

Measurement Guide

LTE FDD/TDD Signal Analyzer

MS2090A Field Master Pro™

MS2080A Field Master™

MS27201A Remote Spectrum Monitor

MS2089A Site Master™

LTE FDD/TDD Signal Analyzer

Option 883

GNSS Receiver

Option 31

Gated Sweep

Option 90

Coverage Mapping

Option 431

Note

Not all instrument models offer every option or every measurement within a given option. Refer to the Technical Data Sheet of your instrument for available options and supported measurements.

The Anritsu logo is displayed in a stylized, blue, sans-serif font.

Unauthorized Use or Disclosure

Anritsu Company has prepared the product user documentation for use by Anritsu Company personnel and customers as a guide for the proper installation, operation, and maintenance of Anritsu Company equipment and software programs. The drawings, specifications, and information contained therein are the property of Anritsu Company, and any unauthorized use of these drawings, specifications, and information is prohibited; they shall not be reproduced, copied, or used in whole or in part as the basis for manufacture or sale of the equipment or software programs without the prior written consent of Anritsu Company.

Export Management

The Anritsu products identified herein and their respective manuals may require an Export License or approval by the government of the product country of origin for re-export from your country. Before you export these products or any of their manuals, please contact Anritsu Company to confirm whether or not these items are export-controlled. When disposing of export-controlled items, the products and manuals must be broken or shredded to such a degree that they cannot be unlawfully used for military purposes.

Contacting Anritsu for Sales and Service

To contact Anritsu, visit the following URL and select the services in your region:

<http://www.anritsu.com/contact-us>

Table of Contents

Chapter 1—General Information

1-1	Introduction	1-1
	Related Manuals	1-1
1-2	Option Descriptions	1-2
	LTE Analyzer (Option 883)	1-2
	Gated Sweep (Option 90)	1-2
	Coverage Mapping (Option 431)	1-2
	GNSS Receiver (Option 31)	1-2
	Other Options and Features	1-2
1-3	Document Conventions	1-2
	User Interface Navigation	1-2
	Illustrations	1-2
1-4	Contacting Anritsu for Sales and Service	1-2

Chapter 2—LTE Analyzer (Option 883)

2-1	Introduction	2-1
2-2	Selecting the Applications/Modes	2-2
2-3	Main Menu	2-3
	Using Menus	2-3
2-4	Setting Frequency and Bandwidth Parameters	2-4
	Configuring the Band	2-4
	FREQ SPAN Menu	2-4
	SIGNAL STANDARDS Dialog	2-5
	GESTURES Menu	2-5
2-5	Setting Amplitude	2-6
	Setting Amplitude Parameters	2-6
	Reference Level Offset for External Loss or External Gain	2-6
	Attenuator Functions	2-6
	Indications of Excessive Signal Level	2-7
	Overpower Warning	2-7
	AMPLITUDE Menu	2-8
2-6	Setting Bandwidth Parameters	2-9
	BANDWIDTH Menu	2-9
2-7	Setting Trace Parameters	2-10
	TRACE Menu	2-10
	Trace Detector Types	2-12
2-8	Setting Sweep Parameters	2-14
	SWEEP Menu – LTE Demod Summary Measurements	2-14
	SWEEP Menu – LTE RF Measurements	2-14
	Gated Sweep (Option 90)	2-15
	GATED SWEEP Menu	2-16
	GATED SWEEP ON Display	2-17
	POWER VS. TIME Display	2-18

Table of Contents (Continued)

2-9	Setting Up Markers	2-19
	Placing a Normal Marker	2-19
	Placing a Fixed Marker	2-20
	Placing a Delta Marker	2-20
	MARKER Menu	2-21
	MARKER PEAK SEARCH Menu	2-22
	Marker Functions	2-23
	Marker Table	2-23
2-10	LTE Measurement Setup	2-24
	MEASURE Menu (LTE)	2-25
2-11	LTE Demod Summary	2-27
	LTE Summary View	2-27
	SIB Measurement	2-29
	SIB USER MNC/MCC MAPS	2-31
	LTE Time Alignment Error (TAE) View	2-34
	LTE Resource Block (RB) Power View	2-35
	LTE Summary Table View	2-36
	SETUP Menu (LTE Demod Summary)	2-37
	Status Panel (LTE Demod Summary)	2-38
2-12	LTE Multi PCI	2-39
	SETUP Menu (LTE Multi PCI)	2-41
	Status Panel (LTE Multi PCI)	2-42
2-13	LTE Channel Power	2-43
	SETUP Menu (LTE Channel Power)	2-44
	Status Panel (LTE Channel Power)	2-45
2-14	LTE Channel Spectrum	2-46
	SETUP Menu (LTE Channel Spectrum)	2-47
	Status Panel (LTE Channel Spectrum)	2-48
2-15	LTE Carrier Aggregation	2-49
	SETUP Menu (LTE Carrier Aggregation)	2-51
	Status Panel (LTE Carrier Aggregation)	2-52
2-16	LTE Adjacent Channel Power	2-53
	SETUP Menu (LTE ACP)	2-54
	STATUS PANEL (LTE ACP)	2-55
2-17	LTE Spectrum Emission Mask	2-56
	Spectrum Emission Mask Measurement Basic Setup	2-57
	SETUP Menu (LTE SEM)	2-57
	Example Custom Signal Emission Mask	2-57
	STATUS PANEL (LTE SEM)	2-59
2-18	LTE Control Channel	2-60
	SETUP Menu (LTE Control Channel)	2-62
	Status Panel (LTE Control Channel)	2-63
2-19	LTE Constellation	2-64
	SETUP Menu (LTE Constellation)	2-67
	Status Panel (LTE Constellation)	2-68

Table of Contents (Continued)

2-20	LTE UL/DL Interference	2-69
	SETUP Menu (LTE UL/DL Interference)	2-71
	Status Panel (LTE UL/DL Interference)	2-73
2-21	LTE Coverage Mapping (Option 431)	2-76
	Outdoor Coverage Mapping	2-77
	Indoor Coverage Mapping	2-79
	MEASURE Menu (Coverage Mapping)	2-80
	SETUP Menu (LTE Coverage Mapping)	2-81
	COLOR SETUP Menu (Coverage Mapping)	2-82
	Status Panel (LTE Coverage Mapping)	2-83
2-22	Presetting the Analyzer	2-84
	PRESET Menu	2-84
2-23	Saving and Recalling Measurements	2-85
	Saving a Measurement	2-85
	Recalling a Measurement	2-86
	FILE Menu	2-87

Appendix A—LTE MIB/SIB Decode

A-1	Introduction	A-1
	Downlink Control Information (DCI)	A-1
	Master Information Block (MIB)	A-2
	MIB Data	A-3
	System Information Block (SIB)	A-4
	SIB Data	A-5
	Anritsu Hardware Status	A-6

Chapter 1 — General Information

1-1 Introduction

This measurement guide describes the Long Term Evolution (LTE) analyzer and its measurement setup functions, including selecting the analyzer and setting up frequency, bandwidth, amplitude, span, and markers. LTE Coverage Mapping Option 431 provides a flexible and convenient tool that plots fundamental transmitter parameters, such as channel power or received signal strength indicator (RSSI), on a digital map. The color of the individual breadcrumbs shown on the map indicates the signal level strength at that location. Digital maps are downloaded into the memory of the instrument.

Related Manuals

For additional information and literature covering your product, visit the product page of your instrument and select the Library tab:

<http://www.anritsu.com/en-US/test-measurement/products/ms2090a>

<http://www.anritsu.com/en-us/test-measurement/products/ms2080a>

<http://www.anritsu.com/en-us/test-measurement/products/ms2720xa>

<http://www.anritsu.com/en-us/test-measurement/products/ms208xa>

Product Information, Compliance, and Safety

Read the Product Information, Compliance, and Safety Guide for important safety, legal, and regulatory notices before operating the equipment:

- Field Master Series and Site Master (MS2089A) – PN: 10100-00069
- Remote Spectrum Monitor – PN: 10100-00064

User Guide

For a complete overview of the instrument hardware and system functions, refer to your instrument user guide. The user guide provides information on the following topics:

- Listing of all related documentation such as measurement guides, programming and maintenance manuals.
- Instrument Care, maintenance and calibration
- External Connections to the top and side panels
- Power Requirements and Battery Information
- System settings such as Wi-Fi, GNSS(GPS), date/time, language settings, etc.
- Other advanced settings and tools such as file management, screenshot settings, port setup, and option configuration.
- Diagnostics and software updates

1-2 Option Descriptions

This section provides a brief overview of the available options covered in this guide.

Note

Not all instrument models offer every option. Some options are available as a time-limited trial. For example, Option 9883 (LTE) is offered as a 90-day time limited option by ordering Option 9883. The option start time begins when the user first activates the option. Please refer to the Technical Data Sheet of your instrument for information on purchasing and activating time limited options

LTE Analyzer (Option 883)

Refer to [Chapter 2, “LTE Analyzer \(Option 883\)”](#) for more information.

Gated Sweep (Option 90)

Refer to [“Gated Sweep \(Option 90\)”](#) section for more information.

Coverage Mapping (Option 431)

Refer to [“LTE Coverage Mapping \(Option 431\)”](#) section for more information.

GNSS Receiver (Option 31)

This option supports external GPS Antenna that is sold separately. It now supports combinations of GPS, GLONASS, Galileo and BeiDou satellite systems. Note that this is a required option which is activated by connecting the instrument with GPS antenna and turning On the GNSS (GPS) settings. Refer to instrument's user guide for more information.

Other Options and Features

For descriptions of other options and features not covered in this guide, refer to your instrument user guide or the product page for a comprehensive list of available documentation.

1-3 Document Conventions

The following conventions are used throughout the instrument and documentation set.

User Interface Navigation

The instrument user interface consists of menus, buttons, toolbars, and dialog boxes. Elements in navigation paths are separated as follows: MARKER > PEAK SEARCH > NEXT PEAK.

Illustrations

Screen-captured images contained in this document are provided as examples. The chapters included in this measurement guide provide information on advanced measurement features, instrument settings and menu overviews, for a featured option. The actual displays, screen menus, and measurement details may differ based on the instrument, model, firmware version, installed options, and current instrument settings.

1-4 Contacting Anritsu for Sales and Service

To contact Anritsu, visit the following URL and select the services in your region:

<http://www.anritsu.com/contact-us>.

Chapter 2 — LTE Analyzer (Option 883)

2-1 Introduction

This chapter gives a brief overview of the Long Term Evolution (LTE) analyzer and its measurement capabilities for Field Master series, Site Master and Remote Spectrum Monitor instruments. The purpose of this chapter is to provide a starting point for making LTE measurements. This chapter describes measurement setup, including selecting the analyzer and setting up frequency, bandwidth, amplitude, span, and markers. After measurements are taken, refer to [Section 2-23 “Saving and Recalling Measurements”](#) for a description of saving, recalling, and managing measurement files. For detailed information about other specific measurements, refer to the appropriate section in this chapter.

A basic understanding of the measurement concepts presented in Spectrum Analyzer measurement guide (10580-00447) is recommended before performing the procedures in this chapter. LTE measurements include the use of additional functions beyond frequency, span, amplitude, and marker functions. [Section 2-4](#) through [Section 2-9](#) explain general setup procedures and settings. [Section 2-10](#) through [Section 2-21](#) provide example LTE measurements that are available in the LTE analyzer.

LTE measurement setups typically conform to the 3GPP and device manufacturer standards. The instrument is designed to make setting up your measurement as easy as possible. Simply refer to the specification for the measurement and base station settings that you are testing, select the measurement, and enter the base station measurement setup parameters. The LTE signal analyzer offers the following measurement options:

RF Measurements

The following display types are provided for RF measurements:

- [LTE Channel Power](#)
- [LTE Adjacent Channel Power](#)
- [LTE Spectrum Emission Mask](#)
- [LTE Channel Spectrum](#)
- [Gated Sweep \(Option 90\)](#) and [GATED SWEEP ON Display](#)
- [LTE UL/DL Interference](#) (including frequency division duplex (FDD) and time division duplex (TDD) signals)

Modulation Measurements

LTE modulation measurements for both FDD and TDD signals can be viewed in:

- [LTE Demod Summary](#)
- [LTE Multi PCI](#)
- [LTE Carrier Aggregation](#)
- [LTE Constellation](#)

LTE Coverage Mapping (Option 431)

“[LTE Coverage Mapping \(Option 431\)](#)” provides the following map modes:

- Channel Power
- Spectral Density
- RSRP
- RSRQ
- SINR

2-2 Selecting the Applications/Modes

The instrument applications/modes are selected from the 9-dot icon or the current application/mode icon. To select an application/mode, press the 9-dot icon in the title bar or the current application icon to display the available applications and modes, illustrated in [Figure 2-1](#). Simply touch the desired application/mode icon to load the new application/mode. The analyzers available for selection depend on the options that are installed and activated on your instrument. Some measurements and views are accessed via other measurement setup menus.

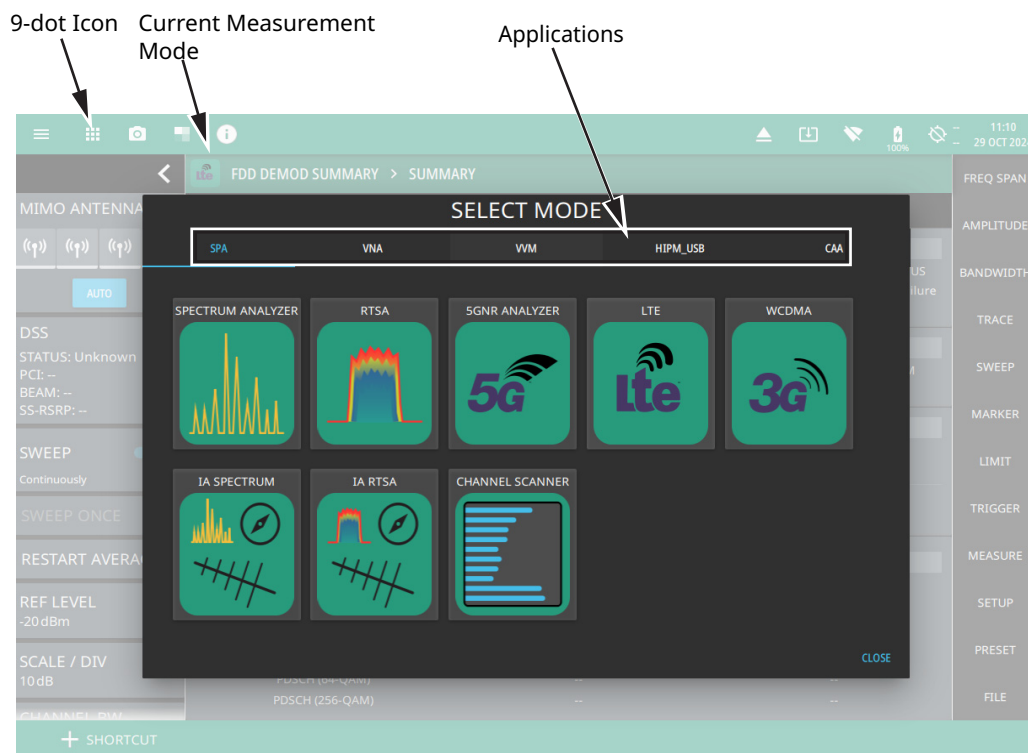


Figure 2-1. Instrument Applications and Modes

2-3 Main Menu

The main menu is the primary access point for all instrument controls and measurement selections. The main function for each main menu button is described below.

FREQ SPAN	FREQ SPAN: Contains all frequency control settings such as center frequency, start and stop frequency, span, frequency offset, and frequency step. Refer to Section 2-4 “Setting Frequency and Bandwidth Parameters” on page 2-4.
AMPLITUDE	AMPLITUDE: Provides access to all amplitude-related settings including reference level, graticule scale, and attenuator/preamp settings. Refer to Section 2-5 “Setting Amplitude” on page 2-6.
BANDWIDTH	BANDWIDTH: Provides access to resolution and video bandwidth settings and Auto ratios, and sets the bandwidth filter types. Refer to Section 2-6 “Setting Bandwidth Parameters” on page 2-9.
TRACE	TRACE: Provides trace- and detection-related controls to set trace behaviors, presets, and access to the trace/detector settings table. When in Spectrogram view, also provides spectrogram cursor controls. Refer to Section 2-7 “Setting Trace Parameters” on page 2-10.
SWEEP	SWEEP: Provides controls for sweep behaviors, number of measurement points, and gated sweep settings (with Option 90). Refer to Section 2-8 “Setting Sweep Parameters” on page 2-14.
MARKER	MARKER: Used to enable and set all marker-related parameters and provides access to the marker table. Refer to Section 2-9 “Setting Up Markers” on page 2-19.
LIMIT	LIMIT: Not used in the LTE analyzer.
TRIGGER	TRIGGER: Not used in the LTE analyzer.
MEASURE	MEASURE: Used to select measurements such as LTE demodulation summary, channel power, channel spectrum, and views such as time alignment error and resource block power. Refer to “MEASURE Menu (LTE)” on page 2-25.
SETUP	SETUP: Measurement controls for setting advanced measurements. Refer to Section 2-10 “LTE Measurement Setup” on page 2-24.
PRESET	PRESET: Opens the PRESET menu with selective trace, marker, limits, and measurement preset commands, or an all inclusive analyzer preset command. Refer to Section 2-22 “Presetting the Analyzer” on page 2-84.
FILE	FILE: Used to save and recall instrument setups and measurements. Refer to Section 2-23 “Saving and Recalling Measurements” on page 2-85.

Figure 2-2. Main Menu

Using Menus

Instrument setup, control, and measurement functions are performed through the use of menus. Menu behaviors are summarized below:

- Pressing a main menu button opens an associated menu.
- The name of the button pressed in the main menu is reflected in the title bar of the resulting menu.
- Menu buttons can change for various measurement settings, instrument setup parameters, and measurement views.
- Pressing the corresponding main menu button for a menu closes the menu.
- Touching status data, a parameter field, or label in the display area opens the corresponding menu and the associated keypad for editing that parameter setting.
- Pressing Accept, Cancel, or the X in the upper right corner closes the menu or keypad.

2-4 Setting Frequency and Bandwidth Parameters

Frequency and channel bandwidth parameters are set using the “[FREQ SPAN Menu](#)” on [page 2-4](#). The channel center frequency and bandwidth can be set manually. When set to manual band, the EARFCN is unassigned. When a predefined EARFCN is selected, the uplink and downlink carrier frequencies are set automatically.

Configuring the Band

These settings are also displayed in the left side status panel and can be directly accessed from those controls.

1. Press FREQ SPAN > CENTER FREQUENCY, and then enter the center frequency using the keypad.
2. Select the channel bandwidth from the CHANNEL BW selection list.
3. Select the EARFCN code form the drop-down selection.

FREQ SPAN Menu

The FREQ SPAN menu is available in all LTE measurements.

FREQUENCY CENTER FREQUENCY 632.450000 MHz SPAN 1.400000 MHz CHANNEL BW 1.4 MHz EARFCN 0 SIGNAL STANDARD None GESTURES	CENTER FREQUENCY: Sets the center frequency of the measurement channel. SPAN: Sets the current frequency span. CHANNEL BW: Sets the measurement channel bandwidth. The available bandwidth settings depend on the selected band and bandwidth option installed in the instrument. EARFCN: E-UTRA Absolute Radio Frequency Channel Number (EARFCN) uniquely identifies the LTE band and carrier frequency. Sets the uplink and downlink carrier frequencies, which range from 0 to 65535. SIGNAL STANDARD: Opens the “SIGNAL STANDARDS Dialog” on page 2-5. This dialog provides a selection list of predefined LTE signal standards. Selecting an LTE signal standard configures the instrument for measurements in the selected band. GESTURES: Opens the “GESTURES Menu” on page 2-5. Not shown in LTE Modulation measurements.
---	---

Figure 2-3. FREQ SPAN Menu (LTE Measurements)

SIGNAL STANDARDS Dialog

The SIGNAL STANDARDS dialog is available in all LTE measurements.

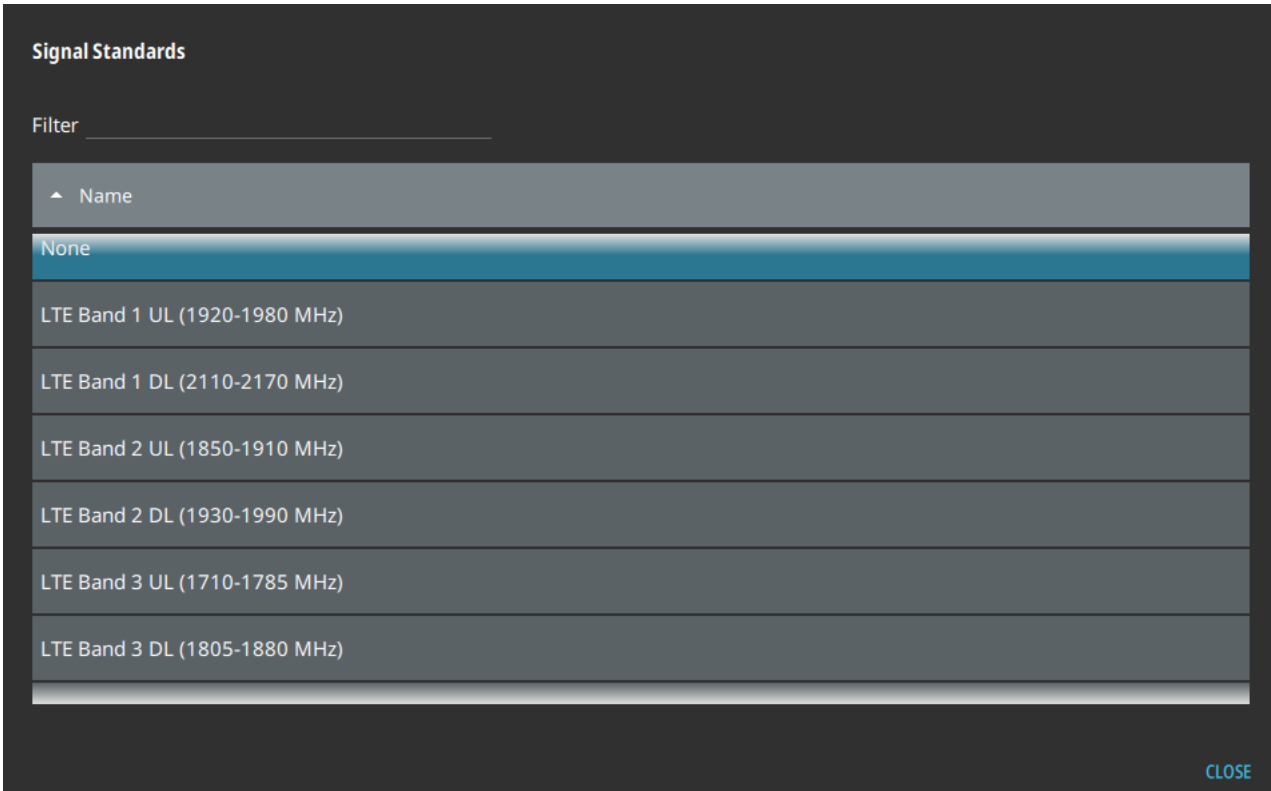
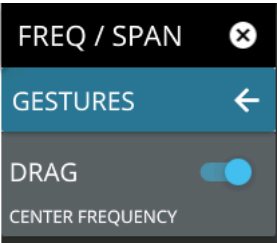


Figure 2-4. SIGNAL STANDARDS Dialog (LTE Measurements)

GESTURES Menu

The GESTURES menu is only available in RF measurements (trace displays).



DRAG: Toggles the touchscreen drag feature on or off. When toggled off, the center frequency will not change when dragging the spectrum display. This can be useful when dragging markers.

Note that the Drag feature can also be toggled on/off by touching the locks under the display.

Figure 2-5. GESTURES Menu (LTE RF Measurements)

2-5 Setting Amplitude

Amplitude-related parameters are set using the [“AMPLITUDE Menu” on page 2-8](#).

Setting Amplitude Parameters

The LTE measurement has two different types of amplitude settings, one for the data capture used to decode the signal internally, and one for the display. The amplitude range refers to the amplitude level used to capture the data. The amplitude reference level is typically an absolute reference level set at the top of the graticule for the power level being measured. Signal levels above this set value will be outside of the display range and may overdrive and saturate the input circuit (refer to [“Indications of Excessive Signal Level” on page 2-7](#)). To set the current amplitude reference level:

1. To automatically set optimum settings, press **AMPLITUDE > AUTO RANGE**. The instrument will dynamically update the attenuation and preamp settings for the capture. **AUTO RANGE** helps ensure that harmonics and spurs are not introduced into the measurements while giving enough power to accurately decode the signal. When auto range is on, the amplifier and preamp cannot be set manually and the reference level is only used to adjust the top end of the y-axis of the plot or graph.
2. To manually set the range and reference level, press **AMPLITUDE > REF LEVEL**, then enter the desired reference level in dBm, or use the **AUTO REF LEVEL** (available when **AUTO RANGE** is disabled). This will set the attenuation and preamp for both the plot and the capture.

Reference Level Offset for External Loss or External Gain

To obtain accurate measurements, you can compensate for any external attenuation or gain by using a reference level offset. The compensation factor is in dB. External attenuation can be created by using an external cable or an external high power attenuator. External gain is typically from an amplifier.

To adjust the reference level for either gain or loss:

1. Press **AMPLITUDE > REF LEVEL OFFSET**.
2. Enter a positive dB value to account for gain or enter a negative dB value to account for loss.
3. The new reference level offset value will be displayed on the instrument and the reference level is adjusted accordingly.

Attenuator Functions

The spectrum analyzer includes a step attenuator at the RF input. This attenuator is used to reduce large signals to levels that make best use of the analyzer's dynamic range. Normally, the input attenuation automatically adjusts as a function of reference level. In the **AMPLITUDE** menu, the **ATTEN LEVEL** allows manual adjustment of the input attenuation. When auto attenuation is selected, both the reference level and the attenuation are increased. The following actions, listed in decreasing order of effectiveness, can facilitate the detection of low-level CW signals:

- Decrease the reference level and attenuation. Refer to [“AMPLITUDE Menu” on page 2-8](#).
- Turn on the preamplifier.

For RF-based measurements:

- Reduce RBW and or VBW (RBW/VBW = 10 is often optimal for this purpose). Refer to [“Setting Bandwidth Parameters” on page 2-9](#).
- Use trace averaging if VBW is already set to 1 Hz.

Indications of Excessive Signal Level

The instrument has built-in features to help prevent input overload. These include auto attenuation and reference level. The instrument will also indicate when a received signal is too high for the current setup by displaying an “ADC Overrange” notification in the title bar (Figure 2-6). Before proceeding with the measurements, adjust the reference level, the attenuation level, and disable the preamplifier if necessary. Adjusting the resolution bandwidth and frequency range may also help when measuring small signals that are near large signals.



Figure 2-6. ADC Overrange

Overpower Warning

The Field Master Series MS2080A/MS2070A and Site Master MS2089A instruments are equipped with an in-built overpower protection hardware in order to manage considerably high range of input power. If the input power range exceeds beyond 5 watts, the protection relay gets activated and a notification alert is displayed as shown in the Figure 2-7. Proceed by removing the high power input source to avoid to damaging the RF circuitry.

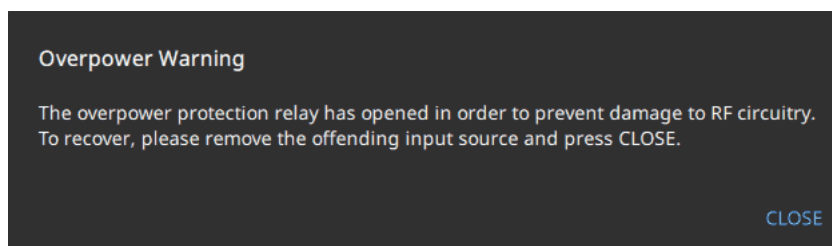


Figure 2-7. Overpower Warning

AMPLITUDE Menu

The AMPLITUDE menu is available in all LTE measurements.

AMPLITUDE AUTO RANGE REF LEVEL -20 dBm AUTO REF LEVEL SCALE / DIV 10 dB Y AXIS UNIT dBm AUTO ATTEN ATTEN LEVEL 15 dB REF LEVEL OFFSET 0 dB PRE AMP GESTURES	AUTO RANGE: The instrument will dynamically update the attenuation and preamp settings for the measurement. Auto range helps ensure that harmonics and spurs are not introduced into the measurements. OFFSET REF LEVEL: The reference level is the top graticule line on the measurement display. If the reference level offset is not zero, the offset reference level is displayed at this menu location. If auto range is enabled, the reference level is graphical only and will have no impact on attenuation or preamp. AUTO REF LEVEL: Auto reference level will change the reference value so as to place the highest signal amplitude at about two graticule lines from the top. This feature is not available when auto range is enabled. SCALE/DIV: The scale can be set from 1 dB per division to 15 dB per division. The default setting is 10 dB. Y AXIS UNIT: Selects the y-axis amplitude units of dBm, dBW, or dBμV, etc. AUTO ATTEN: Input attenuation can be either tied to the reference level (on) or manually selected (off). When input attenuation is tied to the reference level, attenuation is increased as higher reference levels are selected to make sure the instrument input circuits are not saturated by large signals that are likely to be present when high reference levels are required. Auto attenuation is not available when auto range is enabled. ATTEN LEVEL: Manually sets the attenuation level. This feature is not available when auto range or auto attenuation is enabled. REF LEVEL OFFSET: Reference level offset compensates for the presence of external input attenuation or gain. The default offset value is 0 dB. The reference level on the Y-axis will reflect the new offset value. For example, if the reference level was 0 dBm and an offset value of –10 dB is applied, the offset reference level will be 10 dBm. PRE AMP: Turns the low-noise front-end preamplifier on or off. To ensure accurate measurement results, the largest signal into the instrument input when the preamplifier is turned on should be less than –40 dBm. The preamplifier cannot be turned on if auto attenuation is on and reference level is above –40 dBm. GESTURES: Opens the “GESTURES Menu” on page 2-5. Not shown in LTE Modulation measurements.
---	--

Figure 2-8. AMPLITUDE Menu (LTE Measurements)

2-6 Setting Bandwidth Parameters

BANDWIDTH Menu

The BANDWIDTH menu is only available for RF measurements (trace display). See the [“LTE Measurement Setup”](#) on page 2-24.

BANDWIDTH AUTO RBW RBW 1 MHz AUTO VBW VBW 1 MHz VBW TYPE Linear RBW:VBW 3 SPAN:RBW 100	AUTO RBW: When toggle on, the instrument selects the resolution bandwidth based on the current span width. The ratio of span width to RBW can be specified using the SPAN:RBW button. When toggled off (manual), the RBW label at the left edge of the X-axis will be preceded by the “#” symbol. RBW: The current resolution bandwidth is displayed under the RBW button. The RBW can be changed using the keypad or the slider controls. Bandwidth values increment in a 1:3:10 sequence, from 1 Hz to 3 Hz to 10 Hz or from 10 Hz to 30 Hz to 100 Hz, for example. Refer to your instrument technical data sheet for the resolution bandwidth range. AUTO VBW: When toggled on, the instrument selects the video bandwidth based on the resolution bandwidth. The ratio of video bandwidth to resolution bandwidth can be set using the RBW:VBW button. When toggled off (manual), the VBW label at the left edge of the X-axis will be preceded by the “#” symbol. VBW: The current video bandwidth is displayed under the VBW button. The VBW can be changed using the keypad or slider controls. Bandwidth values increment in a 1:3:10 sequence, from 1 Hz to 3 Hz to 10 Hz or from 10 Hz to 30 Hz to 100 Hz, for example. Refer to your instrument technical data sheet for the video bandwidth range. VBW TYPE: Toggles between linear averaging (arithmetic mean) and logarithmic averaging (geometric mean). RBW:VBW: This parameter displays the ratio between resolution bandwidth and video bandwidth. To change the ratio, press this button and use the keypad or the slider controls. SPAN:RBW: Displays the ratio between the span and the resolution bandwidth. The default value is 100, meaning that the span will be 100 times the resolution bandwidth. To change the ratio, press this button and use the keypad or slider controls.
---	--

Figure 2-9. BANDWIDTH Menu (LTE RF Measurements)

2-7 Setting Trace Parameters

Just as in the spectrum analyzer, the LTE analyzer can also display up to 6 traces simultaneously in LTE RF-based measurements (refer to [Section 2-10 “LTE Measurement Setup”](#)). Traces can be enabled from the TRACE menu by selecting the trace from the available selections, or you can select a trace in the left side status panel to make it active. Each trace can have a separate trace type, mode, and detector. When working with traces in a LTE spectrum measurement, refer to the [“TRACE Menu” on page 2-10](#).

Note

Traces are not used in all LTE measurements. For example, non-spectrum based measurements such as Demod Summary, Carrier Aggregation, Multi PCI, Control Channel, and Constellation measurements suppress the Trace menu completely. The UL/DL Interference measurement relies on the Trace menu to select different detector types, but allows only the default Trace 1 and Trace Type settings.

TRACE Menu

The TRACE menu is only available for RF measurements (trace display). Refer to [Section 2-10 “LTE Measurement Setup”](#).

TRACE

SELECT

Trace 1

TYPE

Clear / Write

MODE

Active

DETECTOR TYPE

Peak

CLEAR

AVERAGES

10

PRESET DETECTORS

PRESET TRACES

SELECT: Selects traces 1 through 6. Selecting a trace that is off turns the trace on. The trace type will be Clear/Write, the trace mode will be Active, and the detector type will be Peak. Selecting a trace will draw the trace on top of all other traces. This feature is not available in the spectrogram measurement view because all spectrogram data is created from a single trace.

TYPE: Selects one of the following types of traces:

- Clear/Write:** Clears the trace after each sweep is complete and writes a new trace.
- Average:** The exponential average of all N traces, where N is the AVERAGES number set below. The number of sweeps is displayed in the status panel TRACES table.
- Max Hold:** Represents the maximum value since sweeping began. The number of sweeps is displayed in the status panel TRACES table.
- Min Hold:** Represents the minimum value since sweeping began. The number of sweeps is displayed in the status panel TRACES table.
- Rolling Average:** Is the rolling average of the last N traces, where N is the AVERAGES number set below. The number of sweeps is displayed in the status panel TRACES table.
- Rolling Max Hold:** Is the maximum rolling average value of the last N traces, where N is the AVERAGES number set below. The number of sweeps is displayed in the status panel TRACES table.
- Rolling Min Hold:** Is the minimum value of the last N traces, where N is the AVERAGES number set below. The number of sweeps is displayed in the status panel TRACES table.

TRACE MODE: Selects one of the following trace modes:

- Active:** Displays the selected trace as it is updating.
- Hold/View:** Displays the trace and it is not updating. It displays the last sweep from when the trace mode was set to hold/view. If the frequency or bandwidth settings are changed while a trace is in hold/view mode, the data will be blanked from the screen. In order to see data again, set the trace mode to active.
- Blank:** Does not display the trace and is not updating. It is the same as if the trace was off.

Figure 2-10. TRACE Menu (LTE RF Measurements) (1 of 2)

	DETECTOR TYPE: Selects one of three detector types. Several detection methods tailor the function of the instrument to meet specific measurement requirements. There are often more measurement points across the screen than display points. The various detection methods are different ways of dealing with how measurement points will be shown at each display point. • Peak: This method causes the highest amplitude measurement point to be shown for each display point, assuring that a narrow peak is not missed. • RMS/Avg: In the default case, when the VBW/AVERAGE type is set to Linear, this method detects the average power of measurement points that go into the display point. When VBW/AVERAGE type is set to Log, the traditional average of log (power), such as dBm, is displayed for the detector, as well as for VBW and trace average. • Negative: This method causes the lowest amplitude measurement point to be shown for each display point. This method is also useful when looking at modulated signals, to see if some frequencies are not being used. • Sample: Shows the transient amplitude of the center of sampled data for each display point. This method is useful when measuring low-level signals and noise measurements. Only available in zero span and RSSI measurements. When Sample detector is selected, all traces must use sample detection. CLEAR: Clears the currently active trace data. AVERAGES: Sets the number of trace sweeps (N) to average. Available when the trace type is set to one of the averaging modes. PRESET DETECTORS: Sets all trace detectors to Peak. PRESET TRACES: Presets cursor and trace setup to Clear/Write, Active, with Peak Detector.
--	---

Figure 2-10. TRACE Menu (LTE RF Measurements) (2 of 2)

Trace Detector Types

The figure below illustrates how the available detector types determine a trace data point from the sampled data

Peak Detector

Shows the maximum amplitude of sampled data for each display point, assuring that a narrow peak is not missed.

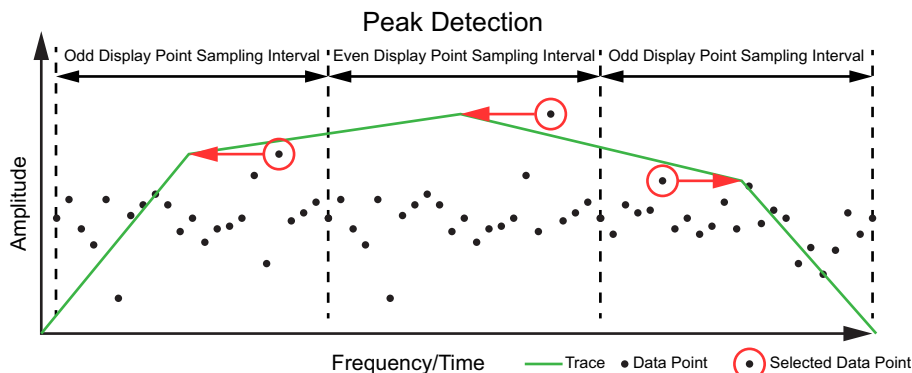


Figure 2-11. Peak Detector Type

RMS/Avg

In the default case, when the VBW/AVERAGE type is set to Linear, this method shows the linear average amplitude of sampled data for each display point, before converting to display units. When VBW/AVERAGE type is set to Log, this method shows the traditional average of log (power), such as dBm for each display point, before converting to display units. Not available in zero span.

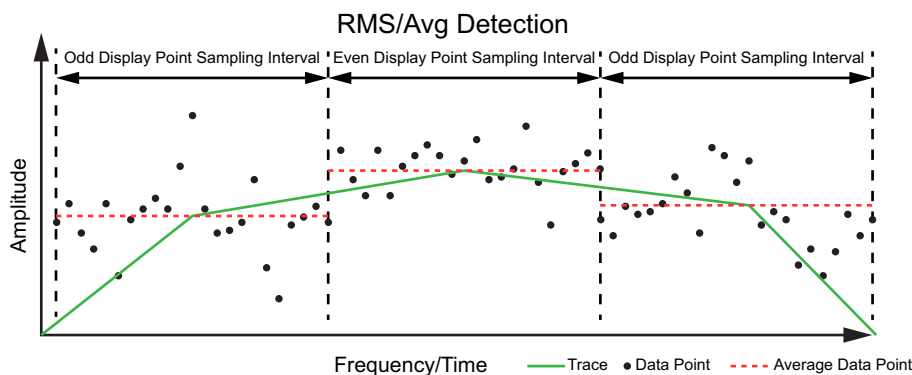


Figure 2-12. RMS/Avg Detector Type

Negative

Shows the minimum amplitude of sampled data for each display point. This method is also useful when measuring modulated signals to see if some frequencies are not being used.

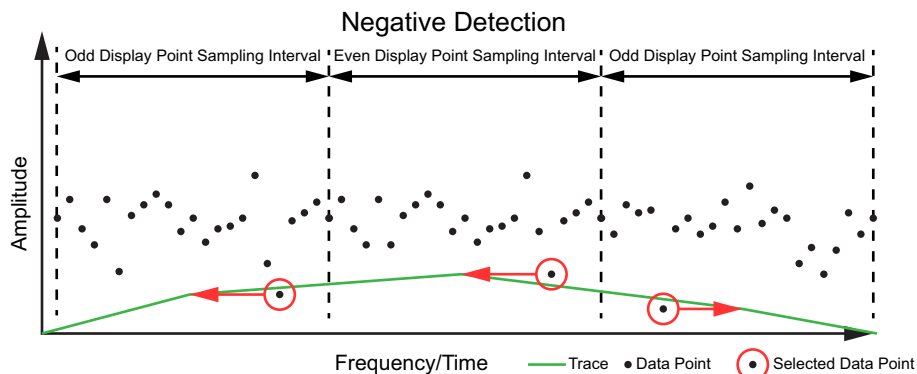


Figure 2-13. Negative Detector Type

Sample

Shows the transient amplitude of the center of sampled data for each display point. This method is useful when measuring low-level signals and noise measurements. Only available in zero span and RSSI measurements.

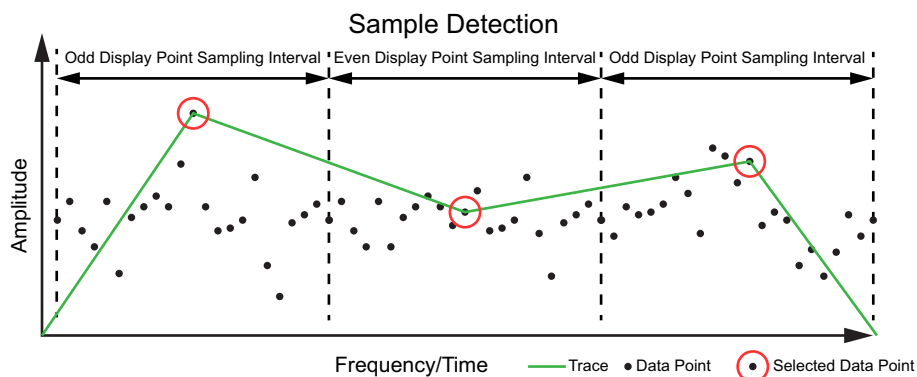


Figure 2-14. Sample Detector Type

Note When Sample detector is selected, all traces must use sample detection.

2-8 Setting Sweep Parameters

When setting up an LTE Demod Summary measurement, sweep parameters are set using the [“SWEEP Menu – LTE Demod Summary Measurements” on page 2-14](#). When setting up an LTE RF measurement, sweep parameters are set using the [“SWEEP Menu – LTE RF Measurements” on page 2-14](#).

SWEEP Menu – LTE Demod Summary Measurements

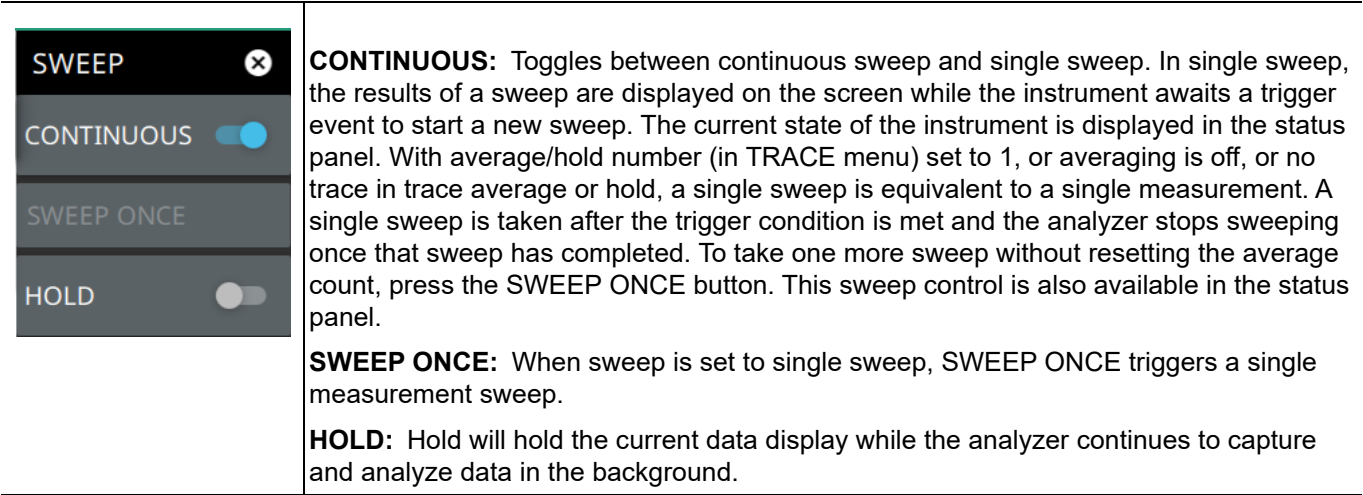


Figure 2-15. SWEEP Menu - LTE Demod Summary Measurements

SWEEP Menu – LTE RF Measurements

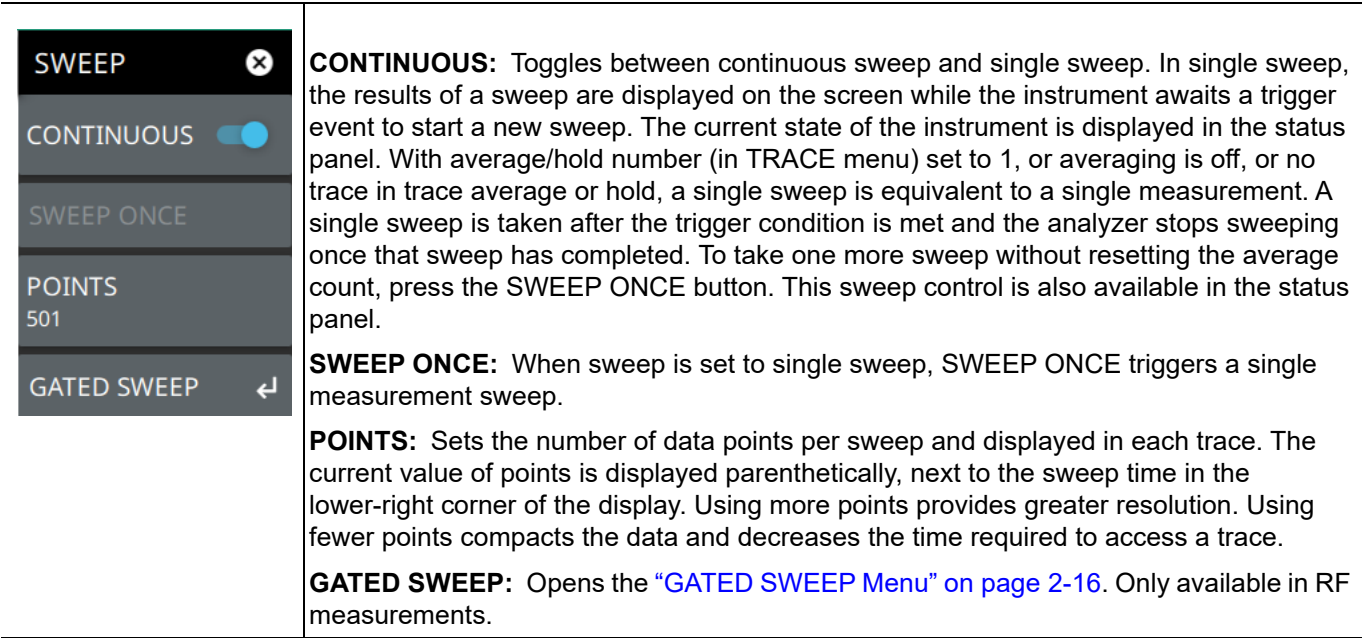


Figure 2-16. SWEEP Menu - LTE RF Measurements

Gated Sweep (Option 90)

Gated sweep is only available on instruments with Option 90 installed and only when an RF-based measurement is selected (Channel Power or Channel Spectrum). Gated sweep allows you to synchronize your sweep with an event so that the analyzer collects data at the appropriate time. This is useful for measuring signals in the time domain such as pulsed RF, time multiplexed, or burst modulated signals. The instrument can use the GNSS (GPS) timing signal as the gating trigger event. This will allow you to synchronize measurements with GNSS (GPS) synchronized communication signals. Set up gated sweep from the **“GATED SWEEP Menu”** on page 2-16.

To set up the instrument for gated sweep measurements:

1. Press SWEEP > GATED SWEEP.
2. Select the GATE SOURCE. The gate source selected determines the trigger source from which the gate is controlled. Not all instrument models and options support all triggering selections, so your choices may vary. The instrument supports a GNSS (GPS) and external trigger gate source.
3. Select one of the available FRAME TIME durations. The frame time sets the total measurement cycle time.
4. Set the GATE DELAY time. The gate delay sets the time from the triggering event to when the instrument starts sweeping and collecting data.
5. Set the GATE LENGTH time. The gate length sets the time for data capture and analysis.
6. If desired, enable PWR VS TIME (refer to **“GATED SWEEP ON Display”** on page 2-17.)

Below is an example of a gated sweep applied to a channel power measurement. The signal level shown varies cyclically with time and would not be measurable without gated sweep.



Figure 2-17. Gated Sweep Measurement

The channel power and gated sweep display panels at the bottom can be tapped to open either the Channel Power SETUP menu or the GATED SWEEP menu.

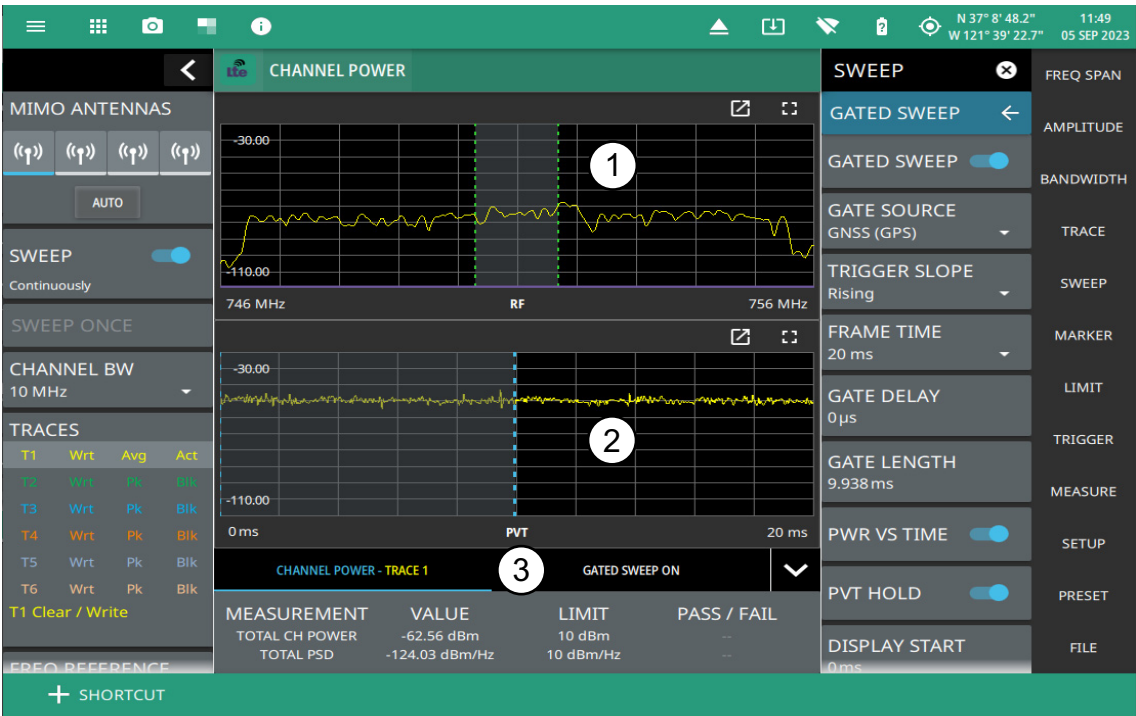
GATED SWEEP Menu

SWEEP 	GATED SWEEP: Toggles gated sweep on or off.
GATED SWEEP 	GATED SOURCE: Selects the trigger source for the gated sweep. GNSS (GPS): This setting synchronizes the trigger source to the GPS PPS. External 1 or 2: Sets the gate reference based on input from the External 1 or External 2 port. Only Field Master Pro and Remote Spectrum Monitor instruments have two external ports.
GATED SWEEP 	
GATE SOURCE GNSS (GPS) 	
TRIGGER SLOPE Rising 	TRIGGER SLOPE: Used when the trigger source is set to External or Video. Sets the trigger slope to rising, falling, or both. When slope is set to Both, the analyzer triggers on both the rising and falling edges. Triggering on both rising and falling edges is not available in zero span.
FRAME TIME 20 ms 	FRAME TIME: Selects the frame time duration of 10 ms, 20 ms, or 1 s.
GATE DELAY 0 μ s	GATE DELAY: Sets the start of the gated sweep. When “GATED SWEEP ON Display” is enabled, the gate delay is indicated by the blue left border of the power vs time display. You can also drag the entire gate to set the desired gate delay.
GATE LENGTH 1 ms	GATE LENGTH: Sets the length of the gated sweep. When “GATED SWEEP ON Display” is enabled, the gate length is indicated by the width between the blue borders of the power vs time display. You can also drag the right blue border to set the desired gate length.
PWR VS TIME 	PWR VS TIME: Enables the “GATED SWEEP ON Display” on page 2-17.
PVT HOLD 	PVT HOLD: Holds the power vs time trace when toggled ON.
DISPLAY START 0 ms	DISPLAY START: When Power vs Time is selected, sets the start of the graticule display.
DISPLAY LENGTH 20 ms	DISPLAY LENGTH: When Power vs Time is selected, sets the time length of the graticule display.
PRESET GTD SWP 	PRESET GTD SWP: Presets gated sweep settings to default values.

Figure 2-18. GATED SWEEP Menu

GATED SWEEP ON Display

When gated sweep toggle in turned ON, a time-domain graph is displayed on the bottom and frequency domain graph is shown on top of it, as shown in .Figure 2-19

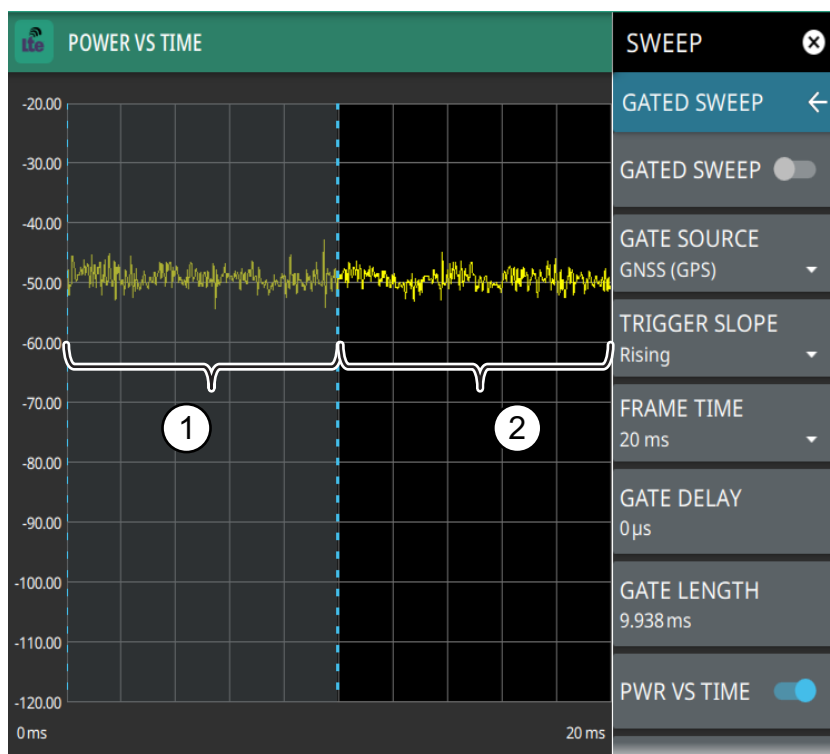


- 1. Frequency domain graph.
- 2. Time domain graph.
- 3. Tabbed table showing the selected measurement and the Gated Sweep details.

Figure 2-19. Gated Sweep ON Display

POWER VS. TIME Display

When power vs time is enabled, a time-domain graph is presented. This graph is a useful visual aid when setting up the GATE DELAY (1) and GATE LENGTH (2) times as you can simultaneously view the signal level within the set frame and relative to your gate delay and length. The display is enabled using the PWR VS TIME toggle setting and should be disabled after setting up the gate delay and length parameters. The gate delay and length are represented by the width of the displayed shaded area flanked with blue lines (see Figure 2-20).



1. Set the gate delay by dragging the left blue setting line. The full time scale is shown along the bottom and the gate delay time will be displayed at the top center of the graticule when it is being adjusted.
2. Set the gate length by dragging the right blue setting line. The full time scale is shown along the bottom and the gate length will be displayed at the top center of the graticule when it is being adjusted.

Figure 2-20. Power vs. Time Display

If the blue gate delay and length setting lines are set outside of the displayed graticule scale, you will see “< Gate Start” and “Gate Stop >” messages at the edge of the display indicating where the blue setting lines are located.

Once the gate has been set up, you can apply gating to the spectrum by toggling GATED SWEEP on. Gating will continue to be applied when you access other measurements and functions of the spectrum analyzer until gated sweep is toggled off or an unsupported instrument configuration is selected.

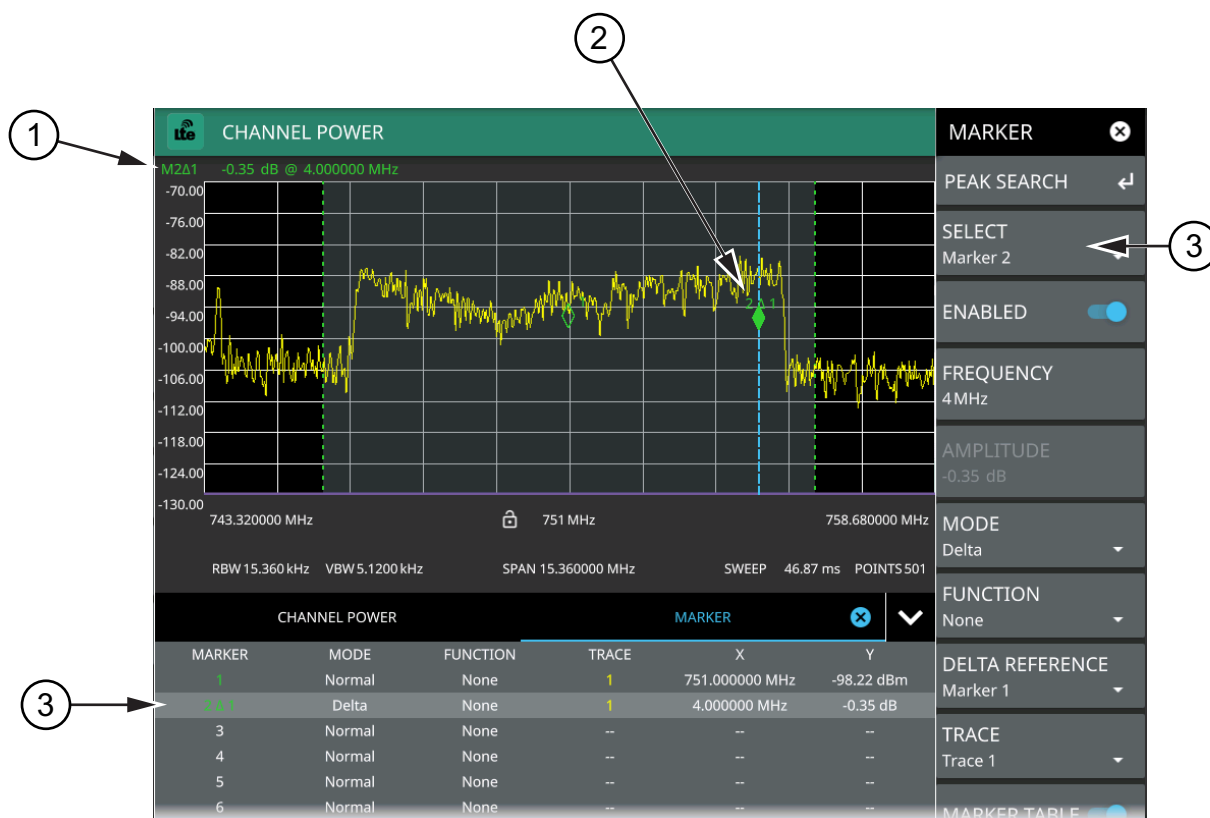
2-9 Setting Up Markers

Marker parameters are set using the “[MARKER Menu](#)” on page 2-21.

Note

Markers are only available in LTE spectrum-based measurements. For example, non-spectrum-based measurements such as Demod Summary, Carrier Aggregation, Multi PCI, Control Channel, Constellation, and Frame Power measurements suppress the Marker menu completely.

Refer to the figure below when working with this section.



1. Normal spectrum view marker information display.
2. Marker located on trace. The active marker is indicated with solid green fill, other markers will show with a hollow fill, fixed markers show as a green X.
3. Selected marker in the MARKER menu and in the marker table. The marker table shows all of the marker parameters and measurement values. You can edit marker parameters from the marker table as well as from the MARKER menu.

Figure 2-21. Marker Table and Marker Settings Panels

Placing a Normal Marker

1. Press MARKER to display markers. If markers were off, Marker 1 will automatically be made active at the current center frequency.
2. Select another marker using MARKER > SELECT, then select one of 12 available markers. If the marker was off, the marker will be made active and placed at the center frequency. If the marker was on, it will be made the active marker. You can enable all 12 markers and place them separately on traces, cursors, or set them as a fixed marker at a static frequency and amplitude.
3. Place a marker by first selecting it as the active marker, then do one of the following:

- a. Enter a new FREQUENCY value.
- b. Drag the marker on the trace (note that anywhere on the vertical dashed blue line can be touched to drag a marker's position).
- c. Use the PEAK SEARCH menu and the desired peak search function to automatically find signal peaks (refer to [“MARKER PEAK SEARCH Menu” on page 2-22](#)).

Placing a Fixed Marker

Fixed markers are set up the same as normal markers above, but are set to Fixed using the MODE button. In addition to setting a fixed frequency, you can set a fixed amplitude. Fixed markers are typically used as a reference marker when measuring amplitude differences relative to an absolute value.

Placing a Delta Marker

When a delta marker is on, its position data is relative to its reference marker. For example, Delta Marker 3 displays x-axis and y-axis data relative to Marker 3. To set a delta marker and its reference:

1. Activate a marker and place it in a reference location as described previously.
2. Select another marker using MARKER > SELECT, then select one of 12 available markers.
3. Set the second marker's MODE to Delta.
4. Place the active delta marker by:
 - a. Entering a new FREQUENCY value.
 - b. Dragging the marker on the trace (note that anywhere on the vertical dashed blue line can be touched to drag a marker's position).
 - c. Use the PEAK SEARCH menu and the desired peak search function to automatically find signal peaks (refer to [“MARKER PEAK SEARCH Menu” on page 2-22](#)).

A delta marker is labeled with a green delta symbol between the each marker number. For example, delta Marker 2 relative to Marker 1 is displayed as “2Δ1”.

MARKER Menu

MARKER 	PEAK SEARCH: Opens the “MARKER PEAK SEARCH Menu” on page 2-22 .
PEAK SEARCH 	SELECT: Turns on the selected marker if it is off or makes it the active marker if it is already turned on. Pressing the MARKER menu button for the first time will turn on Marker 1 as a normal marker at the center frequency, and open the MARKER menu. Pressing the MARKER menu button thereafter opens the MARKER menu to the current active marker, which is displayed in the upper left-hand corner of the screen. When a marker is turned on, it is a normal marker positioned at the center frequency of the selected trace.
SELECT Marker 2 	
ENABLED 	ENABLED: Enables the selected marker.
FREQUENCY 10.182884111 GHz	FREQUENCY: Displays the marker frequency. For delta markers, the frequency is relative to the reference marker. Change the marker frequency by pressing on the marker and dragging it to the desired location. You can also change the marker frequency by touching the value to open the keypad.
AMPLITUDE -39.61 dBm	AMPLITUDE: Displays the current marker amplitude. If the marker is a fixed marker, the amplitude value can be changed by dragging the marker to the desired location or by directly entering the amplitude.
MODE Normal 	MODE: Select marker preference: Normal: A Normal marker is also known as a tracking marker. The frequency is fixed but the amplitude value varies from sweep to sweep. Delta (Δ): A Delta (Δ) marker displays the delta frequency and amplitude between itself and a reference marker. If Marker 1 is selected to be a Delta marker, then Marker 2 is turned on as a reference marker for Marker 1 and it becomes a Fixed marker at the same location. The reference marker can then be switched to a Normal marker if desired. Fixed: A Fixed marker has a fixed amplitude and fixed frequency, which are defined by the user and not related to the trace or sweep data.
FUNCTION Off 	FUNCTION: Sets the function of the currently selected marker to None or Noise. For more information about using marker functions, refer to “Marker Functions” on page 2-23 .
DELTA REFERENCE 	DELTA REFERENCE: Selects the reference marker for a delta marker. A delta marker cannot be its own reference. Only Fixed and Normal markers may be used as a reference for Delta markers.
TRACE Trace 1 	TRACE: Selects the trace number to which the marker is currently attached.
MARKER TABLE 	MARKER TABLE: Toggle on or off the marker table displayed below the screen. Refer to “Marker Table” on page 2-23 .
CENTER ON MARKER	CENTER ON MARKER: Sets the center frequency to the currently active marker's frequency value.
REF LVL TO MARKER	REF LVL TO MARKER: Sets the reference level to the currently active marker's amplitude value.
ALL MARKERS OFF	ALL MARKERS OFF: Turns all markers off, but markers will retain their last frequency position once re-enabled.
PRESET MARKERS 	PRESET MARKERS: Presets marker selections to default values.

Figure 2-22. MARKER Menu

MARKER PEAK SEARCH Menu

MARKER PEAK SEARCH SELECT Marker 1 PEAK SEARCH NEXT PEAK NEXT PEAK LEFT NEXT PEAK RIGHT NEXT POINT LEFT NEXT POINT RIGHT THRESHOLD 0 dBm EXCURSION 0 dB	SELECT: If the selected marker is off it will be turned on and the selected marker positioned at the peak of Trace 1. If the selected marker is on, then it will become the active marker and any subsequent actions in the PEAK SEARCH menu will apply to the selected marker. If no markers are on, pressing the PEAK SEARCH button on the control panel will turn on Marker 1 at the peak of Trace 1. Pressing the PEAK SEARCH button also opens the PEAK SEARCH menu. PEAK SEARCH: Moves the selected marker to the highest peak. NEXT PEAK: Moves the selected marker to the next highest peak regardless of location. NEXT PEAK LEFT: Moves the selected marker to the next peak left of its current position. NEXT PEAK RIGHT: Moves the selected marker to the next peak right of its current position. NEXT POINT LEFT: Moves the selected marker one display point to the left of its current position. Useful for fine tuning the position of a marker. NEXT POINT RIGHT: Moves the selected marker one display point to the right of its current position. Useful for fine tuning the position of a marker. THRESHOLD: If turned on, sets the threshold that a peak has to achieve to be considered a peak. EXCURSION: If turned on, sets the excursion value that a peak amplitude must rise and fall over the peak threshold to qualify as peak.
---	--

Figure 2-23. PEAK SEARCH Menu

Marker Functions

Noise Markers

Noise Markers use an averaging routine applied to multiple data-point groups to calculate the readout, which is typically comparable to using 1 Hz bandwidth filtering. Because the noise marker routine uses groups of data points for the calculation, the noise marker should not be placed in close proximity to measurable signals. You can observe this effect by moving the marker further away from a signal until the marker readout stabilizes to a more consistent value. Noise markers should be used with an RMS/Avg detector type for proper measurement. When a noise marker function is selected, the marker amplitude value is displayed in dBm/Hz, which is the noise level within the resolution bandwidth filter. Delta markers can also be put into a noise function, but the reference marker must also be a noise marker. If they are different functions, one will be updated to match the other. Fixed markers are not allowed to be set to a noise function, so if a noise marker is changed to fixed mode, the function will automatically be set to off.

Marker Table

The Marker table display is useful for displaying many marker parameters at once. The example shown is for the LTE Channel Power measurement. The marker table shows the marker mode and corresponding X and Y values, and the trace to which it is selected. The selected marker is displayed with a highlighted background. Table controls are located on the right of the header. Press the down or up arrow to collapse or expand the table, press X to close the table.

CHANNEL POWER				MARKER		X	Y
MARKER	MODE	FUNCTION	TRACE				
1	Normal	Noise	1			5.800000010 GHz	-142.43 dBm/Hz
2	Normal	Off	3			6.152000010 GHz	-66.84 dBm
3	Normal	Off	1			62.690807800 GHz	-67.91 dBm
4	Off	Off	--			--	--
5	Off	Off	--			--	--
6	Off	Off	--			--	--

Figure 2-24. Marker Table

1. You can select and change a marker's parameters by selecting the marker from either the MARKER menu or the MARKER table.
2. The currently selected marker's value is shown at the top left of the spectrum window with its current amplitude and frequency values.
3. The selected marker is highlighted on the trace display.

2-10 LTE Measurement Setup

LTE base station validation qualifies the performance of both FDD and TDD gNB base stations with essential measurements that are in full compliance with 3GPP. The LTE analyzer features smart measurements that make configuring these measurements and views for LTE compliance testing easy:

- LTE demod summary measurements:
 - Frequency Error
 - Time Offset
 - Cell, Sector and Group ID
 - Modulation Quality
 - Primary/Secondary Synchronization Signal (PSS/SSS) Status
 - Primary Broadcast Channel (PBCH) Power
 - Synchronization Signal (SS) Power
 - Reference Signal (RS) Power
 - Multiple Input Multiple Output Antenna Power (Four Antennas)
 - Time Alignment Error between MIMO Antenna Pairs
 - Resource Block Utilization and OSTP
- LTE Multi PCI demod summary measurements
- Channel Power (CP)
- Channel Spectrum (Occupied Bandwidth)
- Carrier Aggregation
- Adjacent Channel Power (ACP)
- Spectral Emission Mask (SEM)
- Control Channel
- Constellation
- UL/DL Interference
- Coverage Mapping

MEASURE Menu (LTE)

LTE analyzer offers several measurements as listed below. Navigate to MEASURE > MEASUREMENT to select from the measurements.

	MEASUREMENT: Selects the desired measurement type from the following list: • Demod Summary: Displays the current beam measurement status in a quick-view summary that includes the PCI and received power measurement summaries. See “LTE Demod Summary” on page 2-27. • Multi PCI: Displays the current beam measurement status in a quick-view summary that includes the PCI and received power measurement summaries. See “LTE Multi PCI” on page 2-39. • Channel Power: Provides an RF channel power measurement that includes the total channel power, power spectral density (PSD), and pass/fail compliance testing. See “LTE Channel Power” on page 2-43. • Channel Spectrum: Provides an RF occupied bandwidth measurement that includes the occupied bandwidth, total power, and pass/fail compliance testing. See “LTE Channel Spectrum” on page 2-46. • Carrier Aggregation: Provides a component carrier measurement that includes the PCI, reference signal power, EVM, and Frequency error measurement summaries. See “LTE Carrier Aggregation” on page 2-49. • ACP: The ACP table and channel lines are added to the measurement display. Refer to Section 2-16 “LTE Adjacent Channel Power” on page 2-53. • SEM: The spectrum emissions mask table and a spectrum mask is added to the measurement display. Refer to Section 2-17 “LTE Spectrum Emission Mask” on page 2-56. • Control Channel: Provides a component carrier measurement that includes the PCI, reference signal power, EVM, and frequency error measurement summaries. See “STATUS PANEL (LTE SEM)” on page 2-59. • Constellation: Provides a constellation measurement that includes the PCI summary, reference signal power, EVM, and frequency error measurement summaries. See “LTE Constellation” on page 2-64. • UL/DL Interference: Provides FDD/TDD UL/DL interference measurements that includes the PCI summary, total frame, sub-frame, and slot power measurements. See “LTE UL/DL Interference” on page 2-69. • Coverage Mapping: Available when Option 431 is installed. Coverage mapping provides signal strength measurements on the instrument display and will plot color-coded signal values on an interactive map. See “LTE Coverage Mapping (Option 431)” on page 2-76. VIEW: When the measurement is Demod Summary, you can select the type of view: • “LTE Summary View” on page 2-27 • “LTE Time Alignment Error (TAE) View” on page 2-34 • “LTE Resource Block (RB) Power View” on page 2-35 • “LTE Summary Table View” on page 2-36
--	---

Figure 2-25. LTE MEASURE Menu

	SETUP: Opens one of the measurement SETUP menus. The LTE SETUP menus can be access directly via the SETUP or MEASURE menus after the desired measurement has been selected. The setup menu depends on the current measurement and view selected. • “SETUP Menu (LTE Demod Summary)” on page 2-37 • “SETUP Menu (LTE Multi PCI)” on page 2-41 • “SETUP Menu (LTE Channel Power)” on page 2-44 • “SETUP Menu (LTE Channel Spectrum)” on page 2-47 • “SETUP Menu (LTE Carrier Aggregation)” on page 2-51 • “SETUP Menu (LTE Control Channel)” on page 2-62 • “SETUP Menu (LTE Constellation)” on page 2-67 • “SETUP Menu (LTE UL/DL Interference)” on page 2-71 • “SETUP Menu (LTE Coverage Mapping)” on page 2-81 SIB DECODE: Enables display of Mobile Network Code (MNC) and Mobile Country Code (MCC) information. Refer to “SIB Measurement” on page 2-29 for detailed information. SIB USER MNC MAP: Enables or disables custom user configuration of MNC to mobile network names mapping. Refer to “SIB USER MNC/MCC MAPS” on page 2-31 for detailed information. SIB USER MCC MAP: Enables or disables custom user configuration of MCC to mobile network names mapping. Refer to “SIB USER MNC/MCC MAPS” on page 2-31 for detailed information.
--	---

Figure 2-25. LTE MEASURE Menu

2-11 LTE Demod Summary

LTE demod summary measurement is the default measurement in LTE analyzer mode. To select demod summary measurement go to main menu and press **MEASURE > MEASUREMENT > Demod Summary**. LTE demod summary measurements are used for compliance testing of 3GPP LTE networks and can evaluate active antenna systems for dynamic physical layer attributes and received power levels of the transmitted signal.

The instrument can analyze a single physical-layer cell or multiple physical-layer cells at one time. The following considerations apply to each measurement.

Single PCI:

- Better for conducted measurements, directional antenna measurements, or if only one cell is present.
- Only one cell is reported. If multiple cells are present, the analysis may jump to different cells or not analyze any of the cells.

Multi PCI:

- Better sync in over the air field conditions.
- Multiple Cells can be reported and sorted on various measurement parameters.

LTE demodulation summary views present the same measurement parameters in both frequency division duplex (FDD) and time division duplex (TDD). FDD or TDD duplex type is selected using the “[SETUP Menu \(LTE Demod Summary\)](#)” on page 2-37. This section illustrates several LTE FDD measurements using both single PCI and multi PCI analysis techniques.

LTE Summary View

An example FDD LTE Demod Summary measurement is shown in [Figure 2-26](#).

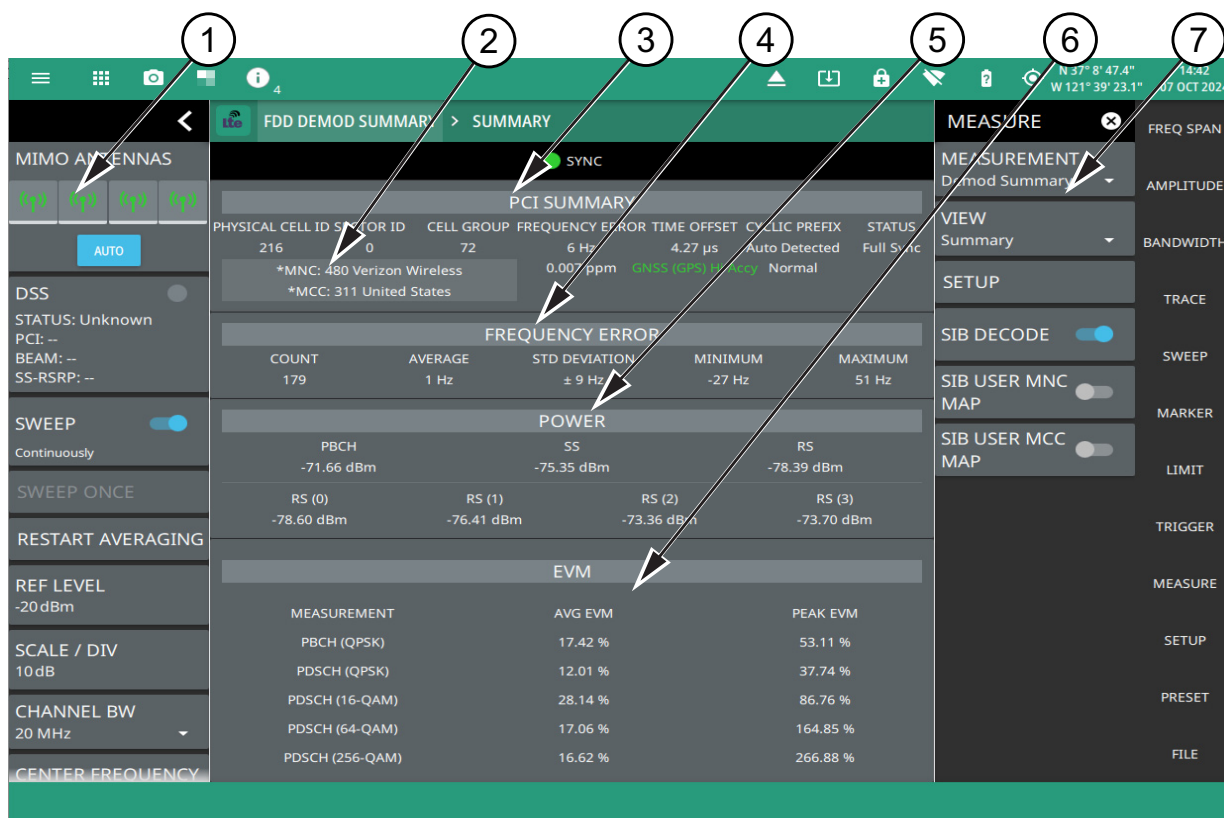


Figure 2-26. LTE FDD Demod Summary Measurement (1 of 2)

1. **LTE Analyzer Status Panel:** Each measurement features a unique status panel that displays settings and information relevant to the current measurement and view settings. This panel provides quick access to the MIMO antenna selection and status, sweep setting, and frequency and bandwidth configuration. See [“Status Panel \(LTE Demod Summary\)” on page 2-38](#).
2. **MNC/MCC Info:** This area shows the Mobile Network Code (MNC) and Mobile Country Code (MCC) codes along with the carrier and the country name. Touch this info to open SIB MEASUREMENT dialog. Note that the asterisk symbol on this information indicates the presence of LAST SIB DECODE info as shown in [Figure 2-27](#). Refer to [“SIB Measurement” on page 2-29](#) for detailed information.
3. **PCI Summary:** This area shows the physical cell ID, including the sector ID, cell group number, frequency error, time offset, sync status. Mobile Network Code (MNC) and Mobile Country Code (MCC). Sync status can indicate if there is a PSS or SSS failure, a Full Sync, or an Unknown condition. Also noted is the instrument’s reference clock accuracy of Internal, External, or GNSS (GPS) high accuracy (requires GPS).
4. **Frequency Error:** This section shows the frequency error of all the measured signals. It is the difference between the measured carrier frequency and the specified carrier frequency. This measurement is only as accurate as the frequency reference that is used and is typically only useful with a good external frequency reference or GNSS (GPS). It consists of the following data:
 - Count: The total number of frequency measurements included in the averaging measurement.
 - Average: The average value of all frequency measurements made.
 - Standard Deviation: The measure of the spread of frequency measurements. The standard deviation is the average difference of all measurements from the average frequency measurement. Typically 68% of all measurements will fall within the standard deviation value shown.
 - Minimum: The single lowest frequency value measured.
 - Maximum: The single highest frequency value measured.
5. **Power Summary:** Shows the received power for each of the following:
 - PBCH: Physical broadcast channel, the main purpose of which is to carry the broadcast information block.
 - SS: Synchronization signal is used as a preamble sequence in LTE for synchronization purposes.
 - RS: Reference signal is used as a pilot subcarrier for channel estimation and tracking in LTE.
 - RS (0 through 3): Reference signal power of each of the MIMO antennas.
6. **EVM Summary:** Shows the RMS (%) of the error vectors between the reconstructed ideal signals and the received signals, divided by the RMS value of the ideal signals. The first column lists the average EVM (rms) value and the second column lists the peak measured value for each of the following as they are received:
 - PBCH (QPSK): Physical broadcast channel, the main purpose of which is to carry the broadcast information block.
 - PDSCH (QPSK): Physical downlink shared channel (quadrature phase shift keying).
 - PDSCH (16-QAM, 64-QAM, 256-QAM): Physical downlink shared channel (quadrature amplitude modulation; 16, 64, and 256 states).
7. **MEASURE Menu:** To turn on SIB DECODE toggle from main menu access MEASURE menu. You can also customize the user map configuration and turn on SIB USER MNC/MCC MAP toggles by loading a preformatted carrier and country csv or txt file.

Figure 2-26. LTE FDD Demod Summary Measurement (2 of 2)

SIB Measurement

The MNC consists of either two or three decimal digits number used to uniquely identify a given network from within a specified country. Note that MNC of 001 is not the same as MNC of 01. Click on the MNC to view the SIB MEASUREMENT dialog that includes the System Information Block (SIB) and Master Block Information (MIB) data.

The MCC consists of three decimal digits excluding digits 1 and 8. The first digit of the mobile country code identifies the geographic region. Click on the MCC to view the SIB MEASUREMENT dialog that includes the System Information Block (SIB) and Master Block Information (MIB) data. Refer to [Appendix A](#) chapter for more information on the SIB measurement header sections tables and the corresponding fields, sub fields and their description.

In LTE MIBs and SIBs are used to carry different system information to customer premises equipment (CPE). The SIB messages are sent on PDSCH through RRC layer. SIB1 is carried under “SystemInformationBlockType 1” message name. Other SIBs (SIB2 to SIB11) are carried under “SystemInformation” message name and can contain multiple SIBs in the one message.

SIB1 is always sent in sub-frame #5 of the Radio-Frame, and continues retransmitting the same message in each 20 ms with different redundancy versions. Each 80ms a new SIB1 is transmitted.

The MIB message is broadcasted on PBCH. There is only one type of MIB. MIB is always sent in sub-frame #0 of the Radio-Frame, and continues retransmitting the same message in each 10 ms with different redundancy versions. Each 40ms a new MIB is transmitted.

Follow the steps below to view the SIB and MIB decodes:

- Press MEASURE menu and turn on SIB DECODE toggle. Notice the display of MNC and MCC information displayed in the PCI Summary section right below the PCI value. The SIB DECODE toggle is off by default because it may slightly slow down the measurement cycle time.
- Touch the MNC and MCC info area on the instrument display to open SIB MEASUREMENT dialog. Notice that you can still view the SIB Measurement dialog by touching the MNC and MCC info area even without any code being displayed. See [Figure 2-26](#).
- Scroll to the bottom of the SIB MEASUREMENT dialog to check the status message. If the status message is “statusSib1DecodeDone” and the “statusNumber” is 40, it indicates the instrument has successfully decoded MNC and MCC information.
- If the status message is “statusCoreset0Unavailable” it means that the SIB does not contain any MCC/MNC information to decode. This situation can legitimately occur if the cell site being tested is a supplementary link. In this case the mobile device would initially connect to a different band and the SIB1 information is provided by that band. For example, the LTE band could be from a non stand-alone network and the frequency band could be used to inform the mobile device of the MCC/MNC. See [“Anritsu Hardware Status” on page A-6](#) for descriptions on the status messages.
- Press CLOSE to close the SIB MEASUREMENT dialog.

Note

The Anritsu Remote and Report Tools (ARRT) PC application provides a few additional capabilities in the SIB Measurement dialog, such as COPY MIB, COPY SIB and COPY ALL, to save data on your computer. On the other hand, saving a setup file saves the MIB and SIB measurement data onto your instrument.



Figure 2-27. LTE SIB MEASUREMENT and LAST SIB DECODE

SIB USER MNC/MCC MAPS

The default MCC/MNC results displayed by the instrument use an ITU library. As new networks are licensed, or networks change ownership or branding, the library may become out of date. Users can create their own MCC/MNC map of network operator names to ensure the displayed results reflect the most recent friendly name for any given network.

Access SIB USER MNC/MCC MAP toggles from MEASURE menu.

Note that these toggles are only enabled when custom user configuration files are placed in the root directory (Internal) of the instrument's memory, or onto an external memory such as an encrypted FIPS compliant USB memory device. The configuration files can be saved as either as.txt or .csv files.

When the user configuration files are not saved in the instrument a parse error message will be displayed in the notification bar and the map toggles cannot be turned on.

To view the USER MNC MAP dialog (see [Figure 2-28](#)) create a configuration file such as carriers.txt or carrier.csv and add the desired MNC, MCC codes and the corresponding carrier names and save the file either on a USB device or in the internal folder of your instrument.

The file contents must follow a specific format as explained below:

version <version code>

XXX,YYY,Carrier Name, wherein XXX represents the MNC and YYY represents the MCC.

For example,

version 1.0

260,1,T-Mobile / PTC S.A

Make sure to rename the version number for e.g. version 2.0 if new entries are added to the configuration files. This will allow you to invoke the recently updated configuration file.

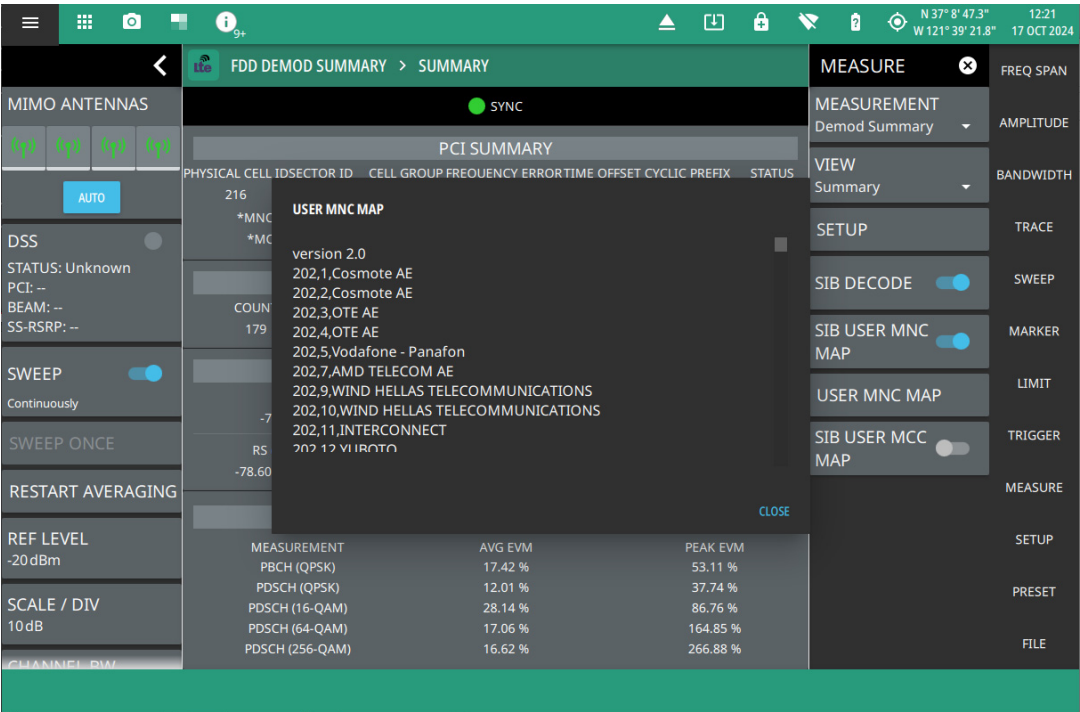


Figure 2-28. LTE USER MNC MAP

Similarly, to view USER MCC MAP dialog turn on SIB USER MNC MAP toggle under MEASURE menu. Create a configuration file such as “countries.txt” and add the desired MCC codes and the corresponding country names with the format as explained below:

The file contents must follow a specific format as explained below:

```
version <version code>
YYY, Country Name, wherein YYY represents the MCC
For example,
version 1.0
311, United States
```

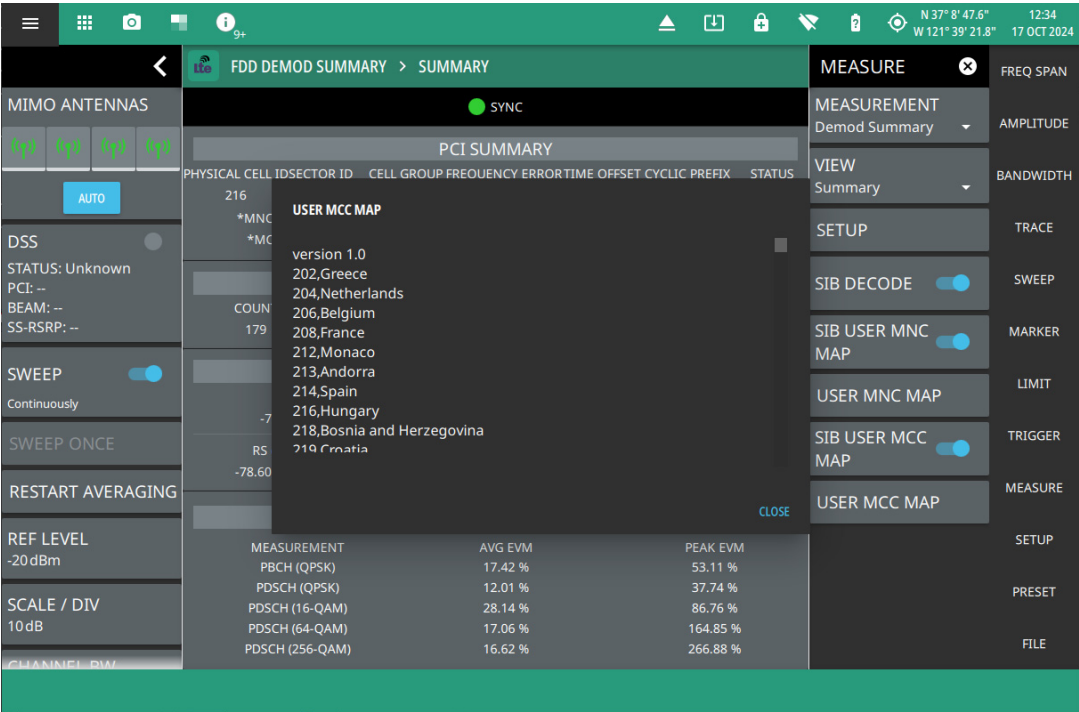


Figure 2-29. LTE USER MCC MAP

LTE Time Alignment Error (TAE) View

An example LTE time alignment error measurement is shown in [Figure 2-30](#).

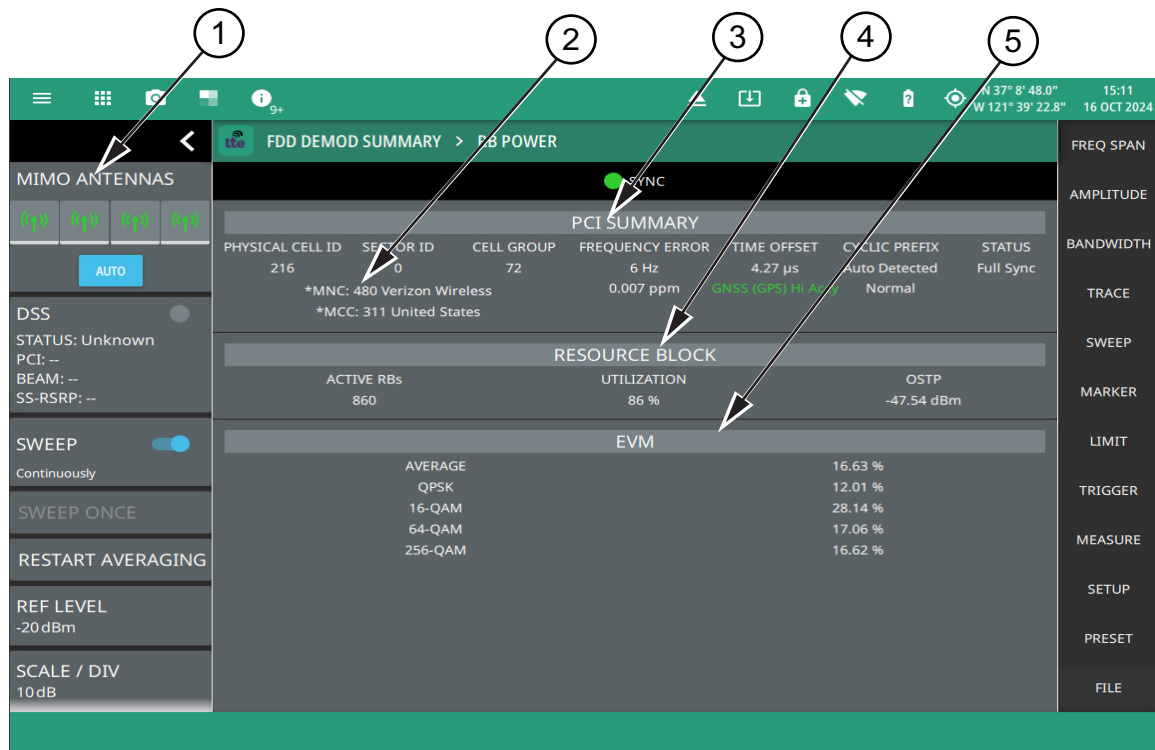


- LTE Analyzer Status Panel:** Each measurement features a unique status panel that displays settings and information relevant to the current measurement and view settings. This panel provides quick access to the MIMO antenna selection and status, sweep setting, and frequency and bandwidth configuration. See [“Status Panel \(LTE Demod Summary\)”](#) on page 2-38.
- MNC/MCC Info:** This area shows the Mobile Network Code (MNC) and Mobile Country Code (MCC) codes along with the carrier and the country name. Touch this info to open SIB MEASUREMENT dialog. Note that the asterisk symbol on this information indicates the presence of LAST SIB DECODE info as shown in [Figure 2-27](#). Refer to [“SIB Measurement”](#) on page 2-29 for detailed information.
- PCI SUMMARY:** This area shows the physical cell ID, including the sector ID, cell group number, frequency error, time offset, and sync status. Sync status can indicate if there is a PSS or SSS failure, a Full Sync, or an Unknown condition. Also noted is the instrument’s reference clock accuracy of Internal, External, or GNSS (GPS) high accuracy (requires GPS).
- Time Alignment Error:** Measures the delay between the signals from two antennas at the antenna ports.
- Power and EVM:** Measures the power of the reference and secondary sync signals, and the PBCH peak and RMS EVM. (EVM will only display for specific antenna combinations of {0}, {0,1}, {0,1,2,3}. All other combinations will display a blank EVM value.)
- MEASURE MENU:** Turn on SIB DECODE toggle to enable MCC and MNC info in PCI summary section.

Figure 2-30. LTE Time Alignment Error (TAE) Measurement

LTE Resource Block (RB) Power View

An example LTE resource block (RB) Power measurement is shown in [Figure 2-31](#).

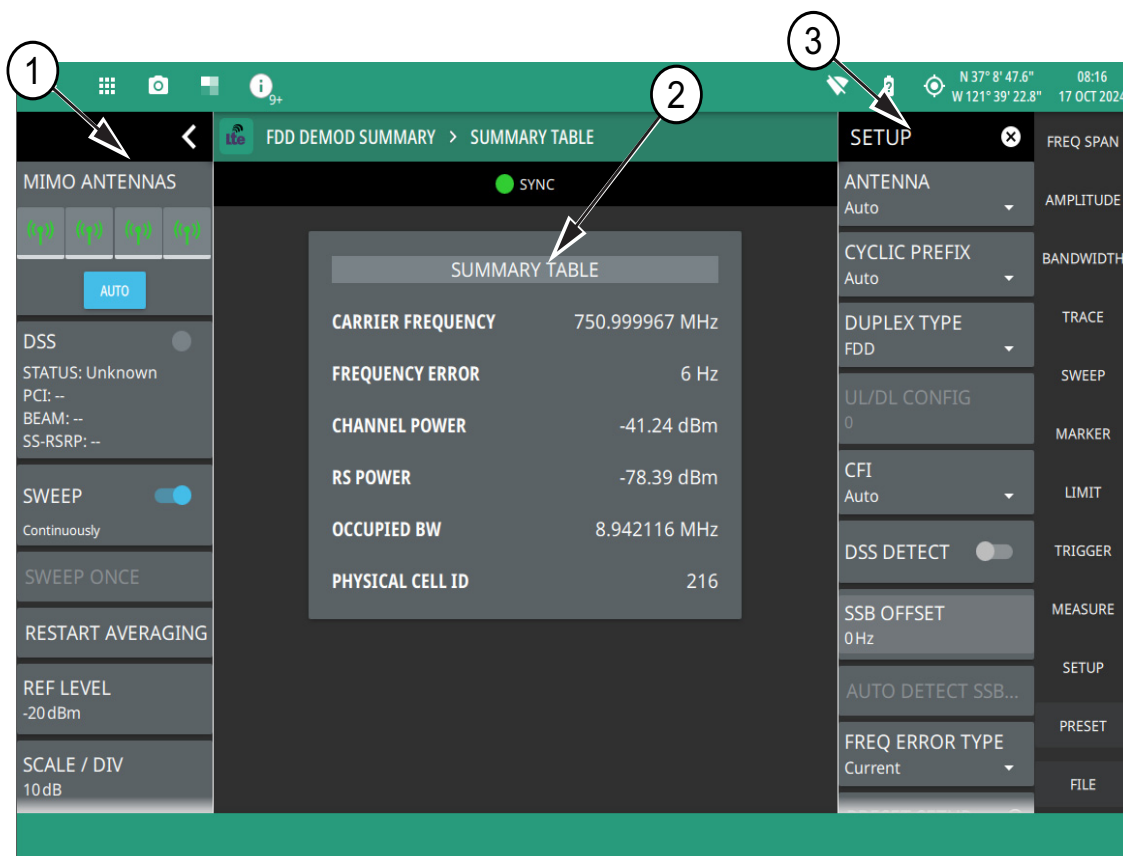


- 1. LTE Analyzer Status Panel:** Each measurement features a unique status panel that displays settings and information relevant to the current measurement and view settings. This panel provides quick access to the MIMO antenna selection and status, sweep setting, and frequency and bandwidth configuration. See [“Status Panel \(LTE Demod Summary\)”](#) on page 2-38.
- 2. MNC/MCC Info:** This area shows the Mobile Network Code (MNC) and Mobile Country Code (MCC) codes along with the carrier and the country name. Touch this info to open SIB MEASUREMENT dialog. Note that the asterisk symbol on this information indicates the presence of LAST SIB DECODE info as shown in [Figure 2-27](#). Refer to [“SIB Measurement”](#) on page 2-29 for detailed information.
- 3. PCI Summary:** This area shows the physical cell ID, including the sector ID, cell group number, frequency error, time offset, and sync status. Sync status can indicate if there is a PSS or SSS failure, a Full Sync, or an Unknown condition. Also noted is the instrument's reference clock accuracy of Internal, External, or GNSS (GPS) high accuracy (requires GPS).
- 4. Resource Block:** Shows the number of active resource blocks, utilization (%), and the OFDM Symbol Transmit Power (OSTP) in dBm.
- 5. EVM:** Shows the RMS (%) of the error vectors between the reconstructed ideal signals and the received signals, divided by the RMS value of the ideal signals for the average signal, QPSK, 16-QAM, 64-QAM, and 256-QAM.

Figure 2-31. LTE Resource Block (RB) Power Measurement

LTE Summary Table View

The LTE Demod summary table displays the measured values of carrier frequency which is calculated as the sum of center frequency and frequency error, channel power, RSRP power, occupied bandwidth and physical cell ID, as shown in [Figure 2-32](#).



- Status Panel:** Each measurement features a unique status panel that displays settings and information relevant to the current measurement and view settings. This panel provides quick access to the measurement frequency, channel bandwidth, and Frequency Error Type. See [“Status Panel \(LTE Demod Summary\)”](#) on page 2-38.
- SUMMARY TABLE:** This field indicates the current beam summary page.
 - **Carrier Frequency:** The sum of center frequency and frequency error.
 - **Average Frequency Error:** The average value of the frequency error of all the measurements. Frequency error is the difference between the received center frequency and the specified center frequency. This is tied to external frequency reference accuracy and is typically useful only with a good external frequency reference. To view current frequency error, select CURRENT from FREQ ERROR TYPE drop-down in the status panel/SETUP menu.
 - **Channel Power:** The total power transmitted within a specified frequency or channel bandwidth.
 - **RS Power:** The reference signal received power measured in dBm.
 - **Occupied BW:** The bandwidth containing 99% of the total integrated power within the transmitted spectrum around the selected center frequency.
 - **Physical Cell ID:** The physical-layer cell ID value.
- SETUP MENU:** Access SETUP menu to set the FREQ ERROR TYPE to either Current or Average. The demod summary measurement settings are configured in the SETUP menu refer to [“SETUP Menu \(LTE Demod Summary\)”](#).

Figure 2-32. LTE Demod Summary Table View

SETUP Menu (LTE Demod Summary)

The SETUP menu is available in MEASURE > MEASUREMENT > Demod Summary > SETUP.

SETUP 	ANTENNA: Sets the MIMO antenna number (0 to 3, or AUTO) to use during a measurement. AUTO will use the antenna with the highest received signal power.
ANTENNA Auto 	CYCLIC PREFIX: Sets the cyclic prefix (or guard time interval) to Normal, Extended, or Auto. The cyclic prefix is a duplication of a fraction of the symbol end. This setting affects the OFDM symbol sensitivity to time dispersion.
CYCLIC PREFIX Auto 	DUPLEX TYPE: Selects either frequency division duplex (FDD) or time division duplex (TDD).
DUPLEX TYPE FDD 	UL/DL CONFIG: Available only in TDD duplex type. Sets the uplink/downlink (UL/DL) configuration, or Frame Format. This selection determines which sub-frames are uplink sub-frames and which are downlink sub-frames, and where the transitions between uplink and downlink sub-frames occur.
UL/DL CONFIG 0	CFI: Selects the control format indicator (CFI) which indicates how many OFDM symbols are used for carrying the control channel at each sub-frame. CFI1 uses the first symbol at the sub-frame for PDCCH allocation. CFI2 uses the first and the second symbol for PDCCH. CFI3 uses the first three symbols for PDCCH.
CFI Auto 	DSS DETECT: Detects the Dynamic Spectrum Sharing (DSS) signal when turned On. This toggle only applies to FDD duplex type.
DSS DETECT 	SSB OFFSET: SSB is the synchronous signal block. The SSB offset sets the frequency offset between the SSB and the center frequency of the channel. Negative values result in an offset lower than the center frequency. Positive values result in an offset higher than the center frequency.
SSB OFFSET 0Hz	AUTO DETECT SSB OFFSET: When DSS DETECT is toggled On, automatic detection of the SSB Offset is enabled.
AUTO DETECT SSB...	FREQUENCY ERROR TYPE: Selects the frequency error type as either current or average. Shows the current frequency error value when CURRENT is selected. Shows the average of frequency error of all the measured channels. Note that this is only available in LTE Demod summary table view.
FREQ ERROR TYPE Current 	PRESET SETUP: Presets the SETUP menu to default settings.
PRESET SETUP 	

Figure 2-33. LTE SETUP Menu (LTE Demod Summary)

Many operators are currently supporting 5G in existing sub 2.5 GHz bands using dynamic spectrum sharing (DSS). DSS technology allocates spectrum resources between LTE and 5G technologies in an LTE frame structure, and is often implemented with a software update to existing LTE radios and antennas. These network deployments usually implement traditional base station and antenna architectures with RF cable feeds between the two components. For this reason, tower crews must implement comprehensive RF cable testing during 5G network deployment and installation and maintenance (I&M).

Status Panel (LTE Demod Summary)

The status panel illustrated in this section is unique to the current analyzer and to the particular measurement and view that is selected.

Figure 2-34 shows the LTE status panel that covers the LTE demod summary measurements.



Figure 2-34. Status Panel with Minimized Icons (LTE Demod Summary Measurement)

2-12 LTE Multi PCI

To select multi PCI measurement go to main menu and press MEASURE > MEASUREMENT > Multi PCI. The multi PCI measurements are set up using the “[SETUP Menu \(LTE Multi PCI\)](#)” on page 2-41. The following measurement is set up to display LTE Multi PCI data. The multi PCI displays the measurement results of every detected beam in a single, sortable table with a bar graph of the selected measurement.

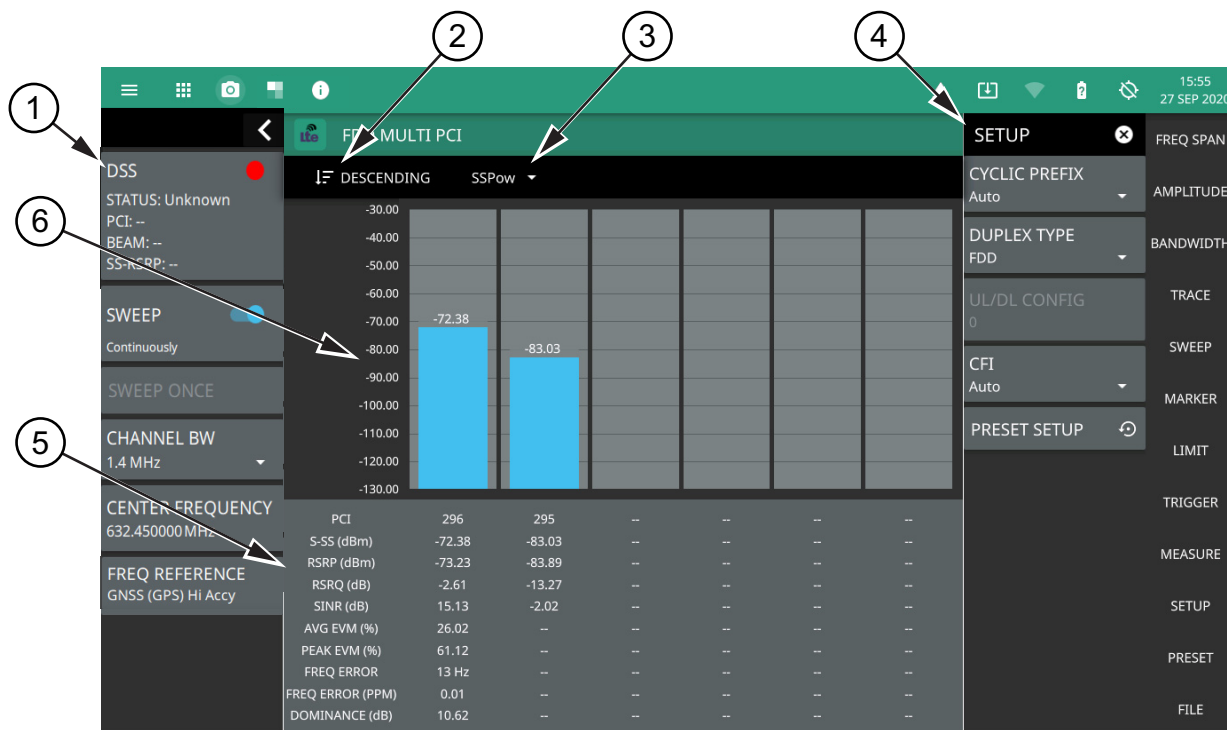


Figure 2-35. LTE Multi PCI (1 of 2)

1. **LTE Analyzer Status Panel:** Each measurement features a unique status panel that displays settings and information relevant to the current measurement and view settings. This panel provides quick access to the measurement frequency and band configuration. See [“Status Panel \(LTE Multi PCI\)” on page 2-42](#).
2. **Sort:** Sets the selected measurement sort order of Descending or Ascending.
3. **Bar Graph Measurement:** Selects which measurement is plotted on the bar graph (RSRP, RSRQ, SINR, PCI, SS Power).
4. **SETUP Menu:** The control channel measurement settings are configured in the SETUP menu. See [“SETUP Menu \(LTE Multi PCI\)” on page 2-41](#).
5. **Table Display:** fields show the beam index value of the corresponding physical-layer cell ID.
 - **PCI:** These fields show the physical-layer cell ID number. When PCI is selected for the bar graph measurement, the values can be sorted in ascending or descending order by tapping the sort button in the bar graph header.
 - **S-SS (dBm):** These fields show the secondary synchronization signal power of the corresponding physical-layer cell ID, measured in dBm. When SS Power is selected for the bar graph measurement, the values can be sorted in ascending or descending order by tapping the sort button in the bar graph header.
 - **RSRP (dBm):** These fields show the reference signal received power, the average power of resource elements (RE) that carry cell-specific reference signals (RS) over the entire bandwidth. When RSRP is selected for the bar graph measurement, the values can be sorted in ascending or descending order by tapping the sort button in the bar graph header.
 - **RSRQ (dB):** These fields show the reference signal received quality, which provide additional information when RSRP is not sufficient to make a reliable handover or cell reselection decision. RSRQ is the ratio between RSRP and RSSI measured in dB. When RSRQ is selected for the bar graph measurement, the values can be sorted in ascending or descending order by tapping the sort button in the bar graph header.
 - **SINR (dB):** These fields show the signal-to-noise and interference ratio of the corresponding physical-layer cell ID, measured in dB. When SINR is selected for the bar graph measurement, the values can be sorted in ascending or descending order by tapping the sort button in the bar graph header.
 - **AVG EVM (%):** Shows the dominant cell's AVG EVM of all of the error vectors between the reconstructed ideal signals and the received signals, divided by the RMS value of the ideal signals.
 - **PEAK EVM (%):** Shows the dominant cell's peak EVM of all of the error vectors between the reconstructed ideal signals and the received signals, divided by the RMS value of the ideal signals.
 - **FREQ ERROR (Hz and PPM):** This is the difference between the measured carrier frequency and the specified carrier frequency of the dominant cell. This number is only as accurate as the frequency reference that is used, and is typically only useful with a good external frequency reference or GNSS (GPS).
 - **DOMINANCE (dB):** Dominance is the ratio of the dominant cell's power for the largest signal to the sum of all other signals found, measured in dB.
6. **Bar Graph Display:** Shows the selected measurement as a bar graph with the current value at the top of the graph.

Figure 2-35. LTE Multi PCI (2 of 2)

SETUP Menu (LTE Multi PCI)

The SETUP menu is available in MEASURE > MEASUREMENT > Multi PCI > SETUP.

SETUP CYCLIC PREFIX Normal DUPLEX TYPE FDD UL/DL CONFIG 0 CFI Auto DSS DETECT SSB OFFSET 0Hz AUTO DETECT SSB... PRESET SETUP	CYCLIC PREFIX: Sets the cyclic prefix (or guard time interval) to Normal, Extended, or Auto. The cyclic prefix is a duplication of a fraction of the symbol end. This setting affects the OFDM symbol sensitivity to time dispersion. DUPLEX TYPE: Selects either frequency division duplex (FDD) or time division duplex (TDD). UL/DL CONFIG: Available only in TDD duplex type. Sets the uplink/downlink (UL/DL) configuration, or Frame Format. This selection determines which sub-frames are uplink sub-frames and which are downlink sub-frames, and where the transitions between uplink and downlink sub-frames occur. CFI: Selects the control format indicator (CFI) which indicates how many OFDM symbols are used for carrying the control channel at each sub-frame. CFI1 uses the first symbol at the sub-frame for PDCCH allocation. CFI2 uses the first and the second symbol for PDCCH. CFI3 uses the first three symbols for PDCCH. DSS DETECT: Detects the Dynamic Spectrum Sharing (DSS) signal when turned On. This toggle only applies to FDD duplex type. SSB OFFSET: SSB is the synchronous signal block. The SSB offset sets the frequency offset between the SSB and the center frequency of the channel. Negative values result in an offset lower than the center frequency. Positive values result in an offset higher than the center frequency. AUTO DETECT SSB OFFSET: When DSS DETECT is toggled On, automatic detection of the SSB Offset is enabled. PRESET SETUP: Presets the SETUP menu to default settings.
--	---

Figure 2-36. LTE SETUP Menu (LTE Multi PCI)

Status Panel (LTE Multi PCI)

The status panel illustrated in this section is unique to the current analyzer and to the particular measurement and view that is selected.

Figure 2-37 shows the LTE status panel that covers the LTE Multi PCI measurements.

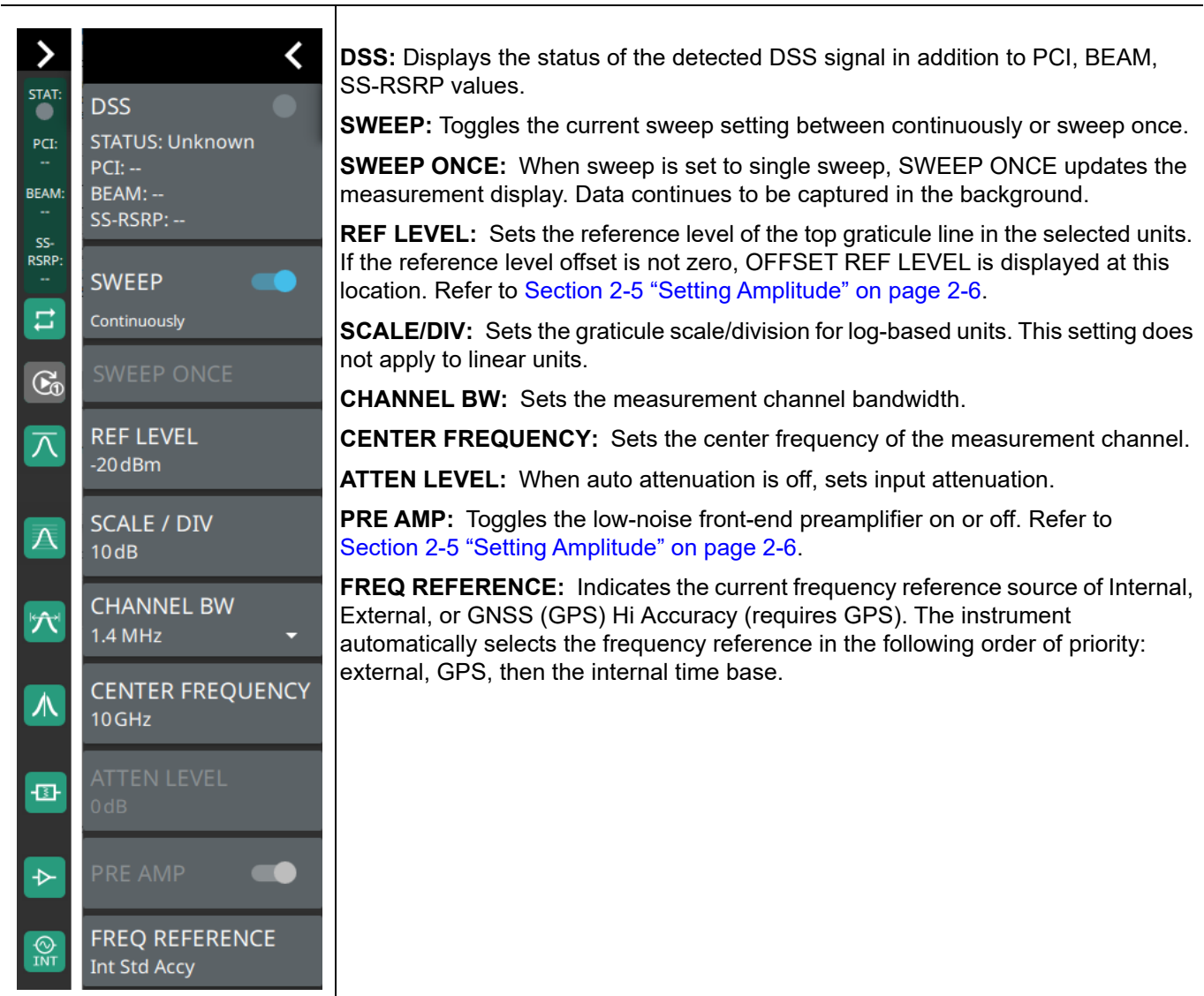


Figure 2-37. Status Panel (LTE Multi PCI Measurement)

2-13 LTE Channel Power

To select channel power measurement go to main menu and press MEASURE > MEASUREMENT > Channel Power. The channel power measurements are set up using the “[SETUP Menu \(LTE Channel Power\)](#)” on page 2-44. Channel power measurements are one of most common measurements for a radio transmitter. This test measures the output power of a transmitter within the specified channel bandwidth.

Out-of-specification power measurements indicate system faults, which can be in the power amplifiers or in filter circuits. Channel power measurements can be used to validate transmitter performance, comply with government regulations, or to keep overall system interference at a minimum.

The channel power measurement is a test performed to measure the power transmitted within a specified frequency or channel bandwidth. The total RF power and power spectral density (PSD) is determined from a channel power measurement. An example of a channel power measurement is shown in [Figure 2-38](#).



- LTE Analyzer Status Panel:** Each measurement features a unique status panel that displays settings and information relevant to the current measurement and view settings. This panel provides quick access to the MIMO antenna selection and status, sweep setting, and frequency and bandwidth configuration. See “[Status Panel \(LTE Channel Power\)](#)” on page 2-45.
- Channel Power:** Channel power is integrated over the shaded region where the dashed green lines indicate the upper and lower frequency thresholds.
- SETUP Menu:** The channel power settings are configured in the SETUP menu. See “[SETUP Menu \(LTE Channel Power\)](#)” on page 2-44.
- Channel Power Summary:** This area shows the channel power measurement summary data and pass/fail test results, when enabled:
 - The total channel power value and the test limit are expressed in dBm with a pass/fail result.
 - The total PSD limit is expressed in dBm with a pass/fail result.
 - Tapping this summary area opens the setup menu.

Figure 2-38. LTE Channel Power Measurement

SETUP Menu (LTE Channel Power)

The channel power SETUP menu is available in MEASURE > MEASUREMENT > Channel Power > SETUP. Once the channel power measurement is selected, the SETUP menu can be quickly accessed by tapping on the summary display area below the spectrum display.

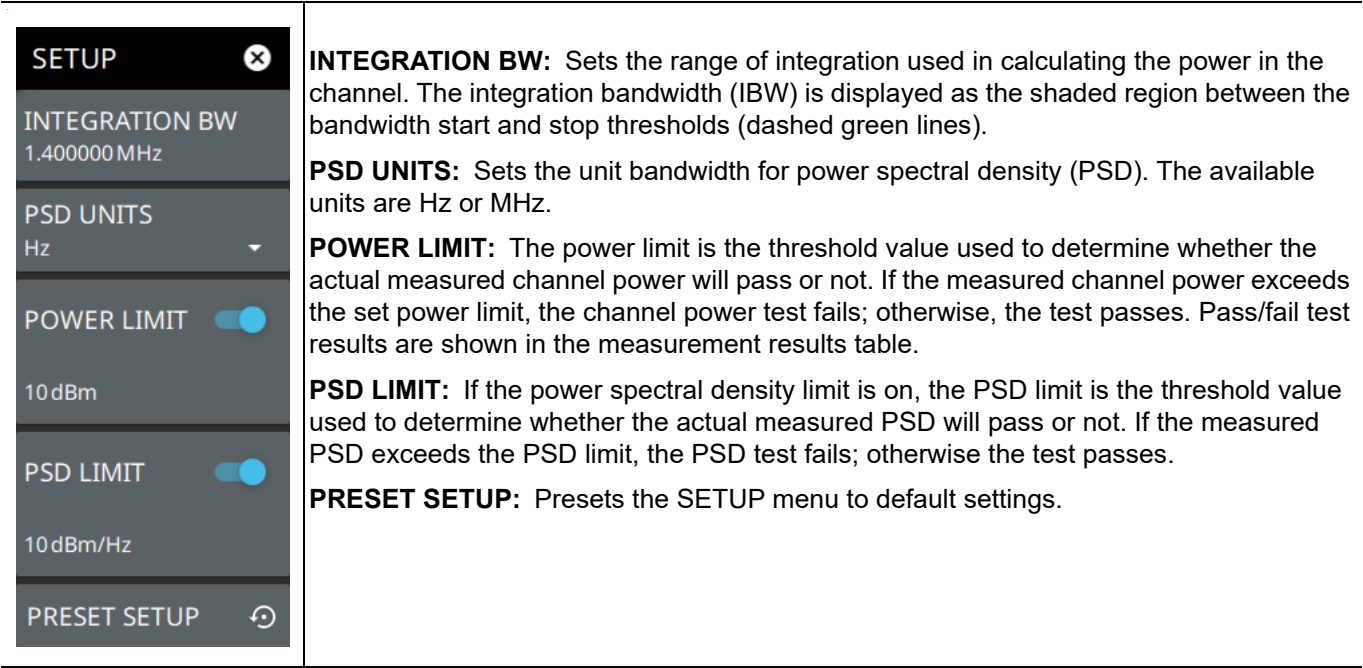


Figure 2-39. LTE SETUP Menu (Channel Power)

Status Panel (LTE Channel Power)

The status panel illustrated in this section is unique to the current analyzer and to the particular measurement and view that is selected.

Figure 2-40 shows the LTE status panel that covers the LTE channel power measurements.

The screenshot displays the LTE Status Panel with the following settings and sections:

- MIMO ANTENNAS:** Toggles the current MIMO antenna setting between AUTO or to select one of the available antennas. When a single antenna is selected, a blue underscore will appear below the antenna icon. The antenna icon is highlighted green when receiving a signal.
- SWEEP:** Toggles the current sweep setting between continuously or sweep once.
- SWEEP ONCE:** When sweep is set to single sweep, SWEEP ONCE updates the measurement display. Data continues to be captured in the background.
- REF LEVEL:** Sets the reference level of the top graticule line in the selected units. If the reference level offset is not zero, OFFSET REF LEVEL is displayed at this location. Refer to [Section 2-5 "Setting Amplitude" on page 2-6](#).
- SCALE/DIV:** Sets the graticule scale/division for log-based units. This setting does not apply to linear units.
- CHANNEL BW:** Sets the measurement channel bandwidth. The available bandwidth settings depend on the selected band and bandwidth option installed in the instrument.
- CENTER FREQUENCY:** Sets the center frequency of the measurement channel.
- ATTEN LEVEL:** When auto attenuation is off, sets input attenuation.
- PRE AMP:** Toggles the low-noise front-end preamplifier on or off. Refer to [Section 2-5 "Setting Amplitude" on page 2-6](#).
- TRACES:** Displays the current status of up to six traces in a quick-view summary. The summary information includes the trace number, type, mode, and detector type. The active trace will show a highlighted background with the mode and detector type restated under the table. Pressing a trace in the summary panel activates the pressed trace and opens the TRACE menu, which allows you to select and set up an individual trace as desired. Refer to [Section 2-7 "Setting Trace Parameters" on page 2-10](#).
- FREQ REFERENCE:** Indicates the current frequency reference source of Internal, External, or GNSS (GPS) Hi Accuracy (requires GPS). The instrument automatically selects the frequency reference in the following order of priority: external, GNSS (GPS), then the internal time base.

The minimized status panel on the left shows the following icons and settings:

- MIMO ANTENNAS:** Four antenna icons, with the first one highlighted green.
- SWEEP:** Continuously (toggle switch is on).
- REF LEVEL:** -20 dBm.
- SCALE / DIV:** 10 dB.
- CHANNEL BW:** 1.4 MHz.
- CENTER FREQUENCY:** 10 GHz.
- ATTEN LEVEL:** 0 dB.
- PRE AMP:** (toggle switch is off).
- TRACES:**

	T1	T2	T3	T4	T5	T6
Wrt	Wrt	Wrt	Wrt	Wrt	Wrt	Wrt
Avg	Avg	Pk	Pk	Pk	Pk	Pk
Act	Act	Blk	Blk	Blk	Blk	Blk
- FREQ REFERENCE:** GNSS (GPS) Hi Accy.

Figure 2-40. Status Panel and Minimized Status Panel Icons (LTE Channel Power Measurement)

2-14 LTE Channel Spectrum

To select channel spectrum measurement go to main menu and press MEASURE > MEASUREMENT >Channel Spectrum. The channel spectrum measurements are set up using the “SETUP Menu (LTE Channel Spectrum)” on page 2-47. Channel spectrum (occupied bandwidth) is a common measurement performed on radio transmitters. This measurement calculates the bandwidth containing the total integrated power occupied in a given signal bandwidth. There are two different methods of calculation depending upon the technique used to modulate the carrier.

- % Integrated Power Method: The occupied frequency bandwidth is calculated as the bandwidth containing the specified percentage of the transmitted power.
- X dB Method: The occupied frequency bandwidth is defined as the bandwidth between the upper and lower frequency points at which the signal level is a desired number of dB below the peak carrier level.

An occupied bandwidth measurement using the % integrated power is shown in Figure 2-41. The occupied bandwidth here is the bandwidth containing 99% of the total channel power. This is calculated from 0.5 % of the total mean power below the lower frequency limit and 0.5% above its upper frequency limit of the signal. Alternatively, the measurement can be set up to use the X dB method where the occupied bandwidth is determined from the upper and lower bandwidth edges that are X dB down from the total mean power of the signal.



Figure 2-41. LTE Channel Spectrum (Occupied Bandwidth) Measurement (1 of 2)

1. **LTE Channel Spectrum Analyzer Status Panel:** Each measurement features a unique status panel that displays settings and information relevant to the current measurement and view settings. This panel provides quick access to the measurement frequency and band configuration. See [“Status Panel \(LTE Channel Spectrum\)”](#) on page 2-48.
2. **Occupied Bandwidth:** Occupied bandwidth is integrated over the shaded region where the dashed green lines indicate the upper and lower frequency thresholds. The analyzer will determine and track the occupied bandwidth of the signal within the current span.
3. **SETUP Menu:** The occupied bandwidth settings are configured in the SETUP menu. See [“SETUP Menu \(LTE Channel Spectrum\)”](#) on page 2-47.
4. Marker frequency values for OBW center, upper and lower frequencies.
5. **OBW Summary:** This area shows the occupied bandwidth measurement summary data and pass/fail test results, when enabled:
 - The occupied bandwidth value and the test limit are expressed in frequency units with a pass/fail result.
 - The total power is integrated over the measured bandwidth and is expressed in dBm.
 - The received signal power is expressed in dBm.
 - The transmit signal frequency error is expressed in frequency units (Hz).
 - Tapping this summary area opens the OBW SETUP menu.

Figure 2-41. LTE Channel Spectrum (Occupied Bandwidth) Measurement (2 of 2)

SETUP Menu (LTE Channel Spectrum)

The Occupied Bandwidth SETUP menu is available in MEASURE > MEASUREMENT > Channel Spectrum > SETUP. Once the channel spectrum measurement is selected, the SETUP menu can be quickly accessed by tapping on the summary display area below the spectrum display.

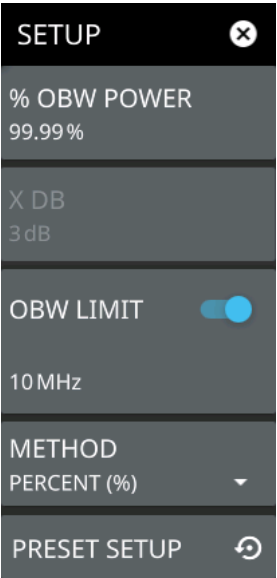
	% OBW POWER: Sets the percentage of the total power that is measured within the occupied bandwidth for the current measurement. The resulting occupied bandwidth and total power values are displayed in the measurements results table. X dB: Sets the x dB value used for the "x dB bandwidth" measurement. The occupied bandwidth is the frequency range between two points on the signal that are x dB down from the highest signal point within the OBW span. OBW LIMIT: Enables limit checking at the specified frequency. The limit test results show as a green PASS or a red FAIL in the measurement table. METHOD: Select the measurement method to be PERCENT (%) or X (dB). PRESET SETUP: Presets the SETUP menu to default settings.
---	---

Figure 2-42. LTE SETUP Menu (Channel Spectrum)

Status Panel (LTE Channel Spectrum)

The status panel illustrated in this section is unique to the current analyzer and to the particular measurement and view that is selected.

Figure 2-43 shows the LTE status panel that covers the LTE Channel Spectrum measurements.

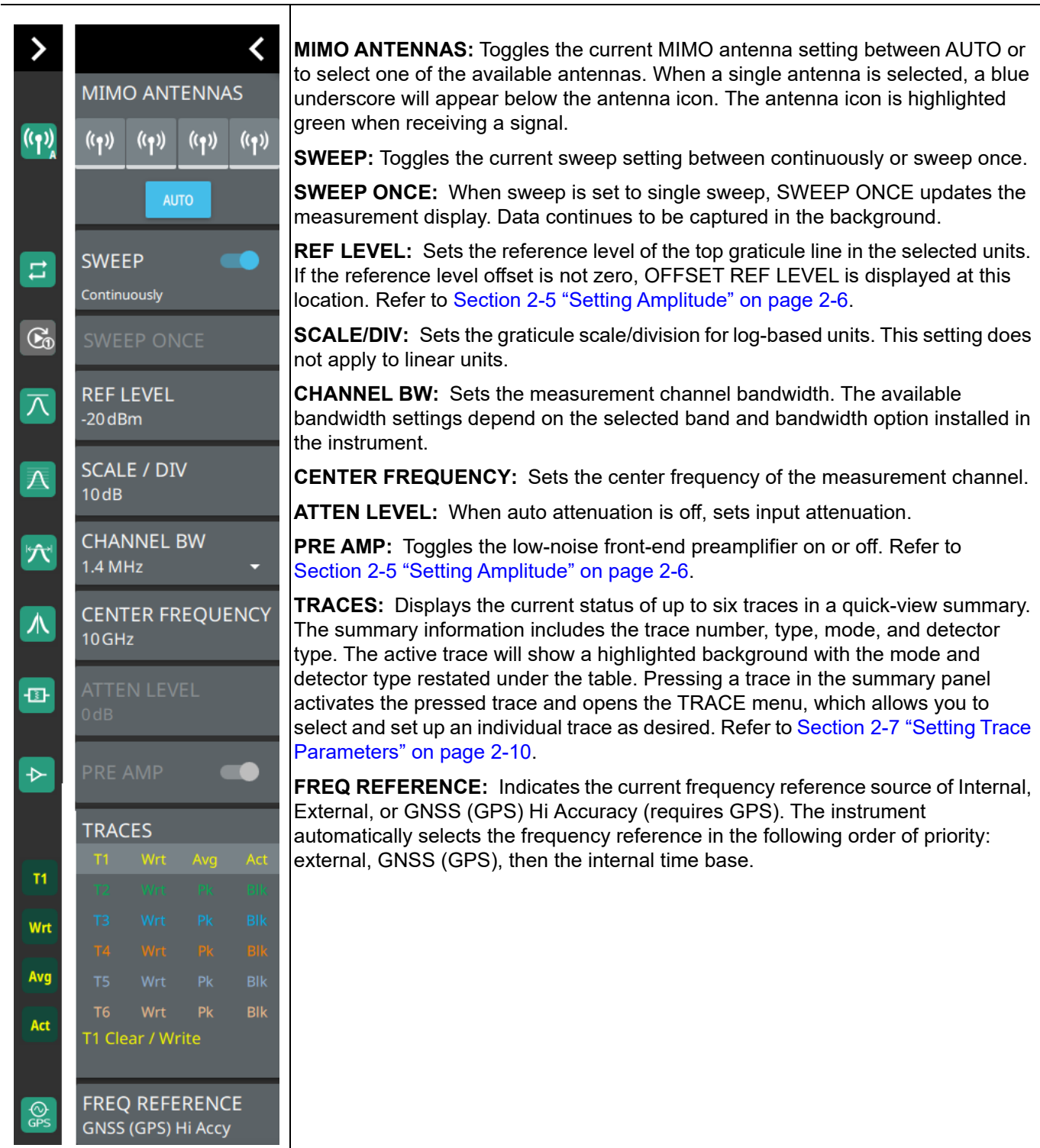


Figure 2-43. Status Panel (LTE Channel Spectrum Measurement)

2-15 LTE Carrier Aggregation

To select carrier aggregation measurement go to main menu and press MEASURE > MEASUREMENT > Carrier Aggregation. The carrier aggregation measurements are set up using the “[SETUP Menu \(LTE Carrier Aggregation\)](#)” on page 2-51. LTE carrier aggregation measurements are used for compliance testing of 3GPP LTE networks and can evaluate active antenna systems for dynamic physical layer attributes and received power levels of the transmitted signal. Carrier aggregation displays up to eight component carrier (CC) measurements. Each carrier can be set up uniquely for signal band. An example LTE carrier aggregation measurement is shown in [Figure 2-44](#).

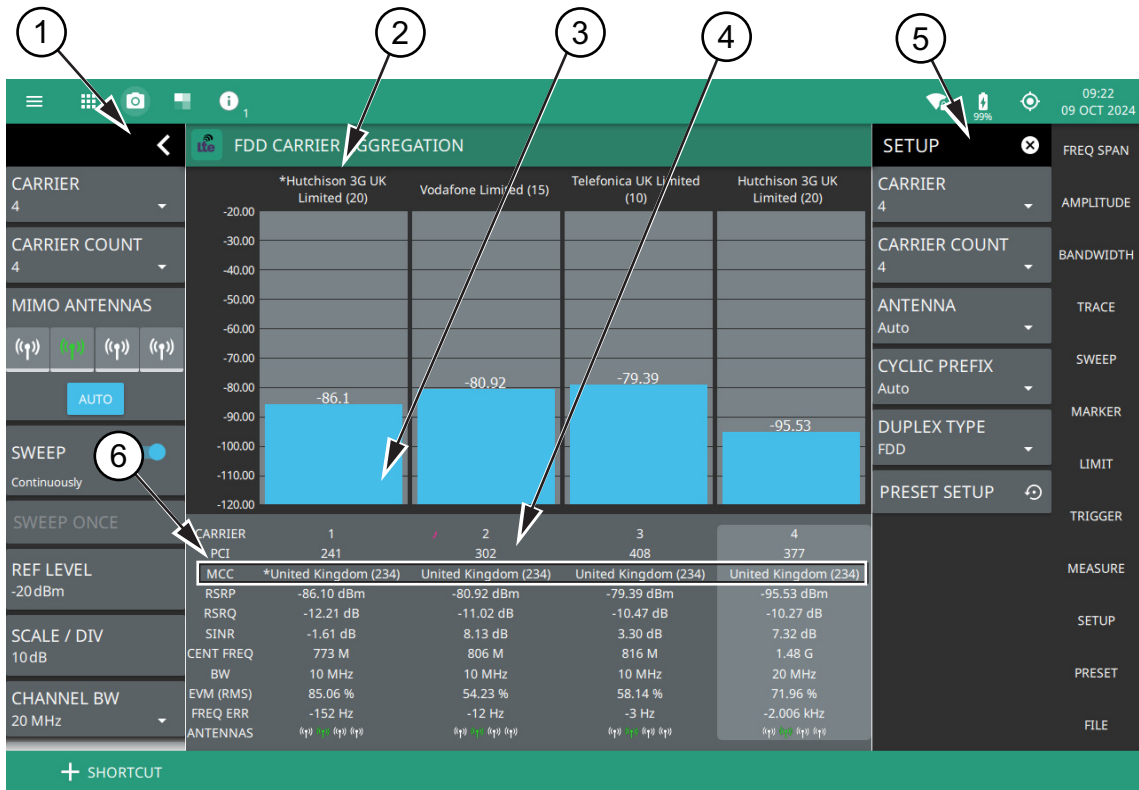


Figure 2-44. LTE Carrier Aggregation Measurement (1 of 2)

-
1. **LTE Analyzer Status Panel:** Each measurement features a unique status panel that displays settings and information relevant to the current measurement and view settings. This panel provides quick access to the MIMO antenna selection and status, current carrier and carrier count, sweep setting, and channel bandwidth configuration. See [“Status Panel \(LTE Carrier Aggregation\)” on page 2-52](#).
 2. **MNC/MCC Info:** This area shows the Mobile Network Code (MNC) and Mobile Country Code (MCC) codes along with the carrier and the country name. Touch this info to open SIB MEASUREMENT dialog. Note that the asterisk symbol on this information indicates the presence of LAST SIB DECODE info as shown in [Figure 2-27](#).
Refer to [“SIB Measurement” on page 2-29](#) for detailed information.
 3. **Signal Level:** This area shows a bar graph of the signal level of the specific carrier.
 4. **Summary Display:** Shows data for each numbered component carrier. The highlighted summary display area is the component carrier data that can be edited, and this area can be touched to select that component carrier for editing. A rotating magenta circle indicates which carrier is currently being measured.
 - Physical Cell ID (PCI) identifying information sent by the transmitter in the sync signal.
 - Reference signal received power (RSRP) measured in dBm indicates the average power received from a single Reference signal or the level of the received signal from the base station.
 - Reference signal received quality (RSRQ) measured in dB indicates the quality of the received signal.
 - Signal interference and noise (SINR) ratio measured in dB is the ratio of the signal level to the noise level. Higher the value, the better is the signal quality.
 - Center frequency of the measurement channel.
 - Channel bandwidth (BW) sets the bandwidth of the component carrier.
 - EVM (RMS) shows the percentage value of all the error vectors between the reconstructed ideal signals and the received signals divided by the RMS value of the ideal signals.
 - Frequency error is the difference between the measured carrier frequency and the specified carrier frequency. This measurement is only as accurate as the frequency reference that is used and is typically only useful with a good external frequency reference or GNSS (GPS).
 - Antennas show the selected MIMO antenna for the specific carrier.
 5. **SETUP Menu:** The component carrier settings are configured in the SETUP menu. See [“SETUP Menu \(LTE Carrier Aggregation\)” on page 2-51](#).
 6. **Mobile Country Code (MCC):** Turn on SIB DECODE toggle under MEASURE menu to enable mobile country code (MCC).
-

Figure 2-44. LTE Carrier Aggregation Measurement (2 of 2)

SETUP Menu (LTE Carrier Aggregation)

The carrier aggregation SETUP menu is available in MEASURE > MEASUREMENT > Carrier Aggregation > SETUP.

SETUP	✕		
CARRIER	1	▼	CARRIER: Selects the component carrier to make active. The active carrier is highlighted in the summary display area and any setting changes will apply to the active carrier. Note that the active carrier is not necessarily the one that is currently being measured.
CARRIER COUNT	2	▼	CARRIER COUNT: Sets the number of carriers to be displayed on the screen and to be measured.
ANTENNA	Auto	▼	ANTENNA: Sets the MIMO antenna number (0 to 3, or AUTO) to use during a measurement. AUTO will use the antenna with the highest received signal power.
CYCLIC PREFIX	Auto	▼	CYCLIC PREFIX: Sets the cyclic prefix (or guard time interval) to Normal, Extended, or Auto. The cyclic prefix is a duplication of a fraction of the symbol end. This setting affects the OFDM symbol sensitivity to time dispersion.
DUPLEX TYPE	FDD	▼	DUPLEX TYPE: Selects either frequency division duplex (FDD) or time division duplex (TDD).
PRESET SETUP		↺	PRESET SETUP: Presets the SETUP menu to default settings.

Figure 2-45. LTE SETUP Menu (Carrier Aggregation)

Status Panel (LTE Carrier Aggregation)

The status panel illustrated in this section is unique to the current analyzer and to the particular measurement and view that is selected.

Figure 2-46 shows the LTE status panel that covers the LTE carrier aggregation measurement.

>

C# 1

CC# 2

<

CARRIER
1

CARRIER COUNT
2

MIMO ANTENNAS

AUTO

SWEEP
Continuously

SWEEP ONCE

REF LEVEL
-20 dBm

SCALE / DIV
10 dB

CHANNEL BW
1.4 MHz

CENTER FREQUENCY
10 GHz

ATTEN LEVEL
0 dB

PRE AMP

FREQ REFERENCE
GNSS (GPS) Hi Accy

CARRIER: Selects the component carrier to make active. The active carrier is highlighted in the summary display area.

CARRIER COUNT: Sets the number of carriers to be displayed on the screen and to be measured.

MIMO ANTENNAS: Toggles the current MIMO antenna setting between AUTO or to select one of the available antennas. When a single antenna is selected, a blue underscore will appear below the antenna icon. The antenna icon is highlighted green when receiving a signal.

SWEEP: Toggles the current sweep setting between continuously or sweep once.

SWEEP ONCE: When sweep is set to single sweep, SWEEP ONCE updates the measurement display. Data continues to be captured in the background.

REF LEVEL: Sets the reference level of the top graticule line in the selected units. If the reference level offset is not zero, OFFSET REF LEVEL is displayed at this location. Refer to [Section 2-5 “Setting Amplitude” on page 2-6](#).

SCALE/DIV: Sets the graticule scale/division for log-based units. This setting does not apply to linear units.

CHANNEL BW: Sets the measurement channel bandwidth. The available bandwidth settings depend on the selected band and bandwidth option installed in the instrument.

CENTER FREQUENCY: Sets the center frequency of the measurement channel.

ATTEN LEVEL: When auto attenuation is off, sets input attenuation.

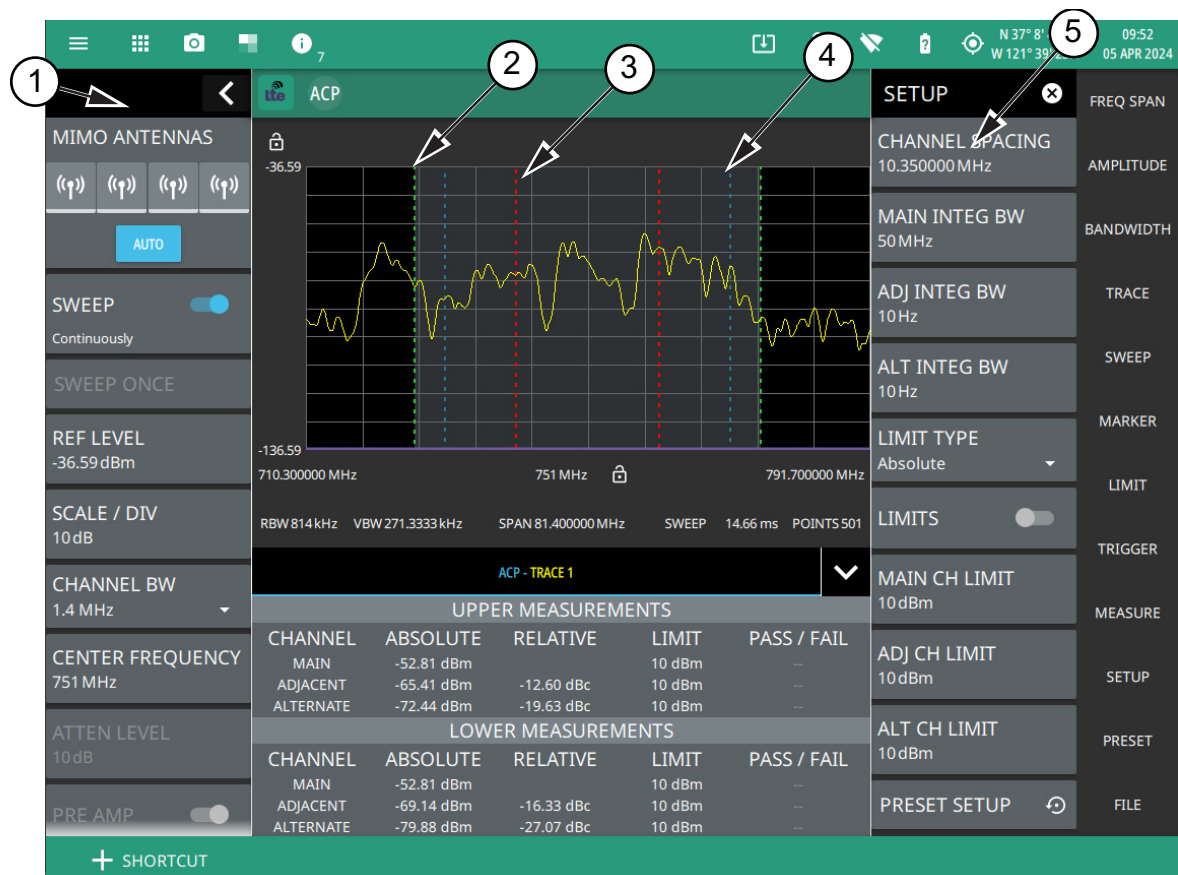
PRE AMP: Toggles the low-noise front-end preamplifier on or off. Refer to [Section 2-5 “Setting Amplitude” on page 2-6](#).

FREQ REFERENCE: Indicates the current frequency reference source of Internal, External, or GNSS (GPS) Hi Accuracy (requires GPS). The instrument automatically selects the frequency reference in the following order of priority: external, GNSS (GPS), then the internal time base.

Figure 2-46. Status Panel (LTE Carrier Aggregation Measurement)

2-16 LTE Adjacent Channel Power

To select Adjacent Channel Power (ACP) measurement go to main menu and press MEASURE > MEASUREMENT. The ACP measurements are set up using the [“SETUP Menu \(LTE ACP\)”](#) on page 2-54. Adjacent channel power is a measure of the power that leaks into adjacent transmit channels. The ACP measurement measures the power present in the transmit channel (refer to [“LTE Channel Power”](#) on page 2-43) along with the adjacent transmit channels that have been configured in the SETUP menu.



1. The status panel provides quick access to common spectrum analyzer settings. See [“STATUS PANEL \(LTE ACP\)”](#) on page 2-55.
2. Green integration bandwidth edge of lower alternate channels.
3. Red integration bandwidth edge of lower adjacent and alternate channels.
4. Blue integration bandwidth edge of lower main and adjacent channels.
5. The ACP measurements parameters are setup using setup menu. See [“SETUP Menu \(LTE ACP\)”](#) on page 2-54.

Figure 2-47. Adjacent Channel Power Ratio Measurement

Frequency and span settings for many signal standards can be set as follows:

1. Select MEASURE on the main menu.
2. Select ACP from the MEASUREMENT button.
3. Select SETUP and then do the following:
 - Channel spacing
 - Main integration bandwidth
 - adjacent integration bandwidth

- alternate integration bandwidth
- Limit testing
- Main channel limit
- adjacent channel limit
- alternate channel limit

Adjacent channel power is a constant measurement; after it is turned on, it remains on until a different measurement is selected or the sweep is paused. ACP is calculated at the end of each sweep.

SETUP Menu (LTE ACP)

The Adjacent Channel Power SETUP menu is available in MEASURE > MEASUREMENT > ACP > SETUP. Once the ACP measurement is selected, the SETUP menu can be quickly accessed by tapping on the summary display area below the spectrum window.

SETUP CHANNEL SPACING 10MHz MAIN INTEG BW 9MHz ADJ INTEG BW 9MHz ALT INTEG BW 9MHz LIMIT TYPE Absolute LIMITS MAIN CH LIMIT 10dBm ADJ CH LIMIT 10dBm ALT CH LIMIT 10dBm PRESET SETUP	CHANNEL SPACING: Sets the channel frequency spacing (center channel to center channel). MAIN INTEG BW: Sets the range of integration used in calculating the power within the channel. The integration bandwidth (IBW) is displayed as two vertical dashed lines for each channel. ADJ INTEG BW: Sets the range of integration bandwidth used in calculating the power in the adjacent channel. ALT INTEG BW: Sets the range of integration used in calculating the power in the alternate channel. LIMIT TYPE: Selects Absolute or Relative for the limit evaluation. LIMITS: Turns on or off the use of ACP limits. MAIN CH LIMIT: Sets the main channel limit. ADJ CH LIMIT: Sets the adjacent channel limit. ALT CH LIMIT: Sets the alternate channel limit. PRESET SETUP: Sets all ACP setup parameters to default. Turns off limits.
--	--

Figure 2-48. SETUP Menu (ACP)

STATUS PANEL (LTE ACP)

Below is the status panel with the corresponding minimized status panel icons for adjacent channel power measurement.

	MIMO ANTENNAS: Toggles the current MIMO antenna setting between AUTO or to select one of the available antennas. When a single antenna is selected, a blue underscore will appear below the antenna icon. The antenna icon is highlighted green when receiving a signal. SWEEP: Toggles the current sweep setting between continuously or sweep once. SWEEP ONCE: When sweep is set to single sweep, SWEEP ONCE updates the measurement display. Data continues to be captured in the background. REF LEVEL: Sets the reference level of the top graticule line in the selected units. If the reference level offset is not zero, OFFSET REF LEVEL is displayed at this location. Refer to Section 2-5 “Setting Amplitude” on page 2-6. SCALE/DIV: Sets the graticule scale/division for log-based units. This setting does not apply to linear units. CHANNEL BW: Sets the measurement channel bandwidth. The available bandwidth settings depend on the selected band and bandwidth option installed in the instrument. CENTER FREQUENCY: Sets the center frequency of the measurement channel. ATTEN LEVEL: When auto attenuation is off, sets input attenuation. PRE AMP: Toggles the low-noise front-end preamplifier on or off. Refer to Section 2-5 “Setting Amplitude” on page 2-6. TRACES: Displays the current status of up to six traces in a quick-view summary. The summary information includes the trace number, type, mode, and detector type. The active trace will show a highlighted background with the mode and detector type restated under the table. Pressing a trace in the summary panel activates the pressed trace and opens the TRACE menu, which allows you to select and set up an individual trace as desired. Refer to Section 2-7 “Setting Trace Parameters” on page 2-10. FREQ REFERENCE: Indicates the current frequency reference source of Internal, External, or GNSS (GPS) Hi Accuracy (requires GPS). The instrument automatically selects the frequency reference in the following order of priority: external, GNSS (GPS), then the internal time base.
--	--

Figure 2-49. Status Panel with Minimized Status Panel Icons (Adjacent Channel Power)

2-17 LTE Spectrum Emission Mask

To select spectral emission mask (SEM) measurement go to main menu and press MEASURE > MEASUREMENT > SEM. The SEM measurements are set up using the “[SETUP Menu \(LTE SEM\)](#)” on page 2-57. The spectrum emission mask (SEM) measurement is a relative measurement method to identify the power level of out-of-band spurious emissions outside of the in-channel bandwidth signal. The SEM measures the power ratio between in-band and adjacent channels. The SEM measurement then identifies the emissions that interfere with other channels. Then, the spurious signal levels of pairs of offset frequencies are identified and related to the carrier power.

The spectral emission mask measurement supports the testing for “Operating Band Unwanted Emissions” described in the 3GPP base station conformance testing document. There is support for LTE masks which are automatically built based on the current carrier frequency/channel and BW values. Masks with the (KR) designation in the title are built according to Korean regulator standards for FR1 signals. The instrument indicates if the signal is within the specified limits by displaying PASS or FAIL. The emission mask information is also displayed in a table format with different frequency ranges and whether the signal PASSED/FAILED in that region. Selecting the SEM measurement does the following:

- Disables all other measurements
- Adds a predefined LTE emission mask
- Sets the span to the mask width
- Sets the detection method to RMS

A spectrum emission mask measurement showing the LTE P<38 dBm mask setting is illustrated in [Figure 2-50](#).

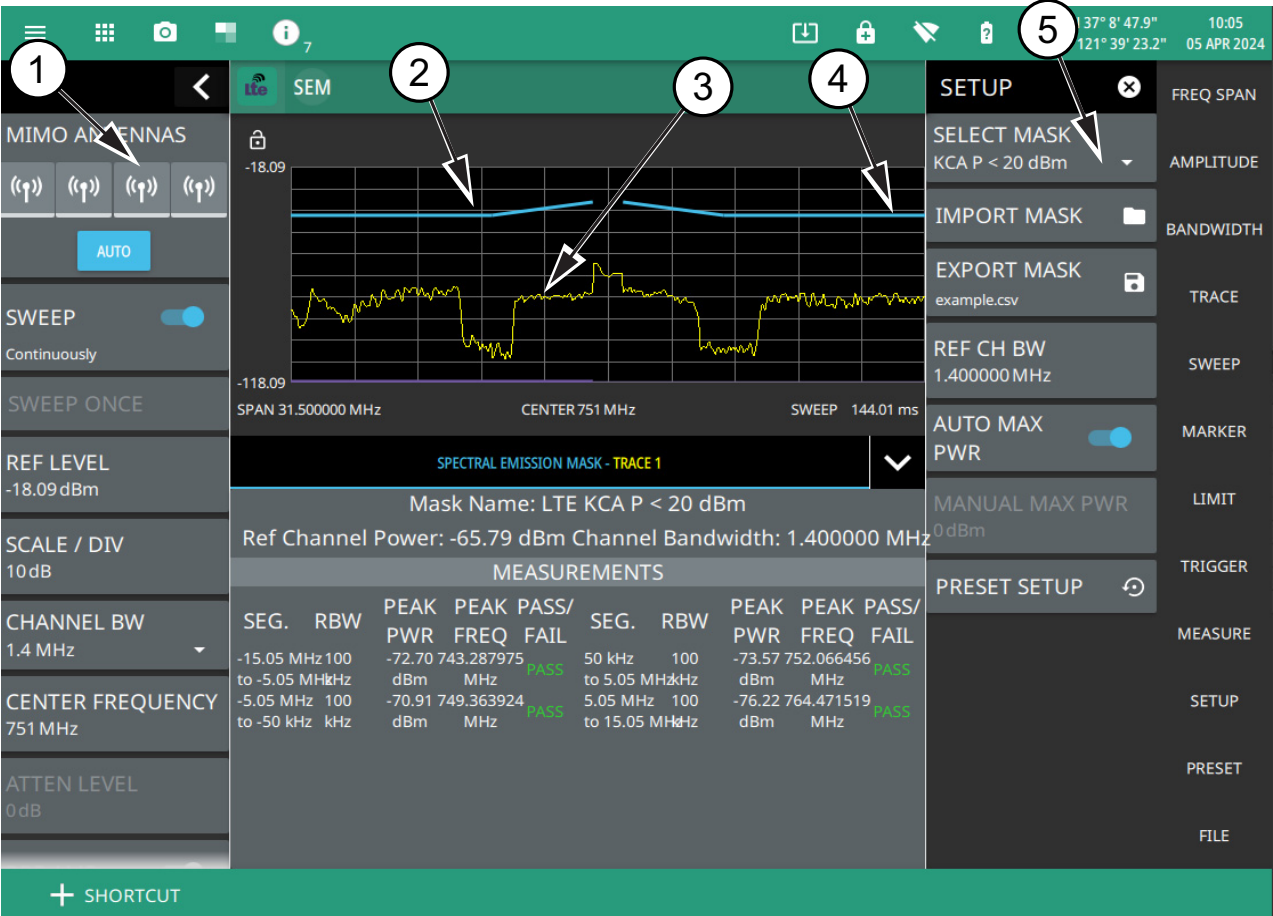


Figure 2-50. SEM Measurement

- 1. The status panel provides quick access to common spectrum analyzer settings. See [“STATUS PANEL \(LTE SEM\)” on page 2-59.](#)
- 2. SEM Mask
- 3. Spectrum Emission
- 4. SEM Mask
- 5. All SEM measurement parameters are set using the setup menu. See [“SETUP Menu \(LTE SEM\)” on page 2-57.](#)

Figure 2-50. SEM Measurement

Spectrum Emission Mask Measurement Basic Setup

- 1. Select MEASURE > MEASUREMENT > SEM from the right side menu.
- 2. Select SETUP and select upper or lower mask (LTE P>38 dBm or LTE P<38 dBm).
- 3. Enter the reference channel bandwidth.
- 4. Toggle AUTO MAX PWR or set MANUAL MAX POWER.
- 5. The SEM measurement results are displayed in a table with pass/fail results.

SETUP Menu (LTE SEM)

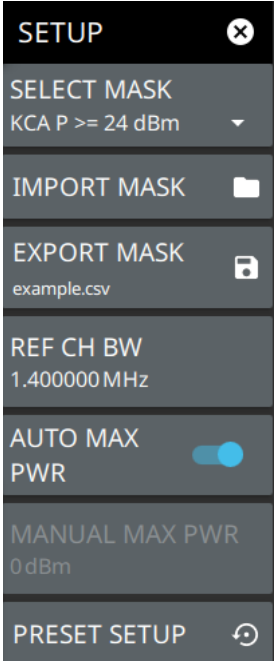
	SELECT MASK: Selects the desired upper or lower emission mask. Choose the desired mask from the list. IMPORT MASK: Used to import a custom user mask. EXPORT MASK: Exports an example user mask as a comma separated value file (see “Example Custom Signal Emission Mask” on page 2-57) or exports the currently selected custom mask. REF CH BW: Sets the reference channel bandwidth for the measurement. AUTO MAX PWR: Toggles automatic max power. Some segments in the mask are dependent on the main channel power. Enabling this automatically calculates the reference channel power by measuring the channel power of the center channel bandwidth. When disabled, the reference power must be entered manually below. MANUAL MAX PWR: Used to manually enter the reference channel power for masks that have limits dependent on main channel power. PRESET SETUP: Presets all values on the SETUP menu to default values.
--	---

Figure 2-51. SETUP Menu (SEM)

Example Custom Signal Emission Mask

To create a custom SEM, use the following steps:

- 1. Export the existing mask as a csv file by pressing the EXPORT MASK button in the SEM SETUP menu.
- 2. From the FILES menu, move the exported file to a USB device and then to a computer for editing.

3. If this is the first time exporting the file, the following data should be in the file:

```
# Example Custom Signal Emission Mask  
# Start Frequency, Stop Frequency, RBW, VBW, Is Start Amplitude Relative, Is  
# Stop Amplitude Relative, Start Amplitude, Stop Amplitude  
-3.5e6, -2.1e6, 100e6, 100e6, 0, 0, -9.5, -9.5  
-2.1e6, -0.7e6, 100e6, 100e6, 0, 0, -9.5, 0.5  
0.7e6, 2.1e6, 100e6, 100e6, 0, 0, 0.5, -9.5  
2.1e6, 3.5e6, 100e6, 100e6, 0, 0, -9.5, -9.5
```

4. Change each of the values as desired. Note that the values must be entered in the listed order of the file header.
5. Save the file to a USB device and insert it into the instrument.
6. Select the IMPORT MASK button in the SEM SETUP menu and select the new file from the USB drive. The file name of the imported mask file will be displayed on the EXPORT MASK button.
7. Select the SELECT MASK button and select Custom.

STATUS PANEL (LTE SEM)

Below is the status panel with the corresponding minimized status panel icons that is unique only to spectral emission mask measurement.

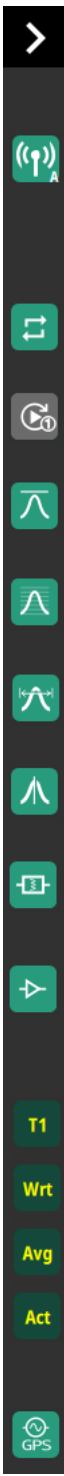
 MIMO ANTENNAS (1) (1) (1) (1) AUTO SWEEP Continuously SWEEP ONCE REF LEVEL -20 dBm SCALE / DIV 10 dB CHANNEL BW 1.4 MHz CENTER FREQUENCY 10 GHz ATTEN LEVEL 0 dB PRE AMP TRACES <table border="1"> <thead> <tr> <th>T1</th> <th>Wrt</th> <th>Avg</th> <th>Act</th> </tr> </thead> <tbody> <tr> <td>T2</td> <td>Wrt</td> <td>Pk</td> <td>Blk</td> </tr> <tr> <td>T3</td> <td>Wrt</td> <td>Pk</td> <td>Blk</td> </tr> <tr> <td>T4</td> <td>Wrt</td> <td>Pk</td> <td>Blk</td> </tr> <tr> <td>T5</td> <td>Wrt</td> <td>Pk</td> <td>Blk</td> </tr> <tr> <td>T6</td> <td>Wrt</td> <td>Pk</td> <td>Blk</td> </tr> <tr> <td colspan="4">T1 Clear / Write</td> </tr> </tbody> </table> FREQ REFERENCE GNSS (GPS) Hi Accy	T1	Wrt	Avg	Act	T2	Wrt	Pk	Blk	T3	Wrt	Pk	Blk	T4	Wrt	Pk	Blk	T5	Wrt	Pk	Blk	T6	Wrt	Pk	Blk	T1 Clear / Write				MIMO ANTENNAS: Toggles the current MIMO antenna setting between AUTO or to select one of the available antennas. When a single antenna is selected, a blue underscore will appear below the antenna icon. The antenna icon is highlighted green when receiving a signal. SWEEP: Toggles the current sweep setting between continuously or sweep once. SWEEP ONCE: When sweep is set to single sweep, SWEEP ONCE updates the measurement display. Data continues to be captured in the background. REF LEVEL: Sets the reference level of the top graticule line in the selected units. If the reference level offset is not zero, OFFSET REF LEVEL is displayed at this location. Refer to Section 2-5 “Setting Amplitude” on page 2-6. SCALE/DIV: Sets the graticule scale/division for log-based units. This setting does not apply to linear units. CHANNEL BW: Sets the measurement channel bandwidth. The available bandwidth settings depend on the selected band and bandwidth option installed in the instrument. CENTER FREQUENCY: Sets the center frequency of the measurement channel. ATTEN LEVEL: When auto attenuation is off, sets input attenuation. PRE AMP: Toggles the low-noise front-end preamplifier on or off. Refer to Section 2-5 “Setting Amplitude” on page 2-6. TRACES: Displays the current status of up to six traces in a quick-view summary. The summary information includes the trace number, type, mode, and detector type. The active trace will show a highlighted background with the mode and detector type restated under the table. Pressing a trace in the summary panel activates the pressed trace and opens the TRACE menu, which allows you to select and set up an individual trace as desired. Refer to Section 2-7 “Setting Trace Parameters” on page 2-10. FREQ REFERENCE: Indicates the current frequency reference source of Internal, External, or GNSS (GPS) Hi Accuracy (requires GPS). The instrument automatically selects the frequency reference in the following order of priority: external, GNSS (GPS), then the internal time base.
T1	Wrt	Avg	Act																										
T2	Wrt	Pk	Blk																										
T3	Wrt	Pk	Blk																										
T4	Wrt	Pk	Blk																										
T5	Wrt	Pk	Blk																										
T6	Wrt	Pk	Blk																										
T1 Clear / Write																													

Figure 2-52. Status Panel with Minimized Status Panel Icons (SEM)

2-18 LTE Control Channel

To select control channel measurement go to main menu and press MEASURE > MEASUREMENT > Control Channel. The control channel measurements are set up using the “[SETUP Menu \(LTE Control Channel\)](#)” on page 2-62. LTE control channel measurement shows the power levels of key physical layer control channels and can evaluate active antenna systems for dynamic physical layer attributes and received power levels. An example LTE control channel measurement is shown in [Figure 2-53](#).

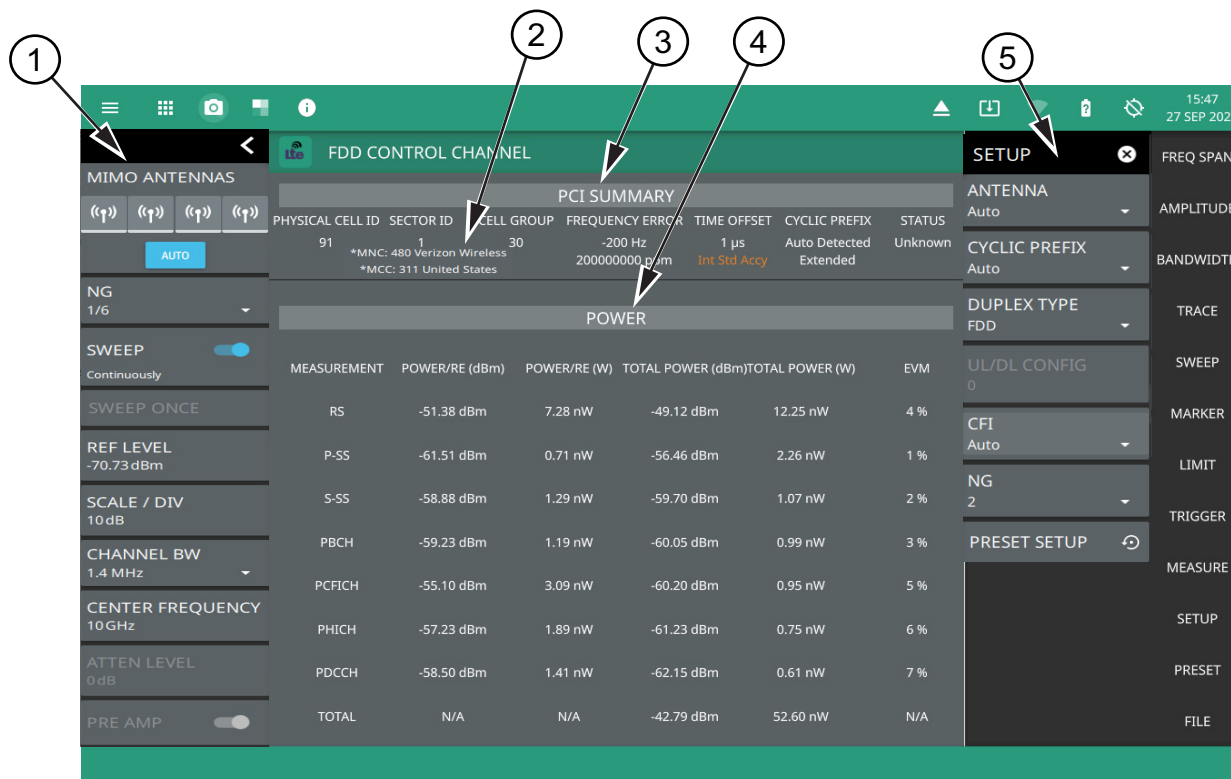


Figure 2-53. LTE Control Channel Measurement (1 of 2)

1. **LTE Analyzer Status Panel:** Each measurement features a unique status panel that displays settings and information relevant to the current measurement and view settings. This panel provides quick access to the MIMO antenna selection and status, NG parameter, sweep setting, and channel bandwidth configuration. See [“Status Panel \(LTE Control Channel\)” on page 2-63](#).
2. **MNC/MCC Info:** This area shows the Mobile Network Code (MNC) and Mobile Country Code (MCC) codes along with the carrier and the country name. Touch this info to open SIB MEASUREMENT dialog. Note that the asterisk symbol on this information indicates the presence of LAST SIB DECODE info as shown in [Figure 2-27](#).
Refer to [“SIB Measurement” on page 2-29](#) for detailed information.
3. **PCI SUMMARY:** This area shows the physical cell ID, including the sector ID, cell group number, frequency error, time offset, cyclic prefix, and sync status. Sync status can indicate if there is a PSS or SSS failure, a Full Sync, or an Unknown condition. Also noted is the instrument’s reference clock accuracy of Internal, External, or GNSS (GPS) high accuracy (requires GPS).
4. **POWER:** Shows power levels in dBm and watts of each physical layer control:
 - Reference Signal (RS) Power: The reference signal is used for downlink channel estimation.
 - Primary Synchronization Signal (P-SS) Power: The primary sync signal is used to obtain slot synchronization. It contains information needed for cell search.
 - Secondary Synchronization Signal (S-SS) Power: The secondary sync signal is used to obtain frame synchronization and cell identity. It contains information needed for cell search.
 - Physical Broadcast Channel (PBCH) Power: This physical channel carries system information for user equipment (UE) requiring access to the network.
 - Physical Control Format Indicator Channel (PCFICH) Power: This channel provides information to enable the UE to decode the PDCCH and PDSCH channels.
 - Physical Hybrid Automatic Repeat Request Indicator Channel (PHICH): Transmits the channel coded HARQ indicator codeword used for error correction.
 - Physical Downlink Control Channel (PDCCH): Physical channel that carries downlink control information (DCI) such as scheduling assignments and other control information.
 - TOTAL: Displays total POWER/RE (power per resource element) and POWER in dBm and watts. The total power for a signal is calculated as the product of the EPRE (Energy per Resource Element) for the signal and the number of REs in one unit (sub-frame, half-frame, or frame) depending on periodicity of the signal in the frame (signal present in every sub-frame, half-frame, or frame), averaged over the number of symbols in the same unit over which REs are counted. Total EVM is not calculated.
5. **SETUP Menu:** The control channel measurement settings are configured in the SETUP menu. See [“SETUP Menu \(LTE Control Channel\)” on page 2-62](#).

Figure 2-53. LTE Control Channel Measurement (2 of 2)

SETUP Menu (LTE Control Channel)

The control channel SETUP menu is available in MEASURE > MEASUREMENT > Control Channel > SETUP.

SETUP ANTENNA Auto CYCLIC PREFIX Auto DUPLEX TYPE FDD UL/DL CONFIG 0 CFI Auto NG 2 PRESET SETUP	ANTENNA: Sets the MIMO antenna number (0 to 3, or AUTO) to use during a measurement. AUTO will use the antenna with the highest received signal power. CYCLIC PREFIX: Sets the cyclic prefix (or guard time interval) to Normal, Extended, or Auto. The cyclic prefix is a duplication of a fraction of the symbol end. This setting affects the OFDM symbol sensitivity to time dispersion. DUPLEX TYPE: Selects either frequency division duplex (FDD) or time division duplex (TDD). UL/DL CONFIG: Available only in TDD duplex type. Sets the uplink/downlink (UL/DL) configuration, or Frame Format. This selection determines which sub-frames are uplink sub-frames and which are downlink sub-frames, and where the transitions between uplink and downlink sub-frames occur. CFI: Selects the control format indicator (CFI) which indicates how many OFDM symbols are used for carrying the control channel at each sub-frame. CFI1 uses the first symbol at the sub-frame for PDCCH allocation. CFI2 uses the first and the second symbol for PDCCH. CFI3 uses the first three symbols for PDCCH. NG: Selects the NG parameter of 1/6, 1/2, 1, or 2. NG is a parameter that determines the number of PHICH (Physical Hybrid ARQ Indicator Channel) groups in an LTE sub-frame (this number is constant for all sub-frames). PRESET SETUP: Presets the SETUP menu to default settings.
---	--

Figure 2-54. SETUP Menu (LTE Control Channel)

Status Panel (LTE Control Channel)

The status panel illustrated in this section is unique to the current analyzer and to the particular measurement and view that is selected. [Figure 2-55](#) shows the LTE status panel with minimized status panel icons that covers the LTE control channel measurement.

>

<

MIMO ANTENNAS

AUTO

NG

1/6

SWEEP

Continuously

SWEEP ONCE

REF LEVEL

-20dBm

SCALE / DIV

10 dB

CHANNEL BW

1.4 MHz

CENTER FREQUENCY

10 GHz

ATTEN LEVEL

0 dB

PRE AMP

FREQ REFERENCE

GNSS (GPS) Hi Accy

MIMO ANTENNAS

Toggles the current MIMO antenna setting between AUTO or to select one of the available antennas. When a single antenna is selected, a blue underscore will appear below the antenna icon. The antenna icon is highlighted green when receiving a signal.

NG

Selects the NG parameter of 1/6, 1/2, 1, or 2. NG is a parameter that determines the number of PHICH (Physical Hybrid ARQ Indicator Channel) groups in an LTE sub-frame (this number is constant for all sub-frames).

SWEEP

Toggles the current sweep setting between continuously or sweep once.

SWEEP ONCE

When sweep is set to single sweep, SWEEP ONCE updates the measurement display. Data continues to be captured in the background.

REF LEVEL

Sets the reference level of the top graticule line in the selected units. If the reference level offset is not zero, OFFSET REF LEVEL is displayed at this location. Refer to [Section 2-5 "Setting Amplitude" on page 2-6](#).

SCALE/DIV

Sets the graticule scale/division for log-based units. This setting does not apply to linear units.

CHANNEL BW

Sets the measurement channel bandwidth. The available bandwidth settings depend on the selected band and bandwidth option installed in the instrument.

CENTER FREQUENCY

Sets the center frequency of the measurement channel.

ATTEN LEVEL

When auto attenuation is off, sets input attenuation.

PRE AMP

Toggles the low-noise front-end preamplifier on or off. Refer to [Section 2-5 "Setting Amplitude" on page 2-6](#).

FREQ REFERENCE

Indicates the current frequency reference source of Internal, External, or GNSS (GPS) Hi Accuracy (requires GPS). The instrument automatically selects the frequency reference in the following order of priority: external, GNSS (GPS), then the internal time base.

Figure 2-55. Status Panel with Minimized Status Panel Icons (LTE Control Channel Measurement)

LTE MG

PN: 10580-00450 Rev. H

2-63

2-19 LTE Constellation

To select constellation measurement go to main menu and press MEASURE > MEASUREMENT > Constellation. The constellation measurements are set up using the “[SETUP Menu \(LTE Constellation\)](#)” on page 2-67. The LTE constellation measurement displays the demodulated symbol point location on an IQ coordinate plot, which illustrates the constellation of a particular modulation format. The instrument displays QPSK, 16-QAM, 64-QAM, and 256-QAM constellations with power and EVM tabular data. An example LTE constellation display and measurement is shown in [Figure 2-56](#).

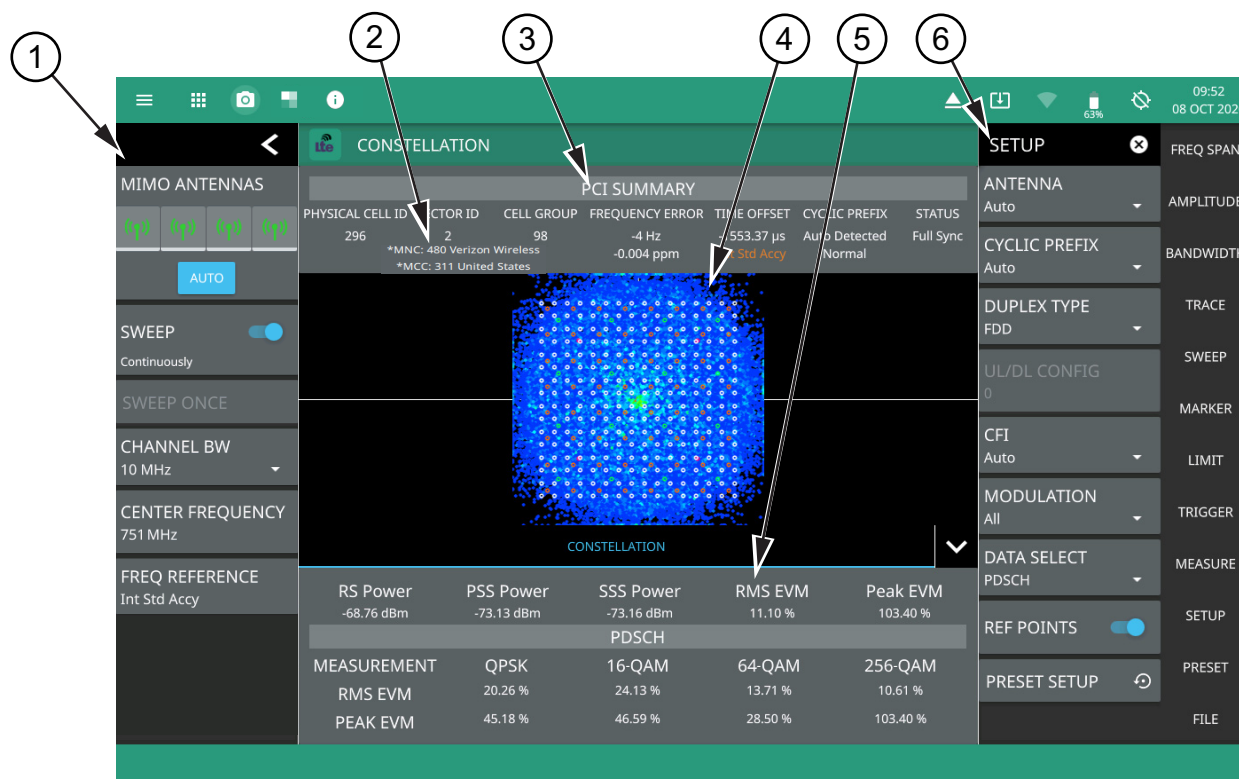
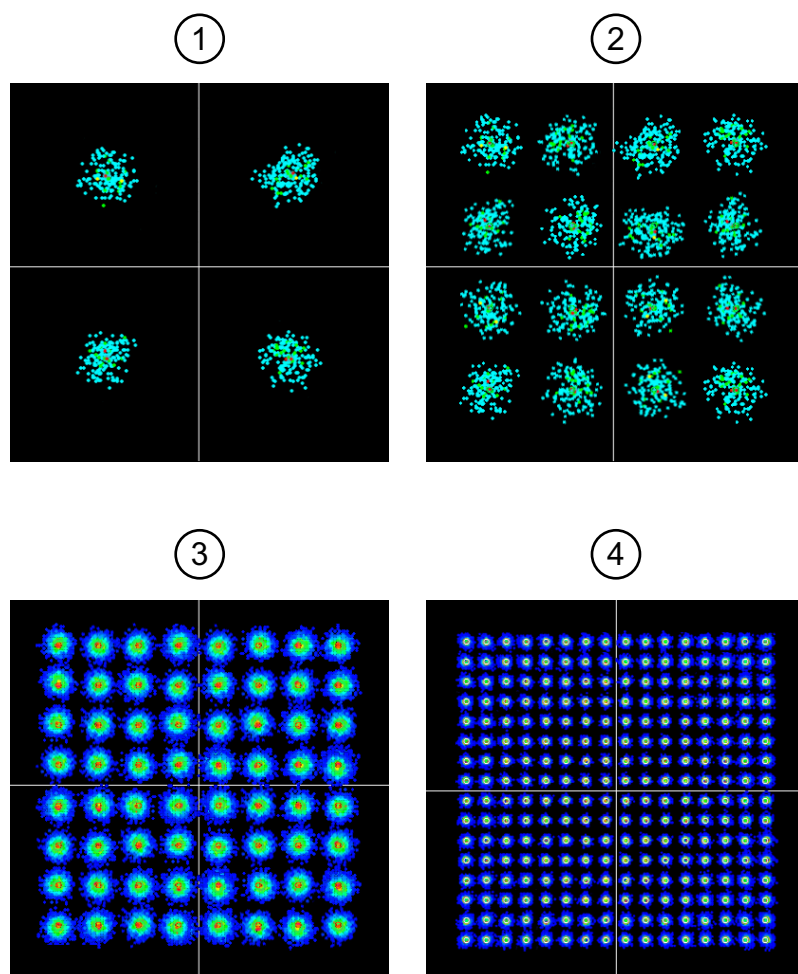


Figure 2-56. LTE Constellation Measurement (1 of 2)

1. **LTE Analyzer Status Panel:** Each measurement features a unique status panel that displays settings and information relevant to the current measurement and view settings. This panel provides quick access to the MIMO antenna selection and status, sweep setting, and channel bandwidth and frequency configuration. See [“Status Panel \(LTE Constellation\)” on page 2-68](#).
2. **MNC/MCC Info:** This area shows the Mobile Network Code (MNC) and Mobile Country Code (MCC) codes along with the carrier and the country name. Touch this info to open SIB MEASUREMENT dialog. Note that the asterisk symbol on this information indicates the presence of LAST SIB DECODE info as shown in [Figure 2-27](#).
Refer to [“SIB Measurement” on page 2-29](#) for detailed information.
3. **PCI SUMMARY:** This area shows the physical cell ID, including the sector ID, cell group number, frequency error, time offset, cyclic prefix, and sync status. Sync status can indicate if there is a PSS or SSS failure, a Full Sync, or an Unknown condition. Also noted is the instrument’s reference clock accuracy of Internal, External, or GNSS (GPS) high accuracy (requires GPS).
4. **Constellation:** This area displays the demodulated symbol point location on an IQ coordinate plot. Points are drawn in colors that are associated with the symbol point density. Warmer colors (red/orange) indicate a higher symbol density where cooler colors (cyan/blue) indicate lower symbol density. The ideal symbol reference point location overlay can be toggled on or off via the SETUP menu.
5. **POWER:** Shows power levels in dBm of each physical layer control:
 - Reference Signal (RS) Power: The reference signal is used for downlink channel estimation.
 - Primary Synchronization Signal (PSS) Power: The primary sync signal is used to obtain slot synchronization. It contains information needed for cell search.
 - Secondary Synchronization Signal (SSS) Power: The secondary sync signal is used to obtain frame synchronization and cell identity. It contains information needed for cell search.
 - Error Vector Magnitude (EVM): RMS and PEAK EVM are shown for each demodulated format (QPSK, 16-QAM, 64-QAM, 256-QAM), including the total RMS EVM and PEAK EVM for the measurement at the top of the table.
6. **SETUP Menu:** The constellation measurement settings are configured in the SETUP menu. See [“SETUP Menu \(LTE Constellation\)” on page 2-67](#).

Figure 2-56. LTE Constellation Measurement (2 of 2)

Figure 2-57, “LTE Constellation Measurement Examples” illustrates example LTE constellation diagrams. The examples are presented with the reference point overlay enabled for the specific modulation type. A tighter grouping of points generally means a better quality signal with fewer symbol errors. Also, the point color indicates the relative symbol density at that location. Red, orange and yellow points represent a higher symbol count and green, cyan, and blue represent a lower symbol count.



1. Over-the-air QPSK measurement.
2. Over-the-air 16-QAM measurement.
3. Conducted 64-QAM measurement.
4. Conducted 256-QAM measurement.

Figure 2-57. LTE Constellation Measurement Examples

Note

The reference point overlay is displayed individually when the modulation format is selected (QPSK, 16-QAM, 64-QAM, or 256-QAM). When the modulation format is set to All, then all modulation reference points are shown. Each modulation format reference point is color coded. These colors do not match the display point colors.

SETUP Menu (LTE Constellation)

The constellation SETUP menu is available in MEASURE > MEASUREMENT > Constellation > SETUP.

SETUP 	ANTENNA: Sets the MIMO antenna number (0 to 3, or AUTO) to use during a measurement. AUTO will use the antenna with the highest received signal power.
ANTENNA Auto 	CYCLIC PREFIX: Sets the cyclic prefix (or guard time interval) to Normal, Extended, or Auto. The cyclic prefix is a duplication of a fraction of the symbol end. This setting affects the OFDM symbol sensitivity to time dispersion.
CYCLIC PREFIX Auto 	DUPLEX TYPE: Selects either frequency division duplex (FDD) or time division duplex (TDD).
DUPLEX TYPE FDD 	UL/DL CONFIG: Available only in TDD duplex type. Sets the uplink/downlink (UL/DL) configuration, or Frame Format. This selection determines which sub-frames are uplink sub-frames and which are downlink sub-frames, and where the transitions between uplink and downlink sub-frames occur.
UL/DL CONFIG 0	CFI: Selects the control format indicator (CFI) which indicates how many OFDM symbols are used for carrying the control channel at each sub-frame. CFI1 uses the first symbol at the sub-frame for PDCCH allocation. CFI2 uses the first and the second symbol for PDCCH. CFI3 uses the first three symbols for PDCCH.
CFI Auto 	MODULATION: Selects the modulation format (ALL, QPSK, 16-QAM, 64-QAM, 256-QAM). When the data format is set to PBCH, only QPSK is available.
MODULATION 256 QAM 	DATA SELECT: Selects the data format of Physical Downlink Shared Channel (PDSCH) or Physical Broadcast Channel (PBCH).
DATA SELECT PDSCH 	REF POINTS: Toggles the ideal reference point locations on or off. Note that each modulation format reference point is color coded.
REF POINTS 	PRESET SETUP: Presets the SETUP menu to default settings.
PRESET SETUP 	

Figure 2-58. SETUP Menu (LTE Constellation)

Status Panel (LTE Constellation)

The status panel illustrated in this section is unique to the current analyzer and to the particular measurement and view that is selected.

Figure 2-59 shows the LTE status panel with minimized status panel icons that covers the LTE constellation measurement.

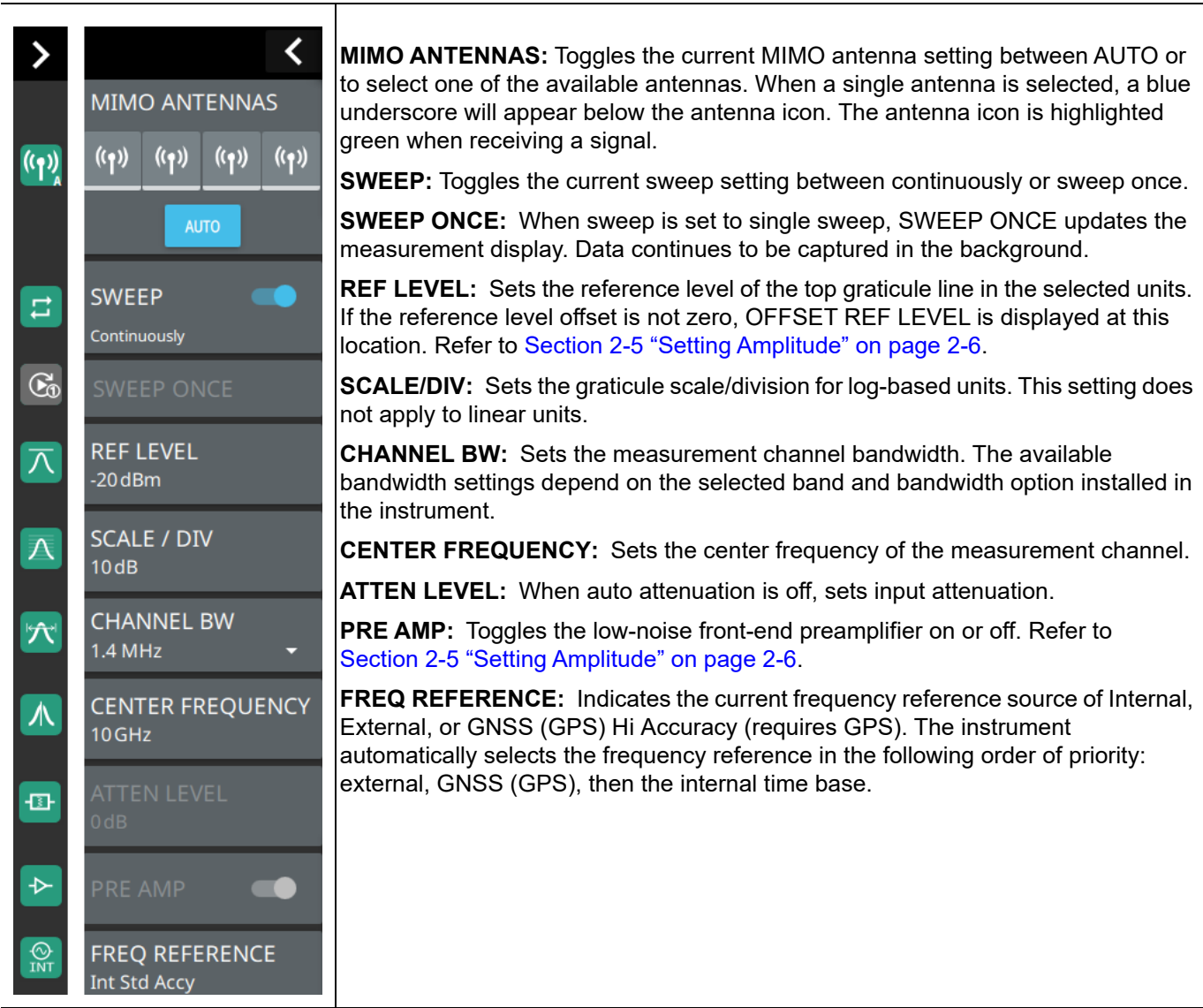


Figure 2-59. Status Panel with Minimized Status Panel Icons (LTE Constellation)

2-20 LTE UL/DL Interference

To select UL/DL interference measurement go to main menu and press MEASURE > MEASUREMENT > UL/DL Interference. The UL/DL Interference measurements are set up using the “[SETUP Menu \(LTE UL/DL Interference\)](#)” on page 2-71. LTE communication systems carry data in frames and sub-frames. The LTE UL/DL Interference measurement provides a power vs. time view of the frame, sub-frames, and slots in an LTE signal. Two types of LTE frame structures are used:

- Type 1 is used in LTE frequency division duplex (FDD) and has an overall length of 10 ms with 10 sub-frames and a total of 20 individual slots. FDD uses different uplink and downlink frequencies.
- Type 2 is used in LTE time division duplex (TDD) and has an overall length of 10 ms with two half frames (each 5 ms long) that are divided into 5 sub-frames (each 1 ms long). TDD uses the same uplink and downlink frequency that is separated in time.

A UL/DL Interference measurement using time domain duplex type is shown in [Figure 2-60](#). The example is showing the complete 10 ms frame power vs. time.

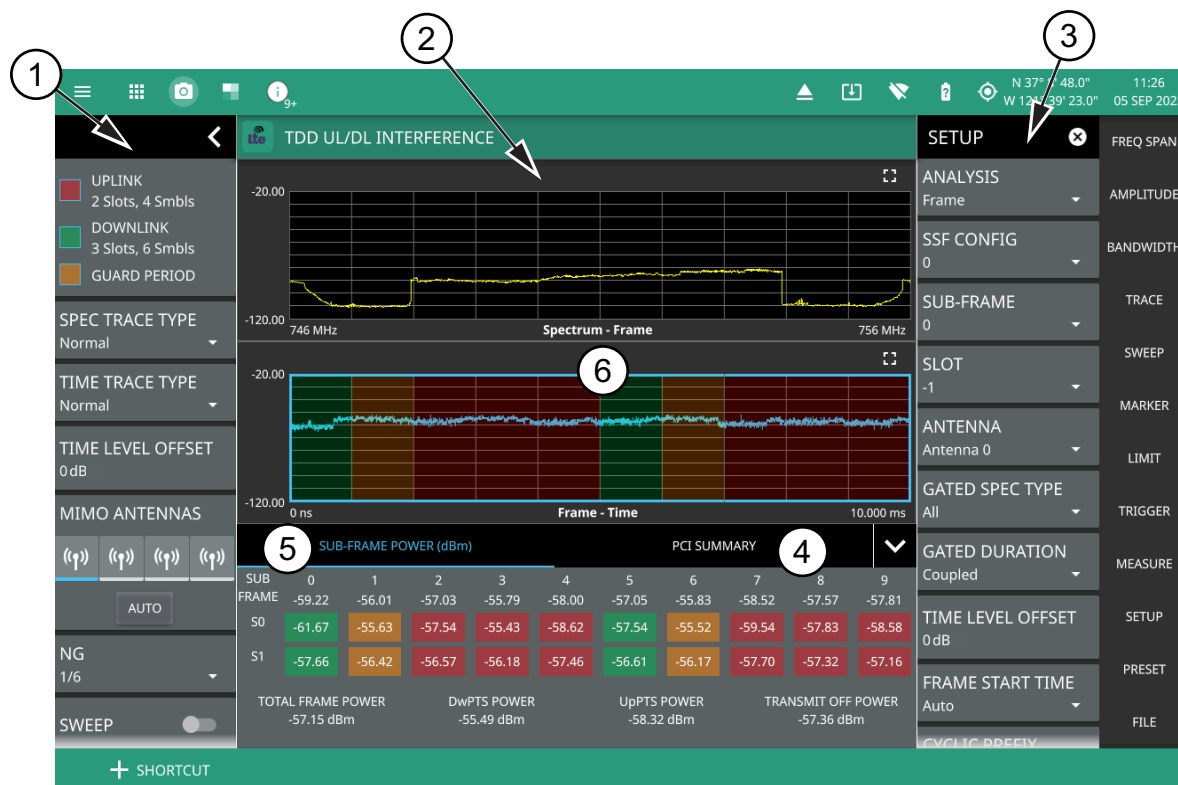


Figure 2-60. LTE UL/DL Interference TDD Measurement (1 of 2)

1. **LTE UL/DL Interference Status Panel:** Each measurement features a unique status panel that displays settings and information relevant to the current measurement and view settings. This panel provides quick access to the measurement frequency and band configuration. See [“Status Panel \(LTE UL/DL Interference\)” on page 2-73](#).
2. **Gated Spectrum of Uplink/Downlink time slots:** Shows trace data of the total frame or sub-frame power measurement in the frequency domain.
3. **SETUP Menu:** The UL/DL Interference measurement settings are configured in the SETUP menu. See [“SETUP Menu \(LTE UL/DL Interference\)” on page 2-71](#).
4. **PCI SUMMARY:** This area shows the physical cell ID, including the sector ID, cell group number, frequency error, time offset, cyclic prefix, and sync status. Sync status can indicate if there is a PSS or SSS failure, a Full Sync, or an Unknown condition. Also noted is the instrument’s reference clock accuracy of Internal, External, or GNSS (GPS) high accuracy (requires GPS).
5. **Sub-Frame Power Summary:** This area shows the frame power measurement summary data. Power measurements are expressed in dBm.
 - The power of each subframe, each of two slots in the subframe, and the total frame power is measured.
 - For TDD duplex type, the downlink pilot time slot (DwPTS), uplink pilot time slot (UpPTS), and transmit off power is measured. (see note below)
6. **UL/DL Interference vs. Time Display:** Shows trace data of the total frame or sub-frame power measurement in the time domain.

Figure 2-60. LTE UL/DL Interference TDD Measurement (2 of 2)

Note	DwPTS carries reference signals, primary synchronization signal, control information, and data.
	UpPTS is typically the sounding reference signal transmission from user equipment and is used for the random access channel to setup and synchronize the transmission.

SETUP Menu (LTE UL/DL Interference)

The UL/DL Interference SETUP menu is available in MEASURE > MEASUREMENT > UL/DL Interference > SETUP. Once the UL/DL Interference measurement is selected, the SETUP menu can be quickly accessed by tapping on the summary display area below the trace display.

SETUP 	ANALYSIS: Selects the analysis time of full frame, sub-frame, or individual slot.
ANALYSIS Frame 	SSF CONFIG: Selects the special sub-frame configuration as Auto or one of 10 manual configurations. The slots/sub-frame configuration choices are outlined below:
SSF CONFIG 0 	• 0: 3 downlink, 10 guard period, 1 uplink • 1: 9 downlink, 4 guard period, 1 uplink • 2: 0 downlink, 3 guard period, 1 uplink • 3: 11 downlink, 2 guard period, 1 uplink • 4: 12 downlink, 1 guard period, 1 uplink • 5: 3 downlink, 9 guard period, 2 uplink • 6: 9 downlink, 3 guard period, 2 uplink • 7: 10 downlink, 2 guard period, 2 uplink • 8: 11 downlink, 1 guard period, 2 uplink • 9: 6 downlink, 6 guard period, 2 uplink
SUB-FRAME 0 	
SLOT 0 	
ANTENNA Auto 	
GATED SPEC TYPE All 	SUB-FRAME: Enables limit checking at the specified frequency. The limit test results show as a green PASS or a red FAIL in the measurement table.
GATED DURATION Coupled 	SLOT: Selects either slot 0 or slot 1.
TIME LEVEL OFFSET 150dB	ANTENNA: Sets the MIMO antenna number (0 to 3, or AUTO) to use during a measurement. AUTO will use the antenna with the highest received signal power.
FRAME START TIME Custom 	GATED SPEC TYPE: Sets the gated spectrum type to uplink, downlink, guard period, all or none. Note that in FDD, only All and None options are available.
FRAME TIME OFFSET 0ms	GATED DURATION: Sets the gated duration to either Frame or Coupled. If frame is selected all the slots and symbols of the selected gated spec type in the entire frame is measured, whereas if Coupled is selected all the slots and symbols of the selected Gated Spec Type in the selected analysis subframe or slot period is measured.
CYCLIC PREFIX Auto 	TIME LEVEL OFFSET: Adjusts the time domain display reference level as an offset from the spectrum reference level. Sets the time level offset in the range from -150 dB to 150 dB.
DUPLEX TYPE FDD 	FRAME START TIME: Choose frame start time from the list of available options:
UL/DL CONFIG 0	• Auto: Performs cell search and frame synchronization for every measurement. • Sync Once: Performs cell search once at the start to obtain frame start time to be used for successive frames. • UTC: UTC is Coordinated Universal Time. 3GPP specifications refer to UTC for network timing measurements. UTC and GNSS(GPS) time are both derived from the same atomic clocks and for the purposes of 3GPP network measurements can be used interchangeable. Represents a TDD start frame start time which corresponds with the coordinated universal time. • Custom: Represents a Custom frame time offset value that ranges from -5 ms to 5 ms.
NG 1/6 	
PRESET SETUP 	

Figure 2-61. LTE SETUP Menu (UL/DL Interference)

	FRAME TIME OFFSET: Sets the frame time offset, if Custom frame start time is chosen. CYCLIC PREFIX: Sets the cyclic prefix (or guard time interval) to Normal, Extended, or Auto. The cyclic prefix is a duplication of a fraction of the symbol end. This setting affects the OFDM symbol sensitivity to time dispersion. DUPLEX TYPE: Selects either frequency division duplex (FDD) or time division duplex (TDD). UL/DL CONFIG: Available only in TDD duplex type. Sets the uplink/downlink (UL/DL) configuration, or Frame Format. This selection determines which sub-frames are uplink sub-frames and which are downlink sub-frames, and where the transitions between uplink and downlink sub-frames occur. NG: Selects the NG parameter of 1/6, 1/2, 1, or 2. NG is a parameter that determines the number of PHICH (Physical Hybrid ARQ Indicator Channel) groups in an LTE sub-frame (this number is constant for all sub-frames). PRESET SETUP: Presets the SETUP menu to default settings.
--	---

Figure 2-61. LTE SETUP Menu (UL/DL Interference)

Status Panel (LTE UL/DL Interference)

The status panel illustrated in this section is unique to the current analyzer and to the particular measurement and view that is selected.

Figure 2-62 shows the LTE status panel with minimized status panel icons that covers the LTE UL/DL Interference measurement.

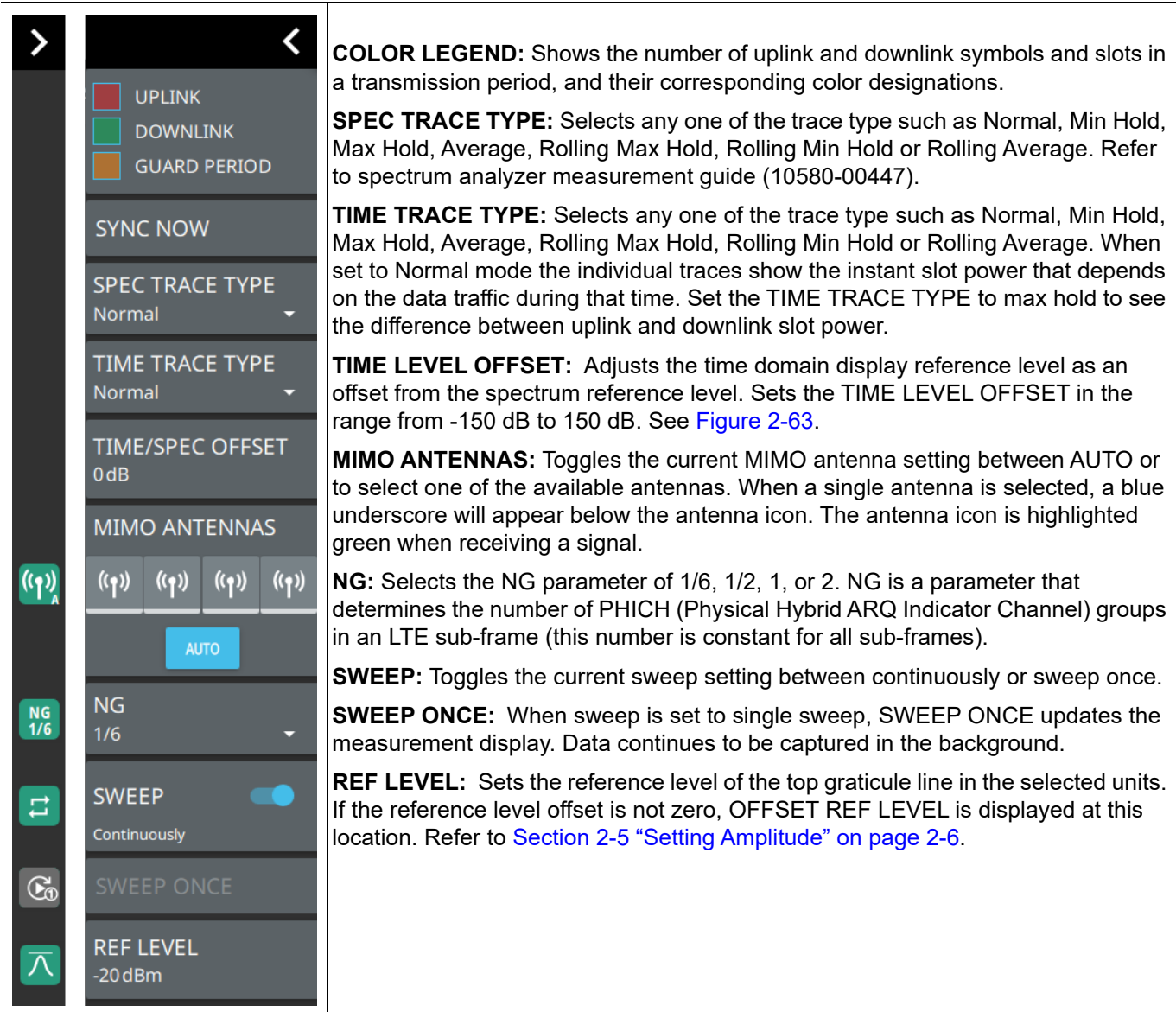
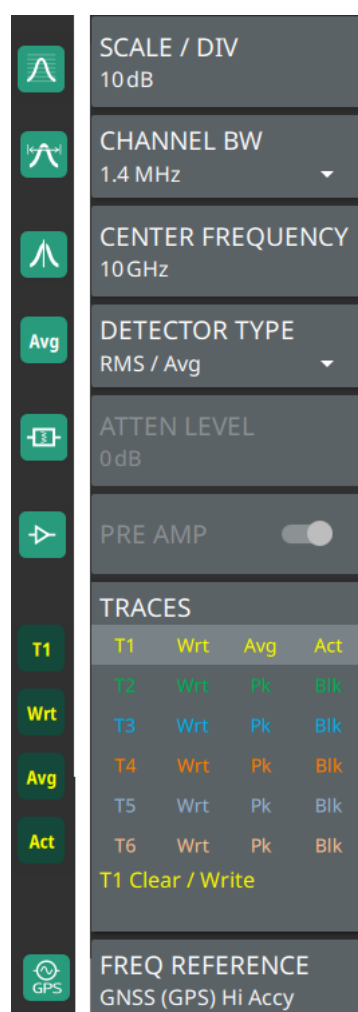


Figure 2-62. Status Panel with Minimized Status Panel Icons (LTE UL/DL Interference Measurement) (1 of 2)



SCALE/DIV: Sets the graticule scale/division for log-based units. This setting does not apply to linear units.

CHANNEL BW: Sets the measurement channel bandwidth. The available bandwidth settings depend on the selected band and bandwidth option installed in the instrument.

CENTER FREQUENCY: Sets the center frequency of the measurement channel.

DETECTOR TYPE: Selects one of three detector types. Several detection methods tailor the function of the instrument to meet specific measurement requirements. There are often more measurement points across the screen than display points. The various detection methods are different ways of dealing with how measurement points will be shown at each display point.

- **Peak:** This method causes the highest amplitude measurement point to be shown for each display point, assuring that a narrow peak is not missed.
- **RMS/Avg:** In the default case, when the VBW/AVERAGE type is set to Linear, this method detects the average power of measurement points that go into the display point. When VBW/AVERAGE type is set to Log, the traditional average of log (power), such as dBm, is displayed for the detector, as well as for VBW and trace average.
- **Negative:** This method causes the lowest amplitude measurement point to be shown for each display point. This method is also useful when looking at modulated signals, to see if some frequencies are not being used.
- **Sample:** Shows the transient amplitude of the center of sampled data for each display point. This method is useful when measuring low-level signals and noise measurements. Only available in zero span and RSSI measurements. When Sample detector is selected, all traces must use sample detection.
- **Normal:** Shows random noise and signal data depending on the nature of the sampled data. If the signal both rises and falls during the sampling interval (random noise), then odd-numbered sampling intervals display the maximum value and even-numbered sampling intervals display the minimum value. Odd-numbered sampling intervals will display the peak value of the previous even-numbered sampling interval when the peak there is higher. If the signal only rises or only falls during the sampling interval (signal), then only the peak value is displayed, and Normal detection is then equivalent to Peak detection.

ATTEN LEVEL: When auto attenuation is off, sets input attenuation.

PRE AMP: Toggles the low-noise front-end preamplifier on or off. Refer to [Section 2-5 "Setting Amplitude" on page 2-6](#).

TRACES: Displays the current status of up to six traces in a quick-view summary. The summary information includes the trace number, type, mode, and detector type. The active trace will show a highlighted background with the mode and detector type restated under the table. Pressing a trace in the summary panel activates the pressed trace and opens the TRACE menu, which allows you to select and set up an individual trace as desired. Refer to [Section 2-7 "Setting Trace Parameters" on page 2-10](#).

FREQ REFERENCE: Indicates the current frequency reference source of Internal, External, or GNSS (GPS) Hi Accuracy (requires GPS). The instrument automatically selects the frequency reference in the following order of priority: external, GNSS (GPS), then the internal time base.

Figure 2-62. Status Panel with Minimized Status Panel Icons (LTE UL/DL Interference Measurement) (2 of 2)



Figure 2-63. Time Trace Type - Max Hold

2-21 LTE Coverage Mapping (Option 431)

To select coverage mapping measurement go to main menu and press MEASURE > MEASUREMENT > Coverage mapping. The coverage mapping measurements are set up using the [“SETUP Menu \(LTE Coverage Mapping\)” on page 2-81](#). Coverage Mapping (Option 431) provides signal strength mapping on the instrument display and will plot color-coded signal values at GNSS (GPS) coordinates for the following measurements:

- **Channel Power:** The total power within the set channel bandwidth.
- **Spectral Density:** The measure of the signal power content versus frequency.
- **RSRP:** Reference Signal Received Power measured in dBm
- **RSRQ:** Reference Signal Received Quality measured in dB
- **SINR:** Signal-to-noise and interference ratio measured in dB

Note	The Coverage Mapping option for outdoor signal mapping requires an active GPS antenna to be connected to the LTE. Offline maps will need to be uploaded to the instrument if an Internet connection is not available. Indoor coverage mapping does not require GNSS (GPS).
-------------	--

Refer to the previous sections in this chapter for details and menu overviews of general spectrum analysis measurements including setting up frequency and bandwidth parameters, sweep settings, trigger types, attenuator options, and preamp settings. Once the basic measurement is set up, select the coverage mapping measurement via MEASURE > MEASUREMENT > Coverage Mapping. Once coverage mapping is selected, start the mapping measurement via MEASURE > START MEAS.

Refer to [“Outdoor Coverage Mapping” on page 2-77](#) and [Figure 2-64, “LTE Coverage Mapping \(Outdoor\)” on page 2-77](#) for an overview of outdoor coverage mapping and the user interface.

Refer to [“Indoor Coverage Mapping” on page 2-79](#) and [Figure 2-65, “LTE Coverage Mapping \(Indoor\)” on page 2-79](#) for an overview of indoor coverage mapping and the user interface.

The setup menu is common to both map types.

Outdoor Coverage Mapping

With a valid GNSS (GPS) signal, the instrument identifies the current location on the displayed map with a location pin. As the location changes during a measurement, colored-coded dots corresponding to the received signal strength/power are placed at distance or time intervals. Using GNSS (GPS) for latitude, longitude, and altitude, data is automatically saved for each location. The instrument logs data automatically based on either a set time or distance interval. If there is no map available when making the measurements, it is still possible to save all of the data to a KML file and then combine the data with a map using other third party tools that can work with KML data. You may also recall a map after taking the data without having to save and recall the measurement data. See [Figure 2-64, “LTE Coverage Mapping \(Outdoor\)”](#) on page 2-77 for an overview of the outdoor coverage mapping interface.

Note

When selecting outdoor coverage mapping and the GNSS (GPS) is off or is turned off, GNSS (GPS) will be enabled with a notification dialog. Aborting the GNSS (GPS) fix from the dialog allows the LTE to start a coverage mapping measurement.

When saving CSV and KML files map point measurement data, the saved data is cumulative of all data points on the map or measurements since the map points were last cleared.

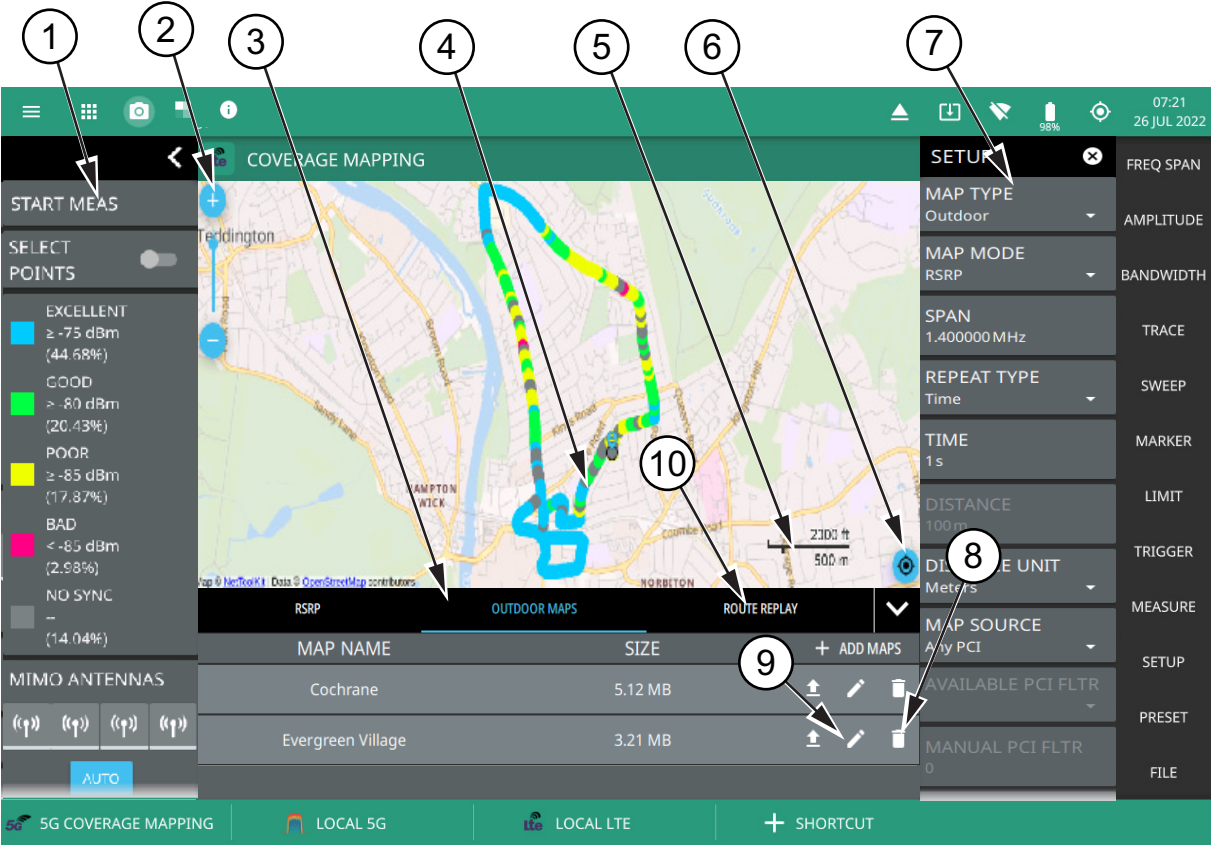


Figure 2-64. LTE Coverage Mapping (Outdoor) (1 of 2)

-
1. The coverage mapping status panel provides quick access to common settings and allows you to start and stop a coverage mapping measurement. A color-coded signal strength legend including the corresponding percentage values are also displayed. See [“Status Panel \(LTE Coverage Mapping\)” on page 2-83](#).
 2. The map zoom tool is used to increase (+) or decrease (-) zoom level. You can also drag the zoom level indicator up or down, or you can pinch to change zoom level.
 3. Tabular section displays the following three measurement sections:
 - Current map measurement mode section includes selected map mode and its value in addition to total number of points, average, minimum and maximum values.
 - Outdoor maps section lists the number of outdoor maps and an option to add more maps.
 - Route replay section consists of current map mode, along with its value, PCI and quality. The section also includes the navigation controls displayed as arrow heads to either move up/down single point or in increments of five.
 4. The map display area shows map data for the current area and color-coded dots corresponding to the signal colors that are set up for the recorded measurement data.
 5. Map scale shows length for both imperial (miles) and metric (kilometers) units.
 6. Re-centering tool to center map on current GNSS (GPS) position.
 7. The SETUP menu is where the coverage mapping measurement settings are configured. See [“SETUP Menu \(LTE Coverage Mapping\)” on page 2-81](#).
 8. The trash can icon is used to delete a saved map.
 9. The Pencil icon is used to edit or rename the saved name of the available map.
 10. The ROUTE REPLAY tab plays back the measurement route covered during coverage mapping.
-

Figure 2-64. LTE Coverage Mapping (Outdoor) (2 of 2)

Indoor Coverage Mapping

Indoor coverage mapping does not use a GNSS (GPS) signal to identify the current location, but rather relies on the user to touch the location pin to where they are located on a building floor plan, or map, that is shown on the instrument display. As the location pin is moved from point to point during a measurement, the map is annotated with dots that are colored-coded to the received signal strength/power. The instrument logs data automatically based on either a set time or distance interval. You may save and recall the measurement as a PNG file or save just the measurement data. See [Figure 2-65, “LTE Coverage Mapping \(Indoor\)”](#) on page 2-79 for an overview of the indoor coverage mapping interface.



1. The coverage mapping status panel provides quick access to common settings and allows you to start and stop a coverage mapping measurement. A color-coded signal-strength legend is shown at the bottom of the panel. See [“Status Panel \(LTE Coverage Mapping\)”](#) on page 2-83.
2. Tabular measurement data shows the current measurement, measurement value in addition to list of saved maps and ROUTE REPLAY option.
3. The map display area shows map data for the current area and color-coded dots that correspond to the signal colors that are set up for the recorded measurement data.
4. The SETUP menu is where the coverage mapping measurement settings are configured. See [“SETUP Menu \(LTE Coverage Mapping\)”](#) on page 2-81.

Figure 2-65. LTE Coverage Mapping (Indoor)

MEASURE Menu (Coverage Mapping)

The view MEASURE menu in coverage mapping measurement, go to main menu and press MEASURE. From measure menu you can access SETUP menu, START MEAS, CLEAR POINTS and SELECT POINTS options.

MEASURE MEASUREMENT Coverage Mapping VIEW Mapping SETUP START MEAS SELECT POINTS CLEAR POINTS	MEASUREMENT: Selects the current measurement. VIEW: Only the Mapping view is available. SETUP: Opens the “SETUP Menu (LTE Coverage Mapping)” on page 2-81. START MEAS: Initiates a coverage mapping measurement. Note that a GPS antenna must be connected and enabled before measurement data can be recorded. SELECT POINTS: Toggle this button to view the value and signal quality of the current measurement. CLEAR POINTS: Clears all measurement points from the map.
---	--

Figure 2-66. MEASURE Menu (Coverage Mapping)

SETUP Menu (LTE Coverage Mapping)

The coverage mapping measurement SETUP menu is available via MEASURE > MEASUREMENT > Coverage Mapping > SETUP. Once the coverage mapping measurement is selected, the SETUP menu can be quickly accessed by tapping on the summary display area below the spectrum window.

SETUP MAP TYPE Indoor MAP MODE Spectral Density INDOOR MAP None SPAN 100 MHz PSD UNITS Hz REPEAT TYPE Time TIME 1 s DISTANCE 100 m DISTANCE UNIT Meters MAP SOURCE Defined PCI AVAILABLE PCI FLTR MANUAL PCI FLTR 193 COLOR SETUP PRESET SETUP	MAP TYPE: Selects indoor or outdoor coverage mapping. MAP MODE: Selects the measurement type for the map: • Channel Power: The total power within the set channel bandwidth (SPAN). • Spectral Density: The measure of the signal power content versus frequency. • RSRP: Reference signal received power indicates the average power received from a single Reference signal or the level of the received signal from the base station. • RSRQ: Reference signal received quality indicates the quality of the received signal. • SINR: Signal interference and noise ratio is the ratio of the signal level to the noise level. Higher the value, the better is the signal quality. Note that field strength measurements can be selected from the Amplitude menu. When field strength is enabled, each measurement is adjusted per m² based on antenna factors. INDOOR MAP: When indoor map type is selected above, this button is available and is used to select the image/map for mapping from the instrument File system. This image is usually a building floor plan or campus layout drawing. SPAN: Sets the current frequency span. For channel power and spectral density measurements, the span is equal to the integration bandwidth. This setting is not available in the RSSI map mode. PSD UNITS: Selects the spectral density units as either Hz or MHz. This option is enabled only if Map Mode is set to Spectral Density and Field Strength option is enabled in Amplitude menu. REPEAT TYPE: Selects when a map data point is recorded. The repeat type can be set to a time interval or distance interval. For indoor coverage mapping, time interval will evenly distribute measurement points between two selected positions; distance interval will plot a single point for every position selected by the user. TIME: When the repeat type is Time, sets the time duration for recording map data points. DISTANCE: When the repeat type is Distance, sets the distance between recording map data points. When using an indoor map type, the distance mode only marks the data points to where the user drags the location pin. DISTANCE UNIT: Selects distance units of Meters or Feet. MAP SOURCE: Selects Any PCI or Defined PCI. If multiple PCIs are detected, then best value of PCI is mapped. But if a Defined PCI option is selected, then the user selected PCI value is mapped. AVAILABLE PCI FLTR: Selects a PCI filter from the list of base station PCIs detected after completing the coverage mapping measurement. MANUAL PCI FLTR: Allows to enter the PCI of a specific base station. COLOR SETUP: Opens the “COLOR SETUP Menu (Coverage Mapping)” on page 2-82. PRESET SETUP: Sets all coverage mapping setup parameters to default, including color setup.
---	--

Figure 2-67. SETUP Menu (Coverage Mapping)

COLOR SETUP Menu (Coverage Mapping)

The coverage mapping measurement COLOR SETUP menu is available in MEASURE > MEASUREMENT > Coverage Mapping > SETUP > COLOR SETUP. Once the coverage mapping measurement is selected, the SETUP menu can be quickly accessed by tapping on the summary display area below the spectrum window.

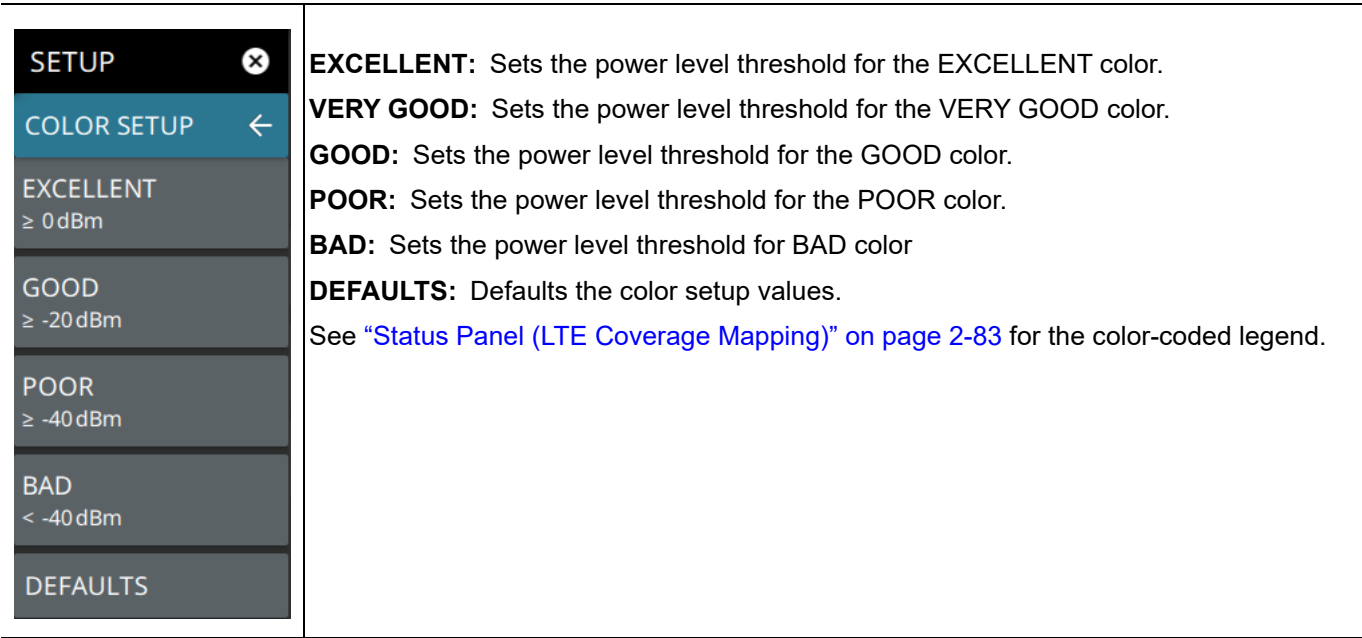


Figure 2-68. COLOR SETUP Menu (Coverage Mapping)

Status Panel (LTE Coverage Mapping)

The status panel illustrated in [Figure 2-69](#) is unique to the coverage mapping measurement.

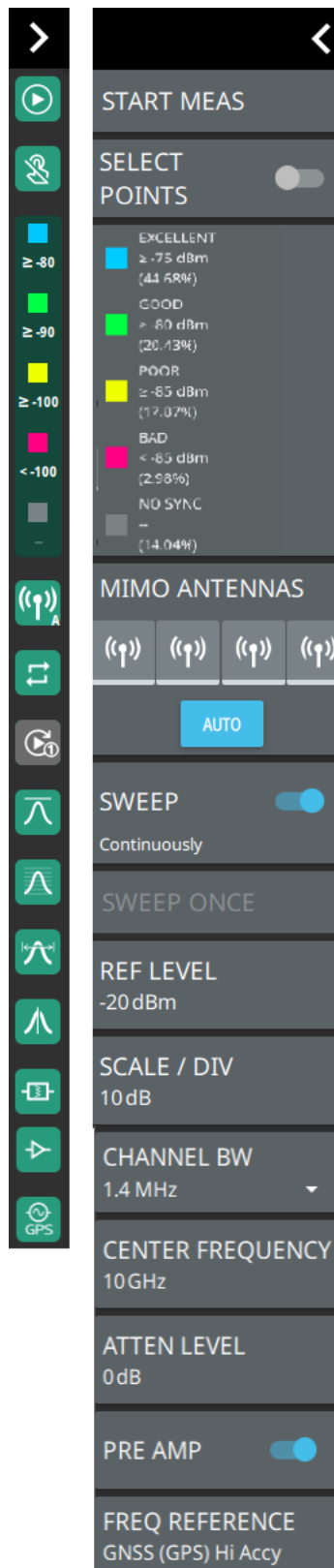


Figure 2-69. STATUS Panel with Minimized Status Panel Icons (Coverage Mapping)

2-22 Presetting the Analyzer

The PRESET menu sets certain settings to the default state. Preset only affects the current analyzer settings, such as those for the spectrum analyzer or for the LTE analyzer. Preset does not affect user files or system settings such as networking settings. For other reset options, such as a complete factory reset of the instrument, refer to “Reset Settings” the Instrument Overview chapter of the user guide. To recover from system software faults, refer to Appendix A, “Instrument Messages and Troubleshooting” chapter of the instrument user guide.

PRESET Menu

PRESET PRESET MARKERS PRESET SETUP PRESET MODE	PRESET MARKERS: Presets all values on the MARKER menu to default values. Not available in LTE Demod Summary measurement. PRESET SETUP: Presets all values on the SETUP menu to default values. PRESET MODE: Presets all of the current analyzer settings to default values.
--	---

Figure 2-70. PRESET Menu

2-23 Saving and Recalling Measurements

The instrument can save measurement setups, native trace and CSV trace data, limit line setups, and screenshots. You can recall setup, native trace, and limit line files. For other file operations such as copy, move, and directory management, refer to “File Management” section in Instrument Overview chapter of the instrument user guide.

Saving a Measurement

To save a measurement or setup, refer to [Figure 2-71](#):

1. Press FILE > SAVE AS...
2. If desired, press the save location to change the destination.
3. Enter the desired file name using the touchscreen keyboard.
4. Select the type of file to save from the selection list.
5. Press SAVE to save the file.

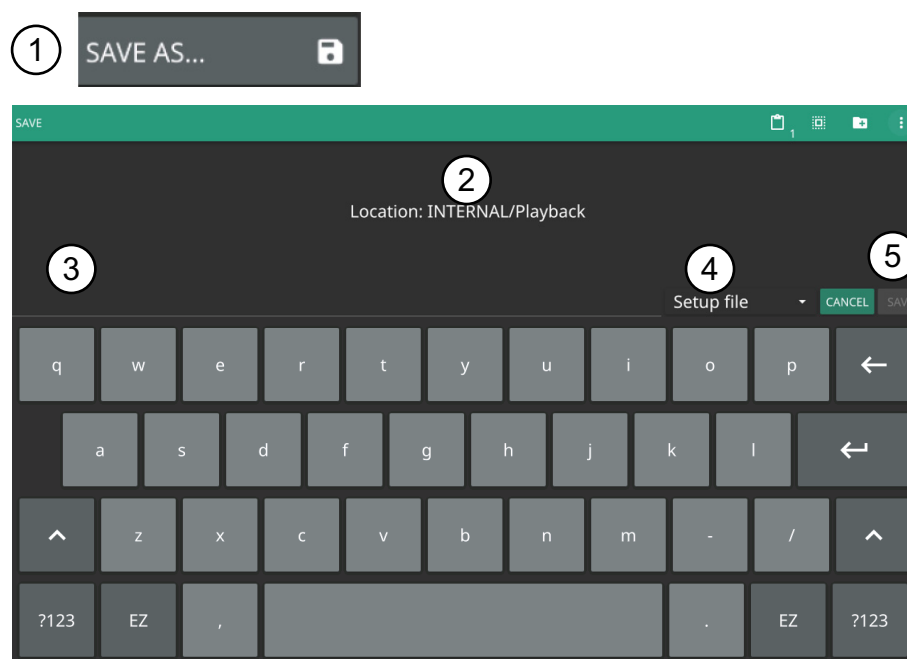


Figure 2-71. File Save Dialog

Once a file has been saved, the QUICK SAVE feature can be used to quickly save the same type of file with an incrementing number appended to the end of the original file name.

Recalling a Measurement

You can recall a saved setup, native trace measurement, and a limit line. When recalling a setup, the instrument setup and operating state will be restored as it was when the setup was saved. When recalling a trace measurement, the instrument setup and on-screen measurement data will be restored as it was when the trace data was saved.

To recall a measurement or setup, refer to [Figure 2-72](#):

1. Press FILE > RECALL...
2. Select the file location.
3. Use the file type filter to shorten the list if needed.
4. Select the desired file from the displayed list.
5. Press OPEN to recall the file.

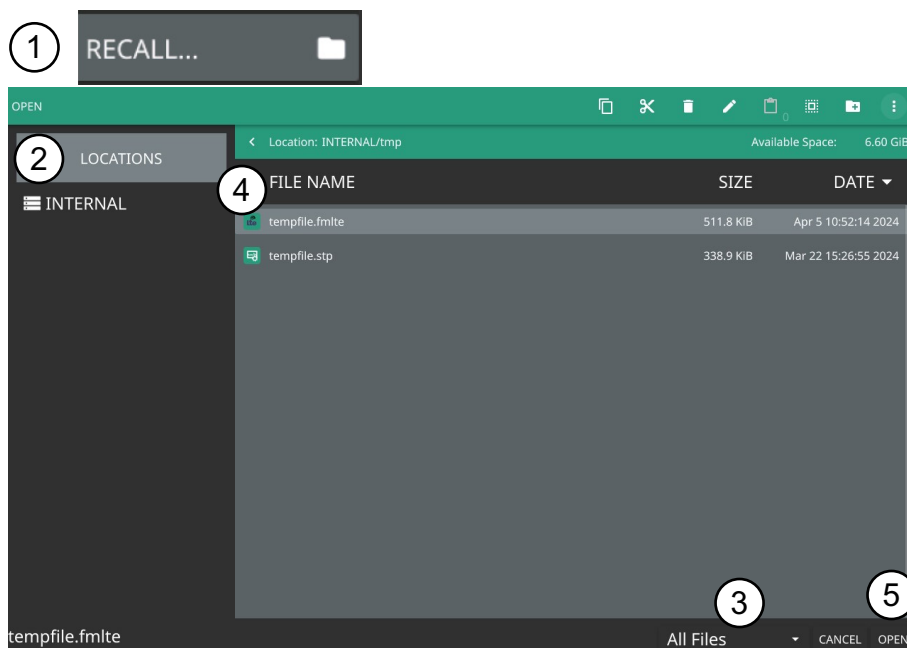


Figure 2-72. File Open Dialog

When a measurement is recalled, the trace or sweep state will be set to hold. To restore active measurements, disable SWEEP > HOLD and/or set TRACE > MODE > Active.

FILE Menu

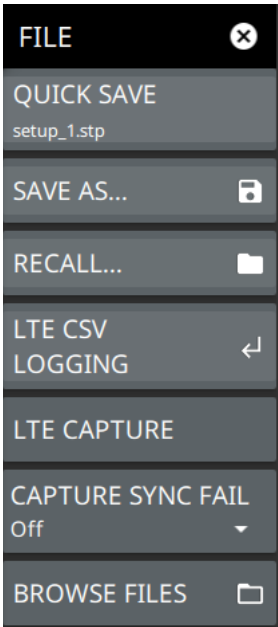
	QUICK SAVE: saves a setup file immediately with the name shown in the button. The number in the name is incremented automatically so that the new name is ready for the next setup file to be saved. SAVE AS: Opens the Save dialog to manually enter a file location, enter a file name, and to set the file type to be saved. Depending on the selected measurement, you can save the following: • Setup: Saves the current instrument setup (stp file type). • Trace: Saves the measurement point (trace) data and the current instrument setup (fmLTE and fmSPA file type). • Trace CSV: Saves the visible trace point data in comma separated value format (csv file type). This format is useful for further analysis using other software tools. • Screenshot: Saves a screenshot of the current measurement (png file type). • Trace + Screenshot: Saves both the current measurement and screenshot files (both fmLTE and png file types). • KML: Saves measurement data in Keyhole Markup Language format, including the instrument model number, installed options, sample data with GNSS (GPS) coordinates, if GNSS (GPS) Option 31 is installed. (Option 431, Coverage Mapping only (Outdoor Map)). Note that the saved data is cumulative of all data points on the map or measurements since the map points were last cleared. RECALL: Opens the Recall File dialog to retrieve a file from a desired location. LTE CSV LOGGING: Opens “LTE CSV LOGGING Menu” on page 2-87 LTE CAPTURE: Initiates a digitized LTE data capture at the selected bandwidth. LTE captures are saved to the internal storage space in the captures folder (bin file type). This feature is meant to help identify LTE signal characteristics during early development. CAPTURE SYNC FAIL: Automatically initiates a digitized LTE data capture when synchronization fails. The setting can be configured to capture just a single event or repeat events. LTE captures are saved to the internal storage space. BROWSE FILES: Refer to “File Management” section of Instrument Overview chapter of the user guide.
---	--

Figure 2-73. FILE Menu

LTE CSV LOGGING Menu

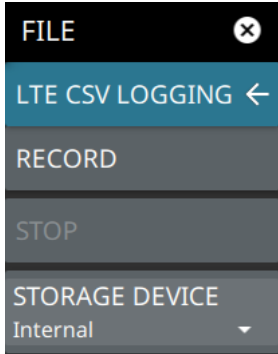
	RECORD: Records the LTE measurement data and saves it as a CSV file. STOP: Stops recording of the CSV logging of the LTE measurement data. STORAGE DEVICE: Selects the storage device to store the LTE CSV file.
---	--

Figure 2-74. LTE CSV Logging Menu

Appendix A — LTE MIB/SIB Decode

A-1 Introduction

This chapter provides detailed information of the LTE SIB MEASUREMENT header sections and the corresponding fields, sub fields and their description. Refer to “[SIB Measurement](#)” on page 2-29 for detailed information on SIB measurement.

Downlink Control Information (DCI)

The DCI header section consists of the following fields. See [Table A-1](#).

Table A-1. DCI Header Section

Field Name	Sub Fields	Range	Default Value	Description
rnti		[0,65535]	0	The RNTI value which is decoded from the CRC.
Location			0	This structure contains information regarding the search space location of the DCI.
	AggregationLevel	{1,2,4,8}	0	The aggregation level ("L") of the decoded DCI as defined in TS 36.213, Section 9.1.1
	nCce	[0,(N{CCE,k} -1)	0	The CCE corresponding to the PDCCH as defined in TS 36.213, Section 9.1.1
dciFormat		{"Format0", "Format1A", "Format1C"}	""	This field represents the DCI format as a string
mcsIdx		[0,31]	0	This field represents the modulation and coding scheme. It has a length of 5 bits if higher layer parameter altMCS-Table is not configured, 6 bits otherwise, as defined in subclause 7.1.7 of [3]
redundancyVersion		[0,4]	0	This field represents the redundancy version (RV) as defined in TS 36.212, Section 5.3.3.
newDataIndicator		{FALSE,TRUE}	FALSE	This field represents the new data indicator (NDI) as defined in TS 36.212, Section 5.3.3.
resourceIndicatorVal		Variable	0	This field represents the resource indicator value (RIV) as defined in TS 36.213, Section 7.1.6. The range of this value depends on the DCI Format.

Table A-1. DCI Header Section

Field Name	Sub Fields	Range	Default Value	Description
harqPid		Variable	0	This field represents the HARQ process number as defined in TS 36.212, Section 5.3.3. The length is 4 bits if higher layer parameter dl-TTI-Length is configured for the cell, otherwise 3 bits for Format1_A, not applicable for Format1_C.
nGap		Variable	0	This field represents the RB gap value as defined in TS 36.211, Table 6.2.3.2-1.

Master Information Block (MIB)

The MIB header section consists of the following fields with corresponding range, default value and description. See [Table A-2](#).

Table A-2. MIB Header Section

Field Name	Range	Default Value	Description
dlBandWidth	{6,15,25,50,75,100}	0	transmission bandwidth configuration, NRB in downlink, see TS 36.101 [42], table 5.6-1. n6 corresponds to 6 resource blocks, n15 to 15 resource blocks and so on.
phichDuration	{"normal", "extended"}	""	Specifies the PHICH configuration. If the UE is a BL UE or UE in CE, it shall ignore this field. This parameter informs about the number of symbols per subframe used by PHICH.
phichResource	{"oneSixth", "half", "one", "two"}	""	Specifies the PHICH configuration. If the UE is a BL UE or UE in CE, it shall ignore this field. This parameter represents the Allocation value ("Ng") which determines the number of PHICH groups per subframe.
systemFrameNum	[0,1023]	0	Defines the 10 bit system frame number (SFN). As indicated in TS 36.211 [21], 6.6.1, the 2 least significant bits of the SFN are acquired implicitly in the P-BCH decoding, i.e. timing of 40ms P-BCH TTI indicates 2 least significant bits (within 40ms P-BCH TTI, the first radio frame: 00, the second radio frame: 01, the third radio frame: 10, the last radioframe: 11). One value applies for all serving cells of a Cell Group (i.e. MCG or SCG). The associated functionality is common (i.e. not performed independently for each cell).

Table A-2. MIB Header Section

Field Name	Range	Default Value	Description
schedulingInfoSib1	[0,31]	0	Indicates the index to the tables that define SystemInformationBlockType1 scheduling information. The tables are specified in TS 36.213 [23], Table 7.1.6-1 and Table 7.1.7.2.7-1. Value 0 means that SystemInformationBlockType1 is not scheduled.
spare	[0,15]	0	The last 4 bits of the MIB which are defined as spare bits

MIB Data

The MIB data header section consists of the following fields. See [Table A-3](#).

Table A-3. MIB Data Header Section

Field Name	Range	Default Value	Description
N/A	N/A	“”	PBCH decoded data represented in hexadecimal format.

System Information Block (SIB)

The SIB header section consists of the following fields. The SIB data structure consists of a list of data elements that have the following fields which are part of the 'PLMN-IdentityInfoList' RRC structure. See [Table A-4](#).

Table A-4. SIB Header Section

Field Name	Sub Fields	Range	Default Value	Description
cellBarred		{FALSE, TRUE}	FALSE	Indicates whether the cell allows UEs to camp on this cell, as specified in TS 38.304 [20]. True indicates cell has been barred. Default value is false in case of MIB decode failure.
cellId		28 bit string	""	Unambiguous identity of a cell within a PLMN. CellIdentity:= BIT STRING (SIZE (28)).
csgIndication				If set to TRUE the UE is only allowed to access the cell if it is a CSG member cell, if selected during manual CSG selection or to obtain limited service, see TS 36.304 [4].
freqBandIndicator				A list of as defined in TS 36.101 [42], table 6.2.4-1, for the frequency band in freqBandIndicator.
intraFreqReselection		{FALSE, TRUE}	FALSE	Controls cell reselection to intra-frequency cells when the highest ranked cell is barred, or treated as barred by the UE, as specified in TS 38.304 [20]. Default value is false in case of MIB decode failure.
pMax			0	Value applicable for the intra-frequency neighbouring E-UTRA cells. If absent the UE applies the maximum power according to the UE capability.
plmnIdentityInfo			Absent if empty	This structure consists of the following information elements.
	plmnIdList	Variable		It is a list of PLMN identities. The first listed PLMN-Identity is the primary PLMN. NOTE 1.
	cellReservedForOperatorUse	{FALSE, TRUE} absent if empty	FALSE	Indicates whether the cell is reserved for operator use, as defined in TS 36.304 [4].

Table A-4. SIB Header Section

Field Name	Sub Fields	Range	Default Value	Description
Info Results				The Info results data structure consists of a list of data elements that have the following fields (represented by subfields):
	Carrier	Variable len string	Not displayed if absent	The carrier information represented as a string corresponding to the decoded MCC-MNC code
	Country	Variable len string	Not displayed if absent	The name of the country represented as a string corresponding to the decoded MCC code
	MCC	[0, 999]	Not displayed if absent	The 3 digit mobile county code (MCC) code decoded from SIB1 data. MCC::= SEQUENCE (SIZE (3)) OF MCC-MNC-Digit.
	MNC	[0, 999]	Not displayed if absent	The 3 digit Mobile Network Code (MNC) code decoded from SIB1 data. MNC::= SEQUENCE (SIZE (2..3)) OF MCC-MNC-Digit
cellReservedForOperatorUse		{FALSE, TRUE}	not displayed if absent	Indicates whether the cell is reserved for operator use (per PLMN), as defined in TS 38.304 [20].
cellId		36 bits	not displayed if absent	Unambiguous identity of a cell within a PLMN
trackingAreaCode (optional)		24 bits	Empty string, if absent	The IE TrackingAreaCode is used to identify a tracking area within the scope of a PLMN, see TS 24.301 [35]. TrackingAreaCode::= BIT STRING (SIZE (16))
qRxLevMin				Parameter "Qrxlevmin" in TS 36.304 [4], applicable for intra-frequency neighbour cells.

SIB Data

The SIB data header section consists of the following fields. See [Table A-5](#).

Table A-5. SIB data Header Section

Field Name	Range	Default Value	Description
N/A	N/A	""	SIB1 data represented in hexadecimal format.

Anritsu Hardware Status

The Anritsu Hardware Status header section consists of the following fields. [Table A-6](#).

Table A-6. Anritsu Hardware Status Header Section

Field Name	Description
hardwareErrors	Description of any hardware errors present during the measurement. For e.g. ADC Overrange, ALC UnlevelHigh, etc.
statusMessage	statusBchDecodeFailed: PBCH decoding failed statusInsufficientBwForCoreset: Insufficient Bandwidth available for CORESET0 decoding. Try measurement again by increasing the BW. statusCoreset0Unavailable: CORESET 0 is not configured in the MIB data. Obtained if kSSB value is greater than maximum possible value. statusDciDecodeFailed: Failed to demodulate CORESET 0 / decode DCI. statusSchDecodeFailed: Failed to demodulate PDSCH data / decode SCH. statusSib1DecodeDone: SIB1 decode done successfully.
statusNumber	Status number corresponding to the status message. If the status number is 40, then the SIB decode is considered to be successful.



10580-00450



H



Anritsu utilizes recycled paper and environmentally conscious inks and toner.

Anritsu Company
490 Jarvis Drive
Morgan Hill, CA 95037-2809
USA
<http://www.anritsu.com>