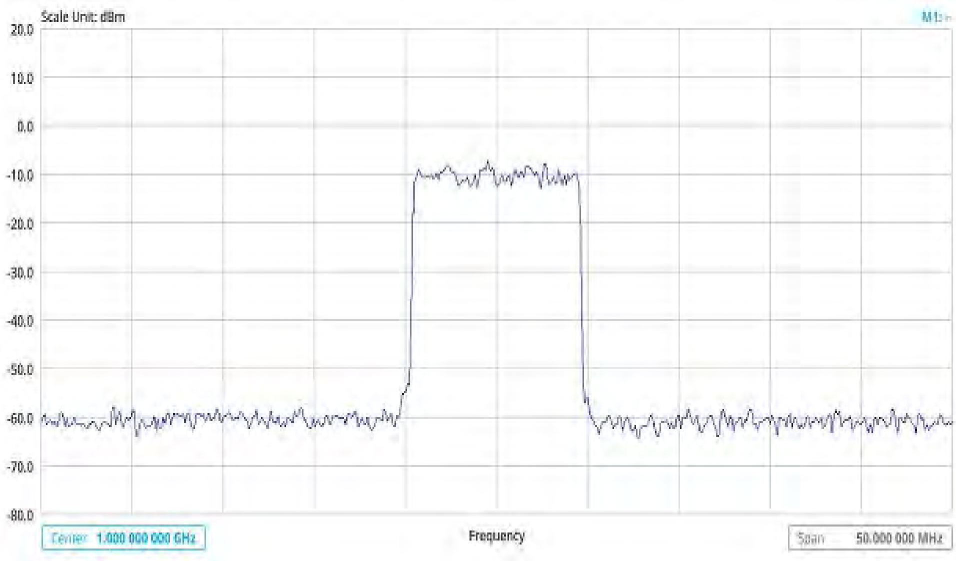
3 Tap **Freq. Ref.**(Frequency Reference) to set the clock source.

– **Internal**: Uses a 10 MHz internal clock
– **External**: Uses external 10 MHz, 13 MHz, or 15 MHz clock automatically set by the instrument
– **GPS**: Uses a built-in GPS as a frequency and timing source

> **NOTE**
> Make sure to set Frequency Reference for all measurement mode in LTE-LTE-A FDD Analyzer to sync the proper clock source.

Figure 38 shows an example of LTE/LTE-A FDD spectrum measurement.

Figure 38 LTE/LTE-A FDD spectrum measurement



Conducting RF measurement

The following sections describe how to conduct RF analysis.

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 9, 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.

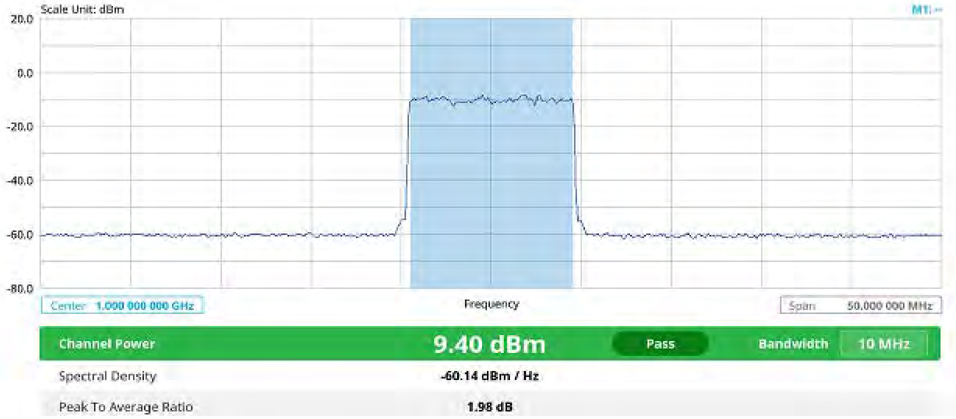
To set limit

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 39 shows an example of LTE/LTE-A FDD channel power measurement.

Figure 39 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 9, 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 40 shows an example of LTE/LTE-A FDD occupied bandwidth measurement.

Figure 40 LTE/LTE-A FDD occupied bandwidth measurement

NOTE
The Occupied Bandwidth measurement shows both of 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 SPA06MA-O 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 9, 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**.

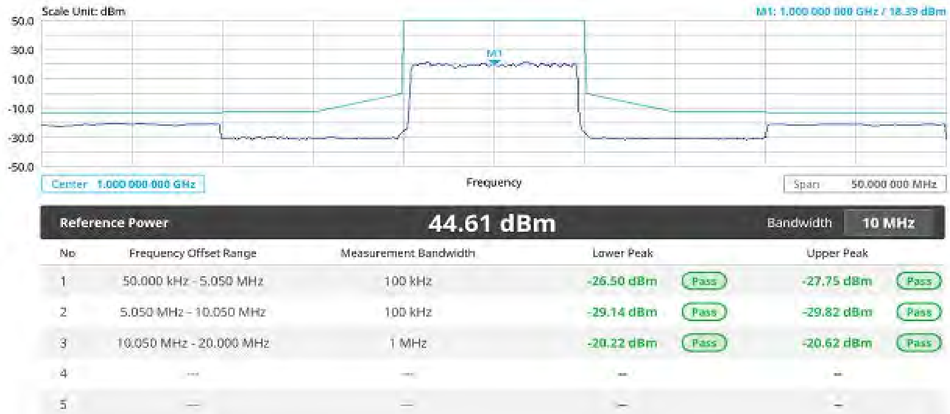
2 Tap to switch the **Test Limits** to **On** or **Off** to enable or disable Pass/Fail indication.

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 41 shows an example of LTE/LTE-A FDD spectrum emission mask measurement.

Figure 41 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 9, 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.

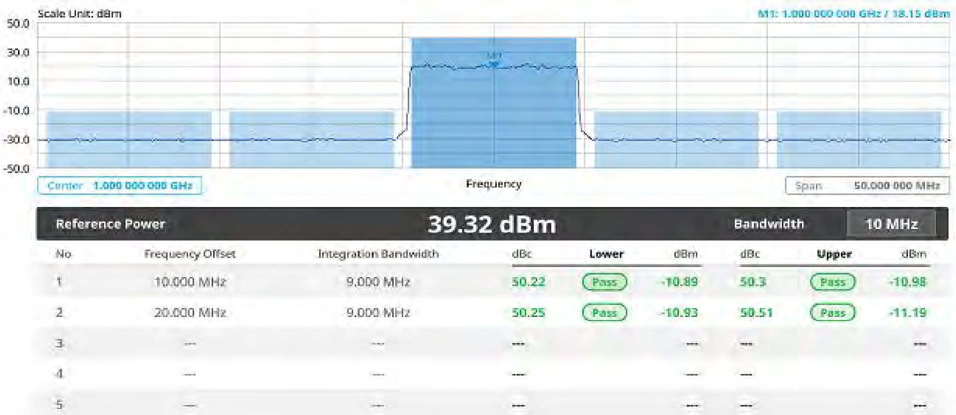
To set limit

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 42 shows an example of LTE/LTE-A FDD ACLR measurement.

Figure 42 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 9, 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.

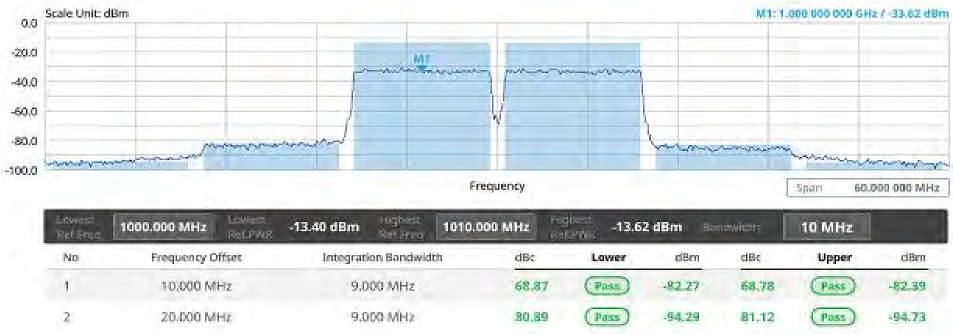
To set limit

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 43 shows an example of LTE/LTE-A FDD Multi-ACLR measurement.

Figure 43 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 SPA06MA-O 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 9, 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.

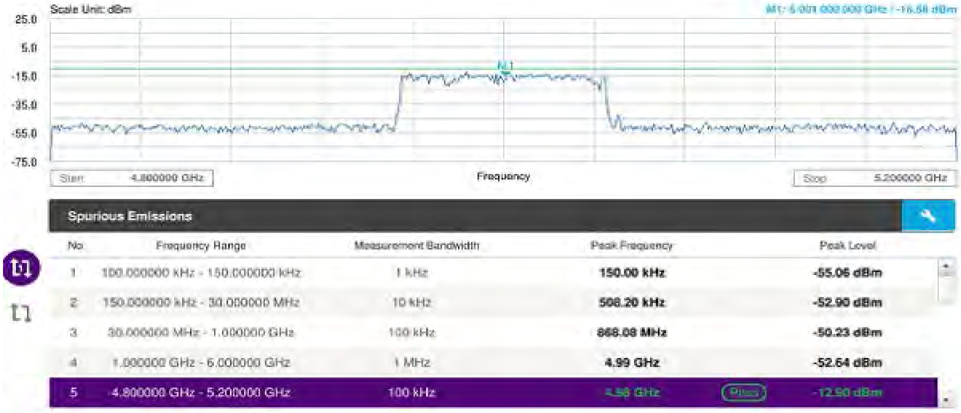
   You can also access this menu through **Menu > Average** on the side bar.

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 44 shows an example of LTE/LTE-A FDD spurious emissions measurement.

Figure 44 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.

Power vs Time

The following sections describe how to conduct Power vs Time 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 9, 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**.

3 Tap **Subframe Number** to set the number of subframe using the on-screen keyboard.

4 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.

5 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
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 45 shows an example of LTE/LTE-A FDD Power vs Time (Frame) measurement.

Figure 45 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.

Conducting modulation measurement

The following sections describe how to conduct modulation 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 9, 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**.
3. Tap **Subframe Number** to set the number of subframe using the on-screen keyboard.
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.
5. *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.

6. *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**.

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**.

   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

To set the limit for	Select and set
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 46 shows an example of LTE/LTE-A FDD constellation measurement.

Figure 46 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.

Setting measure setup

After configuring the spectrum measurement in “Configuring spectrum measurements” on page 9, 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**.

3 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.

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.

5 *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.

6 *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**.

7 Tap **Event Hold** and select **On** or **Off** to enable or disable the event hold feature.When enabled, the display 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.

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
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 47 shows an example of LTE/LTE-A FDD data channel measurement.

Figure 47 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.

Setting measure setup

After configuring the spectrum measurement in "Configuring spectrum measurements" on page 9, 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**.
3. 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.

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.
5. *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.

6. *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**.
7. 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

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 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**.

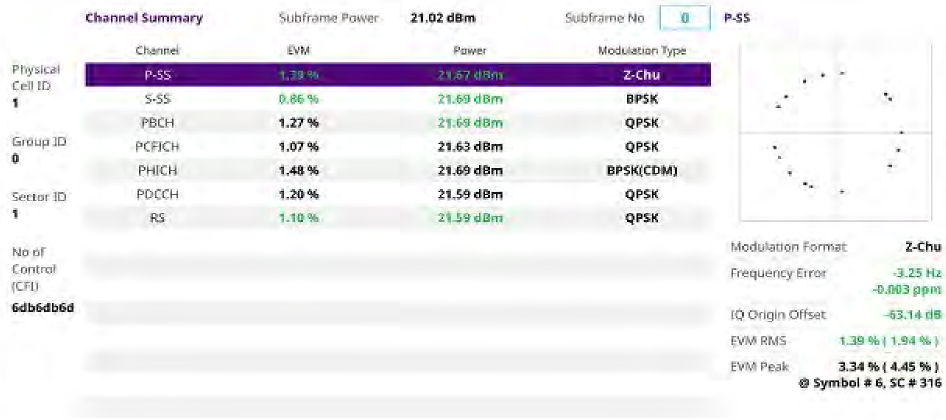
2 Tap the test items and set the limits depending on your selected measurement mode:

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 48 shows an example of LTE/LTE-A FDD control channel measurement.

Figure 48 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 9, 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**.

3 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.

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.

5 *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.

6 *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**.

7 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

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 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 **PDSCH 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 49 shows an example of LTE/LTE-A FDD subframe measurement.

Figure 49 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.

Frame

The Frame measures the modulation accuracy of all the data and control channels at the specified frame (1 ms).

Setting measure setup

After configuring the spectrum measurement in “Configuring spectrum measurements” on page 9, 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**.

3 *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.

4 *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.

5 *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**.

6 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

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**.

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 **PDSCH 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

To set the limit for	Select and set
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
Frame Avg 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

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

Figure 50 shows an example of LTE/LTE-A FDD frame measurement.

Figure 50 LTE/LTE-A FDD 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 the spectrum measurement in “Configuring spectrum measurements” on page 9, 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**.

3 *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.

4 *Optional.* To select the number of antenna ports, tap the **MIMO** and select **2x2** or **4x4**.

5 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.

6 To select the Cyclic Prefix, tap **Cyclic Prefix** and select **Normal** or **Extended**.

To set limit

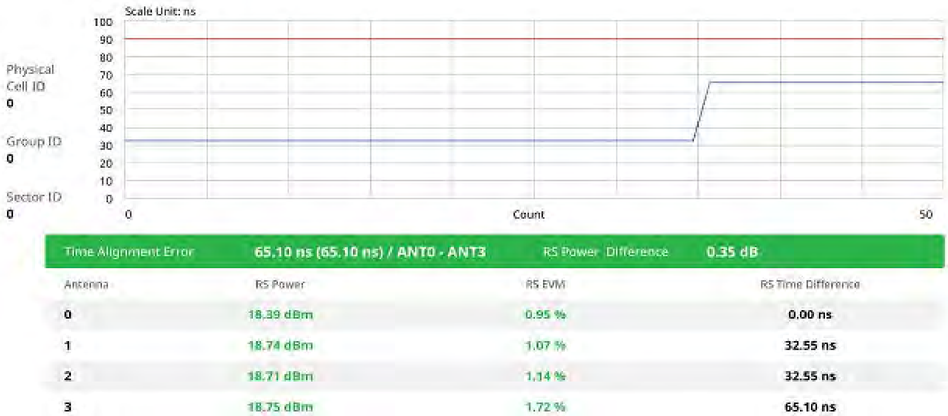
1 Tap **Menu > Limit**.

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 51 shows an example of LTE/LTE-A FDD time alignment error measurement.

Figure 51 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 9, 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**.
3. Tap **Subframe Number** to set the number of subframe using the on-screen keyboard.
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.
5. *Optional.* To set the threshold for PDSCH, tap **PDSCH Threshold** and enter a value by using the on-screen keyboard.
6. *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

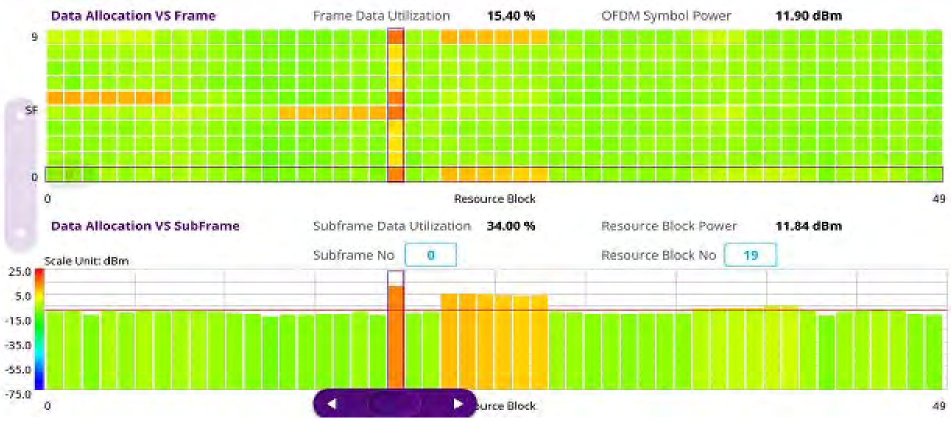
1. Tap **Menu > Display**.
2. Select the display mode from the choice: **PDSCH**, **PMCH** or **Both.**

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 52 shows an example of LTE/LTE-A FDD data allocation map measurement.

Figure 52 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 SPA06MA-O provides carrier aggregation measurements supporting for all the different modes with carrier aggregation bands added to the channel standard.

Setting measure setup

After configuring the spectrum measurement in “Configuring spectrum measurements” on page 9, 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 **CA Configuration** or tap the **Configuration** ( ) icon then the component carrier configuration window appears.
3. Select the number of the component carrier to be set between one and five by tapping the number in **Range** box.
4. 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.
5. Tap **LAA** (License Assisted Access) and select one among the three options: **2.4 GHz**, **5 GHz**, or **Off**.
6. 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**.
7. 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
8. 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.
9. To set the threshold for PDSCH, tap **PDSCH Threshold** and enter a value by using the on-screen keyboard.
10. Tap **PDSCH Precoding** between **On** and **Off** to enable or disable the PDSCH precoding.

To set limit

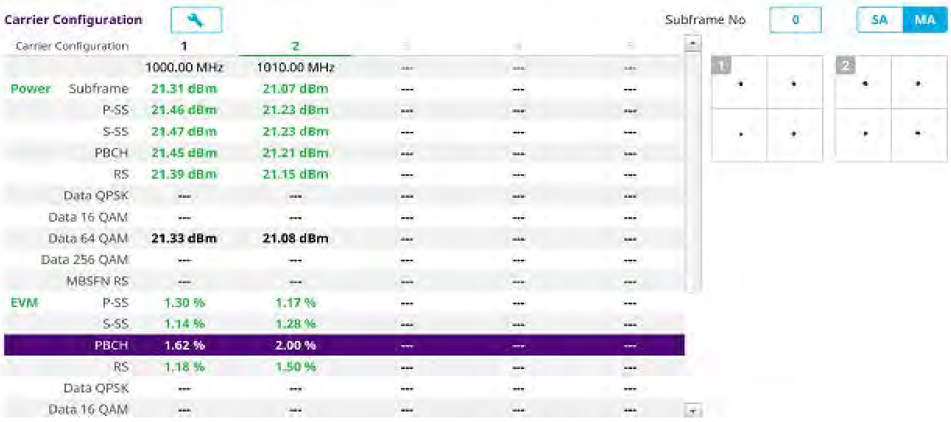
1. Tap **Menu > Limit**.
2. Tap the test items and set the limits depending on your selected measurement mode:

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

To set the limit for	Select and set
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/ Intra Band High

Figure 53 shows an example of LTE/LTE-A FDD carrier aggregation measurement.

Figure 53 LTE/LTE-A FDD carrier aggregation measurement



Conducting OTA measurement

The following sections describe how to conduct 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 9, 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 the **MIMO** and select **2x2** or **4x4** to select the number of antenna ports.

3 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 **GPS** 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
   – **GPS**: When synchronizing the signal processing via the GPS receiver. If you want to check the time error correctly, set the trigger to GPS

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.

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.

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 54 shows an example of OTA LTE/LTE-A FDD channel scanner measurement.

Figure 54 LTE/LTE-A FDD OTA channel scanner measurement

No	Frequency (MHz)	PCI (Grp,Sctr)	Channel Power (dBm)	RSSI (dBm)	RSRP (dBm)	RSRQ (dB)	RS SINR (dB)	S-SS RSSI (dBm)	Time Error (µs)	Freq Error (ppm)	Antenna
1	879.00	301 (100,1)	-23.61	-26.22	-85.61	-42.40	4.31	-79.06	-5001.82	-2119.10	Antenna0
2	889.00	65 (21,2)	-23.81	-25.70	-61.41	-18.72	13.93	-41.91	-5000.62	990.00	Antenna0
3	---	---	---	---	---	---	---	---	---	---	---
4	---	---	---	---	---	---	---	---	---	---	---
5	---	---	---	---	---	---	---	---	---	---	---
6	---	---	---	---	---	---	---	---	---	---	---

Figure 55 LTE/LTE-A FDD OTA channel scanner with frequency error

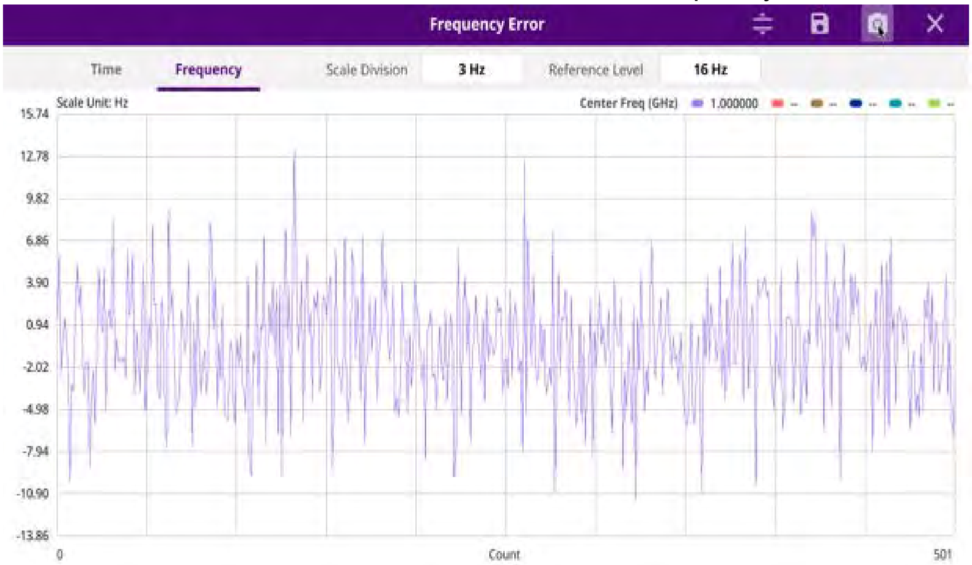
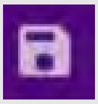
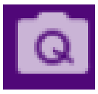
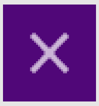


Figure 56 LTE/LTE-A FDD OTA channel scanner with time error

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 that all of these signals 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 9, 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**.

3 Tap the **MIMO** and select **2x2** or **4x4Hz** to select the number of antenna ports.

4 To select the Cyclic Prefix, tap **Cyclic Prefix** and select **Normal** or **Extended**.

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 57 shows an example of OTA LTE/LTE-A FDD ID scanner measurement.

Figure 57 LTE/LTE-A FDD OTA ID scanner measurement

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 9, 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

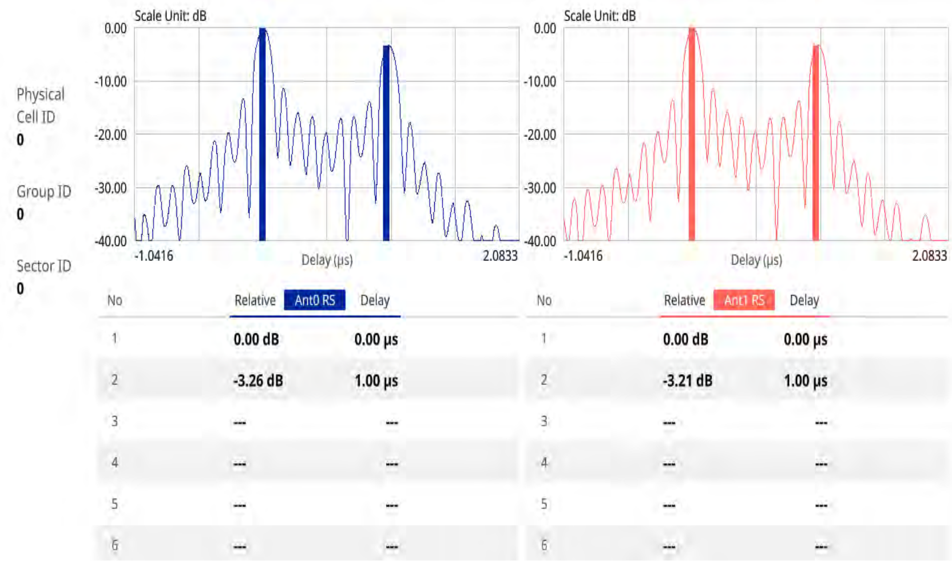
1 Tap the **Setup** ( ) icon in the side bar.

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**.

3. Tap **RS Window** and select the RS window option: **2 µs, 4 µs,** or **8 µs**.
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.
6. Tap the **MIMO** and select **2x2** or **4x4Hz** to select the number of antenna ports.
7. To select the Cyclic Prefix, tap **Cyclic Prefix** and select **Normal** or **Extended**.

Figure 58 shows an example of LTE/LTE-A FDD OTA multipath profile measurement.

Figure 58 LTE/LTE-A FDD 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 9, 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**.

3 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.

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.

5 Tap the **MIMO** and select **2x2** or **4x4Hz** to select the number of antenna ports.

6 *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.

7 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.

8 To set the Multicast Broadcast Single Frequency Network (**MBSFN**) detection automatically or manually for MBMS testing, tap **MBSFN** and select **Auto** or **Manual**.

9 To select the Cyclic Prefix, tap **Cyclic Prefix** and select **Normal** or **Extended**.

10 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 59 shows an example of LTE/LTE-A FDD OTA control channel measurement.

Figure 59 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.

Setting measure setup

After configuring the spectrum measurement in “Configuring spectrum measurements” on page 9, 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

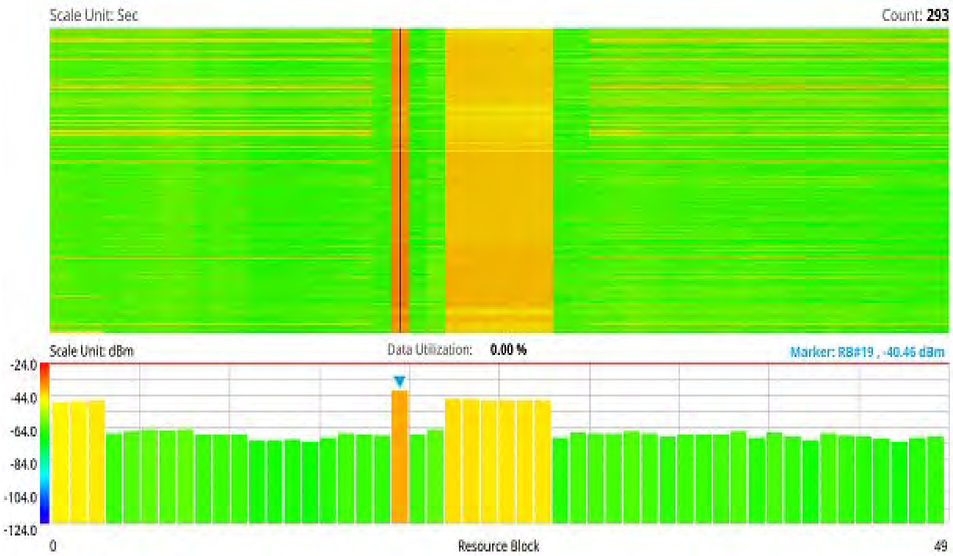
1. Tap the **Setup** ( ) icon in the side bar.
2. Tap **Bandwidth** and select the value from the following choices: **1.4 MHz**, **3 MHz**, **5 MHz**, **10 MHz**, **15 MHz** or **20 MHz**.
3. Tap **Subframe Number** to set the number of subframe using the on-screen keyboard.
4. Tap **Position** to set the number of positions using the on-screen keyboard when **Time Cursor** is set to **On**.
5. *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.
6. *Optional.* To set the threshold for PDSCH, tap **PDSCH Threshold** and enter a value by using the on-screen keyboard.
7. 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.

8. To start a new measurement, tap **Reset**.
9. *Optional.* To select the number of antenna ports, tap the **MIMO** and select **2x2** or **4x4.**
10. *Optional.* To select the Cyclic Prefix, tap **Cyclic Prefix** and select **Normal** or **Extended**.

Figure 60 shows an example of LTE/LTE-A FDD OTA datagram measurement.

Figure 60 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 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 61 shows an example of LTE/LTE-A FDD OTA route map measurement.

Figure 61 OTA route map with LTE/LTE-A FDD analyzer

Loading a map

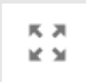
To use any features related to maps, you need to download and install the maps on the instrument. The VIAVI JDMapCreator will help you download maps. Make sure the JDMapCreator application on your computer is connected to the instrument via LAN. You can send a map file with a single layer to the instrument 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 .mcf 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 22 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 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 9 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 **GPS**, **Position**, or **Time**.

a To collect data/plot points automatically as you move around in a vehicle or outside, select **GPS**, 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 **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 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.

7 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.

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.

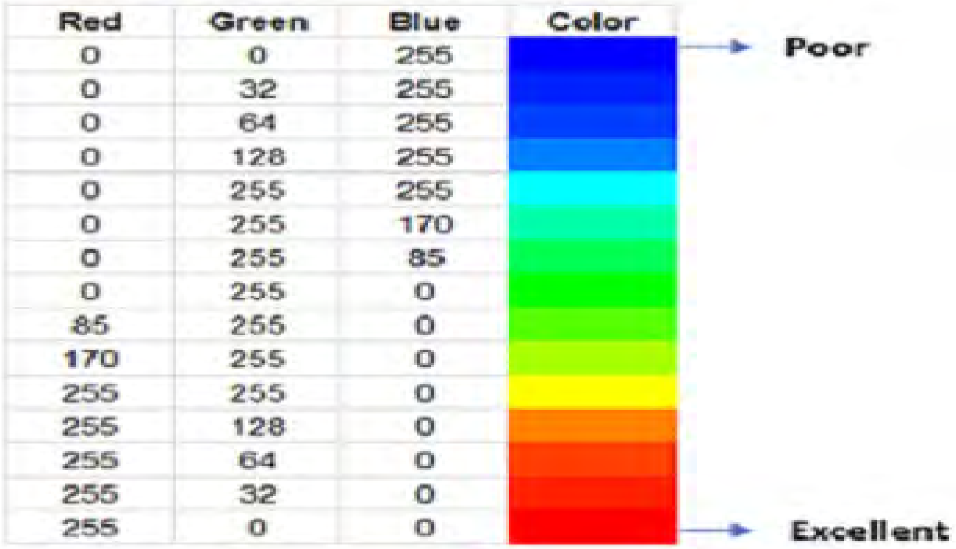
2 Set a value for **Poor** (minimum value) using the on-screen keyboard.

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 62 shows a legend color table.

Figure 62 Legend color table



Red	Green	Blue	Color
0	0	255	
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	

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 **step 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 GPS 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 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.

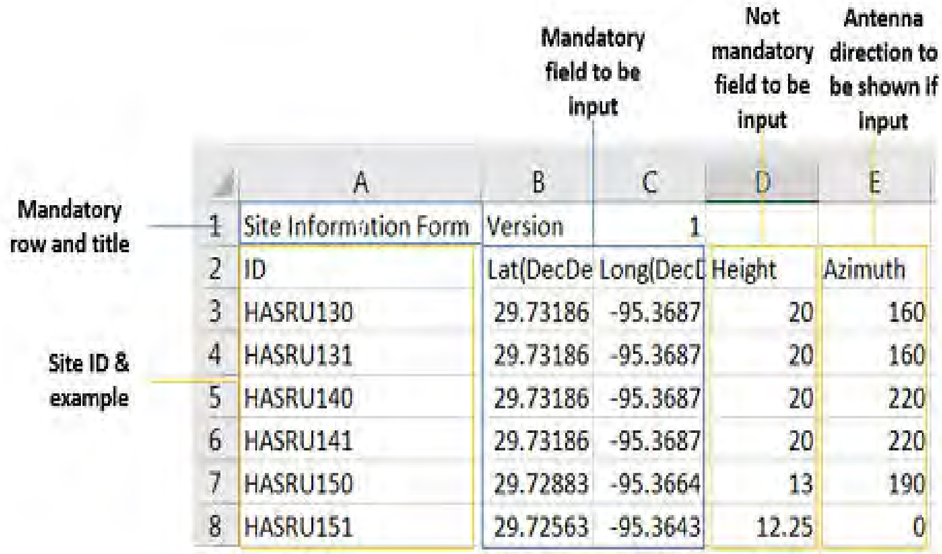
To import cellsite DB

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.

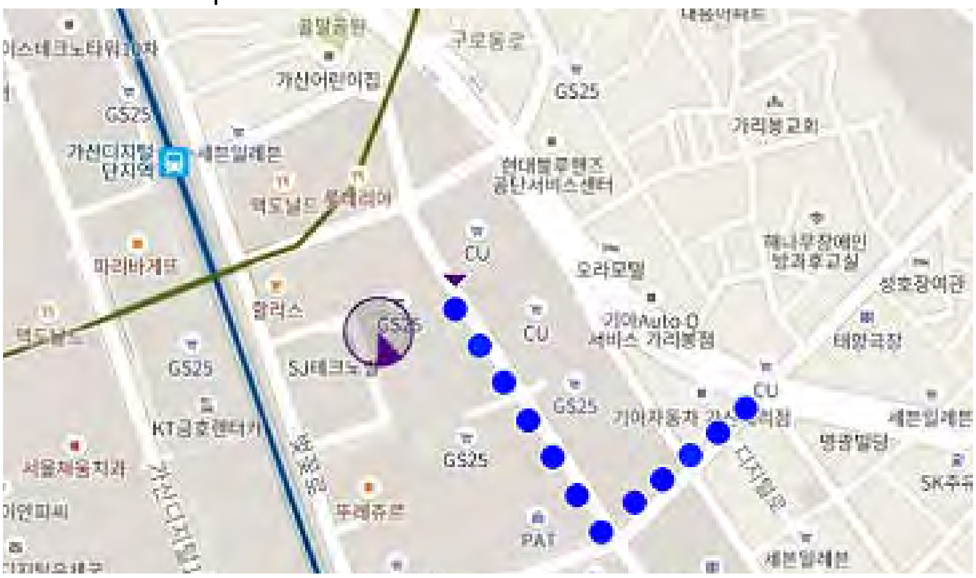
Figure 63 shows an example of an importing cellsite DB.

Figure 63 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 64 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 9, 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**.
3. *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.
4. Tap to switch **PCI (Physical Cell ID)** to **Manual** or **Auto**.
5. *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.
6. *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**.
7. 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

8 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 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.

9 Tap **Menu > Antenna**.

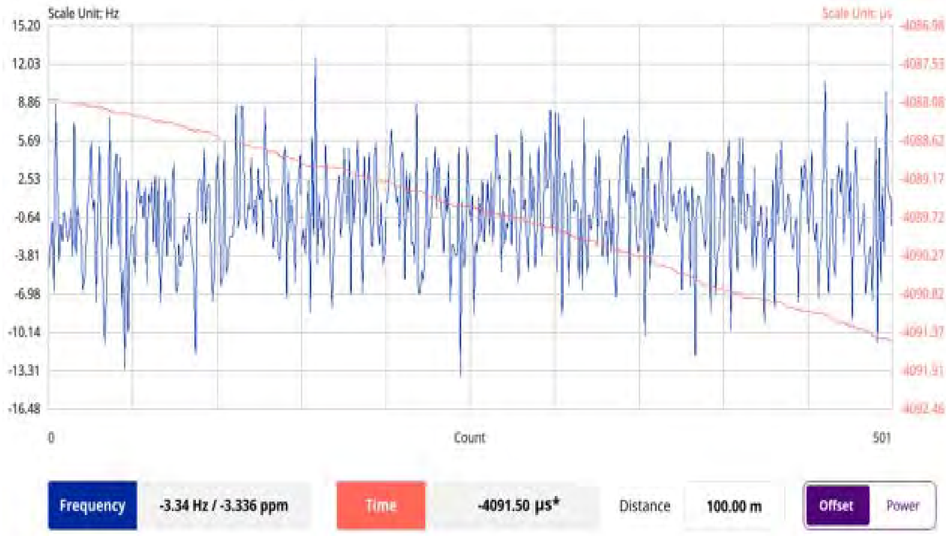
– To assign a antenna port number automatically or manually, tap **Antenna Port** and select the option: **Auto**, **Antenna 0**, or **Antenna 1**.

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 65 shows an example of LTE/LTE-A FDD freq/time/power variation by offset.

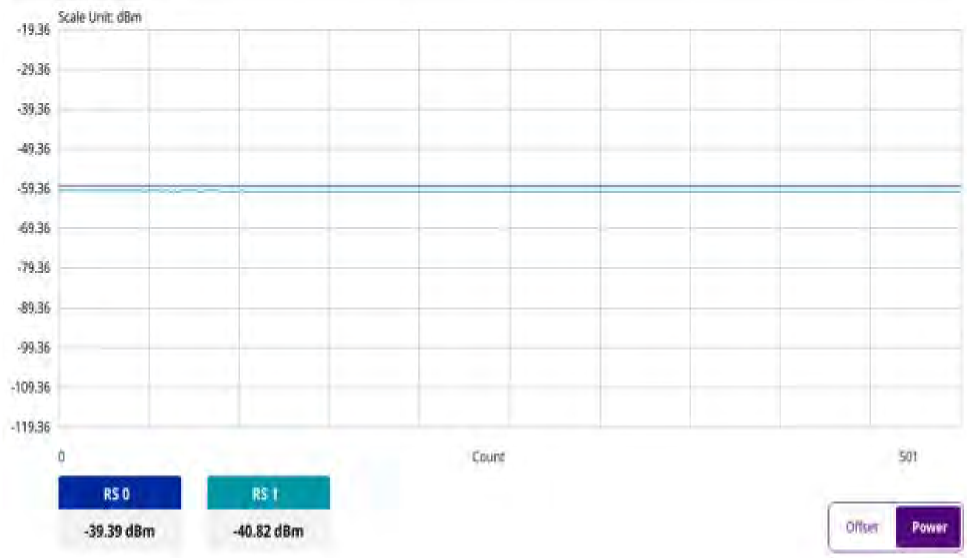
Figure 65 LTE/LTE-A FDD freq/time/power variation by offset



> **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.

Figure 66 shows an example of LTE/LTE-A FDD freq/time/power variation by power.

Figure 66 LTE/LTE-A FDD freq/time/power variation by power



Miscellaneous

The following sections describe how to conduct miscellaneous analysis.

Power statistics CCDF

The Power Statistics Complementary Cumulative Distribution Function (CCDF) measurement characterizes the power statistics of the input signal. It provides PAR (Peak to Average power Ratio) versus different probabilities.

Setting measure setup

After configuring the spectrum measurement in “Configuring spectrum measurements” on page 9, 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.

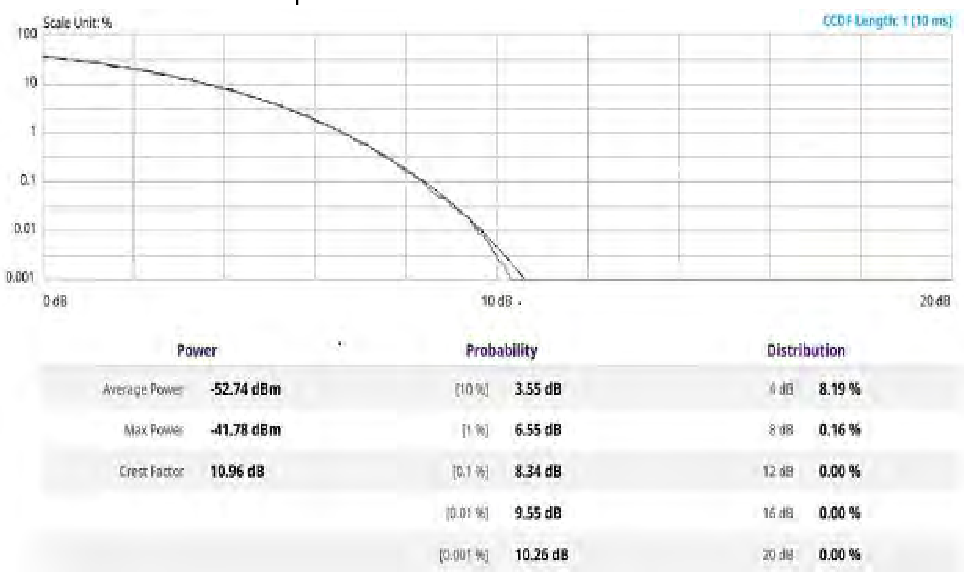
To set measure setup

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

2 Tap **CCDF Length** and select the value between 1 and 100.

Figure 67 shows an example of LTE/LTE-A FDD power statistics CCDF measurement.

Figure 67 LTE/LTE-A FDD power statistics CCDF measurement



6

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

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:

- Spectrum Analysis
  - Spectrum
- RF Analysis
  - Channel Power
  - Occupied Bandwidth
  - Spectrum Emission Mask
  - ACLR
  - Multi-ACLR
  - Spurious Emissions
- Power vs Time
  - Power vs Time (Frame)
  - Power vs Time (Slot)
- Modulation Analysis
  - Constellation
  - Data Channel
  - Control Channel
  - Subframe
  - Time Alignment Error
  - Data Allocation Map
  - Carrier Aggregation
- OTA Analysis
  - OTA Channel Scanner
  - OTA ID Scanner
  - OTA Multipath Profile
  - OTA Control Channel
  - OTA Datagram
  - OTA Route Map
  - Freq/Time/Power Variation
- Miscellaneous
  - Power Statistics CCDF

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:
   – **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)** or **Power vs Time (Slot)**
   – **Modulation Analysis > Constellation, Data Channel, Control Channel, Subframe, Time Alignment Error, Data Allocation Map,** or **Carrier Aggregation**
   – **OTA Analysis > OTA Channel Scanner, OTA ID Scanner, OTA Multipath Profile, OTA Control Channel, OTA Datagram, OTA Route Map,** or **Freq/Time/Power Variation**
   – **Miscellaneous > Power Statistics CCDF**

Conducting spectrum measurement

The following sections describe how to conduct spectrum analysis.

Spectrum

After setting test parameters as described in “Configuring spectrum measurements” on page 9, 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** (

)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**.

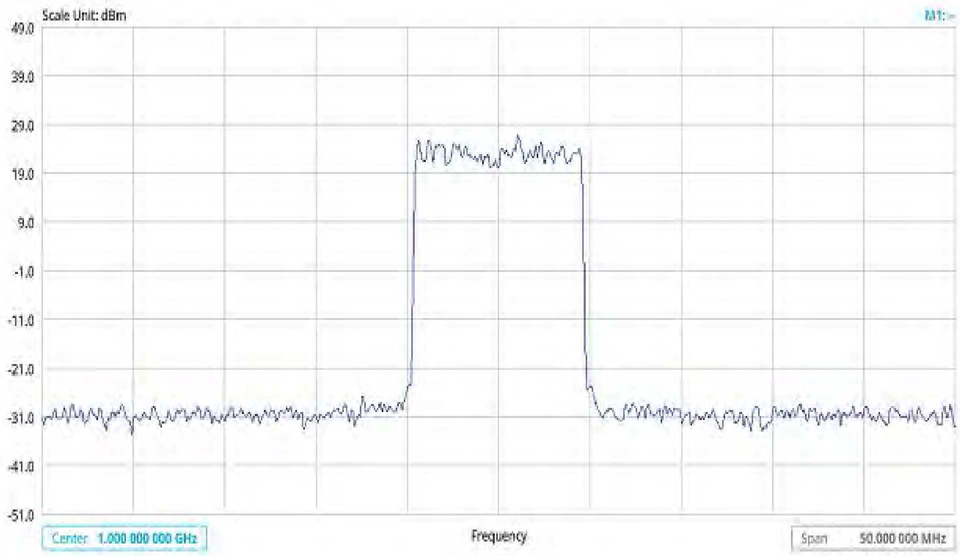
2 Tap **Trigger** and select the options from **Internal**, **External**, or **GPS**.

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
- **GPS**: Uses a built-in GPS as a frequency and timing source

NOTE
Make sure to set Frequency Reference for all measurement mode in LTE-LTE-A TDD Analyzer to sync the proper clock source.

Figure 68 shows an example of an LTE/LTE-A TDD spectrum measurement.

Figure 68 LTE/LTE-A TDD spectrum measurement



Conducting RF measurement

The following sections describe how to conduct RF analysis.

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 9, 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 **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 69 shows an example of LTE/LTE-A TDD channel power measurement.

Figure 69 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 9, 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 **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.

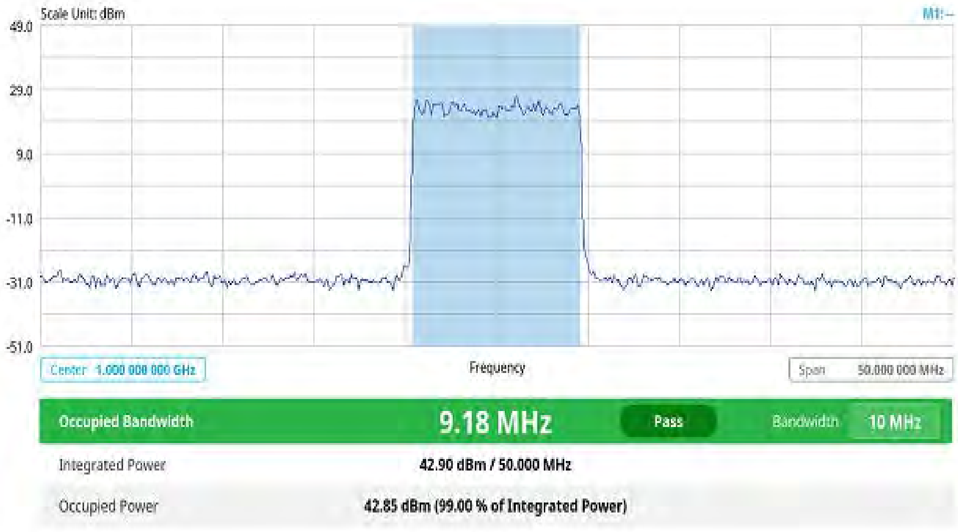
3 Tap **High Limit** to set the upper threshold using the on-screen keyboard.

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 70 shows an example of LTE/LTE-A TDD occupied bandwidth measurement.

Figure 70 LTE/LTE-A TDD occupied bandwidth measurement



> **NOTE**
> The Occupied Bandwidth measurement shows both of 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 SPA06MA-O 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 9, 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**.

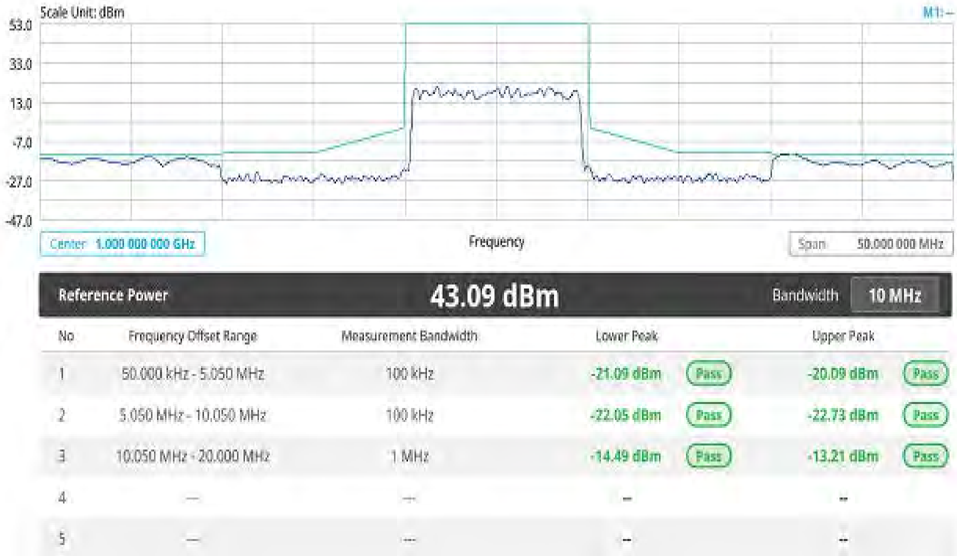
2 Tap to switch the **Test Limits** to **On** or **Off** to enable or disable Pass/Fail indication.

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 71 shows an example of LTE/LTE-A TDD spectrum emission mask measurement.

Figure 71 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 9, 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 72 shows an example of LTE/LTE-A TDD ACLR measurement.

Figure 72 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 9, 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 73 shows an example of LTE/LTE-A TDD Multi-ACLR measurement.

Figure 73 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

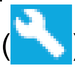
The Spurious Emissions measurement is to identify or determine the power level of in-band or out-of-band spurious emissions within the necessary channel bandwidth and modulated signal. The SPA06MA-O indicates either Pass or Fail based on the specified limit of the signal.

Setting measure setup

After configuring the spectrum measurement in “Configuring spectrum measurements” on page 9, 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.

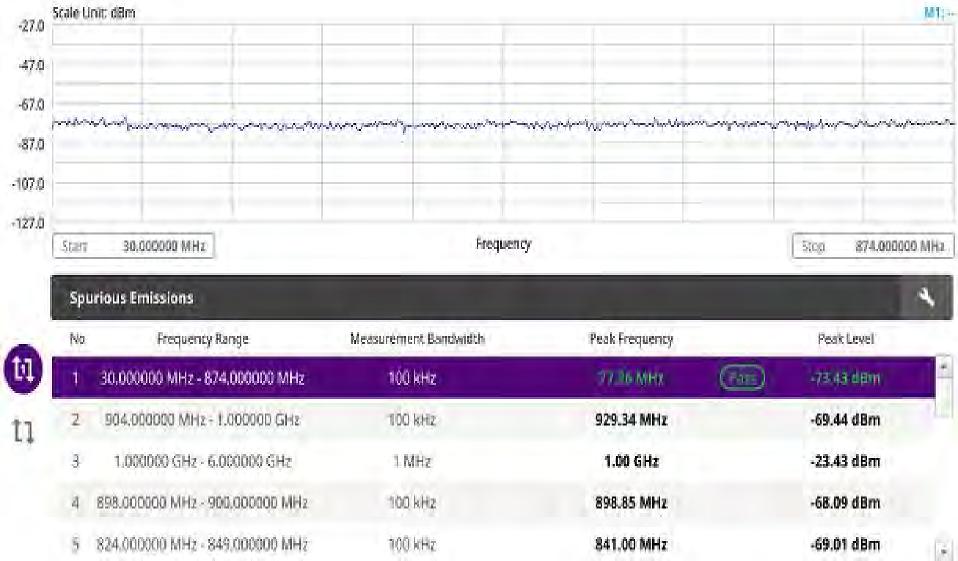
To set limit

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 74 shows an example of LTE/LTE-A TDD spurious emissions measurement.

Figure 74 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.

Power vs Time

The following sections describe how to conduct Power vs Time analysis.

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 9, 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.

5 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 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.

7 Tap **Cyclic Prefix** and select **Normal** or **Extended.**

8 Tap **Delay** and enter a value using the on-screen keyboard to set the amount of delay in **μs.**

9 Tap **Special Subframe** and enter a value using the on-screen keyboard.

To set limit

1 Tap **Menu > Limit**.

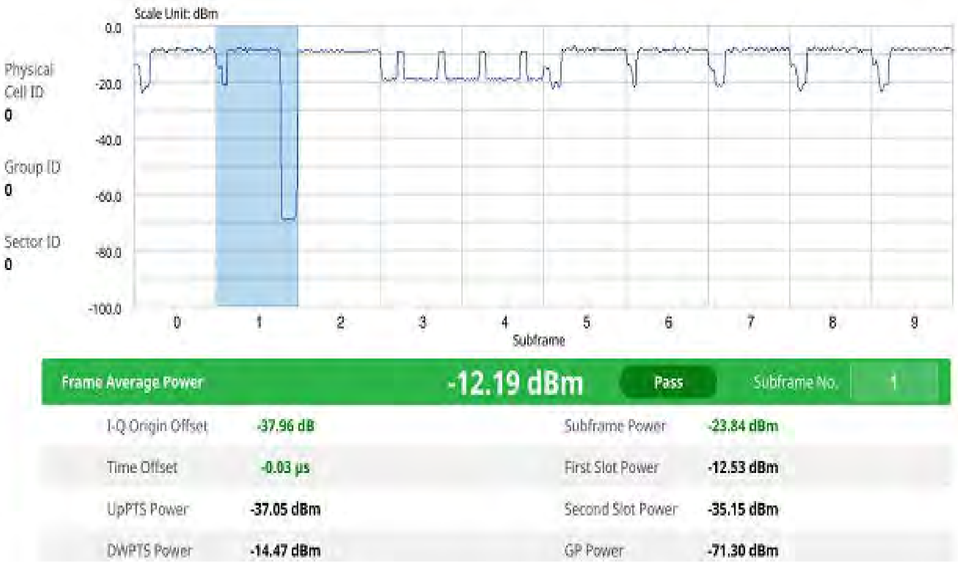
2 Tap the test items and set the limits depending on your selected measurement mode:

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 75 shows an example of LTE/LTE-A TDD power vs time (Frame) measurement.

Figure 75 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 9, 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 **Slot Number** to set the number of slots 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.

5 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 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.

7 Tap **Cyclic Prefix** and select **Normal** or **Extended.**

8 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 76 shows an example of LTE/LTE-A TDD power vs time (Slot) measurement.

Figure 76 LTE/LTE-A TDD power vs time (Slot) measurement

Conducting modulation measurement

The following sections describe how to conduct modulation 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 9, 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**.

3 Tap **Subframe Number** to set the number of subframe using the on-screen keyboard.

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.

5 *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.

6 *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**.

7 Tap **Uplink-Downlink Config** and select the number of uplink/downlink 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 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 77 shows an example of LTE/LTE-A TDD constellation measurement.

Figure 77 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.

Setting measure setup

After configuring the spectrum measurement in “Configuring spectrum measurements” on page 9, 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**.
3. 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.

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.

5 *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.

6 *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**.

7 Tap **Event Hold** and select **On** or **Off** to enable or disable the event hold feature.When enabled, the display 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.

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
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.

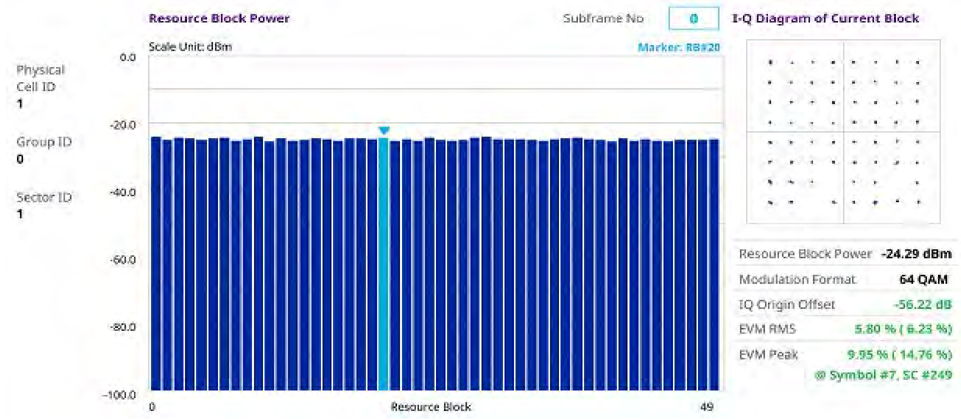
To set marker

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 78 shows an example of LTE/LTE-A TDD data channel measurement.

Figure 78 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.

Setting measure setup

After configuring the spectrum measurement in “Configuring spectrum measurements” on page 9, 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**.

3 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.

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.

5 *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.

6 *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**.

7 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

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 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**.

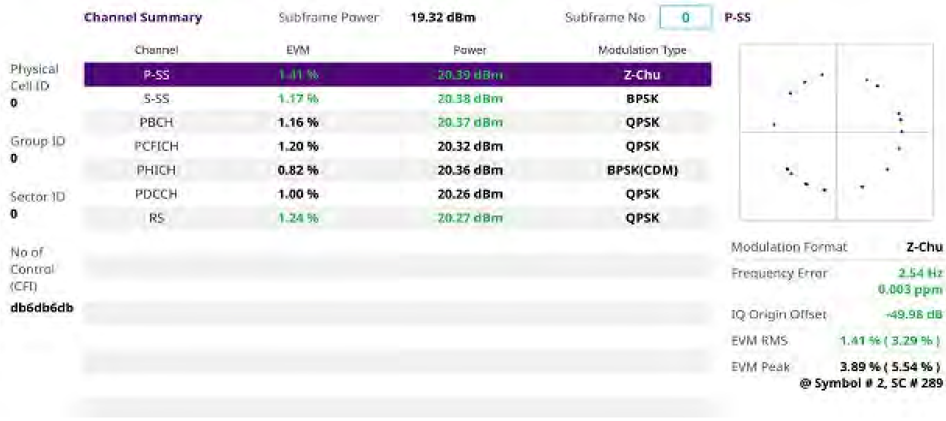
2 Tap the test items and set the limits depending on your selected measurement mode:

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 79 shows an example of LTE/LTE-A TDD control channel measurement.

Figure 79 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 9, 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**.
3. 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.

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.

5 *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.

6 *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**.

7 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

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 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 **PDSCH 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 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 80 shows an example of LTE/LTE-A TDD subframe measurement.

Figure 80 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.

Setting measure setup

After configuring the spectrum measurement in "Configuring spectrum measurements" on page 9, 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**.

3 *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.

4 *Optional.* To select the number of antenna ports, tap the **MIMO** and select **2x2** or **4x4**.

5 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.

6 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.

7 To select the Cyclic Prefix, tap **Cyclic Prefix** and select **Normal** or **Extended**.

To set limit

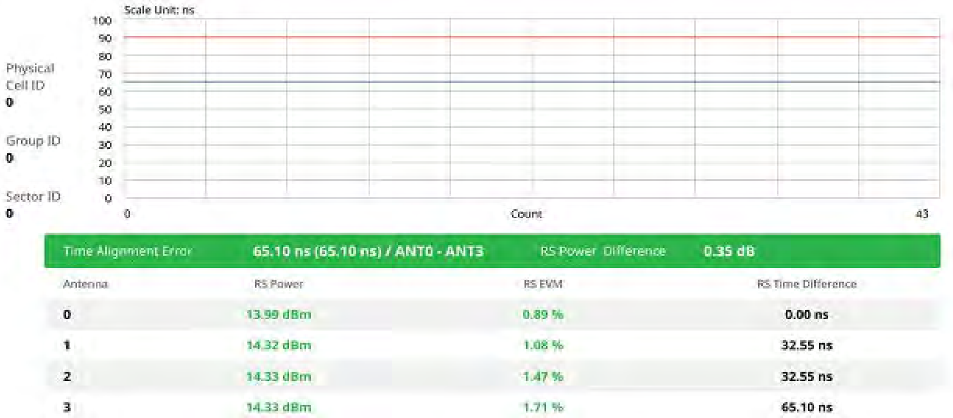
1 Tap **Menu > Limit**.

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 81 shows an example of LTE/LTE-A TDD time alignment error measurement.

Figure 81 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 9, 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**.

3 Tap **Subframe Number** to set the number of subframe using the on-screen keyboard.

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.

5 Tap **Uplink-Downlink Config** and select the number of uplink/downlink using the on-screen keyboard.

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 82 shows an example of LTE/LTE-A TDD data allocation map measurement.

Figure 82 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.

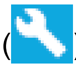
The SPA06MA-O provides carrier aggregation measurements supporting for all the different modes with carrier aggregation bands added to the channel standard.

Setting measure setup

After configuring the spectrum measurement in “Configuring spectrum measurements” on page 9, 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 **CA Configuration** or tap the **Configuration** () icon then the component carrier configuration window appears.

3 Select the number of the component carrier to be set between one and five by tapping the number in **Range** box.

4 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.

5 Tap **LAA** (License Assisted Access) and select one among the three options: **2.4 GHz**, **5 GHz**, or **Off**.

6 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**.

7 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

8 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.

9 To set the threshold for PDSCH, tap **PDSCH Threshold** and enter a value by using the on-screen keyboard.

10 Tap **PDSCH Precoding** between **On** and **Off** to enable or disable the PDSCH precoding.

To set limit

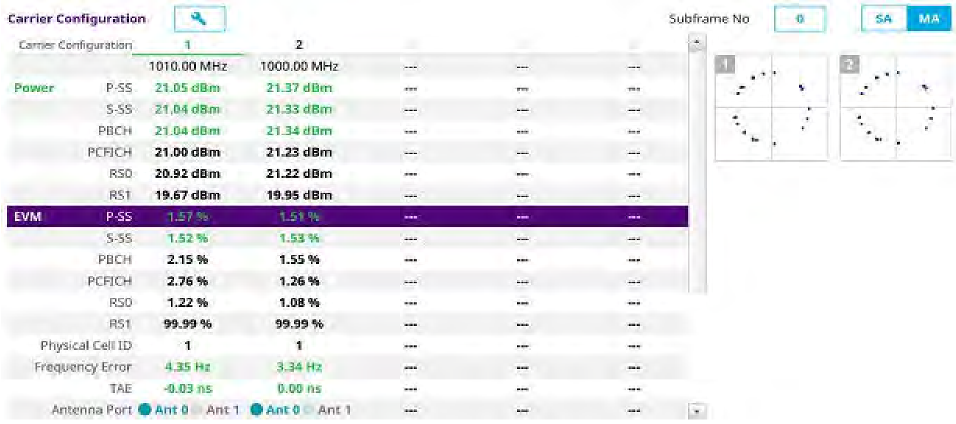
1 Tap **Menu > Limit**.

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/ Intra Band High

Figure 83 shows an example of LTE/LTE-A TDD carrier aggregation measurement.

Figure 83 LTE/LTE-A TDD carrier aggregation measurement



Conducting OTA measurement

The following sections describe how to conduct OTA analysis.

OTA channel scanner

Setting measure setup

After configuring the spectrum measurement in “Configuring spectrum measurements” on page 9, 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 the **MIMO** and select **2x2** or **4x4** to select the number of antenna ports.

3 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 **GPS** 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
   – **GPS**: When synchronizing the signal processing via the GPS receiver. If you want to check the time error correctly, set the trigger to GPS

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.
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.

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 84 shows an example of OTA LTE/LTE-A TDD channel scanner measurement.

Figure 84 LTE/LTE-A TDD OTA channel scanner measurement

Figure 85 LTE/LTE-A TDD OTA channel scanner with frequency error

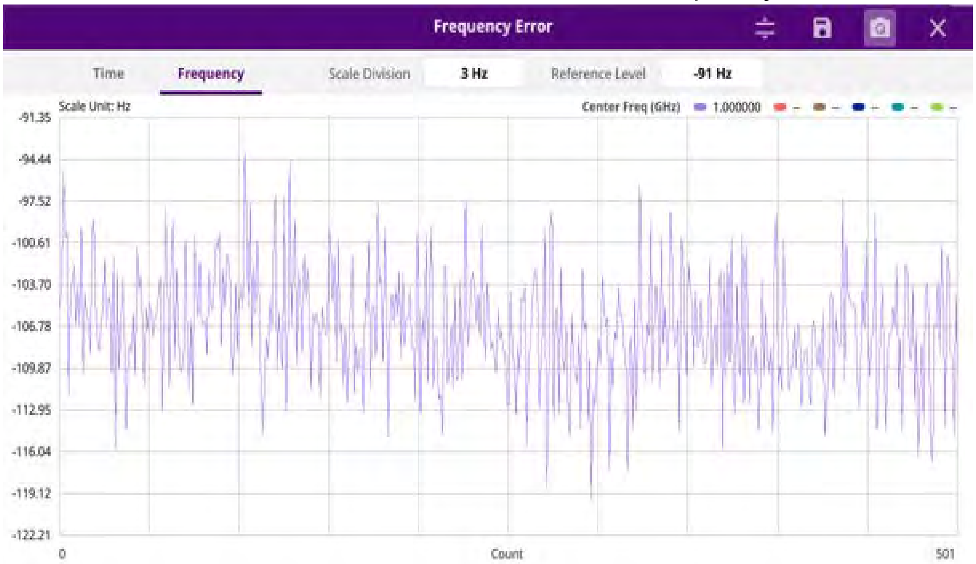
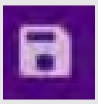
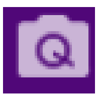
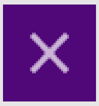


Figure 86 LTE/LTE-A TDD OTA channel scanner with time error

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.

Icon	Description
	**Close**: You can close the screen you are seeing now.

OTA ID Scanner

The LTE mobile receives signals from multiple base stations that all of these signals 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 diffrentiates 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 9, 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**.
3. Tap the **MIMO** and select **2x2** or **4x4** to select the number of antenna ports.
4. To select the Cyclic Prefix, tap **Cyclic Prefix** and select **Normal** or **Extended**.
5. *Optional*: Tap the **Save** icon on the side bar and select the save option from the choices available for your measurement mode.

Figure 87 shows an example of OTA LTE/LTE-A TDD ID scanner measurement.

Figure 87 LTE/LTE-A TDD OTA ID scanner measurement

No	PCI (Grp,Scir)	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)
1	479 (159,2)	-60.89	-19.03	24.39	14.16	-68.76	-48.95	-86.68	-11.17	-1.66
2	---	---	---	---	---	---	---	---	---	---
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 9, 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**.

3 Tap **RS Window** and select the RS window option: **2 µs, 4 µs,** or **8 µs**.

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.
6. Tap the **MIMO** and select **2x2** or **4x4Hz** to select the number of antenna ports.
7. To select the Cyclic Prefix, tap **Cyclic Prefix** and select **Normal** or **Extended**.

Figure 88 shows an example of LTE/LTE-A TDD OTA multipath profile measurement.

Figure 88 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 9, 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**.

3 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.

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.

5 Tap the **MIMO** and select **2x2** or **4x4Hz** to select the number of antenna ports.

6 *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.

7 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.

8 To set the Multicast Broadcast Single Frequency Network (**MBSFN**) detection automatically or manually for MBMS testing, tap **MBSFN** and select **Auto** or **Manual**.

9 To select the Cyclic Prefix, tap **Cyclic Prefix** and select **Normal** or **Extended**.

10 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 89 shows an example of LTE/LTE-A TDD OTA control channel measurement.

Figure 89 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.

Setting measure setup

After configuring the spectrum measurement in "Configuring spectrum measurements" on page 9, 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**.

3 Tap **Subframe Number** to set the number of subframe using the on-screen keyboard.

4 Tap **Position** to set the number of positions using the on-screen keyboard when **Time Cursor** is set to **On**.

5 *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.

6 *Optional.* To set the threshold for PDSCH, tap **PDSCH Threshold** and enter a value by using the on-screen keyboard.

7 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.

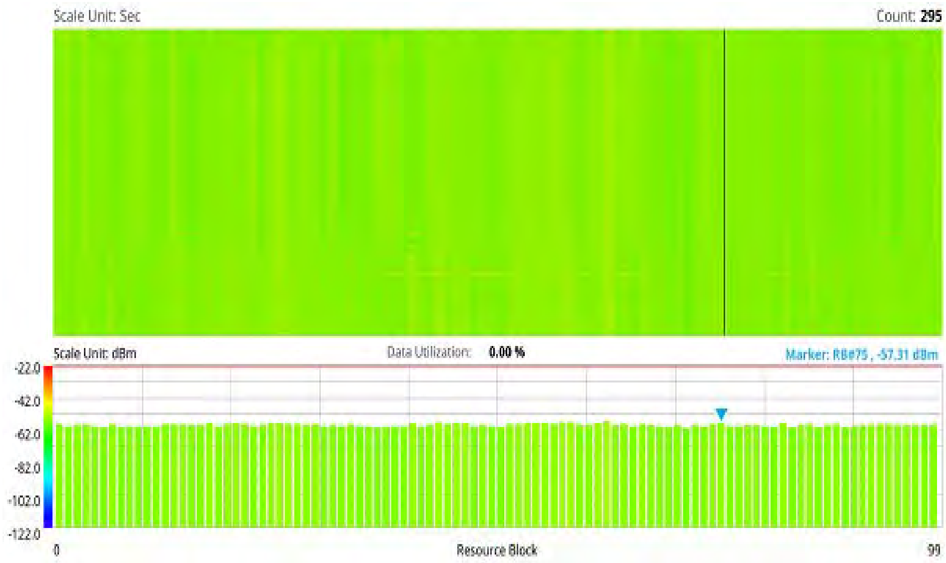
8 TTo start a new measurement, tap **Reset**.

9 *Optional.* To select the number of antenna ports, tap the **MIMO** and select **2x2** or **4x4.**

10 *Optional.* To select the Cyclic Prefix, tap **Cyclic Prefix** and select **Normal** or **Extended**.

Figure 90 shows an example of LTE/LTE-A TDD OTA datagram measurement.

Figure 90 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 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 91 shows an example of LTE/LTE-A TDD OTA route map measurement.

Figure 91 OTA route map with LTE/LTE-A TDD 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

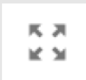
to EQP menu in JDMapCreator. For more information on how to use the JDMapCreator, see the *JDMapCreator 2.0 User Guide*.

To load a map

1. Plug in your USB flash drive that has a map with a file type of .mcf 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 23 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 9 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 **GPS**, **Position**, or **Time**.

a To collect data/plot points automatically as you move around in a vehicle or outside, select **GPS**, 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 **Bandwidth** and select the value from the following choices: **1.4 MHz**, **3 MHz**, **5 MHz**, **10 MHz**, **15 MHz** or **20 MHz**.

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.

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 92 shows a legend color table.

Figure 92 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 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 **step 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 GPS 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 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.

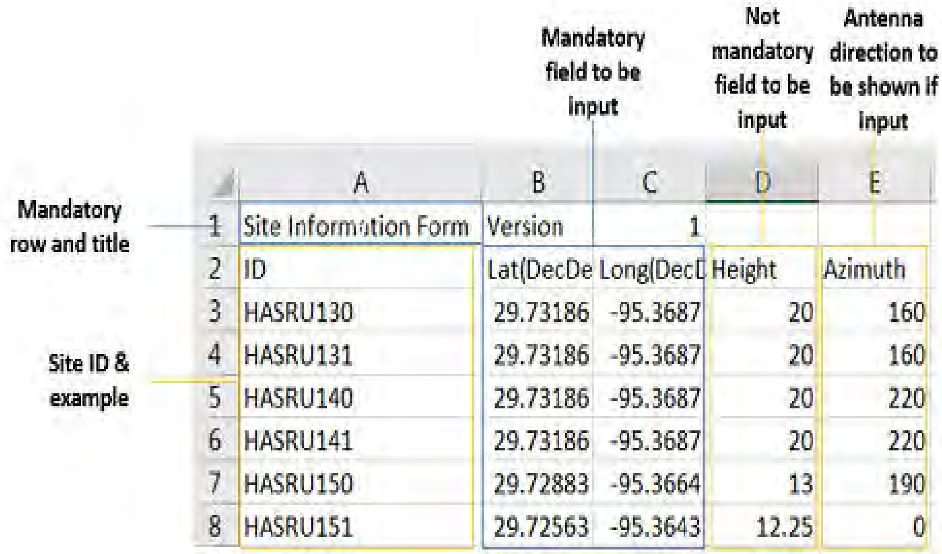
To import cellsite DB

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.

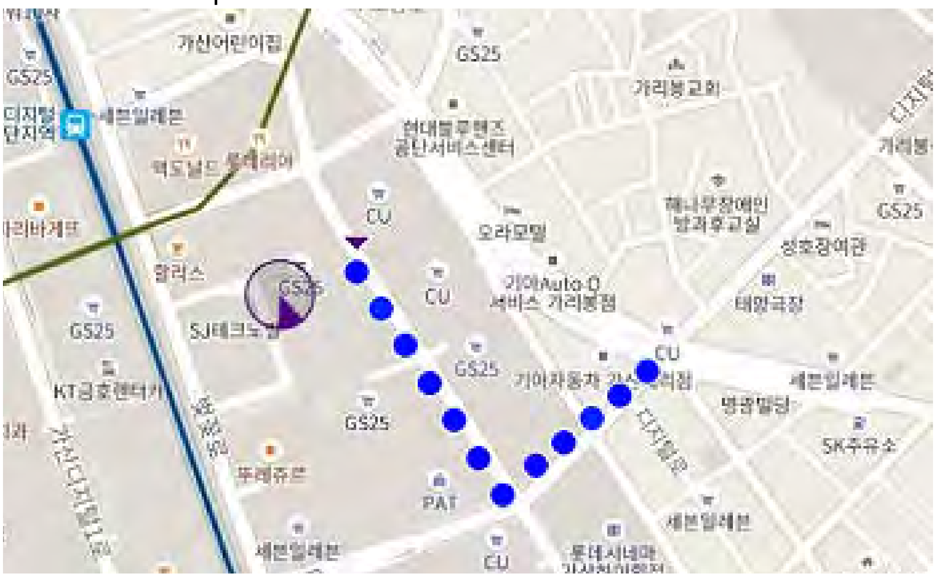
Figure 93 shows an example of an importing cellsite DB.

Figure 93 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 94 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 9, 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**.
3. 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.
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.
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 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**.

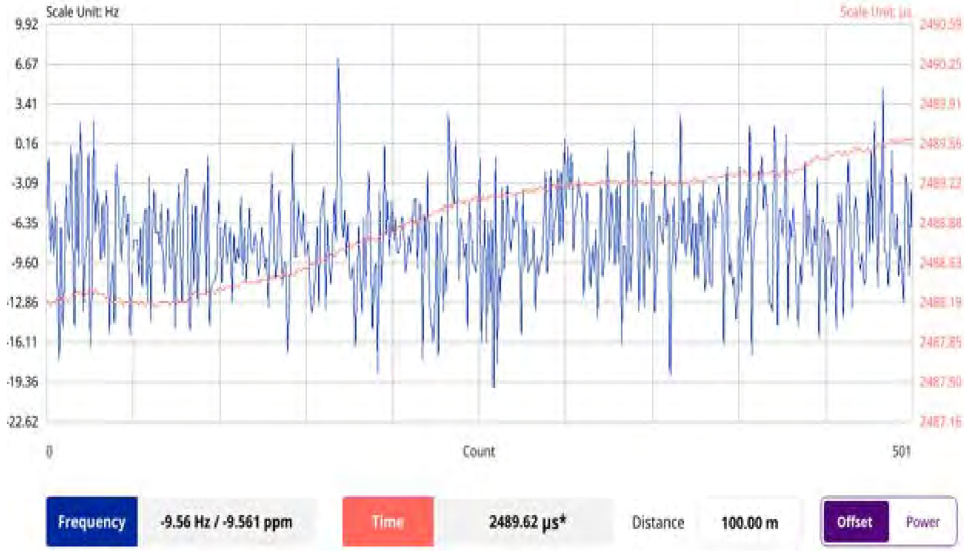
- To assign a antenna port number automatically or manually, tap **Antenna Port** and select the option: **Auto**, **Antenna 0**, **Antenna 1**, **Antenna 2**, and **Antenna 3**. If the MIMO is set to 2x2, the antenna ports 2 and 3 are disabled.

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 95 shows an example of LTE/LTE-A TDD freq/time/power variation by offset.

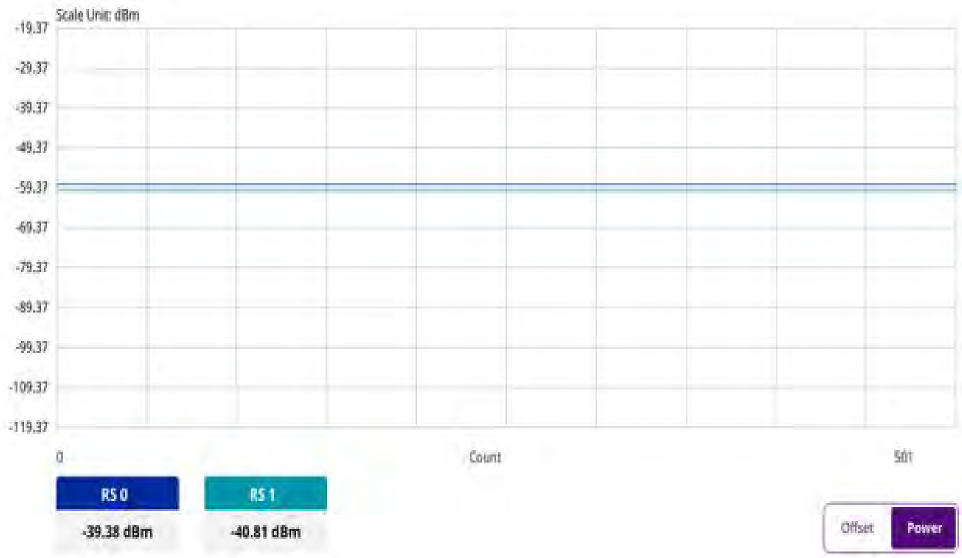
Figure 95 LTE/LTE-A TDD freq/time/power variation by offset



> **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.

Figure 96 shows an example of LTE/LTE-A TDD freq/time/power variation by power.

Figure 96 LTE/LTE-A TDD freq/time/power variation by power



Miscellaneous

The following sections describe how to conduct miscellaneous analysis.

Power statistics CCDF

The Power Statistics Complementary Cumulative Distribution Function (CCDF) measurement characterizes the power statistics of the input signal. It provides PAR (Peak to Average power Ratio) versus different probabilities.

Setting measure setup

After configuring the spectrum measurement in “Configuring spectrum measurements” on page 9, 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 **CCDF Length** and select the value between 1 and 100.

Figure 97 shows an example of LTE/LTE-A TDD power statistics CCDF measurement.

Figure 97 LTE/LTE-A TDD power statistics CCDF measurement

7

Using 5G NR Signal Analyzer

This chapter describes how to use the 5G NR Signal Analyzer. Topics covered in this chapter include:

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 for 5G NR analysis:

- Spectrum Analysis
  - Trigger Spectrum
- RF Analysis
  - 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
- Modulation Analysis
  - Constellation
- Power vs Time
  - Power vs Time (Slot)
  - Power vs Time (Frame)
- PDSCH Analysis
  - PDSCH Constellation
  - EVM vs Subcarrier
  - Allocation Mapper

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:
   - **Spectrum Analysis > Trigger Spectrum**
   - **RF Analysis > 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 Error Variation,** or **Multipath Profile**
   - **Modulation Analysis > Constellation**
   - **Power vs Time > Power vs Time (Slot)**, **Power vs Time (Frame)**
   - **PDSCH Analysis > PDSCH Constellation, EVM vs Subcarrier,** or **Allocation Mapper**

Conducting spectrum measurements

The following sections describe how to conduct spectrum measurements.

Trigger spectrum

Setting measure setup

After configuring the spectrum measurement can configure the measurements just as in Spectrum mode. For more information, see “Configuring spectrum measurements” on page 9.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 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 24 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 25 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 26 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 **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 24 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 24 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)	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)	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 25 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 26 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

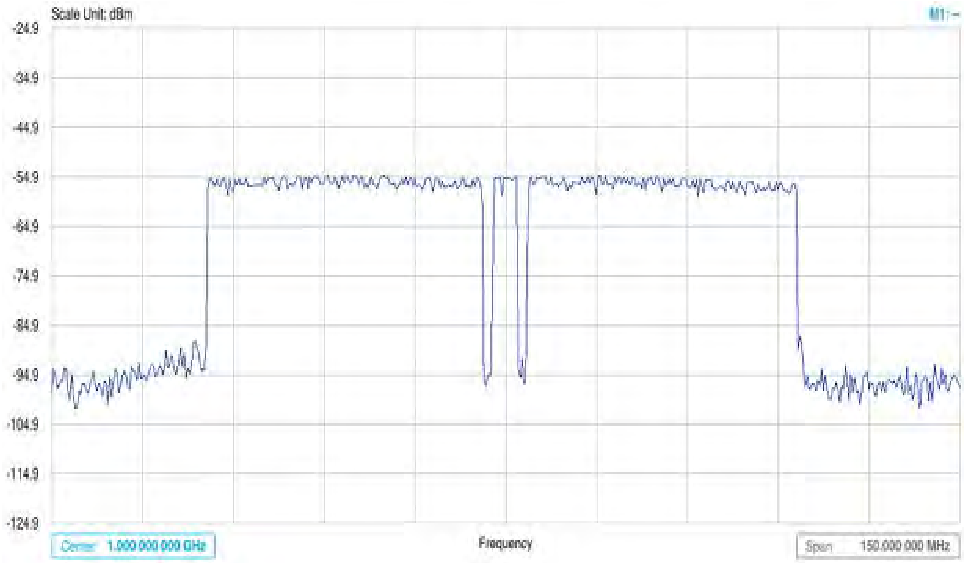
To set trigger

1. Tap the **Menu > Trigger**.
2. Tap **Trigger** and select the options from **Internal**, **External**, or **GPS**.
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
   – **GPS**: Uses a built-in GPS as a frequency and timing source

NOTE
Make sure to set Frequency Reference for all measurement mode in 5G NR Signal Analyzer to sync the proper clock source.

Figure 98 shows an example of trigger spectrum measurement.

Figure 98 5G NR trigger spectrum measurement



Conducting RF measurements

The following sections describe how to conduct RF measurements.

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 9, 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 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 27 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 28 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 29 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 **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.

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.

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 Channel Power or EIRP under the chart in the table, and it will show the automatically calculated value.

Table 27 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)	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)	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 27 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 28 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 29 Sync SCS offset range per SSB SCS and sync SCS resolution

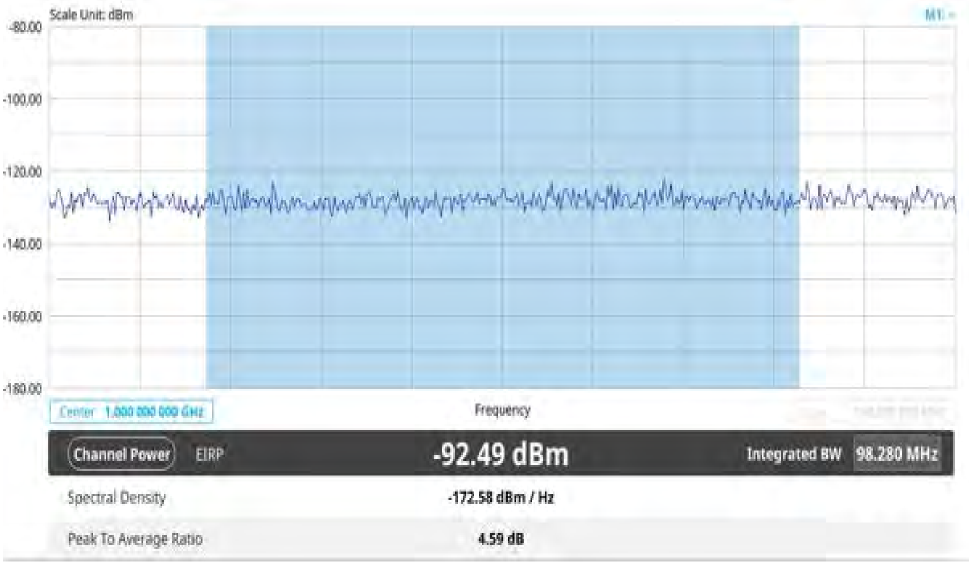
SSB SCS (kHz)	Sync Raster Resolution (kHz)	Sync Raster Offset Range	SSB Frequency = Center Frequency
15	15	0 to 11	0
30	30	0 to 5	0
120	120	0 to 5	0
240	240	0 to 2	0

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 form the choices available for your measurement mode.

Figure 99 shows an example of channel power measurement.

Figure 99 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 9, 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 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 30 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 31 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 32 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 **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 30 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)	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)

Table 30 Setup per operating frequency

Operating frequency	L	Case	SCS	Slots in a burst period
3 to 6 GHz (FR1)	8	B {4,8,16,20} +28*n	30 kHz	10 (0.5 ms)
3 to 6 GHz (FR1)	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 31 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 32 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**.

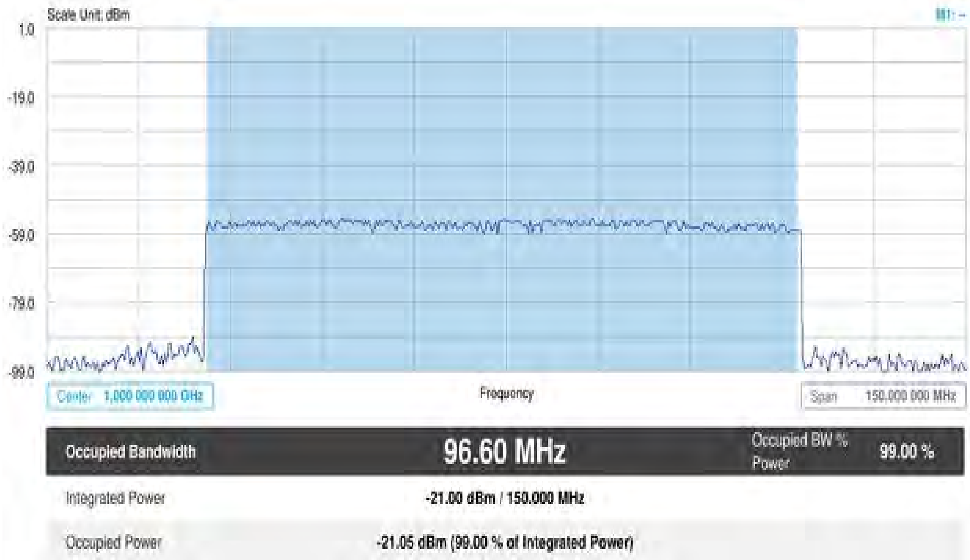
2 Tap to switch the **Test Limits** to **On** or **Off** to enable or disable Pass/Fail indication. The result table color for Pass is green, and the result table color for Fail is red.

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 form the choices available for your measurement mode.

Figure 100 shows an example of occupied bandwidth measurement.

Figure 100 5G NR occupied bandwidth measurement



The Occupied Bandwidth measurement shows both of 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 SPA06MA-O 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 9, 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 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 33 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 34 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 35 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 **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 2-0 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.

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 33 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)	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)	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 34 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 34 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 35 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

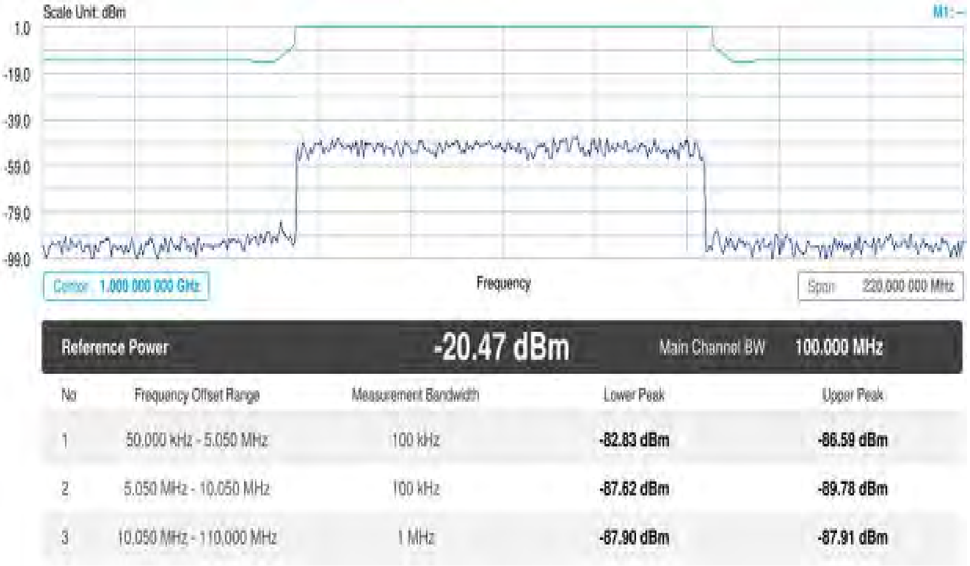
1 Tap **Menu > Limit**.

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 form the choices available for your measurement mode.

Figure 101 shows an example of spectrum emission mask measurement.

Figure 101 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 9, 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 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 36 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 37 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 38 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 **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 2-0 when BS operates at FR2.

13 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.

14 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

15 Tap **Menu** > **Trigger** and tap to switch **Triggered Spectrum** to **On** or **Off**, which takes time for FPGA change.

Table 36 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 36 Setup per operating frequency

Operating frequency	L	Case	SCS	Slots in a burst period
< 3 GHz (FR1)	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)	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 37 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 38 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

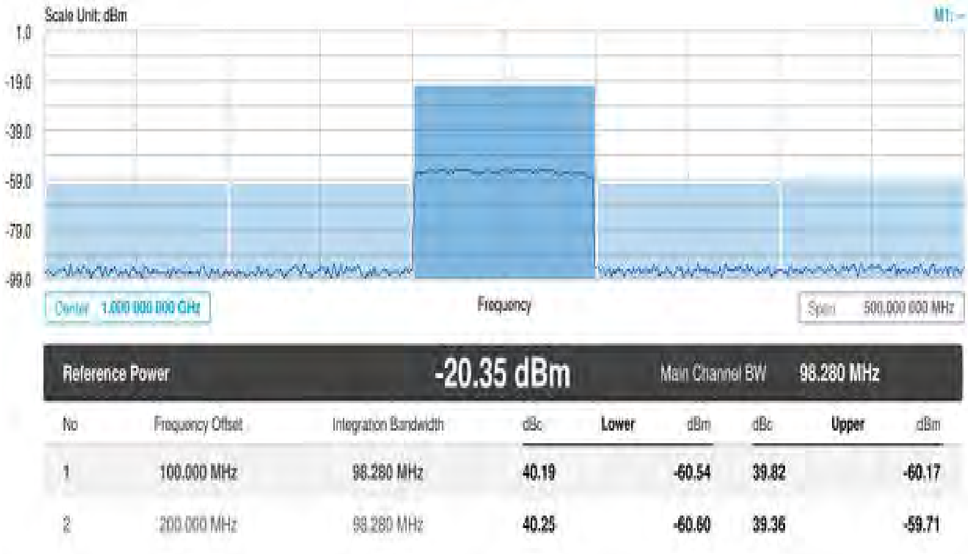
1 Tap **Menu > Limit**.

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 form the choices available for your measurement mode.

Figure 102 shows an example of 5G NR ACLR measurement.

Figure 102 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 9, 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 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 39 below 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 2-0 when BS operates at FR2.

Table 39 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)	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)	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 39 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)

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 form the choices available for your measurement mode.

Figure 103 shows an example of 5G NR Multi-ACLR measurement.

Figure 103 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 SPA06MA-O 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 9, 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 2-0 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

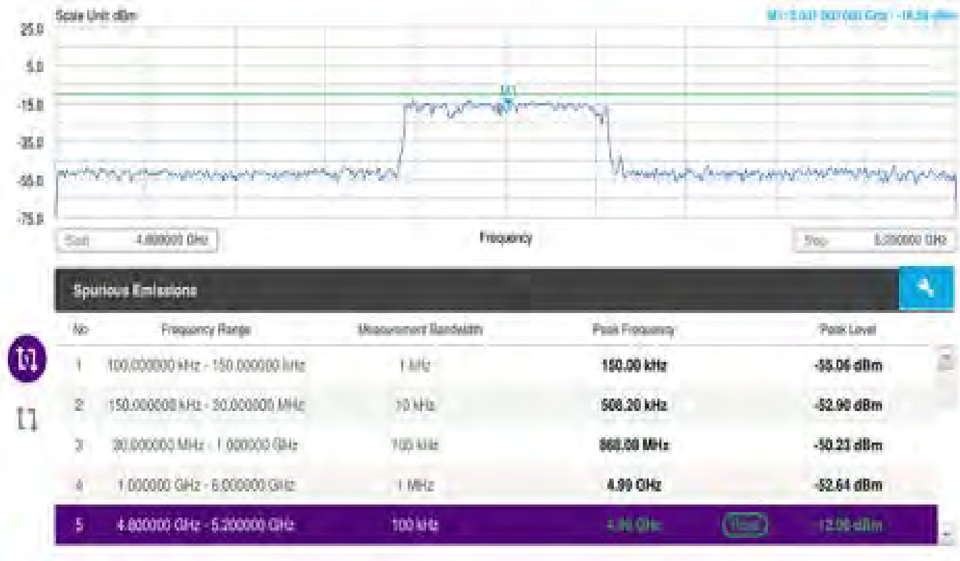
1 Tap **Menu > Limit**.

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 form the choices available for your measurement mode.

Figure 104 shows an example of 5G NR spurious emissions measurement.

Figure 104 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.

Conducting OTA measurement

The following sections describe how to conduct 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 Synchronized 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 9 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 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 40 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 41 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 42 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 to switch **Sorting Type** to **PCI** or **RSRP**.

If you select PCI, it shows PCI information on the measurement screen and if you select RSRP, it shows S-SS RSPR power on the measurement screen. You can also set it in the Detected ID List table.

> **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 40 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)	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 40 Setup per operating frequency

Operating frequency	L	Case	SCS	Slots in a burst period
3 to 6 GHz (FR1)	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 41 Sync raster offset range per SSB SCS and sync raster resolution

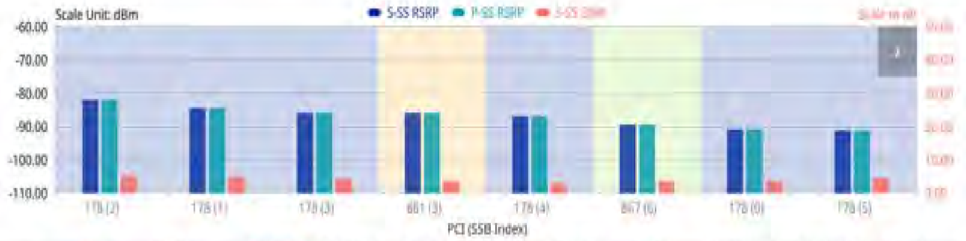
SSB SCS (kHz)	Sync Raster Resolution (kHz)	Sync Raster Offset Range	SSB Frequency = Center frequency
15	180	0 to 250	125
30	180	0 to 506	253
120	720	0 to 92	46
240	720	0 to 48	24

Table 42 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 105 shows an example of beam analyzer measurement.

Figure 105 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 DM-RS EVM (%)	Time Error (µs)
1	178 (59,1)	2 (2,--)	-81.89	-82.30	31.83	5.07	-14.96	-60.85	-76.91	107.21	910.67
2	178 (59,1)	1 (1,--)	-84.31	-83.59	27.46	4.78	-15.83	-63.28	-78.71	379.38	910.67
3	178 (59,1)	3 (3,--)	-85.80	-85.27	28.46	4.12	-18.33	-64.77	-78.31	237.91	910.67
4	861 (287,0)	3 (4,--)	-85.84	-84.65	28.28	3.49	-18.00	-64.80	-79.12	132.46	910.77
5	178 (59,1)	4 (4,--)	-86.88	-87.73	27.27	3.06	-17.10	-65.84	-80.86	313.52	1233.08
6	867 (289,0)	6 (0,--)	-89.39	-89.52	20.83	3.42	-18.07	-68.36	-80.95	103.29	2233.86
7	178 (59,1)	0 (6,--)	-90.83	-92.27	24.15	3.70	-18.83	-69.79	-81.76	152.20	910.67
8	178 (59,1)	5 (6,--)	-91.30	-88.89	23.56	4.46	-19.36	-70.26	-82.40	606.95	1661.21

NOTE
The undetected values in the Detected ID List table will be indicated as "--". You cannot save the measurement as a Result, instead Logging as CSV option is added.

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 incldes:

- **S-SS RSRP (Secondary Synchronized 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)

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 9 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.

   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
   - SCS 60 kHz: 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 MHz

   b If you go with FR2, select the following:

   - SCS 60, 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.

Setting beam analyzer mode

To set up

1 Tap the **Search** 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 106 shows an example of a beam information screen.

Figure 106 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 DM-RS EVM (%)	Time Error (µs)
1	0 (0,0)	4 (2,--)	-57.87	-57.88	34.97	33.83	-10.67	-36.83	-57.67	3.11	2071.88
2	0 (0,0)	2 (4,--)	-57.88	-57.87	35.78	34.54	-10.68	-36.84	-57.68	3.15	1071.88
3	0 (0,0)	7 (7,--)	-57.88	-57.88	36.61	32.74	-10.68	-36.84	-57.67	2.45	3500.00
4	0 (0,0)	6 (6,--)	-57.89	-57.88	33.51	33.94	-10.67	-36.85	-57.69	2.61	3071.88
5	0 (0,0)	0 (0,--)	-57.89	-57.88	34.09	25.81	-10.68	-36.85	-57.71	5.19	71.88
6	0 (0,0)	1 (5,--)	-57.90	-57.88	42.49	29.73	-10.69	-36.86	-57.67	2.60	500.00
7	0 (0,0)	5 (1,--)	-57.90	-57.88	41.38	28.41	-10.69	-36.87	-57.67	2.15	2500.00
8	0 (0,0)	3 (3,--)	-57.91	-57.87	40.66	27.97	-10.69	-36.87	-57.66	2.19	1500.00

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.

Figure 107 shows an example of carrier scanner measurement.

Figure 107 5G NR carrier scanner measurement

NOTE
You cannot save the measurement as a Result or Result as CSV.

Figure 108 5G NR carrier scanner measurement with frequency error

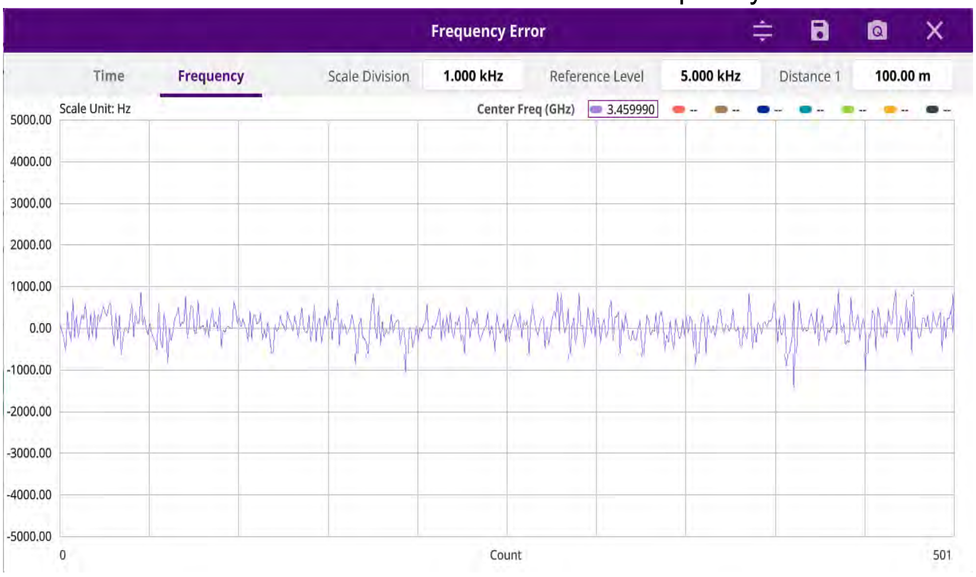
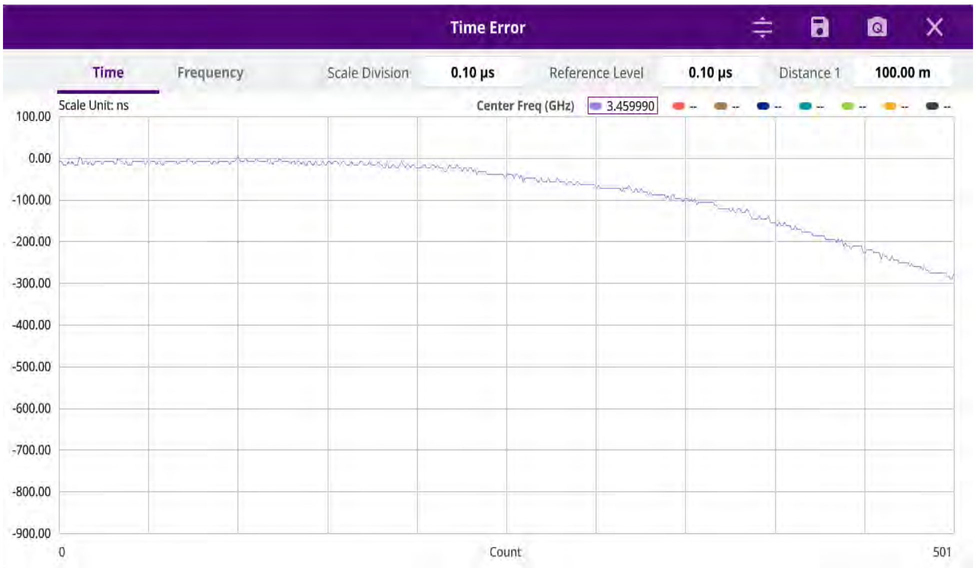
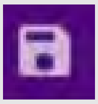
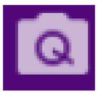
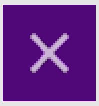


Figure 109 5G NR carrier scanner measurement with time error



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 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 110 shows an example of 5G NR OTA route map measurement.

Figure 110 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 .mcf file type created in JDMap-Creator.
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 43 Map control icons

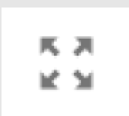
Icon	Description
	Tap to go to your current location on the map. Once tapped, the purple icon appears on the map, indicating your current location.
	Tap to switch to the full screen map view.

Table 43 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 9 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 **GPS**, **Position**, or **Time**.

      - To collect data/plot points automatically as you move around in a vehicle or outside, select **GPS**.
      - 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** or **S-SS SINR**.

   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 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.

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 45 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 46 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**, **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 **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**.

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)	4	C {2,8} +14*n	30 kHz	10 (0.5 ms)

Table 44 Setup per operating frequency

Operating frequency	L	Case	SCS	Slots in a burst period
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)	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
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

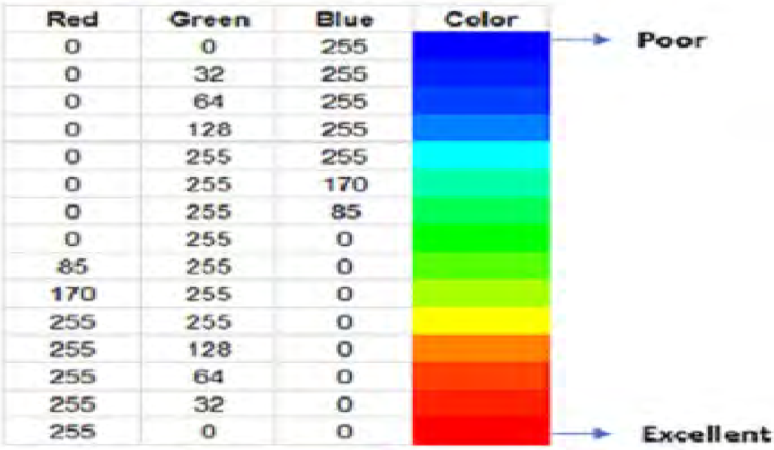
To set limit

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 111 shows a legend color table.

Figure 111 Legend color table



Red	Green	Blue	Color
0	0	255	
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	

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 **step 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 GPS 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 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.

> **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.

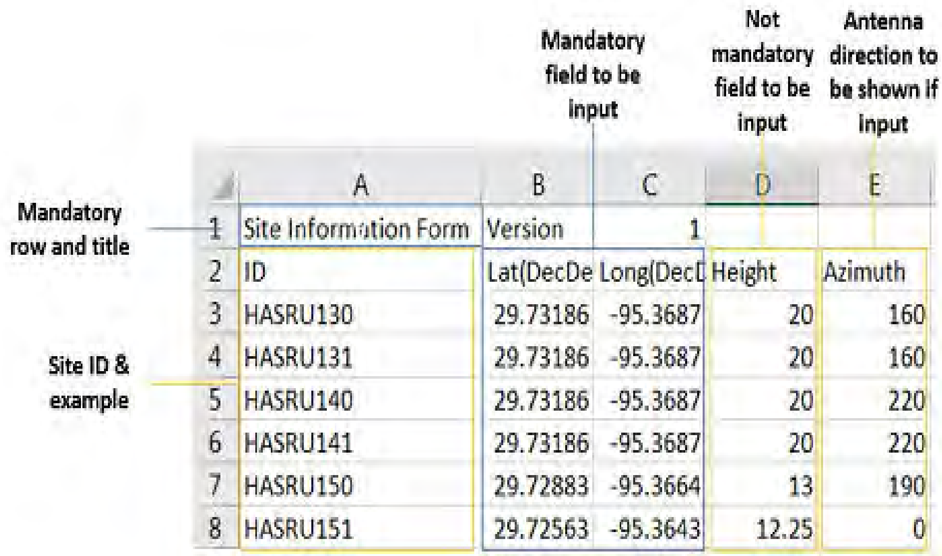
6 Tap the **Load** () icon on the side bar.

7 Import the saved file.

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

Figure 112 shows an example of an importing cellsite DB.

Figure 112 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 113 Route map measurement with site information screen

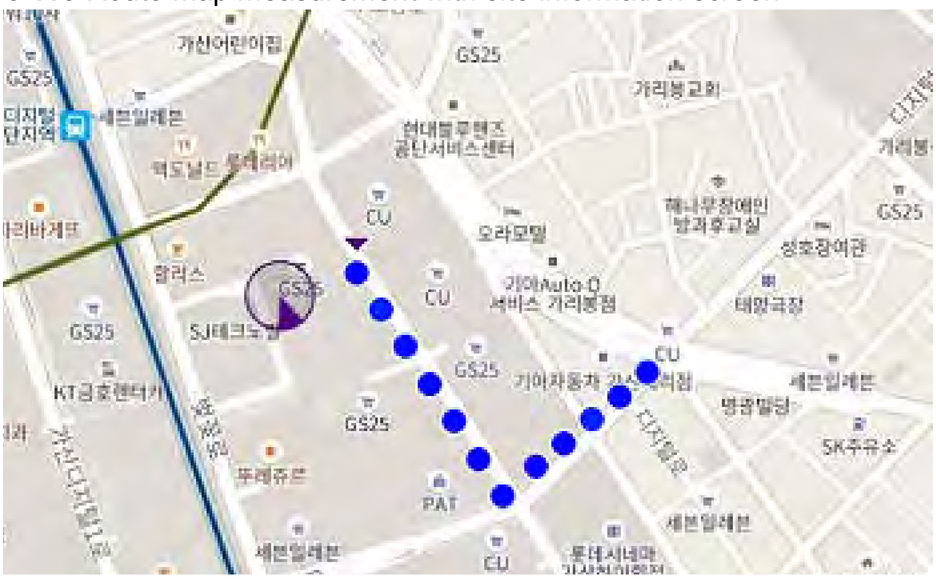
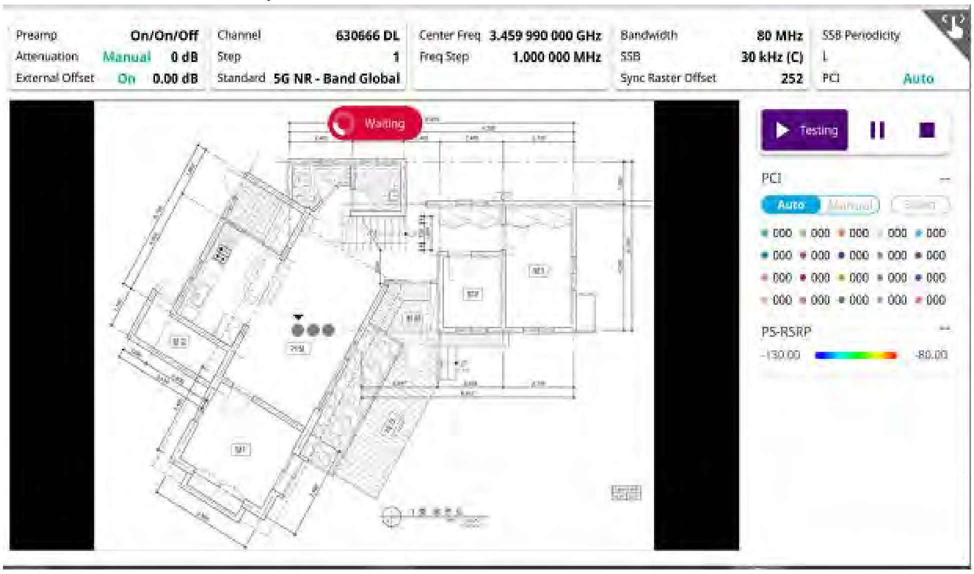


Figure 114 shows an example of OTA route map measurement with Plot Point to Time.

Figure 114 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 9, 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 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.
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 occurred)

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 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)	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)	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

Figure 115 shows an example of 5G NR beam availability index.

Figure 115 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 9, 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 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 50 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 51 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 52 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**.

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)	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)	8	C {2,8} +14*n	30 kHz	10 (0.5 ms)

Table 50 Setup per operating frequency

Operating frequency	L	Case	SCS	Slots in a burst period
> 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

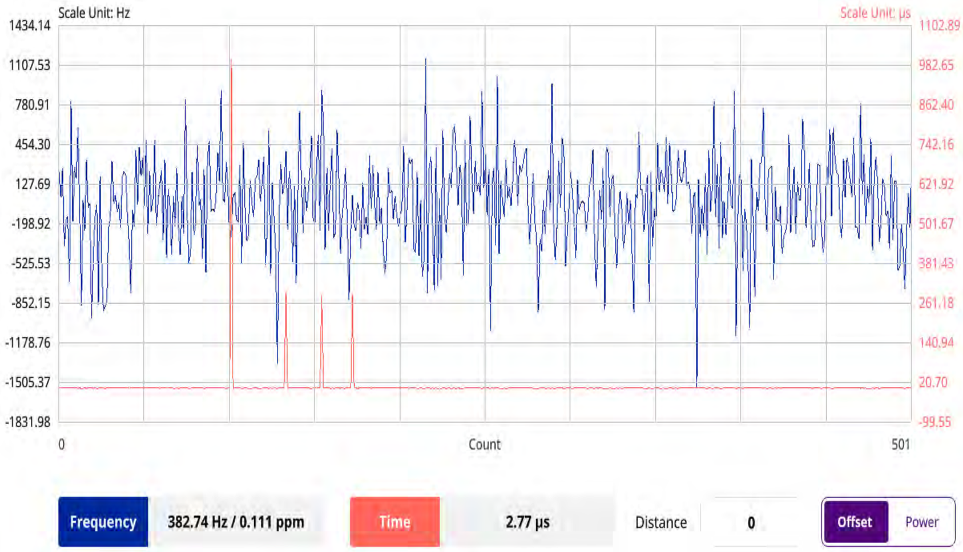
SSB SCS (kHz)	Sync Raster Resolution (kHz)	Sync Raster Offset Range	SSB Frequency = Center frequency
15	180	0 to 250	125
30	180	0 to 506	253
120	720	0 to 92	46
240	720	0 to 48	24

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

Figure 116 shows an example of 5G NR freq/time/power variation by offset.

Figure 116 5G NR freq/time/power variation by offset

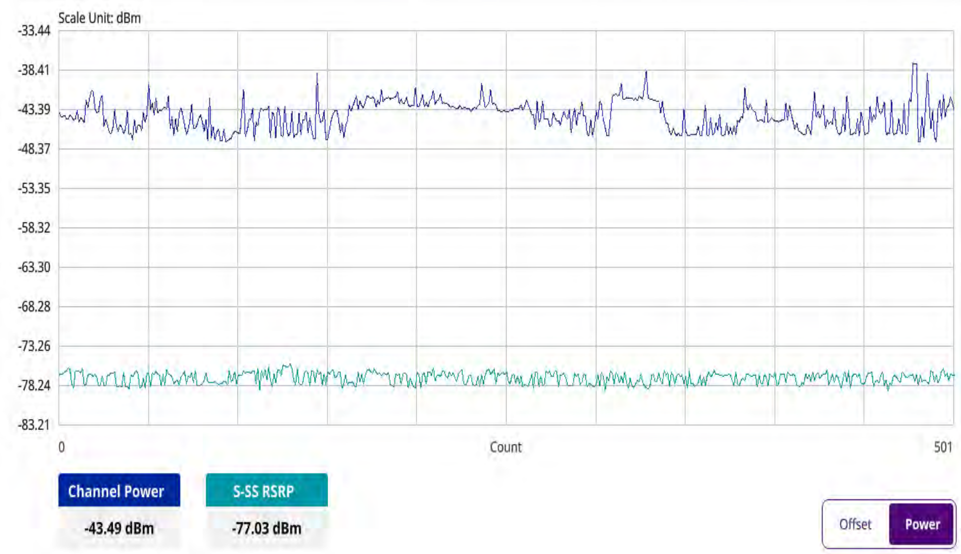


NOTE

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.

Figure 117 shows an example of 5G NR freq/time/power variation by power.

Figure 117 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 9, 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 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 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 54 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 55 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**.

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)	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)	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 54 Sync raster offset range per SSB SCS and sync raster resolution

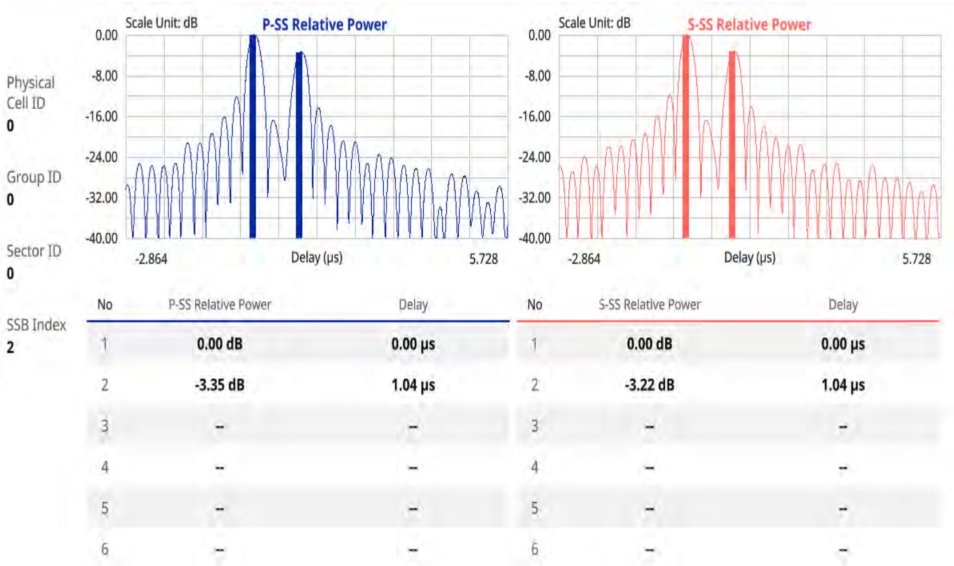
SSB SCS (kHz)	Sync Raster Resolution (kHz)	Sync Raster Offset Range	SSB Frequency = Center frequency
15	180	0 to 250	125
30	180	0 to 506	253
120	720	0 to 92	46
240	720	0 to 48	24

Table 55 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 118 shows an example of 5G NR multipath profile.

Figure 118 5G NR multipath profile



Conducting modulation measurement

The following sections describe how to conduct modulation 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 9, 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 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 56 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 57 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 58 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**.

Table 56 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)	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)	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 57 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 58 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 SPA06MA-O currently measures the PDSCH EVM values based on SIB1 contained PDSCH RB. The SPA06MA-O performs the 3GPP recommended call protocol connection to get SIB1 RDSCH 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 119 shows an example of 5G NR constellation measurement.

Figure 119 5G NR constellation measurement

> **NOTE**
> Once you tap the Time Offset button at the right bottom of the screen, the histogram graph appears.

Power vs Time

The following sections describe how to conduct Power vs Time analysis.

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 9, 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 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 59 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 60 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 61 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 one slot between downlink and uplink.

Table 59 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)	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)	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 60 Sync raster offset range per SSB SCS and sync raster resolution

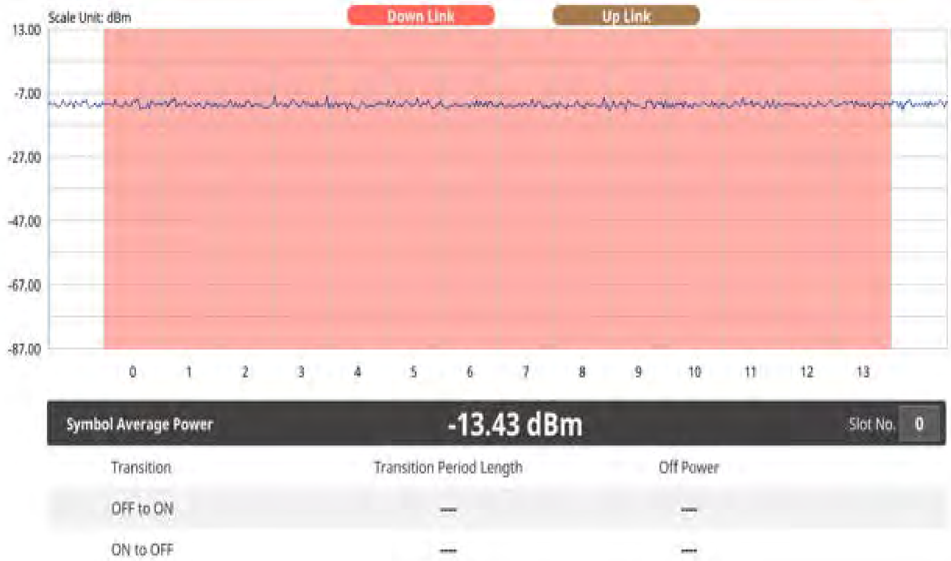
SSB SCS (kHz)	Sync Raster Resolution (kHz)	Sync Raster Offset Range	SSB Frequency = Center frequency
15	180	0 to 250	125
30	180	0 to 506	253
120	720	0 to 92	46
240	720	0 to 48	24

Table 61 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 120 shows an example of 5G NR power vs time (slot) measurement.

Figure 120 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 9, 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 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 62 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 63 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 64 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**.

Table 62 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 62 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)	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)	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 63 Sync raster offset range per SSB SCS and sync raster resolution

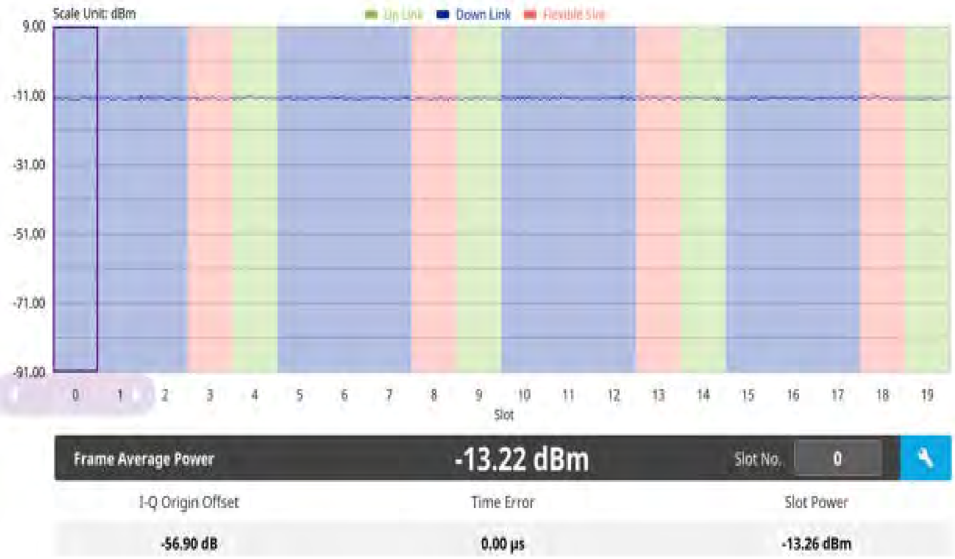
SSB SCS (kHz)	Sync Raster Resolution (kHz)	Sync Raster Offset Range	SSB Frequency = Center frequency
15	180	0 to 250	125
30	180	0 to 506	253
120	720	0 to 92	46
240	720	0 to 48	24

Table 64 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 121 shows an example of 5G NR power vs time (frame) measurement.

Figure 121 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.

Conducting PDSCH measurement

The following sections describe how to conduct PDSCH analysis.

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. SPA06MA-O 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 9, 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 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 65 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 66 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 67 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 **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

14 Tap **PDSCH Configuration** or the **Configuration** icon on the screen to set PDSCH EVM in the PDSCH EVM 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 a 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 NID source 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 istwo 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: https://portal.3gpp.org/desktopmodules/Specifications SpecificationDetails.aspx?specificationId=3213
and check the latest 38.211 documentation.

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.

- **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.

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 hot key on the side bar and select the save option from the choices available for your measurement.

Table 65 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)	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)	8	C {2,8} +14*n	30 kHz	10 (0.5 ms)

Table 65 Setup per operating frequency

Operating frequency	L	Case	SCS	Slots in a burst period
> 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 66 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 67 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 122 shows an example of 5G NR PDSCH constellation measurement.

Figure 122 5G NR PDSCH constellation measurement

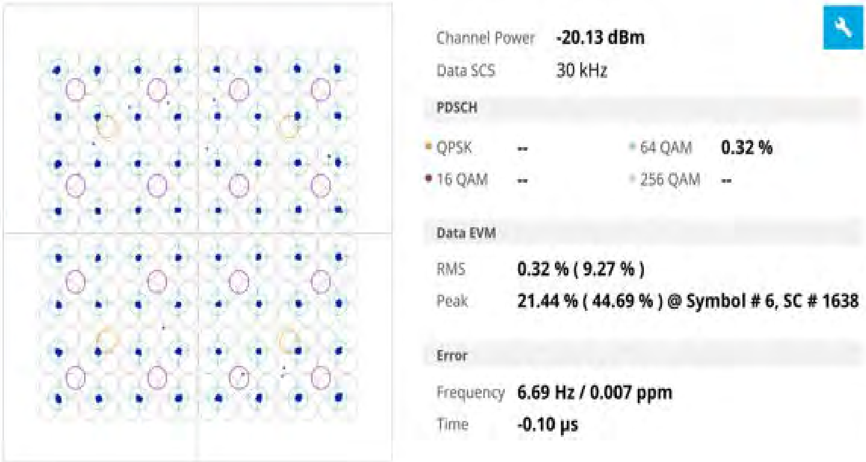


Figure 123 5G NR PDSCH EVM setting summary

> **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

The SPA06MA-O 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 9, 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 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 68 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 69 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 70 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 **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

14 Tap **PDSCH Configuration** or the **Configuration** icon on the screen to set PDSCH EVM in the PDSCH EVM 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 a 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 NID source 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 istwo 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: https://portal.3gpp.org/desktopmodules/Specifications SpecificationDetails.aspx?specificationId=3213
and check the latest 38.211 documentation.

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.

- **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.

Table 68 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)	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)	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 69 Sync raster offset range per SSB SCS and sync raster resolution

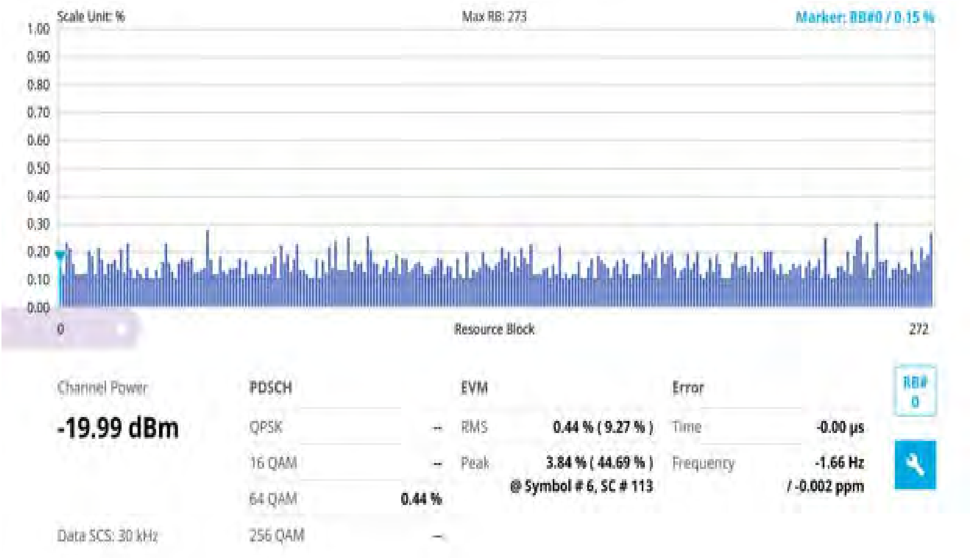
SSB SCS (kHz)	Sync Raster Resolution (kHz)	Sync Raster Offset Range	SSB Frequency = Center frequency
15	180	0 to 250	125
30	180	0 to 506	253
120	720	0 to 92	46
240	720	0 to 48	24

Table 70 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

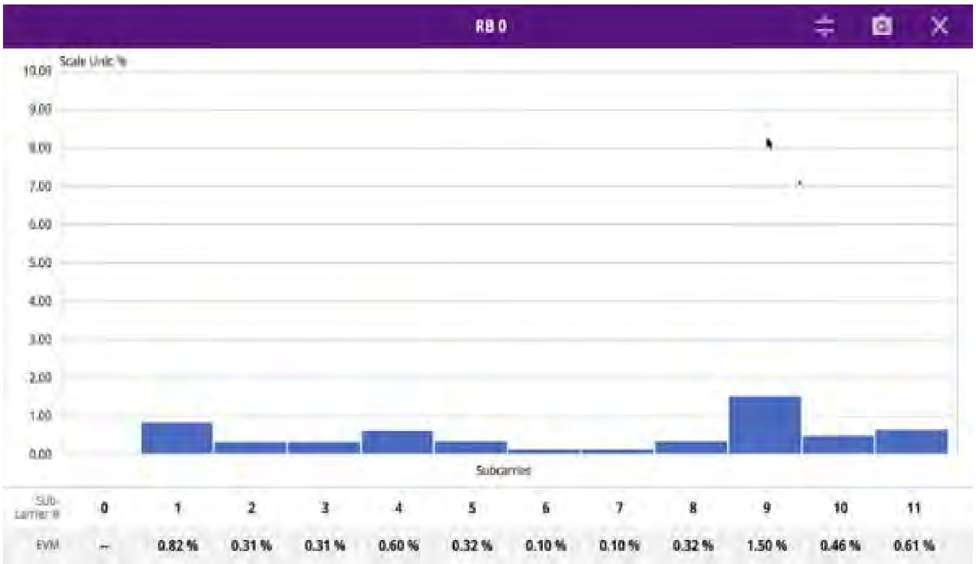
Figure 124 shows an example of 5G NR EVM vs subcarrier measurement.

Figure 124 5G NR EVM vs subcarrier measurement



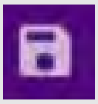
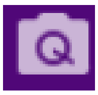
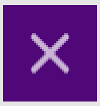
NOTE
EVM vs Subcarrier does not display subcarriers with PT-RS and if there is any of this case, it shows as "– " in value.

Figure 125 5G NR selected RB's EVM vs subcarrier measurement



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).

Using 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.

Allocation mapper

The SPA06MA-O 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 9, 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 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 71 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 72 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 73 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 **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

14 Tap **PDSCH Configuration** or the **Configuration** icon on the screen to set PDSCH EVM in the PDSCH EVM 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 a 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 NID source 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 istwo 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: https://portal.3gpp.org/desktopmodules/Specifications SpecificationDetails.aspx?specificationId=3213
and check the latest 38.211 documentation.

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.

- **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.

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 71 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)	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)	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 72 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 72 Sync raster offset range per SSB SCS and sync raster resolution

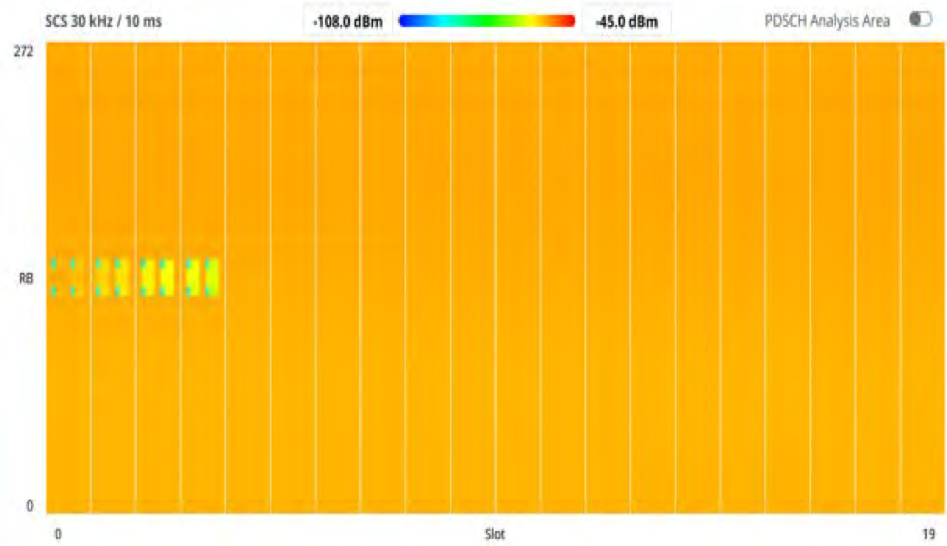
SSB SCS (kHz)	Sync Raster Resolution (kHz)	Sync Raster Offset Range	SSB Frequency = Center frequency
120	720	0 to 92	46
240	720	0 to 48	24

Table 73 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 126 shows an example of 5G NR allocation mapper measurement.

Figure 126 5G NR allocation mapper measurement



NOTE
If you set PDSCH Analysis Area to On, it shows a resource that is currently measuring PDSCH EVM.

8

Using NSA Signal Analyzer

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

- “Introduction” on page 270
- “Selecting mode and measure” on page 270
- “Conducting OTA measurements” on page 270

Introduction

VIAVI SPA06MA-O NSA (Non-standalone) Signal Analyzer focuses on enhanced mobile broadband to provide higher data bandwidth and reliable connectivity. In NSA 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. SPA06MA-O provides LTE and NR measurement simultaneously with easy setup.

Its main 5G NSA test functions are focused on over-the-air measurement such as NSA analyzer, NSA scanner, and NSA route map.

- OTA Analysis
  - NSA Analyzer
  - NSA Scanner
  - Route Map

Selecting mode and measure

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

To select mode and measure

1. Tap **NSA Signal Analyzer** on the **Mode** panel.
2. Tap any measurement mode from the following choices:
   - **OTA Analysis > NSA Analyzer, NSA Scanner,** or **NSA Route Map**

Conducting OTA measurements

The following sections describe how to conduct OTA measurements.

NSA analyzer

SPA06MA-O NSA 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 Synchronized 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

NSA 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 (Synchronized 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 NSA 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 **GPS** 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

– **GPS**: When synchronizing the signal processing via the GPS receiver. If you want to check the time error correctly, set the trigger to GPS

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

– **GPS**: Uses a built-in GPS 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.

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 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 74 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 74 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)	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)	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 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**.

4 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.

5 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.

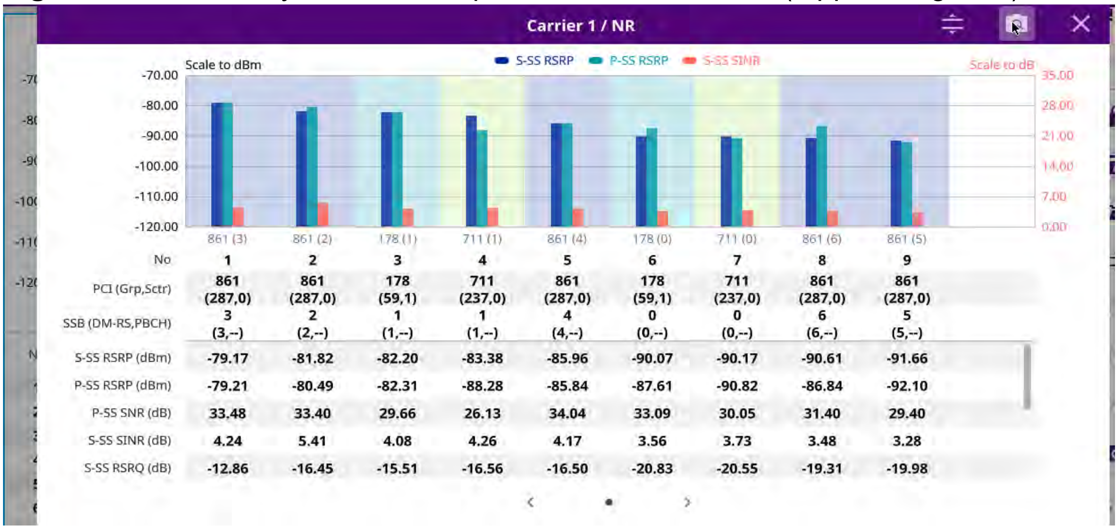
b Tap the **Carrier Information Table** ( ) icon to see the carrier information list.

c Tap the **Chart** ( ) icon to see the carrier information graph.

Figure 127 displays a NSA Analyzer with sweep normal measurement.

Figure 127 NSA Analyzer with sweep normal measurement

Figure 128 NSA Analyzer with sweep normal measurement (tapped Magnifier)



NSA scanner

SPA06MA-ONSA Analyzer provides combined functions which are available in Carrier Scanner in 5G NR mode and Channel Scanner in LTE mode.

NSA Analyzer 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.

NSA Analyzer 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 Synchronized 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)

To set measure setup

After configuring the spectrum measurement in “Configuring spectrum measurements” on page 9, you can set the measure setup to continue your measurement. The setup menus for NSA 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 **GPS** 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
   – **GPS**: When synchronizing the signal processing via the GPS receiver. If you want to check the time error correctly, set the trigger to GPS
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
- **GPS**: Uses a built-in GPS 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.

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 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 75 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 75 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)	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)	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 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**.

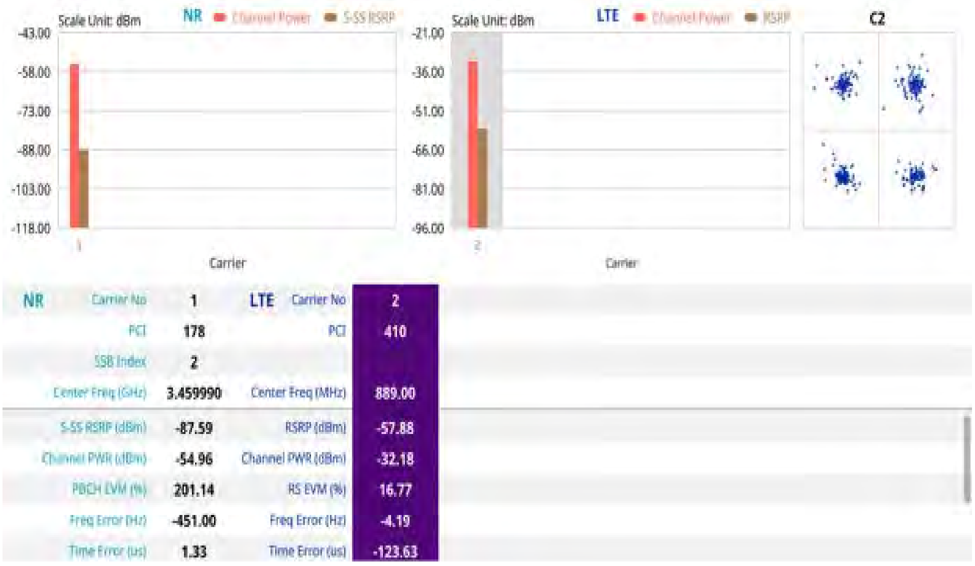
i Tap **Bandwidth** and input the value using the on-screen keyboard.

j Tap to switch **Cyclic Prefix** to **Extended** or **Normal**.

4 Once the carrier setup is done, the carrier setup information appears on the top left screen.

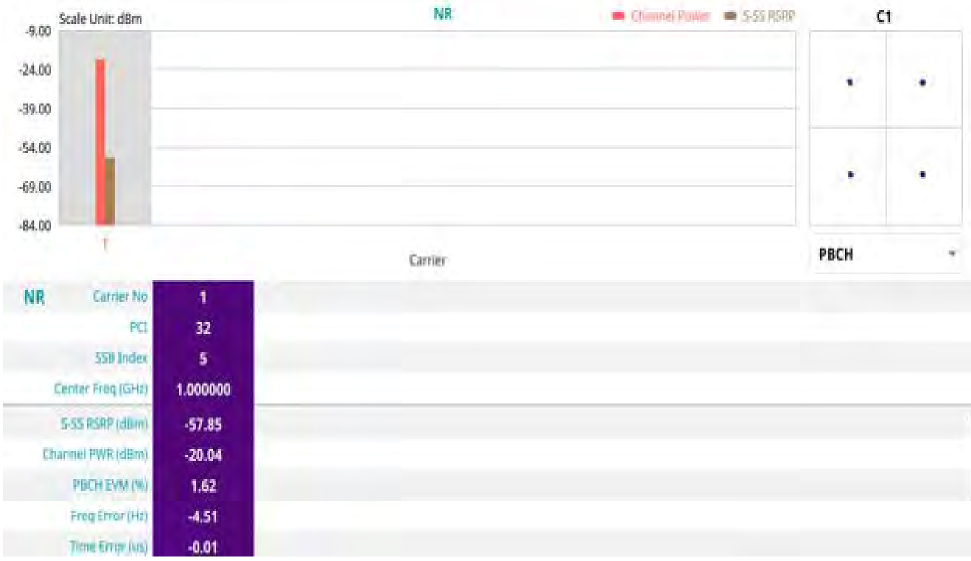
Figure 129 shows an example of NSA scanner with LTE and NR carrier (When tapped LTE carrier) measurement.

Figure 129 NSA 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 130 NSA 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.

Route map

NSA 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 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 131 shows an example of NSA route map measurement.

Figure 131 NSA route map measurement

Loading a map

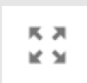
To use any features related to maps, you need to download and install the maps on the instrument. The VIAVI JDMapCreator will help you download maps. Make sure the JDMapCreator application on your computer is connected to the instrument via LAN. You can send a map file with a single layer to the instrument 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 .mcf 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 76 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 9 for more information. The setup menus for NSA 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 **GPS**, **Position**, or **Time**.

a To collect data/plot points automatically as you move around in a vehicle or outside, select **GPS**, 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 GPS 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** or **SNR**.

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 signal 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 **GPS** 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

– **GPS**: When synchronizing the signal processing via the GPS receiver. If you want to check the time error correctly, set the trigger to GPS

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

– **GPS**: Uses a built-in GPS 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.

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 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 77 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 77 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)	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)	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 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 132 shows a legend color table.

Figure 132 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 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 **step 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 GPS 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 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 **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. If the **PCI** is set 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

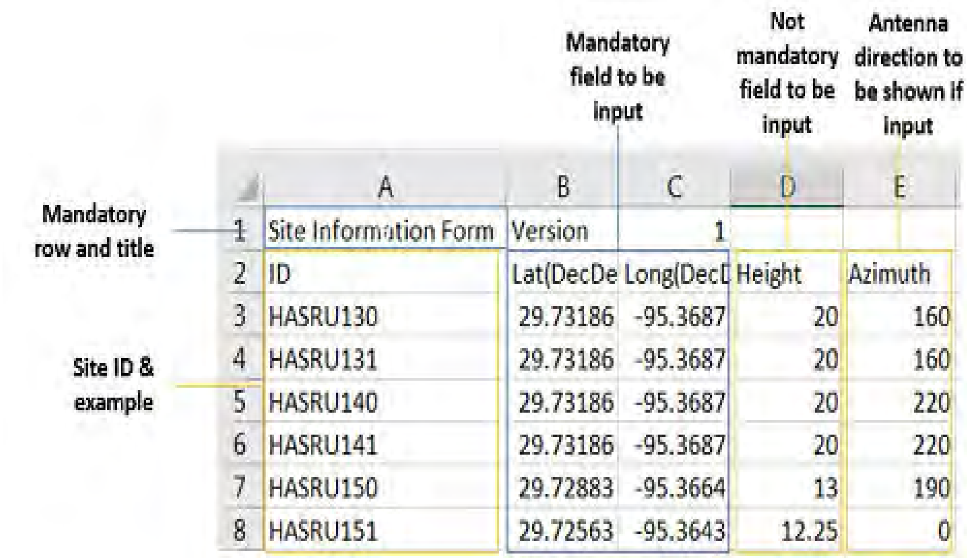
You can import the site DB by creating the 5G site information form.

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 (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 133 shows an example of an importing cellsite DB.

Figure 133 Importing Cellsite DB

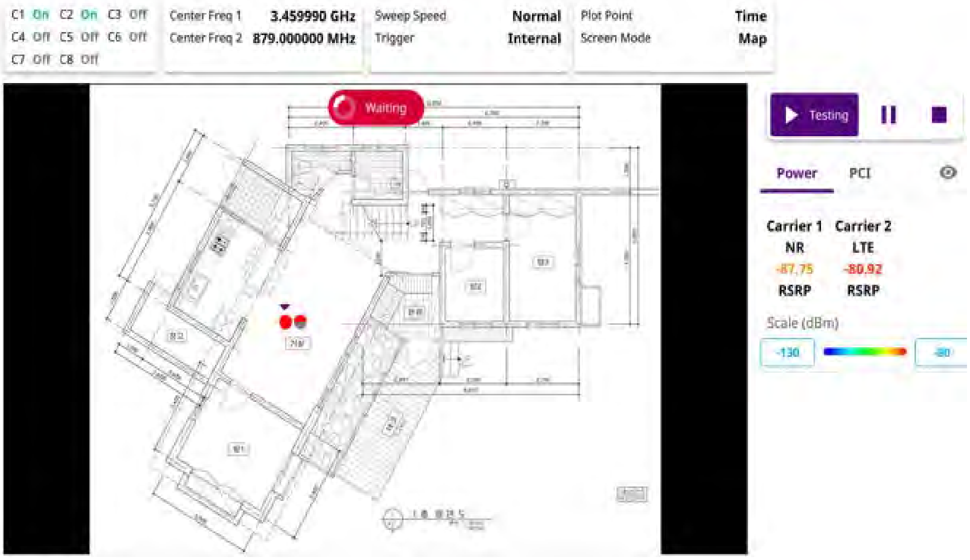


	A	B	C	D	E
1	Site Information Form	Version	1		
2	ID	Lat(DecDe	Long(DecD	Height	Azimuth
3	HASRU130	29.73186	-95.3687	20	160
4	HASRU131	29.73186	-95.3687	20	160
5	HASRU140	29.73186	-95.3687	20	220
6	HASRU141	29.73186	-95.3687	20	220
7	HASRU150	29.72883	-95.3664	13	190
8	HASRU151	29.72563	-95.3643	12.25	0

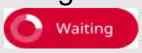
Figure 134 Route map measurement with site information screen

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 135 NSA 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(
) stops, the active indicator(
) shows up.

9

Using 5G DSS Signal Analyzer

This chapter describes how to use the 5G NR Signal Analyzer. Topics covered in this chapter include:

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:

- Spectrum Analysis
  - Spectrum
- RF Analysis
  - Channel Power
  - Occupied Bandwidth
  - Spectrum Emission Mask
  - ACLR
  - Multi-ACLR
  - Spurious Emissions
- Power vs Time
  - Power vs Time (Frame)
  - Power vs Time (Slot)
- Modulation Analysis
  - Constellation
  - Channel Mapper
  - Control Channel
  - Subframe
  - Frame
  - Time Alignment Error
- OTA Analysis
  - OTA Channel Scanner
  - OTA ID Scanner
  - OTA Multipath Profile
  - OTA Control Channel
  - OTA Route Map
  - Freq/Time/Power Variation

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 Error Variation**

Conducting spectrum measurements

The following sections describe how to conduct spectrum measurements.

Spectrum

Setting measure setup

After configuring the spectrum measurement can configure the measurements just as in Spectrum mode. For more information, see “Configuring spectrum measurements” on page 9.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 **Signal Tech Type** to **TDD** or **FDD**.

To set trigger

1 Tap the **Menu > Trigger**.

2 Tap **Trigger** and select the options from **Internal**, **External**, or **GPS**.

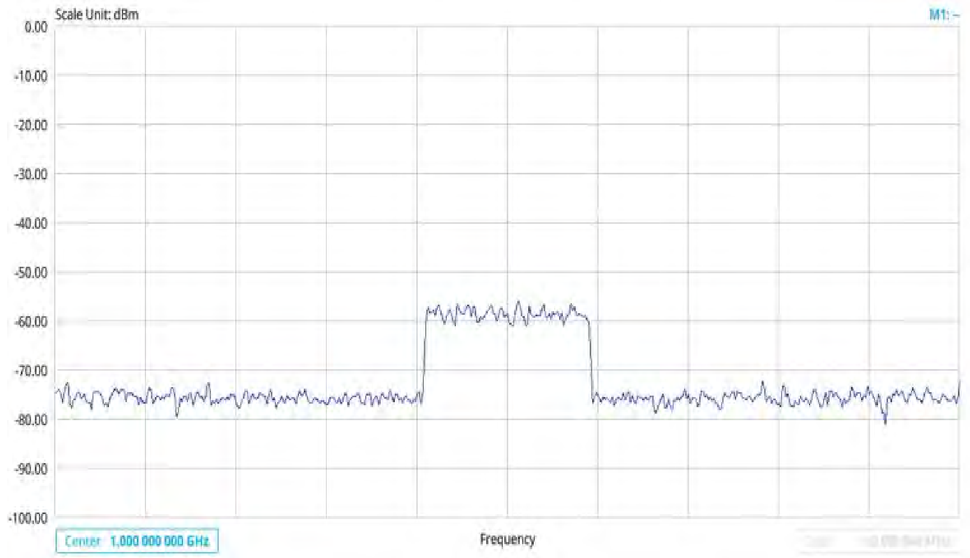
3 Tap **Freq. Ref.**(Frequency Reference) to set the clock source.

– **Internal**: Uses a 10 MHz internal clock
– **External**: Uses external 10 MHz, 13 MHz, or 15 MHz clock automatically set by the instrument
– **GPS**: Uses a built-in GPS as a frequency and timing source

> **NOTE**
> Make sure to set Frequency Reference for all measurement mode in 5G DSS Signal Analyzer to sync the proper clock source.

Figure 136 shows an example of spectrum measurement.

Figure 136 5G DSS spectrum measurement



Conducting RF measurements

The following sections describe how to conduct RF measurements.

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 9, 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 **Signal Tech 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 137 shows an example of channel power measurement.

Figure 137 5G DSS 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 9, 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 **Signal Tech 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 138 shows an example of occupied bandwidth measurement.

Figure 138 5G DSS occupied bandwidth measurement

The Occupied Bandwidth measurement shows both of 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 SPA06MA-O 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 9, 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 **Signal Tech 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

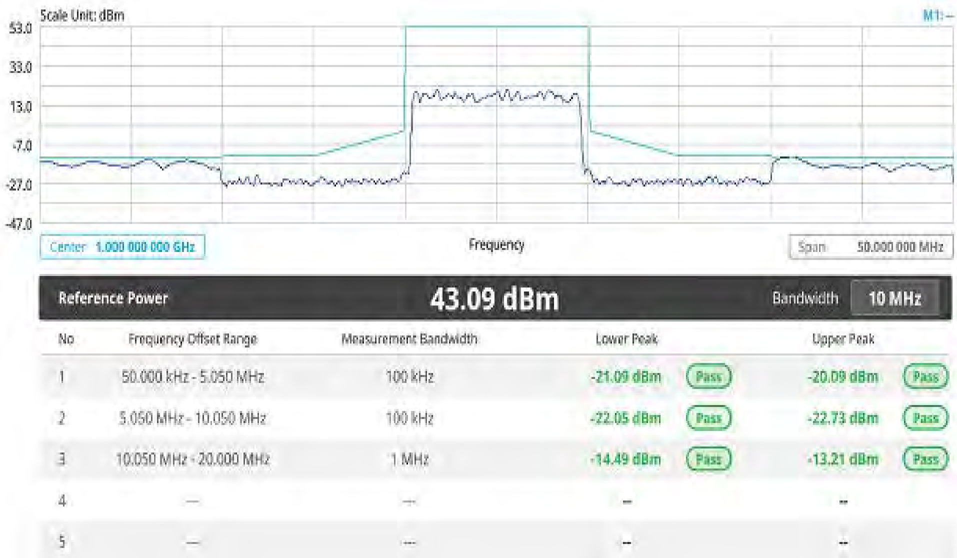
1 Tap **Menu > Limit**.

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 139 shows an example of spectrum emission mask measurement.

Figure 139 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 9, 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 **Signal Tech 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 140 shows an example of ACLR measurement.

Figure 140 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 9, 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 **Signal Tech 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.

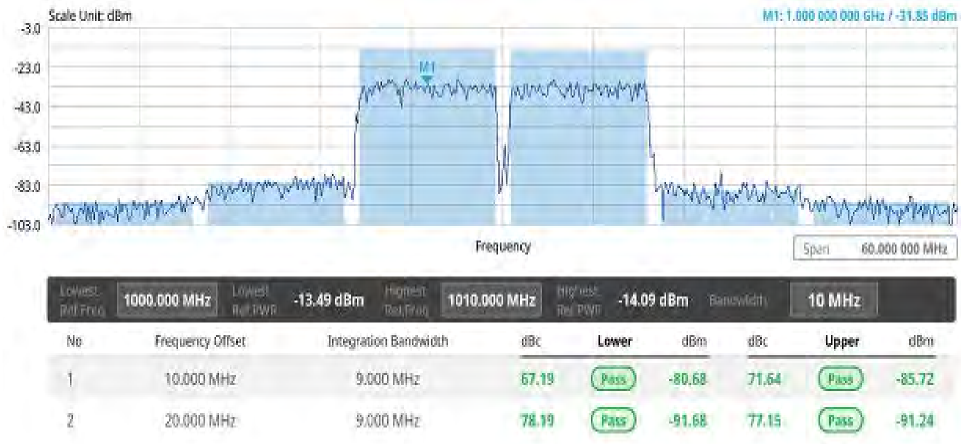
   The input value range is from 1 to 100.

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 141 shows an example of Multi-ACLR measurement.

Figure 141 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 SPA06MA-O 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 9, 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 **Signal Tech 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 142 shows an example of spurious emissions measurement.

Figure 142 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.

Conducting Power vs Time measurements

The following sections describe how to conduct Power vs Time measurements.

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 9, 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 **Signal Tech 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 143 shows an example of Power vs Time (Frame) measurement.

Figure 143 5G DSS Power vs Time (Frame) measurement

Power vs Time (Slot)

The Power vs. Time (Frame) 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 9, 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 **Signal Tech 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**.

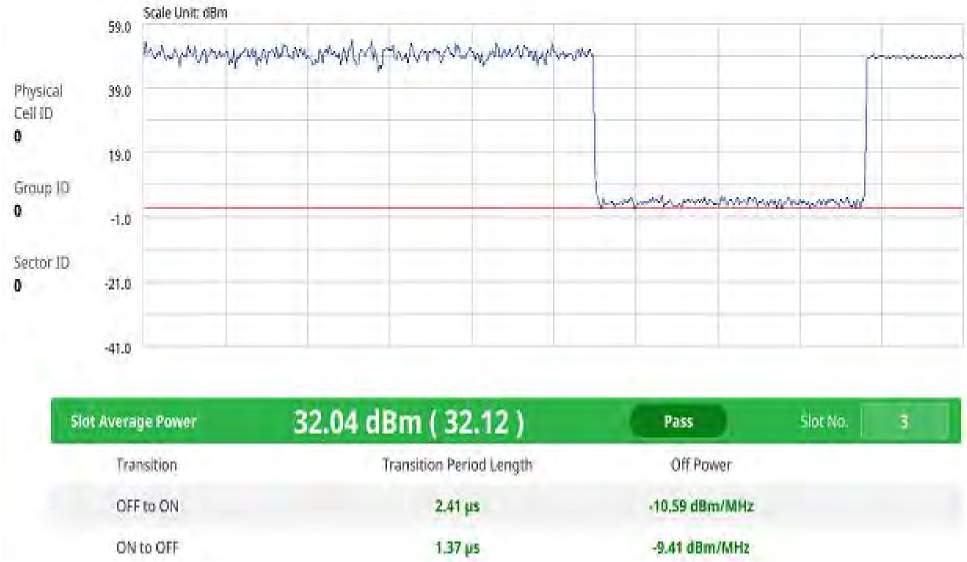
2 Tap the test items and set the limits depending on your selected measurement mode:

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 144 shows an example of Power vs Time (Slot) measurement.

Figure 144 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.

Conducting modulation measurements

The following sections describe how to conduct modulation 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 9, 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 SPA06MA-O 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

To set the limit for	Set
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 form the choices available for your measurement mode.

Figure 145 shows an example of DSS constellation measurement.

Figure 145 5G DSS 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 9, 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 SPA06MA-O 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**.

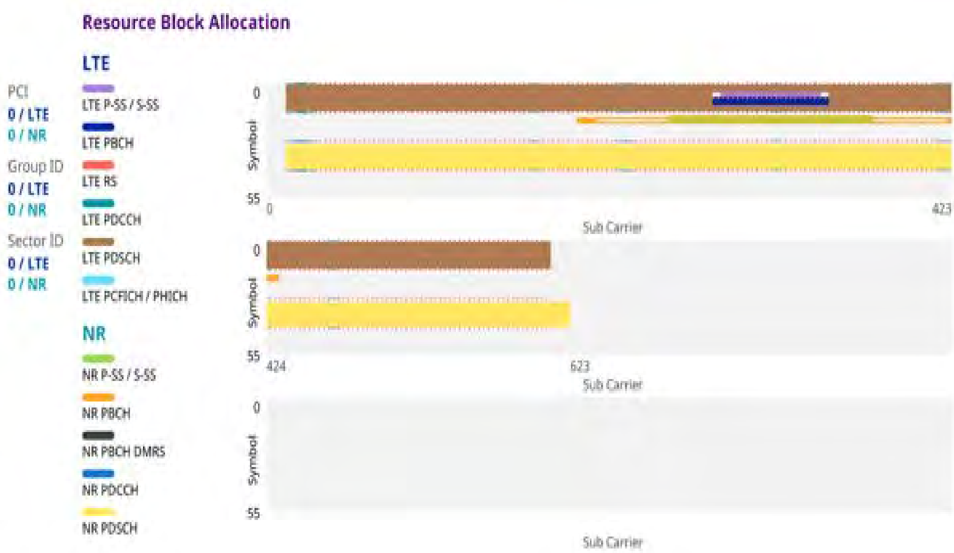
If two or more modulation types are used in a frame, select **Auto**. If the PDSCH uses the same modulation type in a frame or in a subframe, select a specific modulation type to get more accurate EVM.

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 146 shows an example of DSS channel mapper measurement.

Figure 146 5G DSS 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 9, 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 SPA06MA-O 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 SPA06MA-O series with a 2x1 or 4x1 combiner or an antenna

– **Single**: Testing on one single antenna connected to your SPA06MA-O 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
EVMPSS	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:

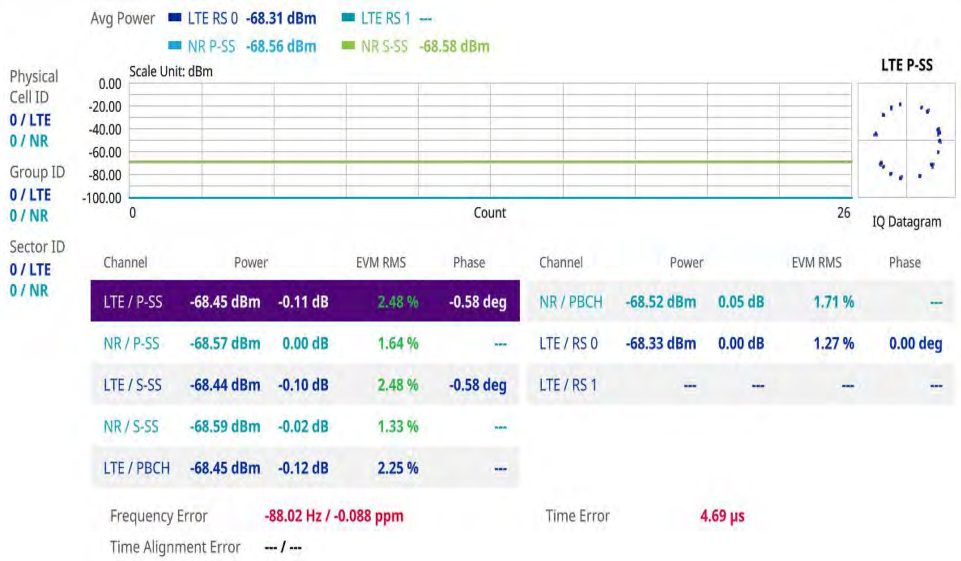
To set the limit for	Set
Frequency error	Test limits On/Off, High/Low Limit
RS EVM	Test limits On/Off, High Limit
P-SS EVM	Test limits On/Off, High Limit
S-SS EVM	Test limits On/Off, High Limit
DL RS power	Test limits On/Off, High/Low Limit

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.
IQ Origin Offset	Test limits On/Off, High Limit

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

Figure 147 shows an example of DSS control channel measurement.

Figure 147 5G DSS 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 9, 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 SPA06MA-O 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 SPA06MA-O series with a 2x1 or 4x1 combiner or an antenna
- **Single**: Testing on one single antenna connected to your SPA06MA-O 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 form 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**.

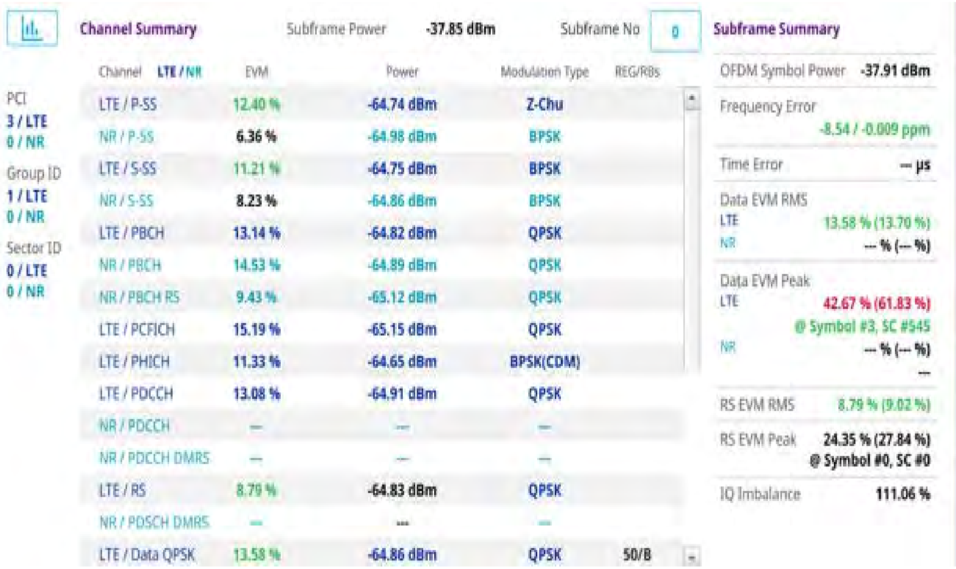
2 Tap **Marker View** between **On** and **Off** to display or dismiss the marker on the chart.

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.

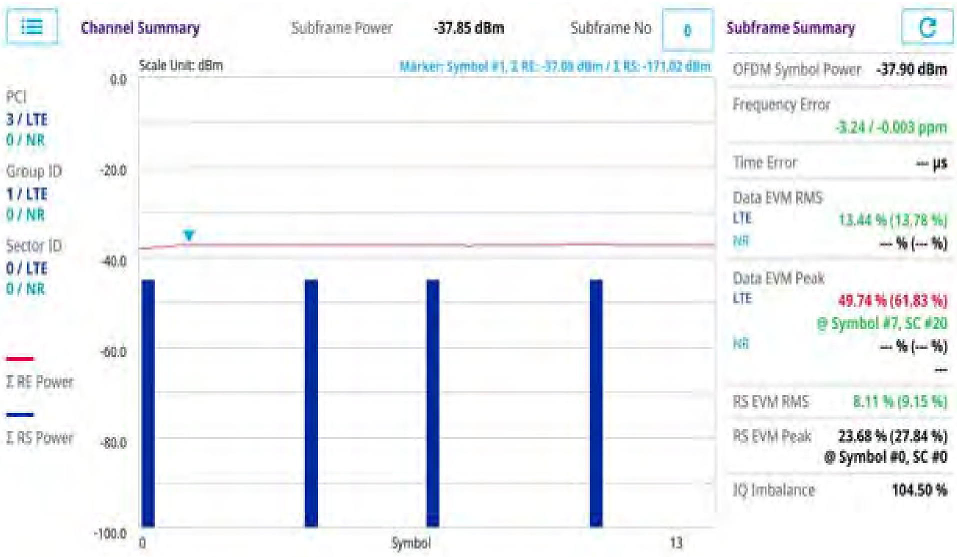
Figure 148 shows an example of DSS subframe measurement.

Figure 148 5G DSS 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 149 5G DSS 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 9, 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 SPA06MA-O 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 SPA06MA-O series with a 2x1 or 4x1 combiner or an antenna
- **Single**: Testing on one single antenna connected to your SPA06MA-O 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:

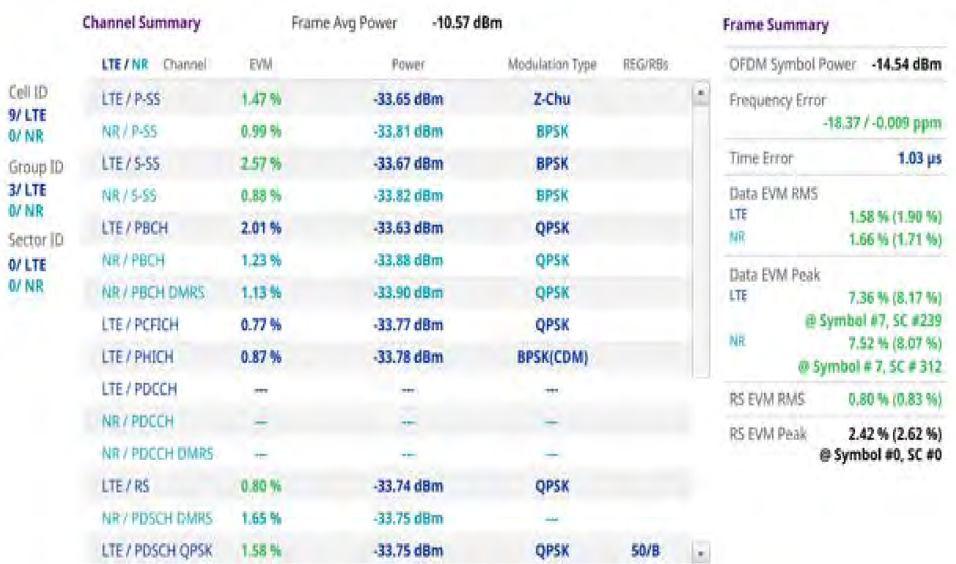
To set the limit for	Set
Frequency error	Test limits On/Off, High/Low Limit
PDSCH EVM	Test limits On/Off, High Limit for QPSK, 16 QAM, 64 QAM, 256 QAM
Data EVM RMS	Test limits On/Off, High Limit
Data EVM Peak	Test limits On/Off, High Limit
RS EVM	Test limits On/Off, High Limit
P-SS EVM	Test limits On/Off, 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 form the choices available for your measurement mode.

Figure 150 shows an example of DSS frame measurement.

Figure 150 5G DSS 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 9, 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.

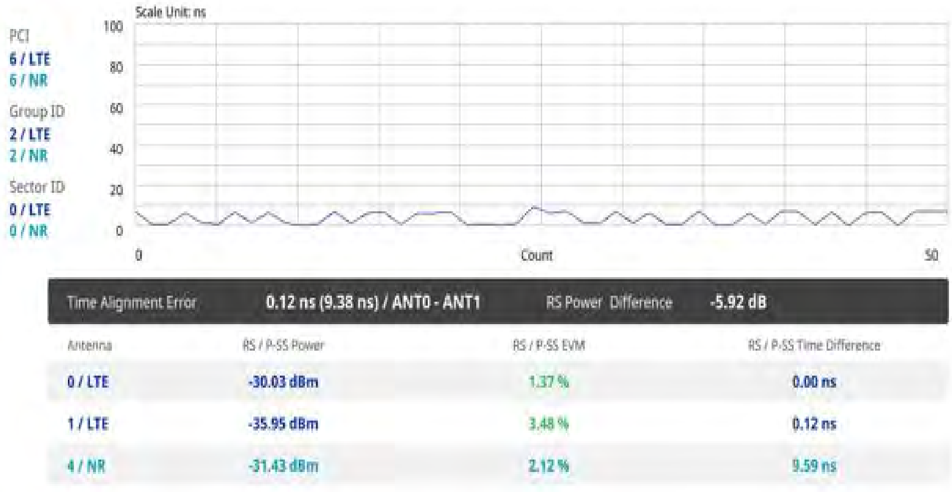
7 Tap **SSB frequency** and input the value using the on-screen keyboard.

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 SPA06MA-O supports.

> **NOTE**
> Based on the GSCN input frequency, the SSB Frequency is automatically changed.

Figure 151 shows an example of DSS time alignment error measurement.

Figure 151 5G DSS DSS time alignment error measurement



Conducting OTA measurement

The following sections describe how to conduct 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 9, 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.

General setting

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 **GPS** 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
   - **GPS**: When synchronizing the signal processing via the GPS receiver

Carrier setting

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.

> **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 SPA06MA-O 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 1007The **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 152 shows an example of OTA channel scanner measurement.

Figure 152 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 that all these signals 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 9, 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 SPA06MA-O 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 153 shows an example of OTA ID Scanner measurement.

Figure 153 5G DSS OTA ID Scanner measurement

> **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 9, 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 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 SPA06MA-O 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**.

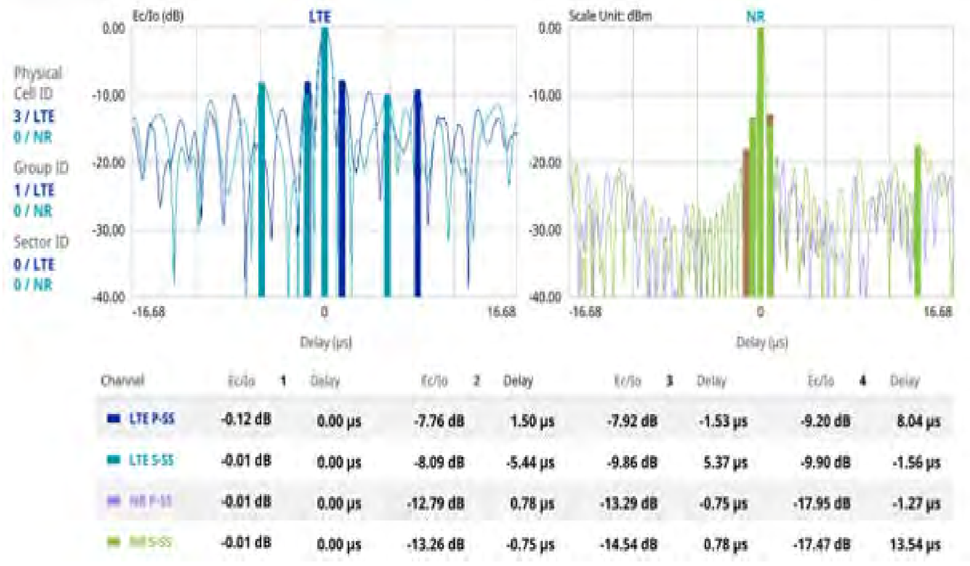
If two or more modulation types are used in a frame, select **Auto**. If the PDSCH uses the same modulation type in a frame or in a subframe, select a specific modulation type to get more accurate EVM.

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 154 shows an example of OTA multipath profile measurement.

Figure 154 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 9, 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 SPA06MA-O 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

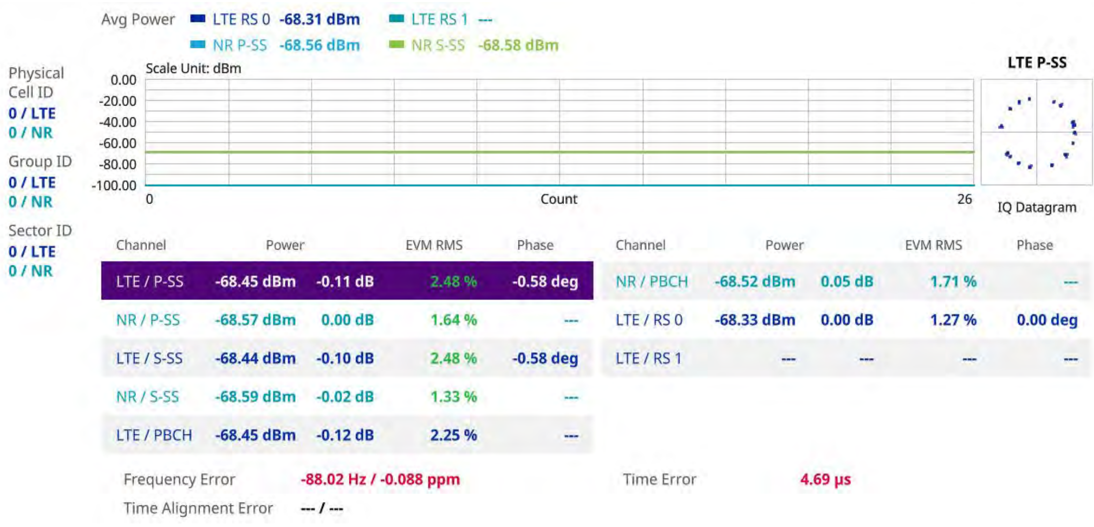
3 Tap **LTE Limit** and set the limits depending on your selected measurement mode:

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 155 shows an example of OTA Control Channel measurement.

Figure 155 5G DSS OTA Control Channel measurement



OTA Route Map

5G route map traces the power level of the strongest beam corresponding 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 156 shows an example of 5G DSS OTA Route Map measurement.

Figure 156 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*.

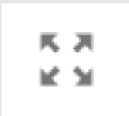
To load a map

1. Plug in your USB flash drive that has a map file in .mcf file type created in JDMap-Creator.
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 78 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

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 9 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 **GPS**, **Position**, or **Time**.

- To collect data/plot points automatically as you move around in a vehicle or outside, select **GPS**.
- 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 SPA06MA-O 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.

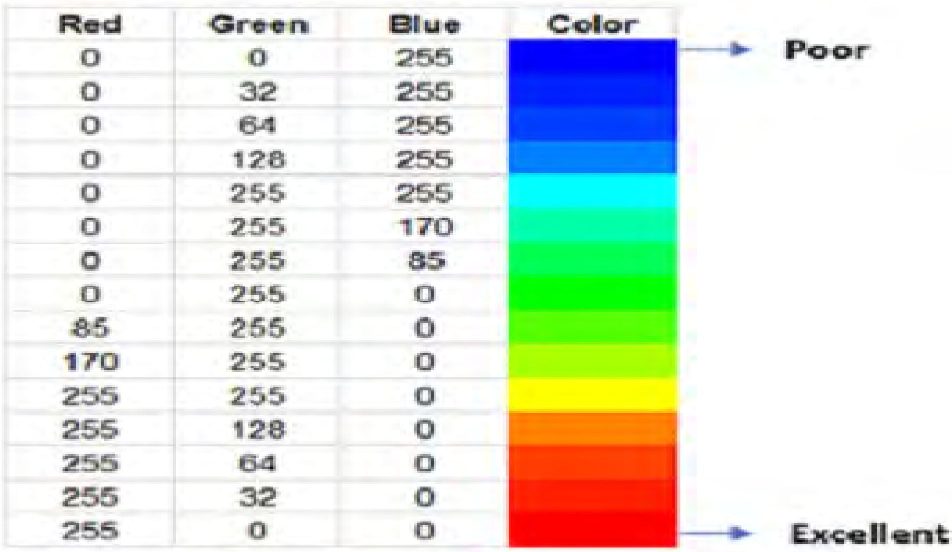
2 Set a value for **Poor** (minimum value) using the on-screen keyboard.

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 157 shows a legend color table.

Figure 157 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 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 **step 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 GPS 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 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.

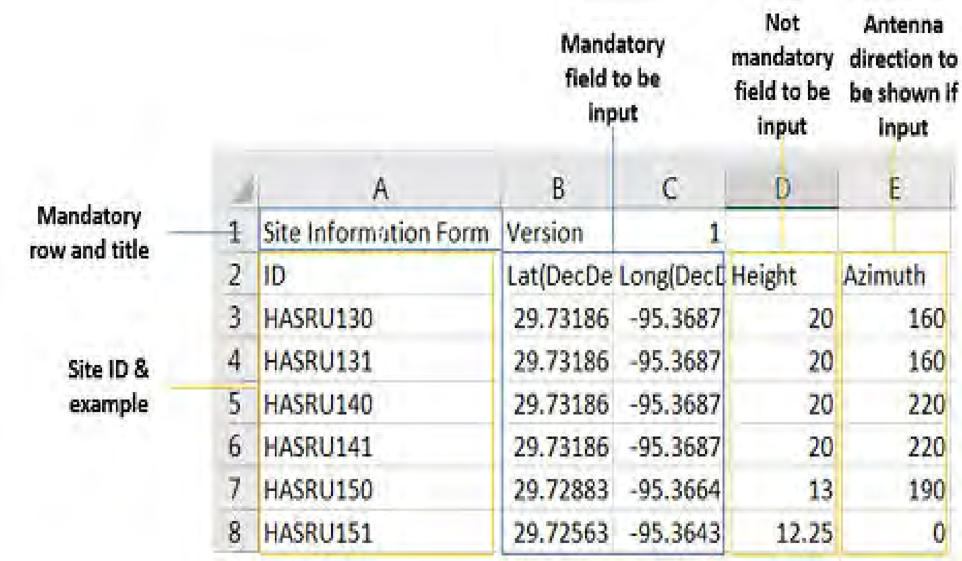
6 Tap the **Load** ( ) icon on the side bar.

7 Import the saved file.

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

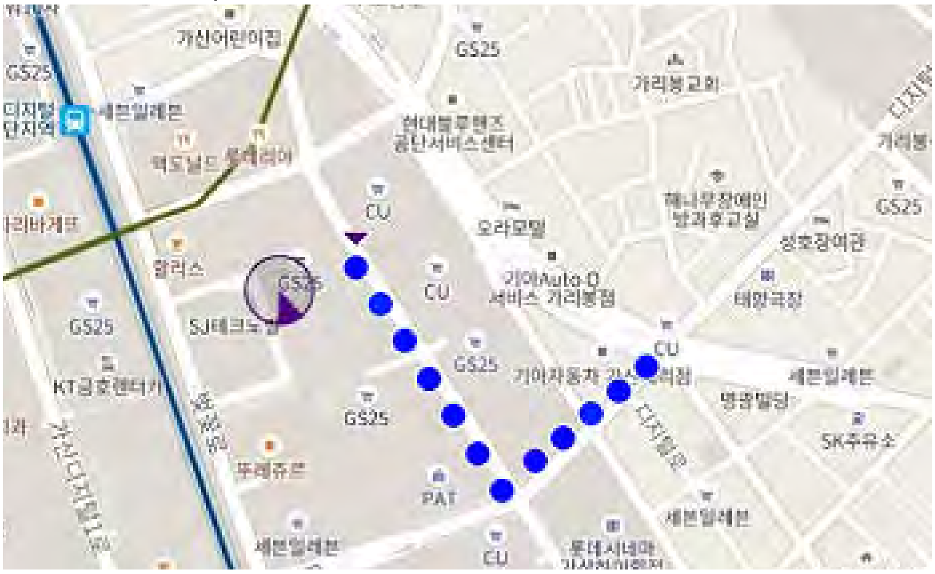
Figure 158 shows an example of an importing cellsite DB.

Figure 158 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 159 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 9, 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 SPA06MA-O 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.

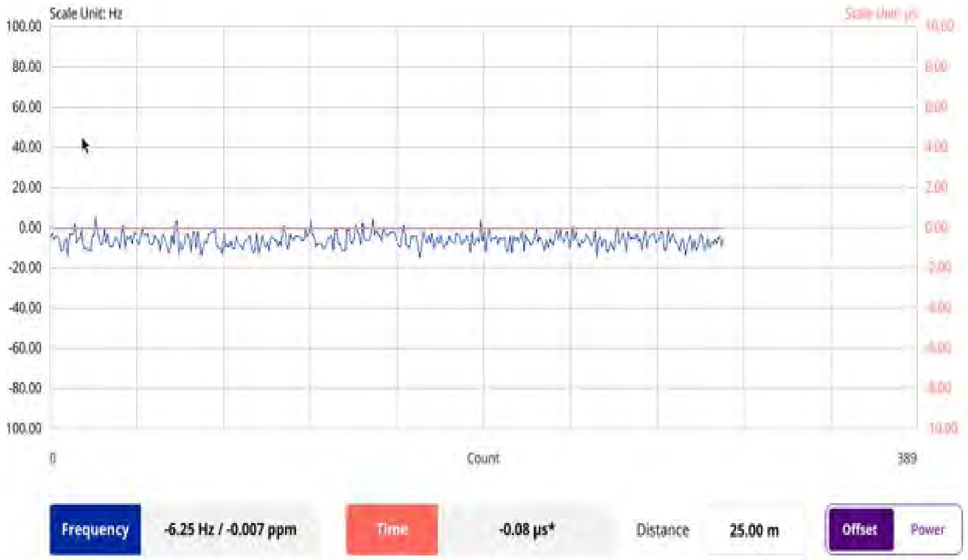
12 Tap **PDSCH Precoding** to set **On** or **Off** to enable or disable the PDSCH precoding.

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 160 shows an example of 5G DSS Freq/Time/Power Variation by offset.

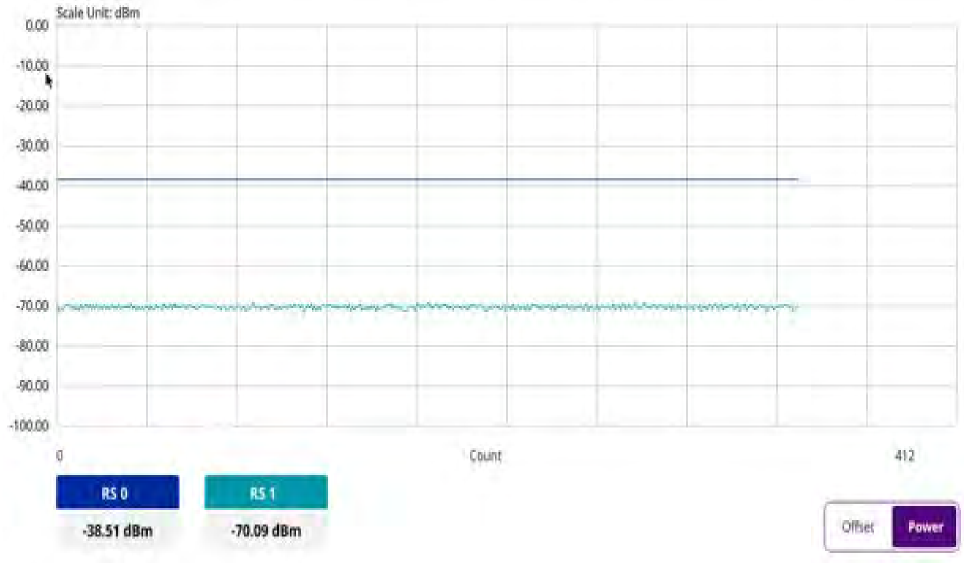
Figure 160 5G DSS Freq/Time/Power Variation by offset



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.

Figure 161 shows an example of 5G DSS Freq/Time/Power Variation by power.

Figure 161 5G DSS Freq/Time/Power Variation by power



10

Using RFoCIPRI Interference Analyzer

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

Introduction

> **NOTE**
> The RFoCIPRI Analyzer is only available on the SPA06MA-O.

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, as all the RF interfaces reside on the RRH, and RY maintenance or trouble-shooting requires climbing to the top of the tower to access the RRH, increasing operational cost and 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 extracts 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:

- Spectrum Analysis
  - Spectrum
  - Spectrogram
  - Spectrum Replayer

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:
- **Spectrum Analysis > Spectrum**
- **Spectrum Analysis > Spectrogram**
- **Spectrum Analysis > Spectrum Replayer**

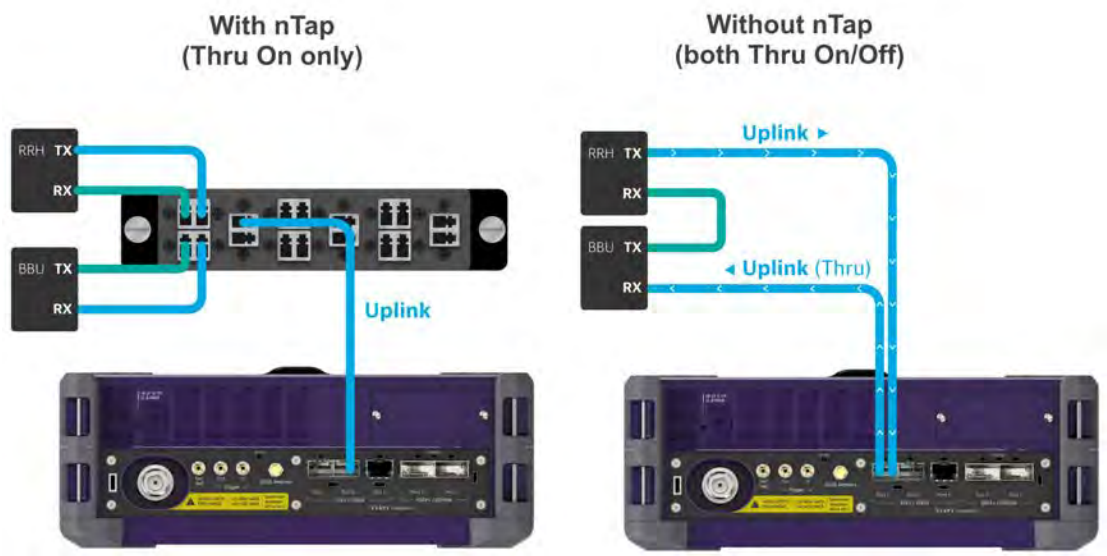
> **NOTE**
> If you have **RF Source** as an option in your Cable and Antenna Analyzer (CAA), you can choose **RF Source On** or **Off** in the Setup menu after tapping **CAA RF Power On**.

Connecting cables

You can connect cables with or without a tap, as shown in Figure 162. 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 162 Connection diagram for interface analysis



Selecting port

RFoCPRI. 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 RF-CPRI mode.

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 test parameters

Configuration of test parameters described in this section is used in the RFoCPRI mode including spectrum, spectrogram, and spectrum replayer measurements.

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** 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.

   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 163 and Figure 164 show an example of Port Configuration with the RFoCPRI Analyzer and an example of Global Settings window.

Figure 163 Port Configuration with RFoCPRI Interference Analyzer

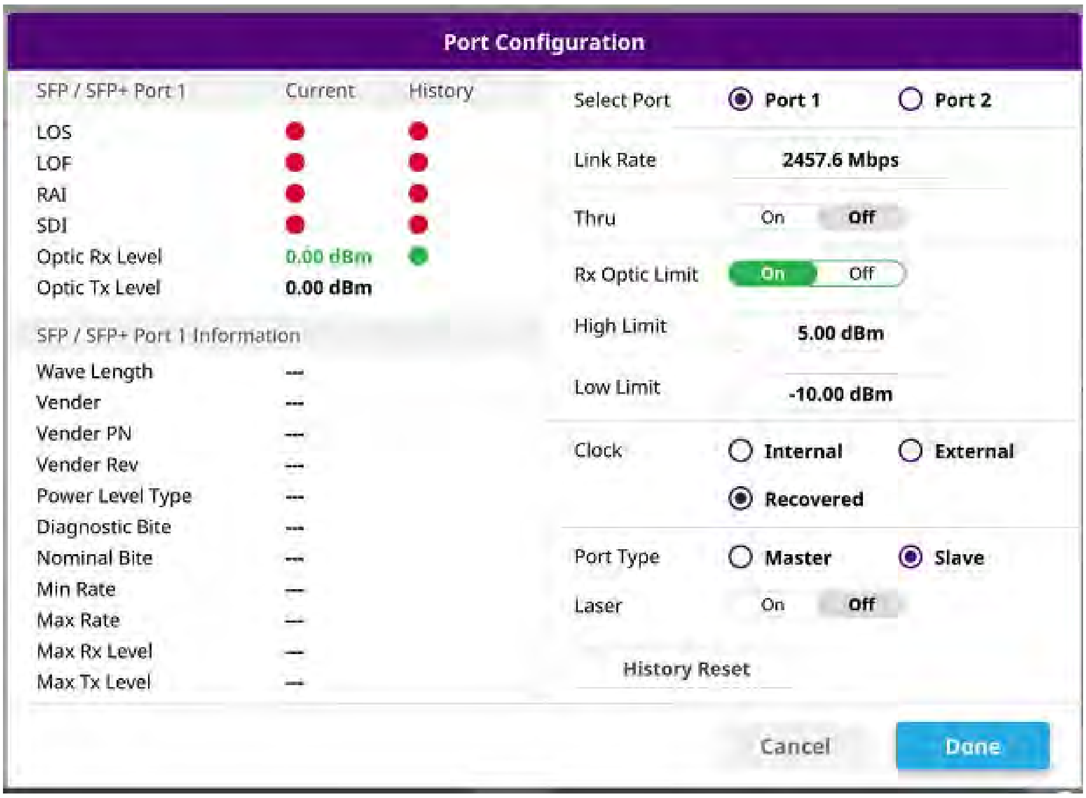
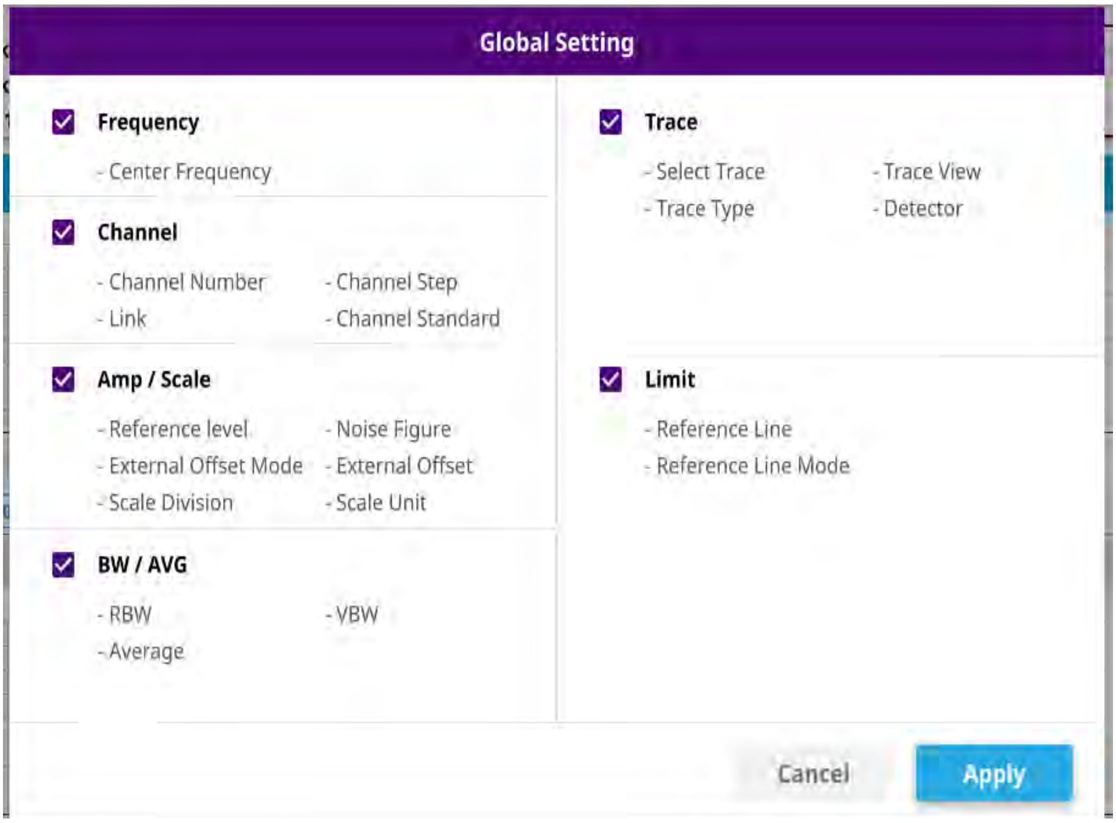


Figure 164 Global Settings window



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, WCDMA

1. Tap the **Setup** ( ) icon on the side bar of each measurement mode.
2. Tap **Rx Settings**.
3. Set the antenna per carrier group by tapping one of the **Map Position (AxC 0 to AxC7)** boxes and enter a value using the on-screen keyboard.

> **NOTE**
> Maximum number of the AxC Group is determined by the factors of link rate, sample width, oversampling, and signal bandwidth.

4. 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.

5. Tap **Stuffing Bit** and enter a value between 0 and 20, using the on-screen keyboard.
6. 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.

7 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**, **AxC 1**, **AxC 2**, **AxC 3**, **AxC 4**, **AxC 5**, **AxC 6**, or **AxC 7**. 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 Container for a basic frame are two AxCs for 5 MHz, four AxCs for 10 MHz, and eight AxCs for 20 MHz.

8 Set the bandwidth of the downlink signal:

a Tap **Bandwidth**.

b 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 2**0 MHz (6 AxC)**, **20 MHz (7 AxC)**, **20 MHz (8 AxC)**. The RBW range changes depending on the bandwidth you selected. Required number of AxC containers may vary depending on the bandwidth you selected.

9 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 times by NEMs.

10 To choose **Uplink** or **Downlink** and **Band** to be tested, tap More and select your preferred band after tapping **Channel Standard**.

Figure 165 and Figure 166 show an example of Rx Settings with the RFoCPRI Analyzer and an example of Rx settings for AxC mode.

Figure 165 RX settings with RFoCPRI Analyzer

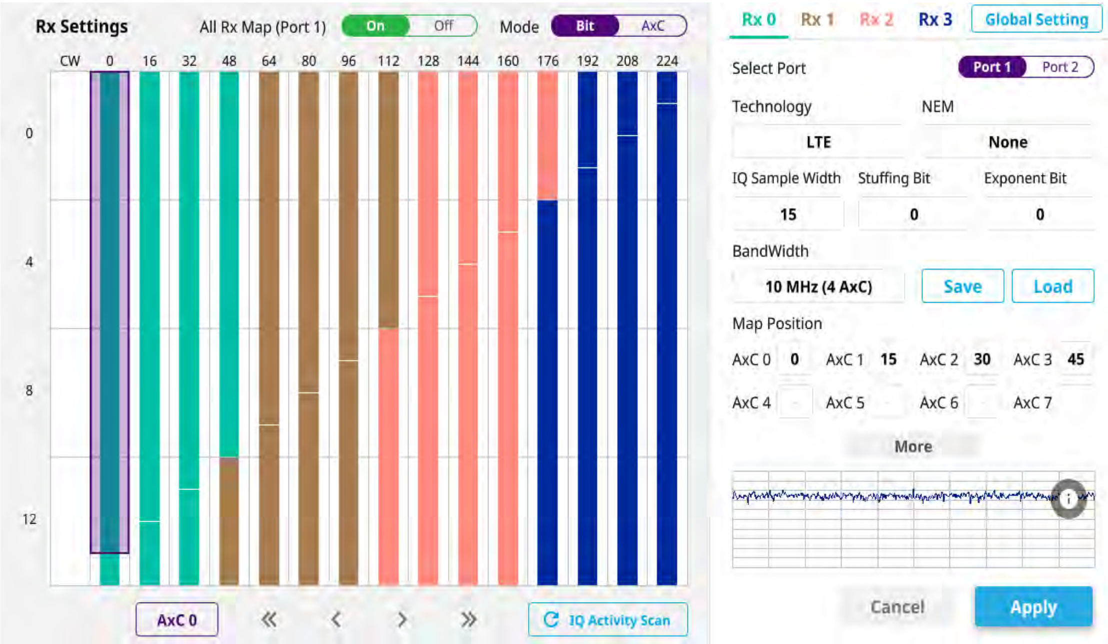
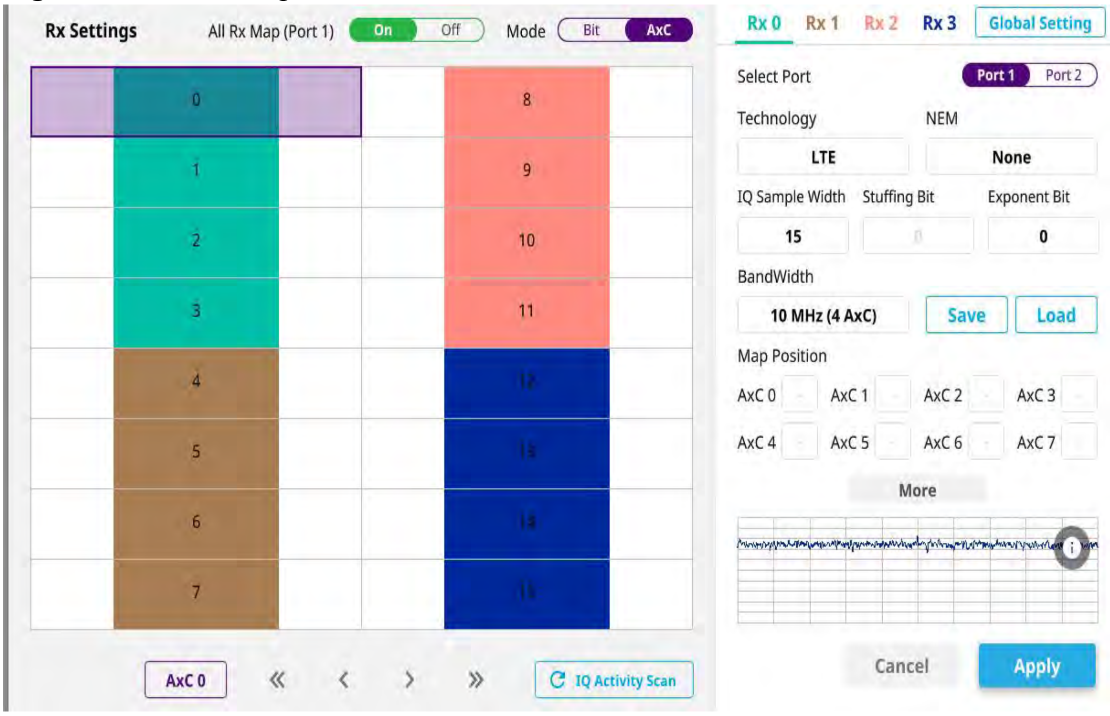


Figure 166 RX settings for AxC Mode



NOTE

If you want to configure each Rx carriers from 1 to 4 with same values, tap the Global Setting icon and tap to switch Global Setting to On, then you can apply the values that you have set in the Global Settings window.

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**, **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 *(Idea 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 167 and Figure 168 show an example of before and after Auto Leveling is enabled.

Figure 167 Before enabling Auto Leveling

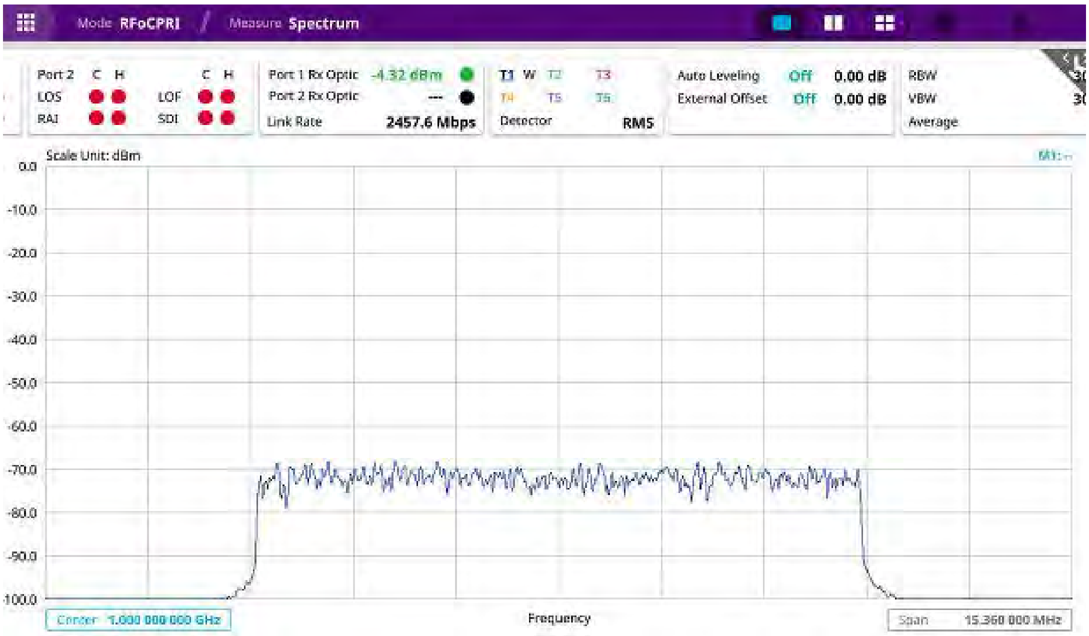


Figure 168 After enabling Auto Leveling

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 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.

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), **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 test parameters” on page 358, you can perform spectrum measurements with an audible indicator. You can also turn on the interference ID.

Figure 169 and Figure 170 shows examples of an RFoCPRI spectrum measurements.

Figure 169 RFoCPRI spectrum measurement

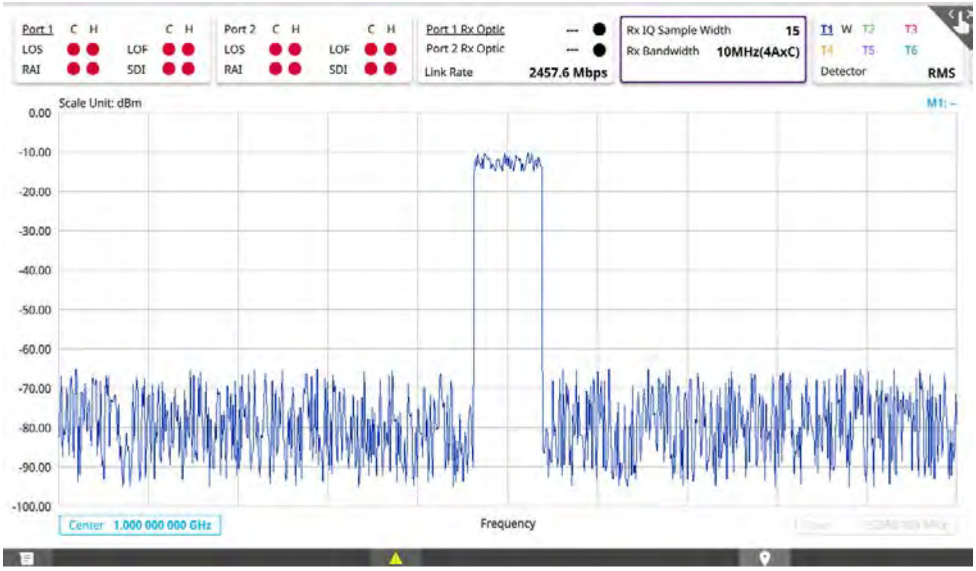
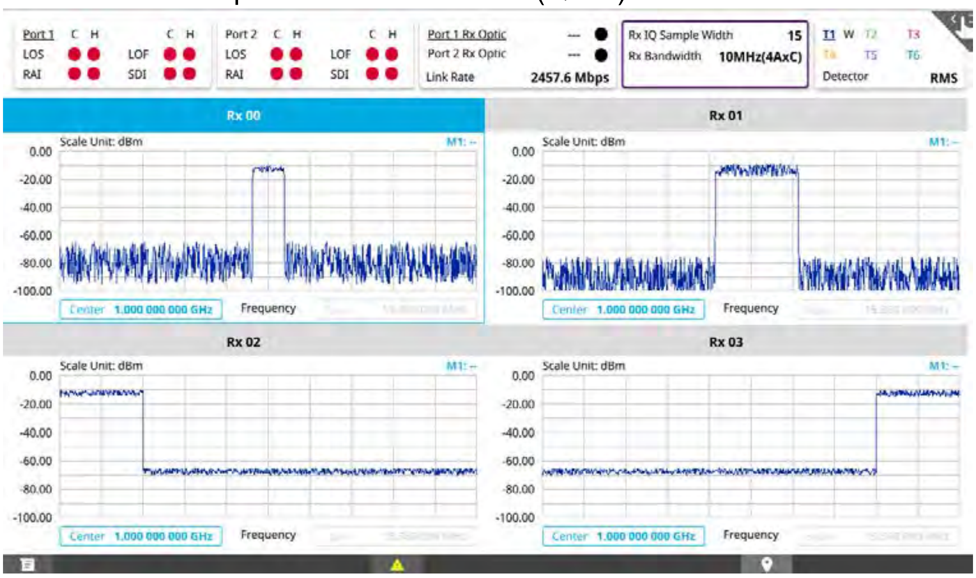


Figure 170 RFoCPRI spectrum measurement (Quad)



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

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**.

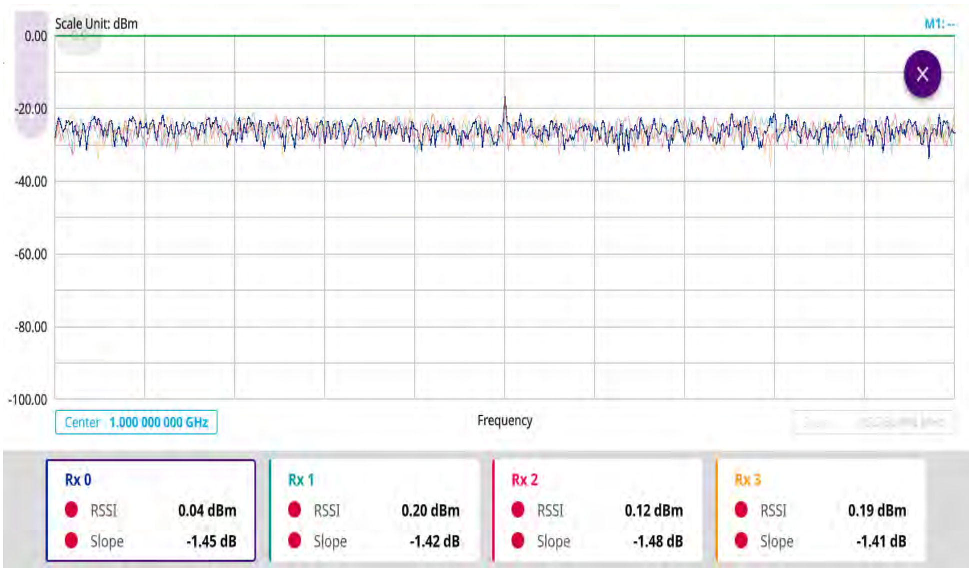
> **NOTE**
> You will find a combo box on the left side of the screen and you can select carriers from Rx0 to Rx3 to be shown in the screen.

3 Go to **Setup** and tap **Flatness** 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 171 RFoCPRI PIM measurement



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.

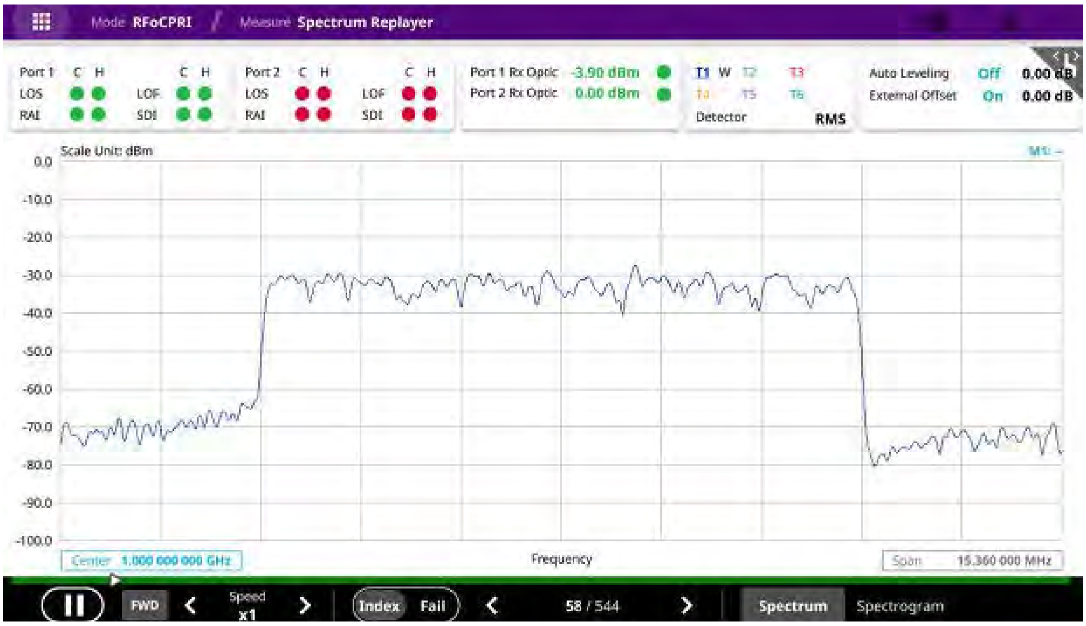
4 Tap **Reset/Restart** to start a new measurement.
5 Tap to switch **Type** to **3D** to **Normal**.
6 Tap **Setup > Port Configuration > History Reset** to clear current (C) and history (H) status of CPRI alarms on LOS and LOF and start a new monitoring.
7 *Optional*: Tap the **Save** icon on the side bar and select a desired save option for your measurement mode.

Using the 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 crate failure points when signals exceed it. The failure points are clearly displayed on the trace timeline for quick access during playback.

Figure 172 shows an example of the RFoCPRI spectrum replay.

Figure 172 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 **Index Fail** 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 173 shows an example of the PRB power.

Figure 173 RFoCPRI PRB power

> **NOTE**
> You can change the Marker position with the purple bar by moving right and left.

11

Using EMF Analyzer

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

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:

- Spectrum Analysis
  - Spectrum
  - Scanner
- Signal Analysis
  - 5G NR Beam Analysis

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 174 shows an example of an isotropic antenna connection.

Figure 174 Connecting an isotropic antenna

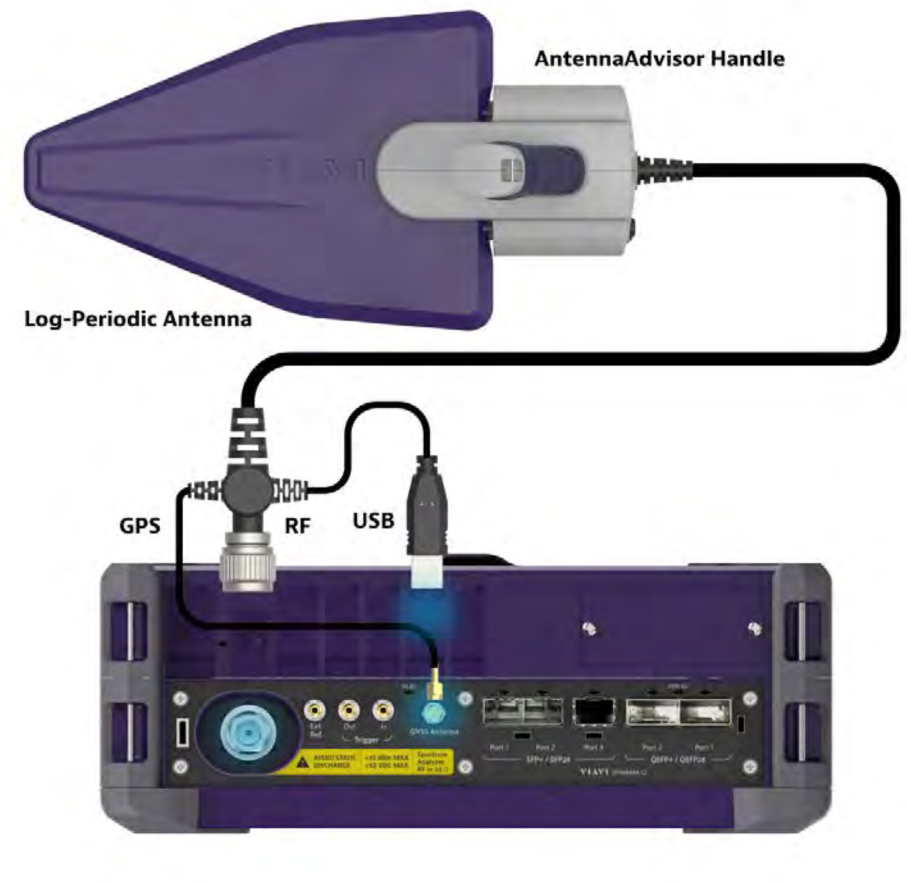
To connect a log-periodic antenna

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.
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 AntennaAdivsor handle to search more exact directional information. You can use a log periodic antenna or Omni antenna alone as well.

Figure 175 shows an example of a log-periodic antenna connection.

Figure 175 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:
   - **Spectrum Analysis > Spectrum > Scanner**
   - **Signal Analysis > 5G NR Beam Analysis**

Conducting spectrum measurement

The following sections describe how to conduct spectrum analysis.

Spectrum

After setting test parameters as described in “Configuring spectrum measurements” on page 9, 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 to switch **Auto Range** to **On** or **Off**.

When you set Auto Range On, the instrument scans to-be-measured bandwidth for EMF in advance and sets appropriate Attenuation and Preamp based on the different received signal level for the choice of axis.

b 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 1 to 60 (second) using the on-screen keyboard.

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 60 minutes 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**.

5 Tap **Move to RtSA** to view the real-time spectrum measurement mode.

6 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 (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.

> **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 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**.

e When the Cable Loss is on, tap **Cable Loss Value** and input the required value using the on-screen keyboard.

> **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.

7 Tap **Cable List** and select between **Standard** and **Custom**.

   a Tap **Standard** and select a cable if you use a cable provided with G700050381 (Isotropic E-Field) antenna.

   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 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.

8 Tap the **Display Mode** icon between **Spectrum** and **Level Recorder**. Refer to the figure 175 and figure 176.

Based on the selection, the measurement screen will change.

9 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 while the Accumulated (Isotropic) EMF Power is the average, maximum, and minimum power taken from the counts of measurements.
   - Integrated BW displays as channel power of the current displayed signal on the measurement 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.

> **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 Isotropic Antenna, E: When connected 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 to switch **Detectors** to **RMS** or **Peak**.

   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'.
5. Tap **Trace Clear All** to clear Min/Max/Isotropic EMF/Accumulated Isotropic EMF 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 limit

1. Tap **Menu > Limit** in the side bar.

2 Tap **Display 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 **Display Line Mode** to **On** or **Off**.

If you set it to On, the display line will appear with the purple bar on the measurement screen and set it to Off, the display 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.

a Tap **ICNIRP Occupational** and **Apply** when EMF power is measured in a site where people work for long hours (occupational).

b Tap **ICNIRP General Public** and **Apply** when EMF power is measured in a public site where unspecified people come and go.

c 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.** To see the storage location, tap the **Folder** ( ) icon. 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. 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** to save the current screen with a fie type,.png.
   b. Select **Report** to save the measurement result in a report format with comments and captured screen images with a file type,.pdf.
   c. Select **Result as CSV** to save the number of points displayed on the screen-with a file type,.csv.
   d. Select **Logging as CSV** to save all measurement results with a file type,.csv.
   e. Select **Setup** to save the setup and test configuration with a file type,.stav.
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.** To see the storage location, tap the **Folder** ( ) icon. 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.

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.

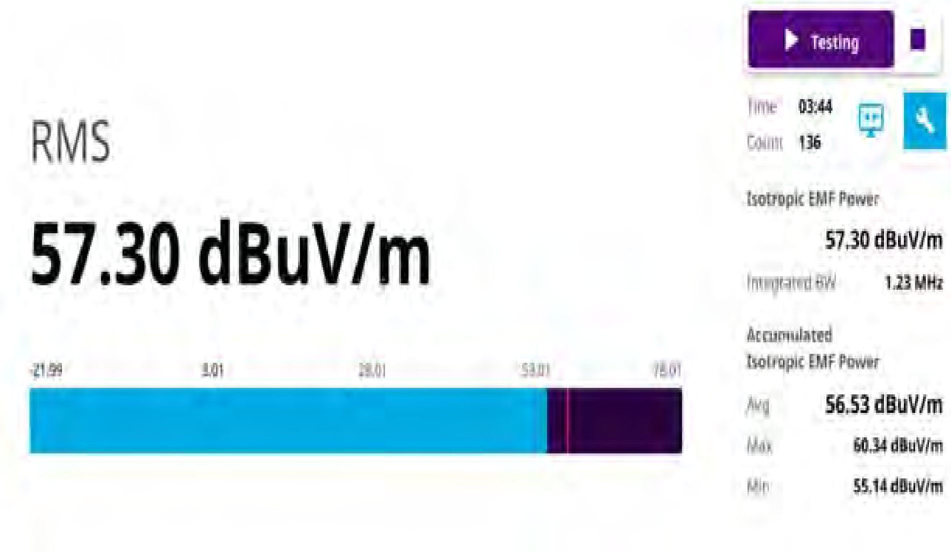
   Information of your selected file appears in the File Information pane.
3. Check the file information on the right pane.
4. Tap the **Load** button to load the file.

> **NOTE**
> When you load CSV file (.csv), you can check the data that you have set up during the measurement. You can find a specific information that you want using the on-screen keyboard or exit by using the Exit button.

Figure 176 shows an example of EMF spectrum measurement.

Figure 176 EMF spectrum measurement

Figure 177 EMF spectrum (level recorder) measurement



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 to switch **Auto Range** to **On** or **Off**.

When you set Auto Range On, the instrument detects and sets each axis and appropriate Attenuation and Preamp for each band in advance.

b 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 1 to 60 (second) using the on-screen keyboard.

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 60 minutes 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 **Move to RtSA** to view the real-time spectrum measurement mode.

4 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 (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.

> **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 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**.

e When the Cable Loss is on, tap **Cable Loss Value** and input the required value using the on-screen keyboard.

> **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.

5 Tap **Cable List** and select between **Standard** and **Custom**.

a Tap **Standard** and select a cable if you use a cable provided with G700050381 (Isotropic E-Field) antenna.

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 GHz. This will automatically compensate the measurement result by calculation the input cable loss.
- Tap the **Delete** icon to delete the customized cable that you have set.

6 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 177 and figure 178.

7 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 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 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**, and **Minimum BW**.

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.

To set limit

1. Tap **Menu > Limit** in the side bar.
2. Tap **Display 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 **Display Line Mode** to **On** or **Off**.

   If you set it to On, the display line will appear with the purple bar on the measurement screen and set it to Off, the display 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.

a Tap **ICNIRP Occupational** and **Apply** when EMF power is measured in a site where people work for long hours (occupational).

b Tap **ICNIRP General Public** and **Apply** when EMF power is measured in a public site where unspecified people come and go.

c 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.** To see the storage location, tap the **Folder** ( ) icon. 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. 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** to save the current screen with a fie type,.png.

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

c Select **Result as CSV** to save the number of points displayed on the screen-with a file type,.csv.

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

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.** To see the storage location, tap the **Folder** ( ) icon. 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.

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 a specific information that you want using the on-screen keyboard or exit by using the Exit button.

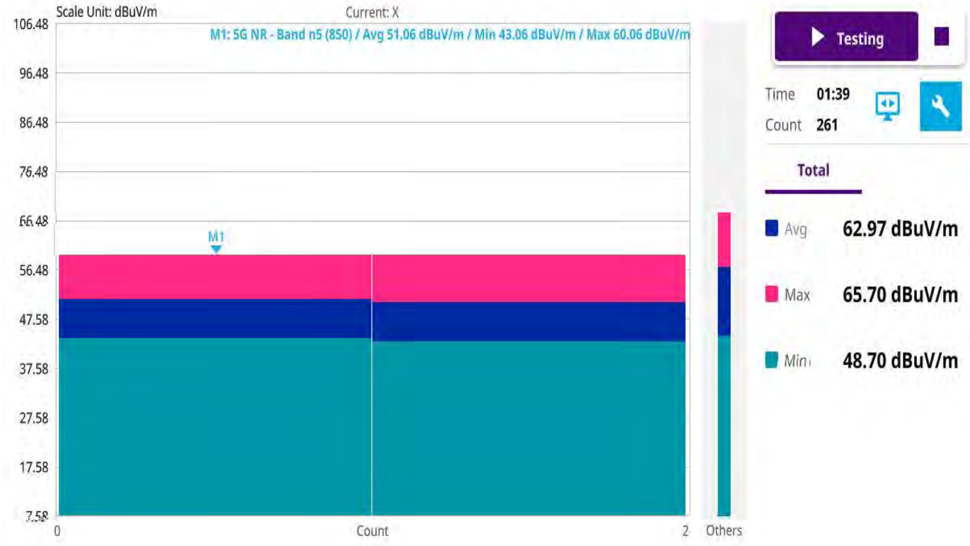
Figure 178 shows an example of EMF scanner measurement for table view.

Figure 178 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. To provide total EMF damage value while measuring EMF power due to unspecified signals, the EMF power of undefined bands also will be added to Total EMF Power.

Figure 179 shows an example of EMF scanner measurement for bar view.

Figure 179 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. To provide total EMF damage value while measuring EMF power due to unspecified signals, the EMF power of undefined bands also will be added to Total EMF Power.

Conducting signal measurement

The following sections describe how to conduct signal 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 9, 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/SSB SCS** and select the Setting in the pop-up window based on your need. SSB is 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 **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**.

7 Tap **SSB Auto Search** and do the following steps:

   a Tap **Search Type** and select from the following three options:

   - **Full-Raster**: You can search in sync raster offset unit that SPA06MA-O defines (FR1: 180 kHz, FR2: 720 kHz).
   - **Full-Raster & SCS**: You can search in SCS unit for the selected SSB (FR1: 15K or 30K, FR2: 120K or 240K).
   - **GSCN**: 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 SPA06MA-O supports.

   b Tap **SSB Auto Search Mode** between **Manual** and **Auto**.

   - **Manual**: You can search SSB automatically with current Preamp and Attenuation setting.
   - **Auto**: You can search SSB and change Preamp and Attenuation automatically based on input signal level.

   c Tap to switch **SSB Auto Search** to **Stop** to set the SSB periodicity based on the base station or to **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.

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**.

> **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.

11 Tap **Test Configuration**.

a Tap to switch **Auto Range** to **On** or **Off**.

If you want to set Auto Scale and Preamp to Auto. You can set it to On.

b 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 1 to 60 (second) using the on-screen keyboard.

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 60 minutes 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 Tap **UL/DL Config** and select **Simple** (default).

g Tap **UL (%)** and input the value using the on-screen keyboard.

h Tap **DL (%)** and input the value using the on-screen keyboard.

i Tap **Move to RtSA** to view the real-time spectrum measurement mode.

12 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.

- When selecting G700050381 (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.

> **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 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.

c *Optional.* Tap to Switch **Cable Loss** to **On** or **Off**.

d When the Cable Loss is on, tap **Cable Loss Value** and input the required value using the on-screen keyboard.

> **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.

13 On the right panel of the screen, tap the **Display Mode** icon between **P vs T** and **Level Recorder**. Refer to fig 179 and fig 180.

Based on the selection, the measurement screen will change.

14 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 chart on the left panel displays based on the values displayed on the right panel.

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)	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)	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

SSB SCS (kHz)	Sync Raster Resolution (kHz)	Sync Raster Offset Range	SSB Frequency = Center Frequency
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** in the side bar.
2. Tap **Display 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 **Display Line Mode** to **On** or **Off**.

   If you set it to On, the display line will appear with the purple bar on the measurement screen and set it to Off, the display 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.

a Tap **ICNIRP Occupational** and **Apply** when EMF power is measured in a site where people work for long hours (occupational).

b Tap **ICNIRP General Public** and **Apply** when EMF power is measured in a public site where unspecified people come and go.

c 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.

3 Tap to switch Sweep mode to **Continue** or **Single**.

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.** To see the storage location, tap the **Folder** ( ) icon. 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. 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** to save the current screen with a fie type,.png.
- **b** Select **Report** to save the measurement result in a report format with comments and captured screen images with a file type,.pdf.
- **c** Select **Result as CSV** to save the number of points displayed on the screen with a file type,.csv.
- **d** Select **Logging as CSV** to save all measurement results with a file type,.csv.
- **e** Select **Setup** to save the setup and test configuration with a file type,.stav.

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.** To see the storage location, tap the **Folder** ( ) icon. 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.

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 a specific information that you want using the on-screen keyboard or exit by using the Exit button.

Figure 180 shows an example of EMF 5G NR beam analyzer measurement.

Figure 180 EMF 5G NR beam analyzer measurement (Extrapolated)

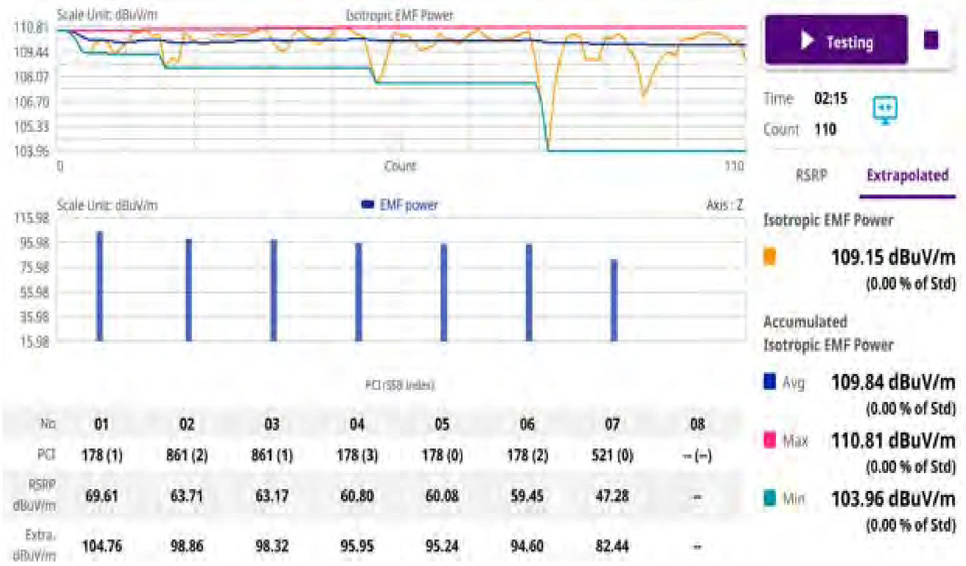


Figure 181 shows an example of EMF 5G NR beam analyzer measurement.

Figure 181 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.

12

Ethernet Testing

This section provides information on testing Ethernet services.

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:

- 400 Gigabit Ethernet with RS(544,514) FEC —Measure pre-FEC and post-FEC performance using Ethernet/MAC layer traffic. Several results are provided at the physical, PCS, RS-FEC, and MAC layers.
- 200 Gigabit Ethernet with RS(544,514) FEC —Measure pre-FEC and post-FEC performance using Ethernet/MAC layer traffic.
- 100 Gigabit Ethernet with or without RS(528,514) FEC —Measure pre-FEC and post-FEC performance using Ethernet/MAC layer traffic.
- 50 Gigabit Ethernet with RS(528,514) FEC — Measure pre-FEC and post-FEC performance using 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.
- 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 — Tests using IPv4.
- 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 reults.
- 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 411.

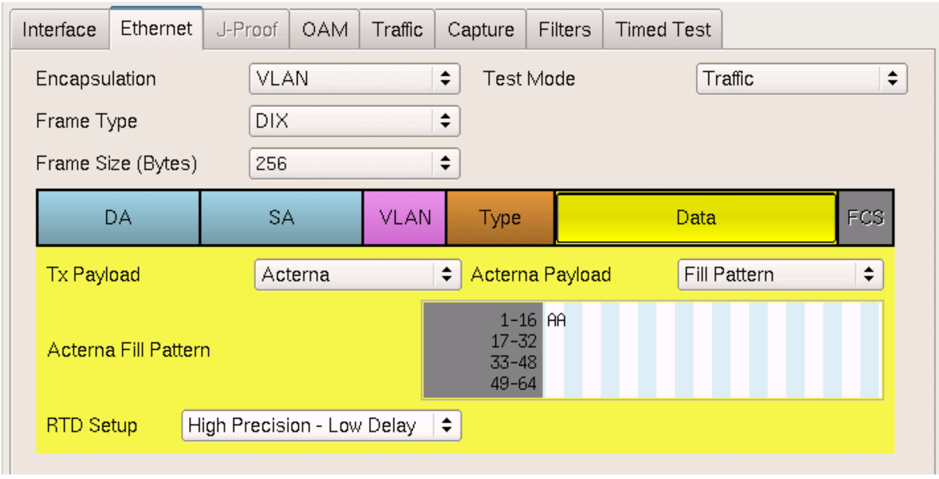
Understanding the graphical user interface

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 182 illustrates the frame settings for a layer 2 traffic test, with the Data field selected.

Figure 182 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 406 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 407
- “Specifying Ethernet frame settings” on page 407
- “Specifying traffic load settings” on page 416
- “Transmitting and analyzing layer 2 traffic” on page 421

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.

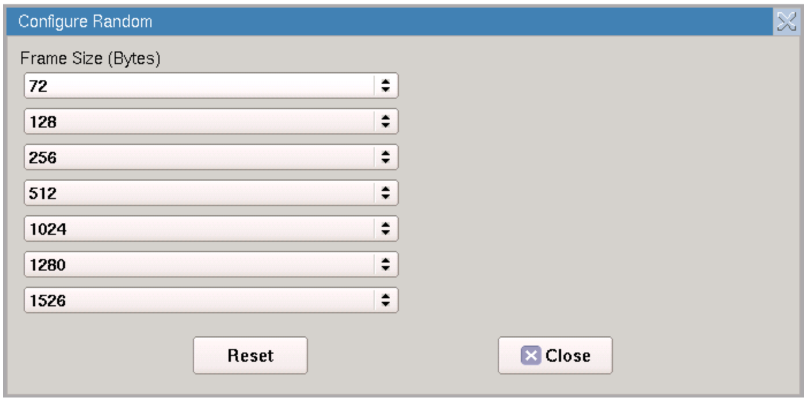
Specifying the settings

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 410.
   - **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 411.
   - **Stacked VLAN.** If you want to transmit stacked VLAN frames, select **Stacked VLAN**, and then refer to "Configuring VLAN tagged traffic" on page 410. 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 183 Configure Random Frame Size



– If you are configuring layer 2 traffic, use the graphical display of a frame to specify the following:

Table 82

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 devicde on the circuit that responds to the hello.

Table 82

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 form 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 only analyze analyze only 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**.**
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 83

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**; other- wise, 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 specified 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.

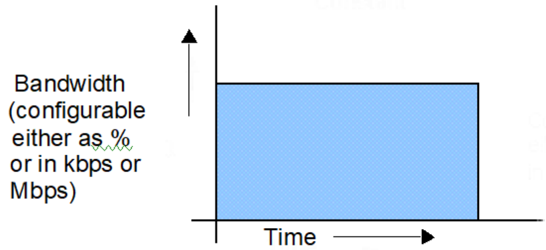
Specifying traffic load settings

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 184.

Figure 184 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.

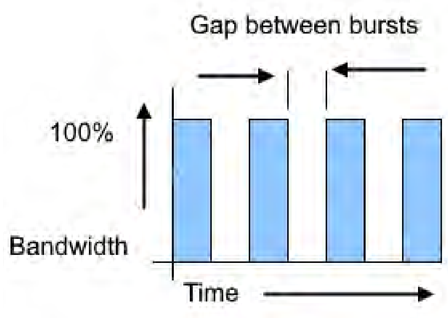
5 If you need to specify other settings for the test, select the appropriate tab; otherwise, press **Results** to return to the Main screen.

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 185.

Figure 185 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.

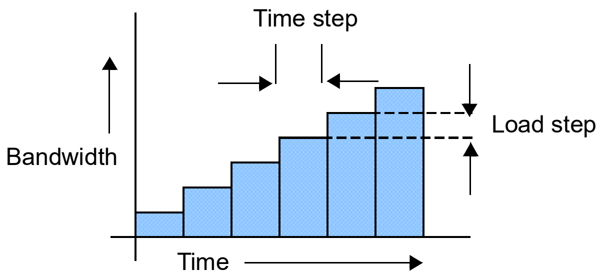
8 If you need to specify other settings for the test, select the appropriate tab; otherwise, press **Results** to return to the Main screen.

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 186.

Figure 186 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 407).
- Frame characteristics for the transmitted traffic (see "Specifying Ethernet frame settings" on page 407).
- Traffic load settings (see "Specifying traffic load settings" on page 416).

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 407).
3. Select the **Ethernet** tab to specify settings that define the frame characteristics of the transmitted traffic (see "Specifying Ethernet frame settings" on page 407).
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 407).
5. Select the **Traffic** tab to specify the type of load the unit will transmit (see "Specifying traffic load settings" on page 416).
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.

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 407.

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 410.
   - **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 411.
   - **Stacked VLAN.** If you want to transmit stacked VLAN frames, select **Stacked VLAN**, and then refer to “Configuring VLAN tagged traffic” on page 410. 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 407).

   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.

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 411.

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 423.

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.

Transmitting and analyzing IP traffic

Before you transmit layer 3 IP traffic, you must specify:

- Interface settings (see “Specifying interface settings” on page 407).
- IP characteristics of the transmitted traffic (see “Specifying transmitted IPv4 packet settings” on page 423).
- Traffic load settings (see “Specifying traffic load settings” on page 416).

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 407).
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 423).
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 411.
5. Select the **Traffic** tab to specify the type of load the unit will transmit (see “Specifying traffic load settings” on page 416).
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.

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 5 “Loopback 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.

13

O-DU Emulation

This chapter describes how to use O-DU Emulation. Topics covered in this chapter include:

- “O-DU Overview” on page 430
- “Using O-DU Emulation” on page 435

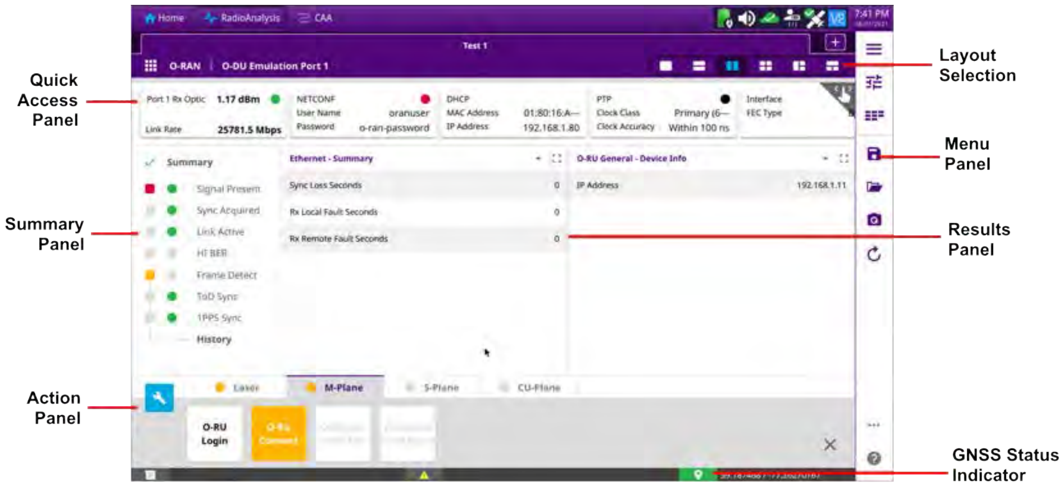
O-DU Overview

Service providers and equipment manufacturers are adopting Open Radio Access Network (O-RAN) to reduce infrastructure deployment cost and lower the barrier to entry for new product innovation.

O-DU Emulation allows the SPA06MA-O to emulate O-RAN Distributed Unit (O-DU) functions and communicate with O-RAN Radio Devices (O-RU) and display information. This allows you to verify O-RU installation.

Figure 187 shows the O-DU Emulation screen.

Figure 187 O-DU Emulation screen



Quick Access panel

The Quick Access panel allows you to quickly access the menus and parameters. Tap an item in the panel to view and configure it.

Table 84 describes the configuration parameters for each item.

Table 84 Quick Access panel items

Parameter	Description
Port Config	
Link Rate	Specifies the link rate in Mbps. **NOTE:** Only 25G link rate is currently supported.
Rx Optic Limit	Enables or disables the Rx Optic Limit for the connection.
High Limit	Specifies the high Rx Optic Limit.
Low Limit	Specifies the low Rx Optic Limit.
Clock	Specifies whether an internal or external clock is used.
Laser	Turns the laser on or off.

Table 84 Quick Access panel items

Parameter	Description
History Reset	Resets the history.
Netconf	
User Name	Specifies the user name used to login to the O-RU.
Password	Specifies the password used to login to the O-RU.
DHCP	
MAC Address	Specifies the MAC Address of the DHCP server.
Encapsulation	Specifies the encapsulation used. The options are: • Tagged • Untagged
VLAN ID	Specifies the VLAN ID.
VLAN Pri	Specifies the VLAN priority. The options are 1 (lowest) to 7 (highest.)
IP Address	Specifies the IP address of the DHCP server.
O-RU Address Mode	Specifies the IP address mode used by the O-RU. The options are: – Static – DHCP
O-RU Address	Specifies the IP address of the O-RU.
PTP	
Clock Class	Specifies the clock class to be emulated in the PTP session. The options are: – Primary (6) – Primary Holdover (7) – Arbitrary (13) – Arbitrary (14) – Primary A (52) – Arbitrary A (58) – Primary B(187) – Arbitrary B (193) – Default (248)
Clock Accuracy	Specifies the clock accuracy. The options are: – Within 25 ns – Within 100 ns – Within 250 2s – Within 1 us – Within 2.5 us – Within 10 us – Within 25 us – Within 100 us – Within 250 us – Within 1 ms – Within 2.5 ms – Within 10 ms
Domain Number	Specifies the domain number.

Table 84 Quick Access panel items

Parameter	Description	
Announce Interval	Specifies the announce interval. The options are:	
	– 16 per second – 8 per second – 4 per second – 2 per second – 1 per second	– 1 second – 2 seconds – 4 seconds – 8 seconds – 16 seconds
Sync Interval		
	– 128 per second – 64 per second – 32 per second – 16 per second – 8 per second – 4 per second	– 2 per second – 1 per second – 2 seconds – 4 seconds – 8 seconds – 16 seconds
Delay Interval	Specifies the Delay Interval. The options are:	
	– 16 per second – 8 per second – 4 per second – 2 per second – 1 per second	– 2 seconds – 4 seconds – 8 seconds – 16 seconds
UTC Offset	Specifies the UTC offset.	
Multicast MAC Address	Specifies the Multicast MAC address type. The options are: – FORWARDABLE – NON-FORWARDABLE	
Interface		
FEC Type	Specifies the FEC Type. The options are: RS(528.514) FEC (IEEE) Bypass	
SyncE		
IPG	Specifies the inter-packet gap.	
SSM Code	Specifies the SSM Code. The options are: – QL_PRC – QL_SSUA – QL_EEC1 – QL_DNU	

Summary Panel

The Summary Panel displays the current and historic status of the connection. The round LEDs on the inside column provide the current state of the key event; the square LEDs on the outside column provide the historical state.

The colors of the LEDs indicate the following:

- Green — An event occurred as expected.
- Yellow — An event occurred that warrants additional investigation
- Red — An error, anomaly, alarm, or defect has occurred.

> **NOTE**
> ToD Sync and 1PPS Sync statuses are only available if the unit is connected to a GNSS.

You can reset the indicator history by pressing the Reset button ( ) on the **Side Menu**.

Results Panel

The **Results Panel** displays information received from the O-RU. The following procedure describes how to select the information to be displayed.

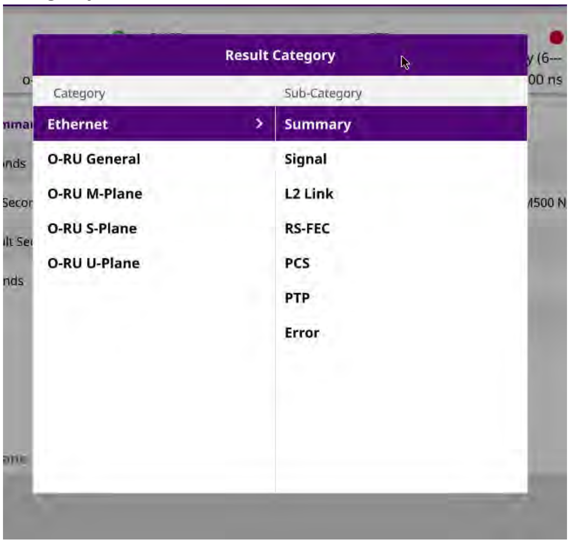
To select result information to be displayed

1. Tap the column heading of the results panel you want to display result information in, as shown in Figure 188.

Figure 188 Column heading

2. The **Result Category** window appears, as shown in Figure.

Figure 189 Results Category window



3 Select the **Category** and **Sub-Category** of information you want to display.

You can display up to four panels of information. See "Layout Selector" on page 435 for more information.

Action Panel

The Action Panel appears at the bottom of the page, providing tabs with the buttons required to perform your test.

Table describes the tabs and associated buttons.

Table 85 Action Panel tabs and buttons

Button	Description
Laser tab	
Laser	Enables and disables the laser. – Disabled: Switch is gray and to the left – Enabled: Switch is green and to the right.
M-Plane tab	
O-RU Login	Sends the O-RU Login information specified in **NETCONF**. See Table 84 for details.
O-RU Connect	Connects to the O-RU device.
Configure O-RU PTP	Configures the PTP with the parameters specified in **PTP**. See Table 84 for details.
Configure O-RU SyncE	Configures the SyncE with the parameters specified in **PTP**. See Table 84 for details.
S-Plane tab	

Table 85 Action Panel tabs and buttons

Button	Description
SyncE	Activates a SyncE session.
PTP	Activates a PTP session.

Each tab has an indicator that displays whether an operation for that tab is occurring:

- Gray— No operation on tab.
- Yellow— An operation is in progress

You can hide the **Action Panel** by tapping the **X** in the lower right corner of the panel. To reveal the panel, tap the wrench icon ().

Layout Selector

The Layout Selector buttons allow you to select the layout of information in the Results panel. Press the layout button to select the layout of information panels in the Remote Panel.

Using O-DU Emulation

The following procedure outlines the steps for using O-DU Emulation.

To use O-DU Emulation

1 Start the application:

- **a** Tap **Home**.
- **b** Tap **Radio Analysis**, then tap **O-DU Emulation**.

2 Configure the FEC type:

- **a** In the Quick Access panel, tap **FEC Type**.
- **b** Configure the parameters. See Table 84 for parameter descriptions.

3 Wait for the Status LEDs in the Summary Panel to show green, then turn on the laser:

- **a** In the action panel, tap the **Laser** tab.
- **b** Tap the **Laser** switch to turn on the laser.

4 Connect to the O-RU:

- **a** Tap the **M-Plane** tab.
- **b** If required, configure the NETCONF parameters:
  - **i** In the Quick Access panel, tap **NETCONF**.

ii Configure the NETCONF parameters, as described in Table 84.

iii In the **Action Panel**, tap **O-RU Connect**. When connected, the status LED of the **NETCONF** interface turns green and results appear under **Device Info** in the **Results Panel**.

5 Configure the O-RU with PTP and SyncE settings:

a In the **Interface Panel**, tap **PTP** or **SyncE** and configure the parameters, as described in Table 85.

b On the **M-Plane** tab, tap **Configure O-RU PTP** or **Configure O-RU SyncE** to apply the configuration.

6 Begin the PTP and/or SyncE sessions:

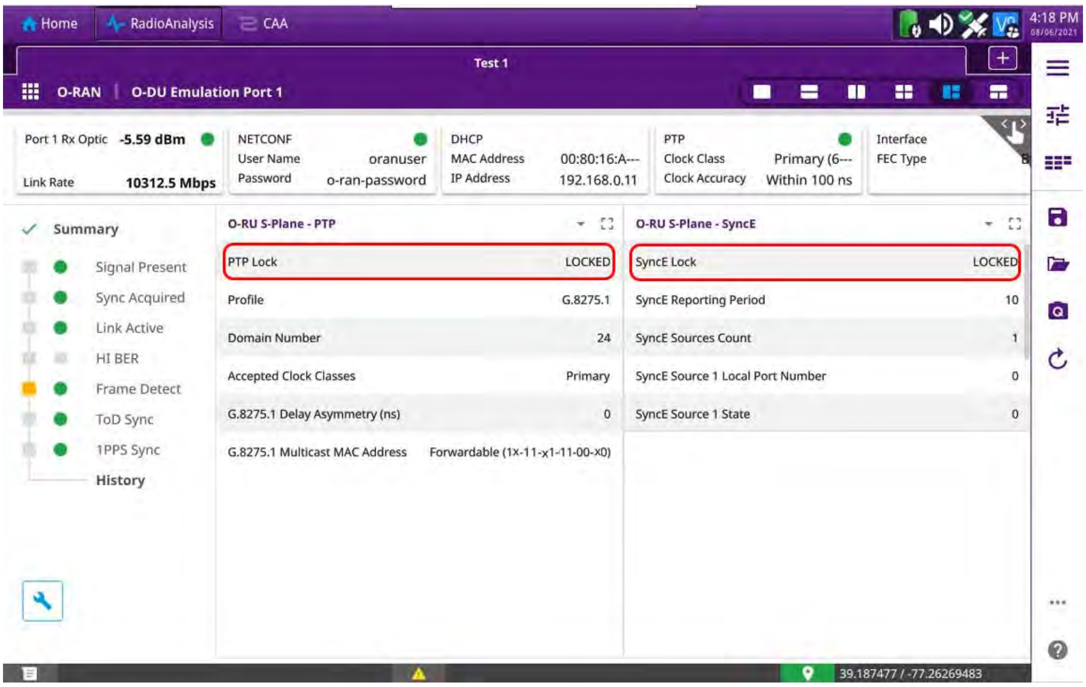
a In the Action Panel, tap the **S-Plane** tab.

b Tap on the **SyncE** or **PTP** button to start the respective session.

NOTE
You must have a GNSS connected to start a PTP session.

When the O-DU connection is complete, the **PTP Lock** and **Sync Lock** results read “LOCKED” in the Results panel, as shown in Figure 190.

Figure 190 O-DU connected



14

Using Blind Scanner

This chapter describes how to use the Blind Scanner. Topics covered in this chapter include:

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 and 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.

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 the **Blind Scanner** measurement mode, then tap **Done**.

Configuring blind scan

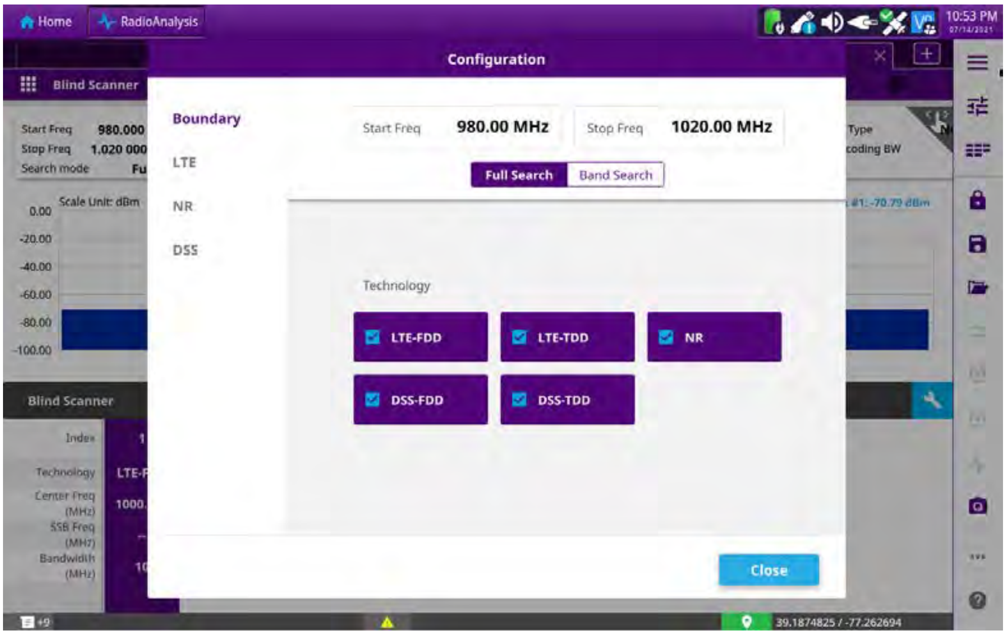
The following procedure describes how to configure Blind Scan.

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.

   The **Configuration** page appears, as shown in Figure.

Figure 191 Configuration page



2 On the left side of the page, tap **Boundary.**

3 Tap **Start Freq** and enter the start frequency of the range you want to scan using the on-screen keyboard.

4 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.

5 In the Technology section, tap to select the technology type(s) to be included in the scan.

6 On the left side of the page, tap a technology type to configure its specific parameters. Table 86 describes the parameters.

Table 86 Technology parameters

Parameter	Description
LTE	
CP Type	Specifies the cyclic prefix (CP) of the signal. The options are: – Normal – Extended
NR	
SCS	Specifies the Subcarrier Spacing (SCS) mode used by the signal. The options are: – 30 kHz – 15 kHz

Table 86 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	
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 The Synchronization Signal/PBCH block (SSB) type to scan. The options are: – GSCN – NR-ARFCN

7 Tap **Close.**

Performing Blind Scan

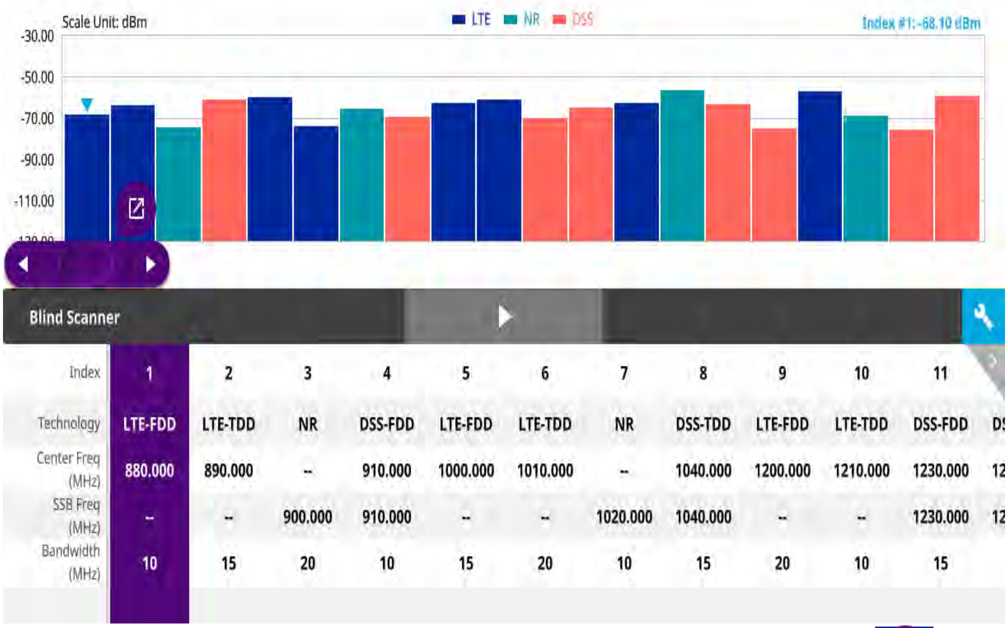
The following procedure describes how to perform Blind Scan.

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 192.

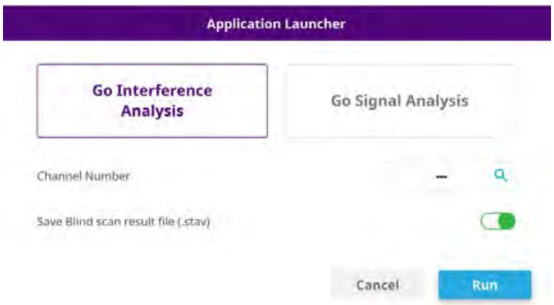
Figure 192 Blind Scan result



3 To further analyze the results, tap the Application Launcher button ( ).

4 The **Application Launcher** screen appears, as shown in Figure 193.

Figure 193 Application Launcher screen



5 Select the analysis type you wish to perform, then tap **Run**.

– Interference: If selected TDD, it moves to Gated Sweep of Spectrum Analyzer and if selected other than TDD, it moves to Persistent Spectrum of Real-time Spectrum Analyzer.

– Signal: it moves to the searched Technology.

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.

NOTE

You can load the Blind Scan measurement result file (`.bstav`). in LTE-FDD/TDD Analyzer, 5G NR Signal Analyzer, NSA Analyzer, and DSS Signal Analyzer.

15

Physical specifications

Table 87 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)

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SPA06MA-O User’s
Guide 22145360 R006
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