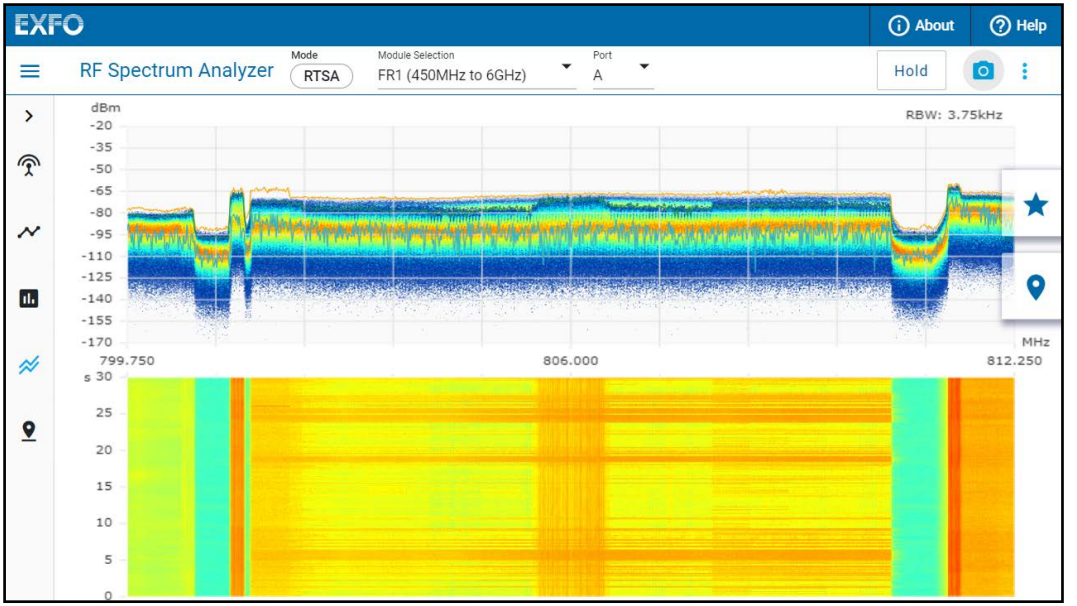
User Guide

RFSA

RF Spectrum Analyzer



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Units of Measurement

Units of measurement in this publication conform to SI standards and practices.

Patents

The exhaustive list of patents is available at EXFO.com/patent.

Document version: 12.0.0.1

Contents

1 Introducing the RF Spectrum Analyzer

The RF Spectrum Analyzer provides visibility into 4G LTE and 5G RF environments using an antenna connected to the FTBx-88260 module on the FTB-1v2 Pro.

Operation Modes

The following operation modes are available depending on the installed software options:

Real-Time Spectrum Analyzer (RTSA)

The **Real-Time Spectrum Analyzer (RTSA)** mode provides continuous acquisition of RF signals with 100 MHz of analysis bandwidth. Quick characterization of wireless signals and detection of intermittent interference is possible with the combination of the RTSA persistence and spectrogram view. No software option is required.

Spectrum Analyzer

The **Spectrum Analyzer** mode provides the visualization of uplink or downlink spectrum for a specified range of timeslots using the TDD gated sweep. Time Division Duplexing (TDD) is a transmission technique whereby the uplink and downlink signals are transmitted on the same frequency using synchronized timed intervals. Both spectrum analysis and interference analysis for TDD require the use of a measurement technique called gated sweep. No software option required.

5GNR Signal Analyzer

The **5GNR Signal Analyzer** mode provides demodulation of 5GNR signals validating over-the-air (OTA) performance of cell sites and ensures smooth communication with user equipment. Metrics on up to 12 PCI/beams are displayed for FR1/FR2 based on the selected sorting and filtering with the corresponding power measurements. Requires the **5GNRAnalyzer** software option.

LTE Signal Analyzer

The LTE Signal Analyzer mode provides the demodulation of 4G/LTE signals validating over-the-air (OTA) performance of cell sites and metrics. Metrics on up to 12 PCI are displayed with the corresponding power measurements, based on the selected sorting and filtering. Requires the **LTEAnalyzer** software option.

Technical Specifications

To obtain this product's technical specifications, visit the EXFO website at *www.exfo.com*.

Conventions

Before using the product described in this guide, you should understand the following conventions:

WARNING

Indicates a potentially hazardous situation which, if not avoided, could result in *death or serious injury*. Do not proceed unless you understand and meet the required conditions.

CAUTION

Indicates a potentially hazardous situation which, if not avoided, may result in *minor or moderate injury*. Do not proceed unless you understand and meet the required conditions.

CAUTION

Indicates a potentially hazardous situation which, if not avoided, may result in *component damage*. Do not proceed unless you understand and meet the required conditions.

IMPORTANT

Refers to information about this product you should not overlook.

2 Getting Started

Supported Modules and Software Options

The **RF Spectrum Analyzer** application is supported with the FTBx-88260 module on the FTB-1v2 Pro. By default the **Real-Time Spectrum Analyzer (RTSA)** and **Spectrum Analyzer** operation modes are available. The **5GNR Signal Analyzer** and **LTE Signal Analyzer** operation modes are available respectively by enabling the following software options: **5GNRAnalyzer** and **LTEAnalyzer**.

Software Installation

If the **RF Spectrum Analyzer** application is not already installed, see the FTB-1v2 Pro user guide for more information on how to install this application.

Starting the RF Spectrum Analyzer Application

From **Mini ToolBox X** (NetBlazer), tap the **RF Spectrum Analyzer** application button.

Connecting the Antenna

Connect an antenna to either the TA-FR1 or TA-FR2 transceiver system.

CAUTION

Make sure the power level at the RF IN port of the TA-FR1/TA-FR2 does not exceed the maximum values, dBm and VDC, allowed to avoid damaging the TA-FR1/TA-FR2:

TA-FR1 (SMA female connector):
450 MHz - 6 GHz, 50Ω, 30 dBm max (≥ 10 dB attenuation), +/- 50 VDC max

TA-FR2 (K male connector):
24.25 GHz - 40 GHz, 50Ω, 20 dBm max (≥ 10 dB attenuation), +/- 50 VDC max

Quick Test Setup Procedure

To setup a quick test:

1. Having an antenna connected to the FTBx-88260, start the **RF Spectrum Analyzer** application.
2. Tap **Mode** to select the testing mode: **Real-Time Spectrum Analyzer (RTSA)**, **Spectrum Analyzer**, **5GNR Signal Analyzer**, or **LTE Signal Analyzer**.
3. Tap **Frequency Band** to select the frequency band: **FR1 (450 MHz to 6 GHz)** or **FR2 (24.25 GHz to 40 GHz)**. The port should be automatically selected, otherwise tap **Port** to manually select the port **A** or **B** of the FTBx-88260.
4. Open the menu if not already open by tapping on the menu icon (☰) then follow the following steps depending on the selected test mode.

For Real-Time Spectrum Analyzer (RTSA):

1. Tap **Frequency** and select the **Center Frequency** to center the graph on the screen (see *Frequency* on page 16).
2. Tap **Amplitude** and select the to **Ref Level** and **Scale/Div** to fine tune the spectrum (see *Amplitude* on page 17).
3. Tap **Graph** to either fine tune the persistence graph or enable the display of the **Spectrogram** (see *Graph* on page 18).
4. Tap **Trace** to display different traces on the graph: **Max**, **Sample**, **Average**, **Max Hold**, or **Min Hold** (see *Trace* on page 19).
5. Tap **Markers** to enable markers on a trace showing either the highest amplitude peak on the graph (**Max**), **Sample**, **Average**, **Max Hold**, or **Min Hold** (see *Marker* on page 20).

For Spectrum Analyzer:

1. Tap **Frequency** and select the **Center Frequency** to center the graph on the screen (see *Frequency* on page 23).
2. Tap **Amplitude** and select the to **Ref Level** and **Scale/Div** to fine tune the spectrum (see *Amplitude* on page 24).
3. Tap **Graph** to enable and set the display of the **Spectrogram** (see *Graph* on page 25).
4. Tap **Bandwidth** to set the resolution bandwidth (**RBW**) and video bandwidth (**VBW**) (see *Bandwidth* on page 25).
5. Tap **Trace** to display different traces on the graph: **Max**, **Sample**, **Max Hold**, or **Min Hold** (see *Trace* on page 26).
6. Tap **Markers** to enable markers on a trace showing either the highest amplitude peak on the graph (**Max**), **Sample**, **Max Hold**, or **Min Hold** (see *Marker* on page 27).

For 5GNR Signal Analyzer:

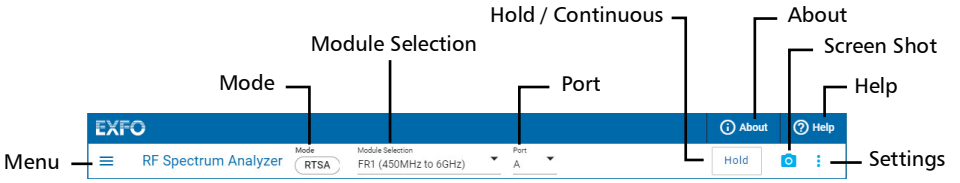
1. Tap **Frequency** and select the center frequency parameters (see *Frequency* on page 40).
2. Tap **Amplitude** and select the amplitude parameters if needed (see *Amplitude* on page 42). **Pre-Amp** may be enabled for better results.

For LTE Signal Analyzer:

1. Tap **Frequency** and select the center frequency parameters (see *Frequency* on page 45).
2. Tap **Amplitude** and select the amplitude parameters if needed (see *Amplitude* on page 42). **Pre-Amp** may be enabled for better results.

3 Graphical User Interface Overview

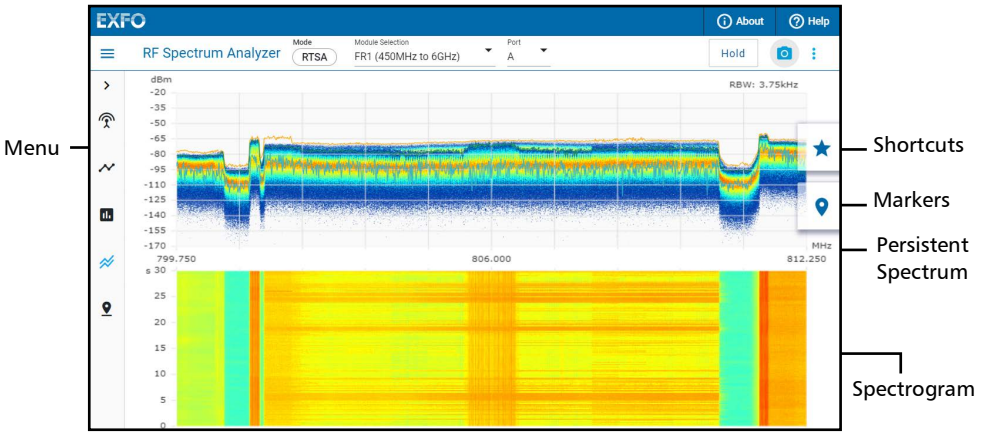
This chapter describes the RF Spectrum Analyzer graphical user interface. The following identifies the common main window settings and controls.



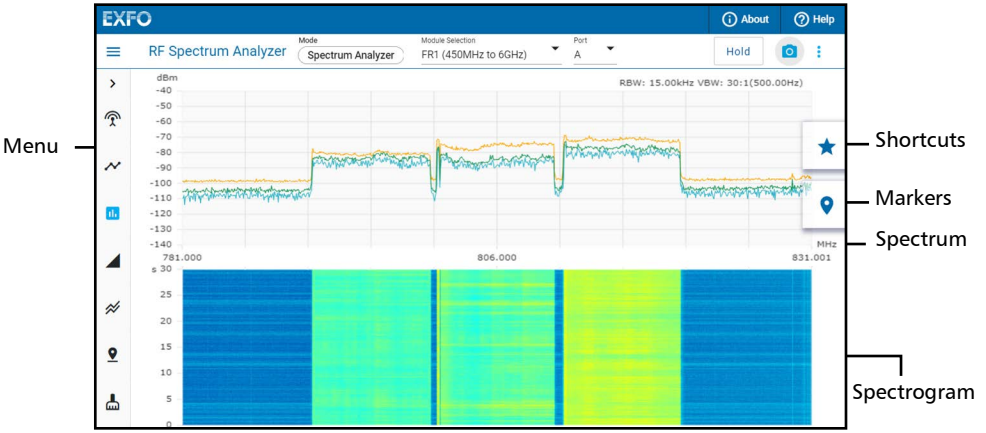
Mode (Mode Selection)

Allows selecting the **RF Spectrum Analyzer** testing mode:

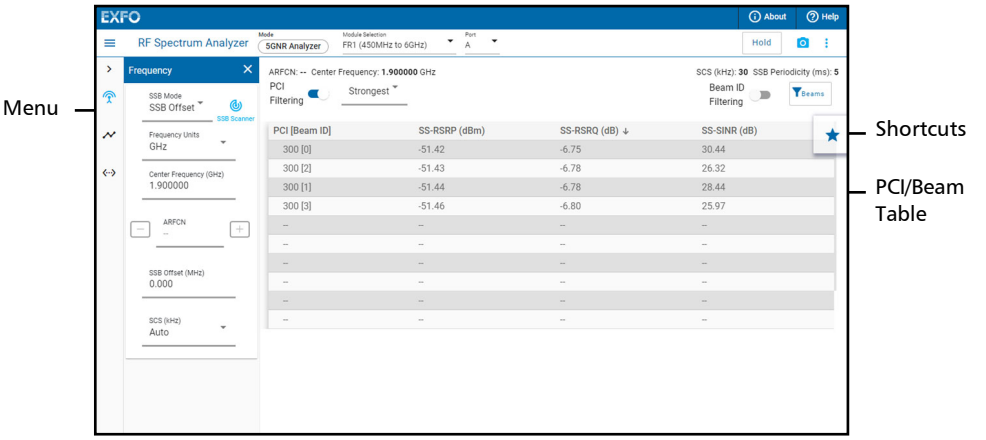
➤ **Real-Time Spectrum Analyzer (RTSA)**



➤ Spectrum Analyzer

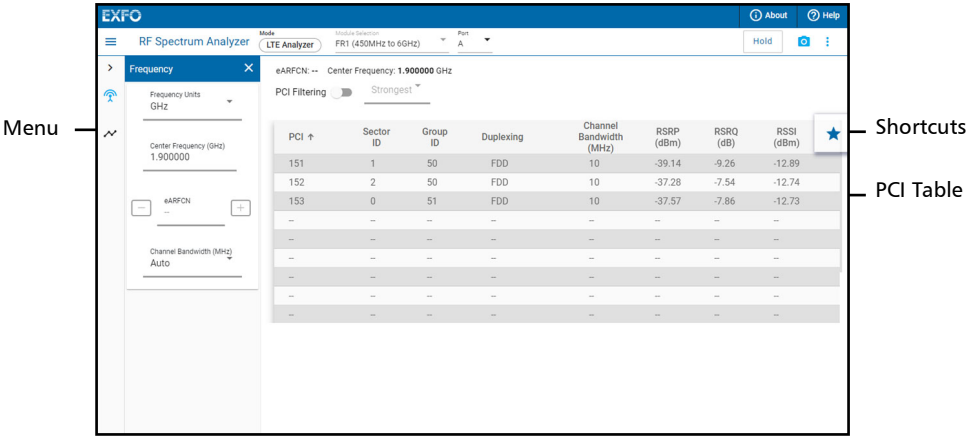


➤ 5GNR Signal Analyzer (5GNR Analyzer)[1]



1. Software option required.

➤ **LTE Signal Analyzer (LTE Analyzer)**[1]



Module Selection

Allows selecting the module: **FR1 (450 MHz to 6 GHz)** or **FR2 (24.25 GHz to 40 GHz)**.

Port

Allows selecting the port on the module: **A** or **B**. The port is auto-selected based on the selected module and its corresponding detected transceiver adapter.

1. Software option required.

Status Indication

The status indication is only displayed, on top of either the graph or results, when there is a warning or a problem as follows:

- Transceiver System Validation status (See the NetBlazer user guide for more information)
- Power Overload Indication: RF input power is too high. When this occurs, attenuation is applied step by step (10, 20, 30 dB) until either the power is no more exceeding the maximum value or the maximum attenuation is reached. If the problem persists, see *Solving Common Problems* on page 64 for more information.
- ADC Overrange Indication: Analog to Digital Converter input is over range. Overrange condition impacts the accuracy of measurements, it is recommended to turn off **Pre-Amp** and/or add attenuation to clear the condition.

About

About (i) mainly displays the product version details and gives access to technical support information, TA details, and software options.

Technical Support

Displays technical support information.

TA Details

Displays information for each inserted TA-FR1/TA-FR2 transceiver systems: **Module ID**, **Serial Number**, **Revision**, **Calibration Date**.

Software Options

Displays the list of software options. See the NetBlazer user guide for more information.

Help

Help (?) displays the help information related to the RF Spectrum Analyzer application.

Settings

General Settings

Audio Output Device allows selection of the platform audio output device used by the RF Spectrum Analyzer application.

Volume allows adjusting the volume level.

Save Configuration

Save Configuration, available with **5GNR Signal Analyzer** and **LTE Signal Analyzer**, allows saving the configuration to a file.

Load Configuration

Load Configuration allows loading a previously saved **5GNR Signal Analyzer** or **LTE Signal Analyzer** configuration file.

Restore Default

Restores all RF Spectrum Analyzer‘s configuration parameters to factory default settings.

Menu

Expands or collapses the main **Menu**.

Icon	Menu	Mode			
		RTSA	Spectrum Analyzer	5GNR Analyzer	LTE Analyzer
	Expands or collapses the main **Menu**	X	X	X	X
	Frequency	X	X	X	X
	Amplitude	X	X	X	X
	Graph	X	X	-	-
	Bandwidth	-	X	-	-
	Trace	X	X	-	-
	Markers	X	X	-	-
	Sweep	-	X	-	-
	Expands the text menu	X	X	X	X
	Collapses the text menu	X	X	X	X
	Demod	-	-	X	-

Screen Shot

Captures the RF Spectrum Analyzer application as appearing on the display and save it to the following folder; the name of the file contains the date and time: Users\<User>\Documents\RF-Spectrum-Analyzer\Screenshots

Persistent Spectrum

For **Real-Time Spectrum Analyzer (RTSA)**, displays the persistent spectrum graph when **Persistent Spectrum** is enabled (See *Graph* on page 18 and *Spectrum Graph* on page 21) including traces when enabled.

Spectrum

For **Spectrum Analyzer**, displays the spectrum graph of enabled traces (See *Trace* on page 26 and *Graph (Traces)* on page 34).

Spectrogram

Displays the spectrogram graph when **Spectrogram** is enabled. For **Real-Time Spectrum Analyzer (RTSA)** See *Graph* on page 18 and *Spectrogram* on page 22. For **Spectrum Analyzer** refer *Graph* on page 25 and *Spectrogram* on page 34).

Markers

Displays the list of enabled markers having their trace enabled including the following statistics for each marker: **ID**, **Frequency**, **Amplitude**, **Delta Frequency**, **Delta Amplitude**. For Real-Time Spectrum Analyzer (RTSA) See *Marker* on page 20 and *Markers* on page 22. For Spectrum Analyzer, See *Marker* on page 27 and *Markers* on page 35.

Shortcuts

Provides quick access to some **Frequency** and **Amplitude** configuration settings.

- For Real-Time Spectrum Analyzer (RTSA), see *Frequency* on page 16 and *Amplitude* on page 17.
- For Spectrum Analyzer, see *Frequency* on page 23 and *Amplitude* on page 24.
- For 5GNR Signal Analyzer, see *Frequency* on page 40 and *Amplitude* on page 42.
- For LTE Signal Analyzer, see *Frequency* on page 45 and *Amplitude* on page 46.

PCI/Beam Table

For 5GNR Signal Analyzer, displays the 5G PCI/beam table (see *PCI/Beam Table* on page 42).

PCI Table

For LTE Signal Analyzer, displays the LTE PCI table (see *PCI Table* on page 46).

Hold / Continuous

For **Real-Time Spectrum Analyzer (RTSA)** and **Spectrum Analyzer** modes, hold pauses the refresh of the displayed graph and spectrogram. However the spectrum processing is still running in background. Continuous displays the live graph and spectrogram.

For **5GNR Signal Analyzer** and **LTE Signal Analyzer** modes, hold pauses the refresh of the displayed statistics and signal information. However statistics continue to be measured in background. Continuous refreshes the displayed statistics and signal information continuously.

4 Real-Time Spectrum Analyzer (RTSA)

The **Real-Time Spectrum Analyzer (RTSA)** mode provides continuous acquisition of RF signals with 100 MHz of analysis bandwidth. The **RTSA** provides fast signal processing to avoid missing short/intermittent events.

Frequency

Note: ***Frequency*** *settings are coupled on all RF Spectrum Analyzer modes.*

- **Frequency Unit** allows selecting the frequency unit: **MHz** or **GHz** (default).
- **Center Frequency** allows selecting the center frequency for the displayed spectrum: **500** MHz to **5950** MHz for FR1 (default is **1.9** GHz); **24.3** GHz to **39.95** GHz for FR2 (default is **28** GHz).
- **Span (MHz)** allows selecting the frequency span of the displayed spectrum graph: **6.25**, **12.5**, **25**, **50**, **100** MHz. It has the effect of expanding or contracting the width of the graph.
- **Channel Mode** allows selecting the channel mode: **5G** (default) or **LTE**. **LTE** is only available with FR1.
  - **ARFCN** (Absolute Radio Frequency Channel Number), available with 5G channel mode, allows selecting the channel number of the center frequency: **100000** to **796666** for FR1; **2017499** to **2278332** for FR2. The **Center Frequency** is automatically updated following the channel selected.
  - **eARFCN** (E-UTRA Absolute Radio Frequency Channel Number), available with LTE channel mode, defines the channel number of the center frequency:

Range	Downlink/Uplink
0 to 5379	Downlink
5730 to 7399	
7500 to 10359	

Range	Downlink/Uplink
18000 to 22949	Uplink
23010 to 23379	
23730 to 27759	
36000 to 60254	Downlink/Uplink
65536 to 70545	Downlink
131072 to 133471	Uplink
133572 to 134181	

Amplitude

Note: ***Amplitude*** *settings are coupled on all RF Spectrum Analyzer modes.*

- **Ref Level (dBm)** sets the maximum power value displayed on the graph: **-150** dBm to **50** dBm (default is **-20** dBm). This has the effect of moving the graph vertically on the screen.
- **Scale/Div (dB)** sets the spacing between divisions on the graph: **1** to **15** dB (default). This has the effect of condensing or expanding the graph vertically on the screen.
- **Ref Level Offset** is used to compensate for the gain or attenuation provided by the connected external device: **Disabled** (default), **Attenuation**, **Gain**; **0** to **50** dB (default is **0** dB).
- **Pre-Amp** when enabled (disabled by default) increases the signal amplitude for weak signals.
- **Attenuation** is used to lowering the amplitude of a signal: **0**, **10** (default), **20**, **30** dB.

Graph

- **Persistent Spectrum** check box when selected (default) plots the power magnitude against frequency, with color denoting the percentage of time a plot point is present at the current location.
- **Density Mapping** allows adjusting the colors that are assigned to the signal density by setting the low and high threshold levels: **0** to **100** (**0** and **100** by default).
- **Decay** sets the period of time a dot on the graph that is no longer detected is kept: **0** to **10** seconds (default is **5** s) or infinite when the **Infinite Decay** check box is selected. A dot that is no longer detected is gradually faded for the decay period until it is no longer visible. The decay period is disabled when **Infinite Decay** is enabled.
- **Infinite Decay** check box when selected (cleared by default) keeps all dots on the graph even if they are no longer detected. When the **Infinite Decay** check box is cleared, the dots that are no longer detected are faded following the decay period.
- **Spectrogram** check box when selected (cleared by default), displays a visual representation of frequency in the X axis against time in the Y axis (also known as Waterfall). It is useful for seeing small changes in signal amplitude as well as picking out intermittent interferers.
  - **2D/3D** allows displaying the **Spectrogram** in two-dimensional (**2D**; default) or three-dimensional (**3D**) view.
  - **Amplitude Scale** allows adjusting the amplitude of the signal shown in the spectrogram by selecting the low (cooler color) and high (hotter color) threshold values in dBm.
  - **Spectrogram Source Trace** allows selecting the spectrogram trace to be displayed: **Max** (default), **Sample**, **Average**, **Max Hold**, **Min Hold**. See Trace *on page 19* for more information.
  - **Spectrogram Reset** clears the spectrogram graph data.

Trace

Each enabled trace is displayed on the graph using a specific color.

Note: *A trace is automatically enabled when enabling a marker that it is located on that trace or when selecting that trace on a marker that is already enabled.*

- **Peak Trace** when enabled, disabled by default, displays a line representing the positive peak detector of the spectrum updated at the refresh interval.
- **Sample Trace** when enabled, disabled by default, displays a line representing the power for each frequency at the same sample instance updated at the refresh interval.
- **Average Trace** check box when selected, cleared by default, displays a line representing the average amplitude of the sample trace based on the number of **Averages** selected.

  Averages defines the number of sample traces that is used to generate the **Average Trace** line: **1** to **100** (**10** by default).
- **Max Hold Trace** when enabled, disabled by default, displays a line representing the maximum amplitude of the spectrum that were recorded over time.
- **Min Hold Trace** when enabled, disabled by default, displays a line representing the minimum amplitude of the spectrum that were recorded over time.
- **Clear Trace** allows resetting the following traces and their history on the graph: **Max Hold Trace**, **Min Hold Trace**, and **Average Trace**.

Marker

Markers are points on a trace with fixed frequency which follow the trace amplitude.

Market Settings

- **Reference Marker** allows selecting the marker (default is **Marker 1**) to be used as the reference for reporting **Delta Frequency** and **Delta Amplitude** statistics. The marker is identified with an asterisk on the graph and in the marker table.
- **Delta Frequency Units** sets the frequency unit for the markers: **Follow Center Frequency** (uses the unit set for **Center Frequency**), **kHz** (default for FR1), **MHz** (default for FR2), **GHz**.

Audible Tone

- **Audible Tone**, when enabled (disabled by default), allows hearing an audible tone based on the source marker amplitude. This is helpful for hands-free operation of the equipment for either antenna peaking or interference hunting. To adjust the volume of the audible tone, refer to **Volume** from *General Settings* on page 25.
- **Tone Source** allows selecting the source marker used for audible tone.
- **Level Range** allows adjusting the low and high source marker amplitude values respectively mapped to the low and high audible tone pitch.

  It is also possible from the graph to drag the top and bottom control to adjust the level range as needed. The **Level Range** can be moved up or down by dragging the shaded area.
- **Mute When Out of Range** allows muting (default) the audible tone when source is outside the **Level Range**.

Marker 1 to Marker 12

- **Marker 1** to **Marker 12** check boxes when selected (cleared by default) allow displaying the markers on the spectrum graph. An enabled marker is identified as M<*marker #*> on the graph. An enabled marker is only displayed when its trace is also enabled; selecting a trace for an enabled marker or enabling the marker, automatically enables the selected trace.
- **Frequency** sets the frequency of the corresponding marker.
- **Trace** allows selecting on which trace the marker is located: **Max** (default), **Sample**, **Average**, **Max Hold**, **Min Hold**. See Trace *on page 28* for more information. Selecting a trace and activating the marker automatically enables the selected trace.
- **Go To Peak** moves the marker to the point of greatest amplitude on the trace.
- **Snap to Peak** finds the highest peak within the selection region on the screen and uses the corresponding frequency for this marker. Tap on the **Snap to Peak** button, then press and drag the highlighted region to the desired location on the screen.

Spectrum Graph

The spectrum graph is displayed when the **Persistent Spectrum** check box is selected, it plots the power magnitude against frequency, with color denoting the percentage of time a plot point is placed at the current location. The following information is reported on top-right of the graph:

- **RBW**
- **ARFCN** when defined
- **eARFCN** when defined, followed by the link direction: **Downlink**, or **Uplink**.

Spectrogram

The spectrogram (also known as Waterfall) is displayed when the **Spectrogram** check box is selected, it displays a visual representation of frequency in the X axis against time in the Y axis. It is useful for seeing small changes in signal amplitude as well as picking out intermittent interferers. The spectrogram is reset when either changing the frequency or pressing the **Spectrogram Reset** button.

Markers

The markers table displays the following information for enabled markers having their trace enabled. See *Marker* on page 20 and *Trace* on page 19 for more information.

- **ID** is the marker identification number. The reference marker is identified with an asterisk next to its ID.
- **Frequency** is the marker configured frequency. Press on the icon to recenter the Spectrum Graph to the corresponding marker frequency.
- **Amplitude** is the marker configured amplitude.
- **Delta Frequency** is the frequency absolute difference between the current marker and the reference marker. Only available when the reference marker is enabled having its trace enabled.
- **Delta Amplitude** is the amplitude absolute difference between the current marker and the reference marker. Only available when the reference marker is enabled having its trace enabled.

Shortcuts

Shortcuts provides quick access to some **Frequency** and **Amplitude** configuration settings. See *Frequency* on page 16 and *Amplitude* on page 17.

5 Spectrum Analyzer

The **Spectrum Analyzer** mode provides continuous acquisition of RF signals with 100 MHz of analysis bandwidth.

Frequency

Note: ***Frequency*** *settings are coupled on all RF Spectrum Analyzer modes.*

- **Frequency Unit** allows selecting the frequency unit: **MHz** or **GHz** (default).
- **Center Frequency** allows selecting the center frequency for the displayed spectrum: **500** MHz to **5950** MHz for FR1 (default is **1.9** GHz); **24.3** GHz to **39.95** GHz for FR2 (default is **28** GHz).
- **Span (MHz)** allows selecting the frequency span of the displayed spectrum graph: **0.1** to **100** MHz (default). It has the effect of expanding or contracting the width of the graph.
- **Channel Mode** allows selecting the channel mode: **5G** (default) or **LTE**. **LTE** is only available with FR1.
  - **ARFCN** (Absolute Radio Frequency Channel Number), available with 5G channel mode, allows selecting the channel number of the center frequency: **100000** to **796666** for FR1; **2017499** to **2278332** for FR2. The **Center Frequency** is automatically updated following the channel selected.
  - **eARFCN** (E-UTRA Absolute Radio Frequency Channel Number), available with LTE channel mode, defines the channel number of the center frequency:

Range	Downlink/Uplink
0 to 5379	Downlink
5730 to 7399	
7500 to 10359	

Range	Downlink/Uplink
18000 to 22949	Uplink
23010 to 23379	
23730 to 27759	
36000 to 60254	Downlink/Uplink
65536 to 70545	Downlink
131072 to 133471	Uplink
133572 to 134181	

Amplitude

Note: ***Amplitude*** *settings are coupled on all RF Spectrum Analyzer modes.*

- **Ref Level (dBm)** sets the maximum power value displayed on the graph: **-150** dBm to **50** dBm (default is **-20** dBm). This has the effect of moving the graph vertically on the screen.
- **Scale/Div (dB)** sets the spacing between divisions on the graph: **1** to **15** dB (default). This has the effect of condensing or expanding the graph vertically on the screen.
- **Ref Level Offset** is used to compensate for the gain or attenuation provided by the connected external device: **Disabled** (default), **Attenuation**, **Gain**; **0** to **50** dB (default is **0** dB).
- **Pre-Amp** when enabled (disabled by default) increases the signal amplitude for weak signals.
- **Attenuation** is used to lowering the amplitude of a signal: **0**, **10** (default), **20**, **30** dB.

Graph

- **Spectrogram** check box when selected (cleared by default), displays a visual representation of frequency in the X axis against time in the Y axis (also known as Waterfall). It is useful for seeing small changes in signal amplitude as well as picking out intermittent interferers.
- **2D/3D** allows displaying the **Spectrogram** in two-dimensional (**2D**; default) or three-dimensional (**3D**) view.
- **Amplitude Scale** allows adjusting the amplitude of the signal shown in the spectrogram by selecting the low (cooler color) and high (hotter color) threshold values in dBm.
- **Spectrogram Source Trace** allows selecting the spectrogram trace to be displayed: **Max** (default), **Sample**, **Average**, **Max Hold**, **Min Hold**. See Trace *on page 26* for more information.
- **Spectrogram Reset** clears the spectrogram graph data.

Bandwidth

- **RBW** (Resolution Bandwidth) balances the amount of detail against the scan speed of the signal by filtering how close two signals can still be resolved into two separate peaks. The resolution bandwidth value depends on the selected span (**120** KHz by default).
- **VBW** modifies the Video Bandwidth. Reducing the bandwidth smooths the waveform and produces a thinner trace by decreasing the amount of noise. This is useful when identifying a weak interferer which would otherwise be lost in the noise. The video bandwidth is a ratio of the **RBW** selectable from **1:1** to **100:1** (default is **10:1**)

Trace

Each enabled trace is displayed on the graph using a specific color.

Note: *A trace is automatically enabled when enabling a marker that it is located on that trace or when selecting that trace on a marker that is already enabled.*

- **Peak Trace** when enabled, disabled by default, displays a line representing the positive peak detector of the spectrum updated at the refresh interval.
- **Sample Trace** when enabled, disabled by default, displays a line representing the power for each frequency at the same sample instance updated at the refresh interval.
- **Max Hold Trace** when enabled, disabled by default, displays a line representing the maximum amplitude of the spectrum that were recorded over time.
- **Min Hold Trace** when enabled, disabled by default, displays a line representing the minimum amplitude of the spectrum that were recorded over time.
- **Clear Trace** allows resetting the following traces and their history on the graph: **Max Hold Trace**, and **Min Hold Trace**.

Marker

Markers are points on a trace with fixed frequency which follow the trace amplitude.

Marker Settings

- **Reference Marker** allows selecting the marker (default is **Marker 1**) to be used as the reference for reporting **Delta Frequency** and **Delta Amplitude** statistics. The marker is identified with an asterisk on the graph and in the marker table.
- **Delta Frequency Units** sets the frequency unit for the markers: **Follow Center Frequency** (uses the unit set for **Center Frequency**), **kHz** (default for FR1), **MHz** (default for FR2), **GHz**.

Audible Tone

- **Audible Tone**, when enabled (disabled by default), allows hearing an audible tone based on the source marker amplitude. This is helpful for hands-free operation of the equipment for either antenna peaking or interference hunting. To adjust the volume of the audible tone, refer to **Volume** from *General Settings* on page 25.
- **Tone Source** allows selecting the source marker used for audible tone.
- **Level Range** allows adjusting the low and high source marker amplitude values respectively mapped to the low and high audible tone pitch.

  It is also possible from the graph to drag the top and bottom control to adjust the level range as needed. The **Level Range** can be moved up or down by dragging the shaded area.
- **Mute When Out of Range** allows muting (default) the audible tone when source is outside the **Level Range**.

Marker 1 to Marker 12

- **Marker 1** to **Marker 12** check boxes when selected (cleared by default) allow displaying the markers on the spectrum graph. An enabled marker is identified as M<*marker #*> on the graph. An enabled marker is only displayed when its trace is also enabled; selecting a trace for an enabled marker or enabling the marker, automatically enables the selected trace.
- **Frequency** sets the frequency of the corresponding marker.
- **Trace** allows selecting on which trace the marker is located: **Max** (default), **Sample**, **Max Hold**, **Min Hold**. See Trace *on page 36* for more information. Selecting a trace and activating the marker automatically enables the selected trace.
- **Go To Peak** moves the marker to the point of greatest amplitude on the trace.
- **Snap to Peak** finds the highest peak within the selection region on the screen and uses the corresponding frequency for this marker. Tap on the **Snap to Peak** button, then press and drag the highlighted region to the desired location on the screen.

Sweep (TDD Gated Sweep)

Gate

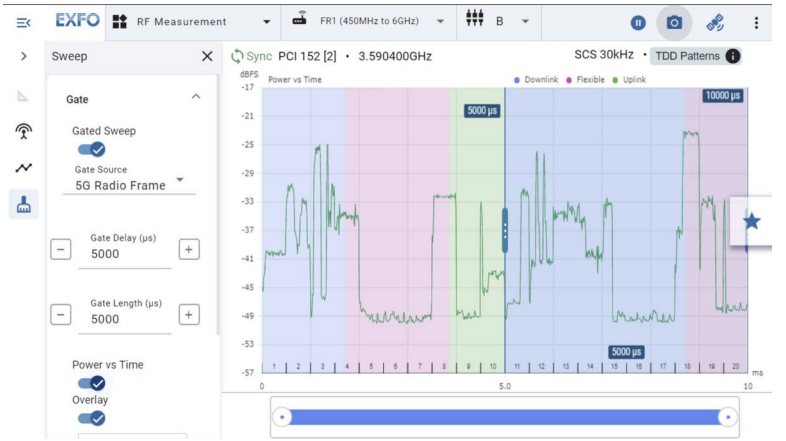
- **Gated Sweep** when enabled (disabled by default) enables the production of the spectrum graph based on the samples within the defined sweep gate allowing to only focus on uplink or downlink. **Gated Sweep** is displayed once enabled with its synchronization status on the top-left corner of the graph. The synchronization status is displayed when the **Gate Source** is a **Radio Frame** (**5G** or **LTE**); **Sync** is displayed in green when synchronized, otherwise it is red.
- **Gate Source** allows selecting the synchronization source for the gate: **Internal** (default), **5G Radio Frame**, or **LTE Radio Frame**.
- **Gate Delay (µs)** allows setting the beginning of the gate: **0** to **19980** µs (default is **5000** µs). The maximum value depends on the **Gate Length** selected.
- **Gate Length (µs)** allows setting the duration of the gate: **10** µs to **10000** µs (default is **5000** µs). The maximum value depends on the **Gate Delay** selected. Changing the gate length may automatically adjust the RBW and Span values.
- **Power vs Time** when enabled (disabled by default) allows the production of a power over time graph. Drag the left and right control to adjust the sweep gate as needed. It is also possible to move the **Gate Delay** and **Gate Length** at the same time by dragging the shaded area. Once adjusted, clear the **Power vs Time** check box to return to the spectrum graph to display the frequency amplitude of the selected sweep gate. Typically, when hunting for interferers, they are easier to see when setting the gate in the quieter parts of the radio frame (e.g. flexible slots).

Note: *When **Gated Sweep** is disabled, the **Power vs Time** functionality will also be disabled.*

➤ **Zoom** allows taking a bigger section and more precise measurement by using the scale found at the bottom of your screen. To take a zoom measurement, drag the handles of the zoom bar, or drag the whole interval to obtain a more precise view of the radio frame. Milliseconds and slot scales at the bottom of the graph indicate the part of the frame that is shown.

➤ **Frame Duration** (ms) allows selecting the X axis length of the **Power vs Time** graph: **10 ms** (default) or **20 ms**.

➤ **Auto-TDD**: This feature helps program gate delay and gate length in the gated sweep mode. It interprets data in the 5G signal to extract TDD configuration parameters. Based on those parameters, Auto-TDD highlights the type of slots (uplink, flexible or downlink) by drawing a color-coded background on the **Power vs Time** graph. Details about the TDD configuration are available by tapping on the pattern information icon at the top right corner of the graph.



Using the color-coded graph, the gate delay/length can be configured to target a certain period of the radio frame (e.g. flexible slots when hunting interferers). This can be done by dragging the gate start and end on the graph, or by using the **Snap to Boundaries** mode. First, tap the **Snap to Boundaries** button and then:

1. Drag the left or right control handle which will latch on the nearest boundary as previewed by a yellow bar.
2. Drag the whole shaded area which will set both delay and length to the boundaries of the region.
3. Tap once on a region to set both delay and length to the boundaries of the clicked region.

Error conditions: **No SIB1** will be reported when the signal cannot be properly interpreted, for instance if the signal is too weak or noisy. **No TDD Info** will be reported if TDD parameters cannot be determined (e.g. signal is FDD).

Limitations: This feature is supported for 5G NR signals on FR1 transceiver adapter only.

Note: *TDD parameters that correspond to a 20ms periodicity are not supported by* ***Auto-TDD*** *and will report* ***Unsupported pattern combination****.*

Note: *The following menus are not available when* ***Power vs Time*** is enabled: ***Graph***, ***Bandwidth***, ***Trace***, *and* ***Markers****.*

5G Sync Location

Allows using the 5G radio frame as a synchronization source. The **Center Frequency** is decoupled from the **Frequency** menu.

- **Adjust Sync Power** allows to automatically adjust the power at the sync location in case the gated sweep cannot synchronize.
- **Copy CF** allows copying the center frequency settings (from the **Frequency** menu) to be used for the synchronization source.
- **SSB Mode** allows selecting the method of entry for the SSB location:
  - **GSCN** allows selection of the SSB channel number: **1124** to **9582** for FR1; **22256** to **23167** for FR2. The **Center Frequency** is automatically updated following the SSB channel selected.
  - **SSB Offset** (default) allows selection of the frequency offset (default is 0 MHz) relative to the **Center Frequency** selected.
- **SSB Scanner** ( ), see **SSB Scanner** on page 40.
- **Frequency Unit** allows selecting the frequency unit: **MHz** or **GHz** (default).

- **Center Frequency** allows selecting the center frequency for the 5GNR signal: **450** MHz to **6000** MHz for FR1 (default is **1.9** GHz); **24.25** GHz to **40** GHz for FR2 (default is **28** GHz). Not configurable but automatically updated when using **GSCN** - **SSB Mode**.
- **ARFCN** (Absolute Radio Frequency Channel Number), available when **SSB Mode** is set to **SSB Offset**, allows selecting the channel number of the center frequency: Range 90000 to 800000 for FR1; Range 2016667 to 2279165 for FR2. The **Center Frequency** is automatically updated following the **ARFCN** selected.
- **SCS** defines the Sub Carrier Spacing of the SSB: **Auto** (default), **15**, **30** kHz for FR1; **Auto** (default), **120**, **240** kHz for FR2. When **Auto** is selected, the SCS of the SSB is automatically determined and its value is reported when succeeded.

LTE Sync Location

Allows using the LTE radio frame as a synchronization source. The **Center Frequency** is decoupled from the **Frequency** menu.

- **Copy CF** allows copying the center frequency settings (from the **Frequency** menu) to be used for the synchronization source.
- **Frequency Unit** allows selecting the frequency unit: **MHz** or **GHz** (default).
- **Center Frequency** allows selecting the center frequency for the LTE signal: **450** MHz to **6** GHz for FR1 (default is **1.9** GHz).
  - **eARFCN** (E-ULTRA Absolute Radio Frequency Channel Number) defines the channel number of the center frequency:

Range (Downlink only)
0 to 5379
5730 to 7399
7500 to 10359
36000 to 60254
65536 to 70545

Graph (Traces)

Displays the graph of enabled traces. The following information is reported on top-right of the graph:

- **RBW**
- **VBW**
- **ARFCN** when defined
- **eARFCN** when defined, followed by the link direction: **Downlink**, or **Uplink**.

Spectrogram

The spectrogram (also known as Waterfall) is displayed when the **Spectrogram** check box is selected, it displays a visual representation of frequency in the X axis against time in the Y axis. It is useful for seeing small changes in signal amplitude as well as picking out intermittent interferers. The spectrogram is reset when either changing the frequency or pressing the **Spectrogram Reset** button.

Markers

The markers table displays the following information for enabled markers having their trace enabled. See *Marker* on page 27 and *Trace* on page 26 for more information.

- **ID** is the marker identification number. The reference marker is identified with an asterisk next to its ID.
- **Frequency** is the marker configured frequency. Press on the icon to recenter the Spectrum Graph to the corresponding marker frequency.
- **Amplitude** is the marker configured amplitude.
- **Delta Frequency** is the frequency absolute difference between the current marker and the reference marker. Only available when the reference marker is enabled having its trace enabled.
- **Delta Amplitude** is the amplitude absolute difference between the current marker and the reference marker. Only available when the reference marker is enabled having its trace enabled.

Shortcuts

Shortcuts provides quick access to some **Frequency** and **Amplitude** configuration settings. See *Frequency* on page 23 and *Amplitude* on page 24.

6 5GNR Signal Analyzer

The **5GNR Signal Analyzer** mode provides demodulation of 5GNR signals validating over-the-air (OTA) performance of cell sites and ensures smooth communication with user equipment. Requires the **5GNRAnalyzer** software option.

Frequency

Note: ***Frequency*** *settings are coupled on all RF Spectrum Analyzer modes.*

- **SSB Mode** allows selecting the method of entry for the SSB location:
  - **GSCN** allows selection of the SSB channel number: **1124** to **9582** for FR1; **22256** to **23167** for FR2. The **Center Frequency** is automatically updated following the SSB channel selected.
  - **SSB Offset** (default) allows selection of the frequency offset (default is 0 MHz) relative to the **Center Frequency** selected.
- **SSB Scanner** ( )
  - **Search Raster** allows the selection of the raster that will be used by the SSB scan process: **GSCN** (default) or **ARFCN**.
  - **Search Range** allows selecting the frequency range that will be used for scanning.

    Current Span (default) scans a 100 MHz frequency range centered on the configured **Center Frequency**.

    Start/Stop scans the frequency range from the **Start Frequency** and **Stop Frequency** values.

    Band scans the frequency range within the selected band.

- **Start Scan** / **Stop Scan** starts/stops the SSB scan process. The scan automatically stops once completed. Use the **Stop Scan** button to manually stop the scan once the desired entry appears in the table. The following information are displayed for each table entry: **GSCN/ARFCN**, **Frequency**, and **PCI**.

  Use the  button of the desired entry from the results table to automatically set the **SSB Mode** and its corresponding **GSCN/ARFCN** value. The beam table is then refreshed to reflect the new settings.

- **SSB Periodicity ≤20ms (Fast Scan)** when enabled (default) allows scanning for SSB periodicity up to 20 ms (fast scan); when disabled allows scanning for all SSB periodicity, including those longer than 20 ms (slow scan).

➤ **Frequency Unit** allows selecting the frequency unit: **MHz** or **GHz** (default).

➤ **Center Frequency** allows selecting the center frequency for the 5GNR signal: **450** MHz to **6000** MHz for FR1 (default is **1.9** GHz); **24.25** GHz to **40** GHz for FR2 (default is **28** GHz). Not configurable but automatically updated when using **GSCN** - **SSB Mode**.

➤ **ARFCN** (Absolute Radio Frequency Channel Number), available when **SSB Mode** is set to **SSB Offset**, allows selecting the channel number of the center frequency: Range 90000 to 800000 for FR1; Range 2016667 to 2279165 for FR2. The **Center Frequency** is automatically updated following the **ARFCN** selected.

➤ **SCS** defines the Sub Carrier Spacing of the SSB: **Auto** (default), **15**, **30** kHz for FR1; **Auto** (default), **120**, **240** kHz for FR2. When **Auto** is selected, the SCS of the SSB is automatically determined and its value is reported when succeeded.

Amplitude

Note: ***Amplitude*** *settings are coupled on all RF Spectrum Analyzer modes.*

- **Amplitude Offset** sets an attenuation or gain value to apply to the amplitude measurements: **Disabled** (default), **Attenuation**, **Gain**; **0** to **50** dB (default is **0** dB).
- **Pre-Amp** when enabled (disabled by default) increases the signal amplitude for weak signals.
- **Attenuation** is used to lowering the amplitude of a signal: **0**, **10** (default), **20**, **30** dB.

Demod

SSB Periodicity ≤20ms when enabled (default) allows scanning for SSB periodicity up to 20 ms; when disabled allows scanning for all SSB periodicity, including those longer than 20 ms.

PCI/Beam Table

Information

The following information is reported on top of the PCI/Beam table:

- **GSCN/ARFCN** channel number when applicable
- **Center Frequency**
- **SCS** (kHz) indicates the detected SCS. Only displayed when **SCS** is set to **Auto** (see *Frequency* on page 43) and **PCI Filtering** is enabled.
- **SSB Periodicity** is the time it takes for the same beam index to be repeated. Range is 0 to 200 ms. Only displayed when **PCI Filtering** is enabled.

Filtering

- **PCI Filtering** when enabled (default) allows filtering the results based on either the **Strongest** PCI (default) or a **Specific** PCI. For a specific PCI, select it from the list or enter its value.
- **Beam ID Filtering** when enabled (disabled by default), displays only the beams that have been selected (**All** by default). Use the **Beams** button to select the beam to be displayed.

Table

Up to 12 PCI/beams are displayed for FR1/FR2 based on the selected sorting and filtering. Sorting is available on any column of the table; descending order on the SS-RSRQ column by default.

- **PCI [Beam ID]** indicates respectively the Physical Cell ID (**PCI**: 0 to 1007) and the beam index (**Beam ID**: **0** to **7** for FR1; **0** to **63** for FR2).
- **SS-RSRP** (Secondary Synchronization Signal - Reference Signal Received Power) is the linear average of the power contributions of the resource elements carrying secondary synchronization signals. Range is -160 to 0 dBm.
- **SS-RSRQ** (Secondary Synchronization Signal - Reference Signal Received Quality) is the ratio of *N * SS-RSRP / NR carrier RSSI* from the same set of resource blocks, where N is the number of resource blocks in the NR carrier RSSI (NR carrier Received Signal Strength Indicator) measurement bandwidth. Range is -50 to 30 dB.
- **SS-SINR** (Secondary Synchronization Signal - Signal-to-noise and Interference Ratio) is the linear average over the power contribution of the resource elements carrying secondary synchronization signals divided by the linear average of the noise and interference power contribution. Range is -30 to 50 dB.

Shortcuts

Shortcuts provides quick access to some **Frequency** and **Amplitude** configuration settings. See *Frequency* on page 40 and *Amplitude* on page 42.

7 LTE Signal Analyzer

The **LTE Signal Analyzer** mode provides the demodulation of 4G/LTE signals validating over-the-air (OTA) performance of cell sites and metrics ensuring smooth communication with user equipment. Requires the **LTEAnalyzer** software option.

Frequency

Note: ***Frequency*** *settings are coupled on all RF Spectrum Analyzer modes.*

- **Frequency Unit** allows selecting the frequency unit: **MHz** or **GHz** (default).
- **Center Frequency** allows selecting the center frequency for the LTE signal: **450** MHz to **6** GHz for FR1 (default is **1.9** GHz).
  - **eARFCN** (E-ULTRA Absolute Radio Frequency Channel Number) defines the channel number of the center frequency:

Range (Downlink only)
0 to 5379
5730 to 7399
7500 to 10359
36000 to 60254
65536 to 70545

- **Channel Bandwidth** allows bandwidth selection of the channel to be analyzed: **Auto** (default), **1.4** MHz, **3** MHz, **5** MHz, **10** MHz, **15** MHz, **20** MHz. When **Auto** is selected, the detected LTE Channel Bandwidth is automatically decoded from the PBCH and used to calculate the metrics; if the decoding fails, the condition is reported and no metrics are available.

Amplitude

Note: ***Amplitude*** *settings are coupled on all RF Spectrum Analyzer modes.*

- **Amplitude Offset** sets an attenuation or gain value to apply to the amplitude measurements: **Disabled** (default), **Attenuation**, **Gain**; **0** to **50** dB (default is **0** dB).
- **Pre-Amp** when enabled (disabled by default) increases the signal amplitude for weak signals.
- **Attenuation** is used to lowering the amplitude of a signal: **0**, **10** (default), **20**, **30** dB.

PCI Table

Information

The following information is reported on top of the PCI table:

- **eARFCN** channel number when applicable
- **Center Frequency**

Filtering

PCI Filtering when enabled (default) allows filtering the results based on either the **Strongest** PCI (default) or a **Specific** PCI. For a specific PCI, select it from the list or enter its value.

Table

Up to 12 PCI are displayed based on the selected sorting and filtering. Sorting is available on any column of the table; descending order on the RSRQ column by default.

- **PCI** indicates the Physical Cell ID: 0 to 503.
- **Sector ID** indicates the sector ID: 0, 1, or 2.
- **Group ID** indicates the group ID: 0 to 167.

- **Duplexing** indicates the duplexing of the LTE signal: **TDD** or **FDD**.
- **Channel Bandwidth** indicates the detected LTE Channel Bandwidth when the **Channel Bandwidth** is set to **Auto**. This column is hidden when **Channel Bandwidth** is not set to **Auto**.
- **RSRP** (Reference Signal Received Power) is the linear average over the power contributions of the resource elements carrying cell-specific signals within the considered measurement frequency bandwidth. Range is -160 to 0 dBm.
- **RSRQ** (Reference Signal Received Quality) is the ratio of *N * RSRP / E-ULTRA carrier RSSI* from the same set of resource blocks, where N is the number of RB's of the E-UTRA carrier RSSI (Received Signal Strength Indicator) measurement bandwidth. Range is -20 to 0 dB.
- **RSSI** (Received Signal Strength Indicator) is the linear average of the total received power observed only in certain OFDM symbols of measurement subframes, in the measurement bandwidth, over *N* number of resource blocks by the UE from all sources, including co-channel serving and non-serving cells, adjacent channel interference, thermal noise, etc. Range is -160 to 0 dB.

Shortcuts

Shortcuts provides quick access to some **Frequency** and **Amplitude** configuration settings. See *Frequency* on page 45 and *Amplitude* on page 46.

8 RF Measurement

The **RF Measurement** mode provides interference hunting capability as well as channel power measurement validating that the radio transmitter output power is within specifications. Requires the **RFMeasurement** software option.

Measurement

Measurement Mode

Measurement Mode is set to **Channel Power**.

RF Measurement

➤ **3GPP Presets** allows calculating the Integration Bandwidth based on the following selections:

For 5GNR:

- **Band**: **FR1** (default) or **FR2**
- **Channel Bandwidth (MHz)**
- **SCS (kHz)**

For LTE:

- **Direction**: **Downlink** (default) or **Uplink**
- **Channel Bandwidth (MHz)**

Resulting Transmission Bandwidth indicates the calculated bandwidth based on the selected 3GPP Presets. Applying the 3GPP Presets changes the **Integration Bandwidth** to this value.

➤ **Integration Bandwidth (MHz)** determines the bandwidth over which the integration is performed to measure channel power: **0.1** to **100** MHz (default is **20** MHz).

➤ **Averages** defines the number of single channel power measurement that is used to compute the average channel power: **1** (default), **2**, **3**, **5**, **10**, **20**, **50**, or **100**.

Audible Tone

Audible Tone, when enabled (disabled by default), allows hearing an audible tone based on the actual channel power value. This is helpful for hands-free operation of the equipment for either antenna peaking or interference hunting. To adjust the volume of the audible tone, refer to **Volume** from *General Settings* on page 12.

- **Level Range** allows adjusting the low and high channel power values respectively mapped to the low and high audible tone pitch.

  It is also possible from the graph to drag the top and bottom control to adjust the level range as needed. The **Level Range** can be moved up or down by dragging the shaded area.

- **Mute When Out of Range** allows muting (default) the audible tone when source is outside the **Level Range**.

Frequency

Note: ***Frequency*** *settings are coupled on all RF Spectrum Analyzer modes.*

- **Frequency Unit** allows selecting the frequency unit: **MHz** or **GHz** (default).
- **Center Frequency** allows selecting the center frequency for the LTE signal: **450** MHz to **6** GHz for FR1 (default is **1.9** GHz).
- **Channel Mode** allows selecting the channel mode: **5G** (default) or **LTE**. **LTE** is only available with FR1.
  - **ARFCN** (Absolute Radio Frequency Channel Number), available with 5G channel mode, allows selecting the channel number of the center frequency: **100000** to **796666** for FR1; **2017499** to **2278332** for FR2. The **Center Frequency** is automatically updated following the channel selected.
  - **eARFCN** (E-ULTRA Absolute Radio Frequency Channel Number) defines the channel number of the center frequency:

Range (Downlink only)
0 to 5379
5730 to 7399
7500 to 10359
36000 to 60254
65536 to 70545

- **Span (MHz)** allows selecting the frequency span of the displayed spectrum graph: **0.1** to **100** MHz (default). It has the effect of expanding or contracting the width of the graph.

Amplitude

Note: ***Amplitude*** *settings are coupled on all RF Spectrum Analyzer modes.*

- **Ref Level (dBm)** sets the maximum power value displayed on the graph: **-150** dBm to **50** dBm (default is **-20** dBm). This has the effect of moving the graph vertically on the screen.
- **Scale/Div (dB)** sets the spacing between divisions on the graph: **1** to **15** dB (default). This has the effect of condensing or expanding the graph vertically on the screen.
- **Auto Scale** automatically adjusts the **Scale/Div** and **Ref Level** to display the full graph.
- **Ref Level Offset** is used to compensate for the gain or attenuation provided by the connected external device: **Disabled** (default), **Attenuation**, **Gain**; **0** to **50** dB (default is **0** dB).
- **Pre-Amp** when enabled (disabled by default) increases the signal amplitude for weak signals.

  Attenuation is used to lowering the amplitude of a signal: **0**, **10** (default), **20**, **30** dB.

Sweep (TDD Gated Sweep)

Gate

Note: *See* Sweep (TDD Gated Sweep) *on page 29.*

5G Sync Location

Allows using the 5G radio frame as a synchronization source. Available when **5G Radio Frame** is selected as the **Gate Source**. The **Center Frequency** is decoupled from the **Frequency** menu.

- **Adjust Sync Power** allows to automatically adjust the power at the sync location in case the gated sweep cannot synchronize.
- **Copy CF** allows copying the center frequency settings (from the **Frequency** menu) to be used for the synchronization source.
- **SSB Mode** allows selecting the method of entry for the SSB location:
  - **GSCN** allows selection of the SSB channel number: **1124** to **9582** for FR1; **22256** to **23167** for FR2. The **Center Frequency** is automatically updated following the SSB channel selected.
  - **SSB Offset** (default) allows selection of the frequency offset (default is 0 MHz) relative to the **Center Frequency** selected.
- **SSB Scanner** ( ), see **SSB Scanner** on page 40.
- **Frequency Unit** allows selecting the frequency unit: **MHz** or **GHz** (default).
- **Center Frequency** allows selecting the center frequency for the 5GNR signal: **450** MHz to **6000** MHz for FR1 (default is **1.9** GHz); **24.25** GHz to **40** GHz for FR2 (default is **28** GHz). Not configurable but automatically updated when using **GSCN** - **SSB Mode**.
- **ARFCN** (Absolute Radio Frequency Channel Number), available when **SSB Mode** is set to **SSB Offset**, allows selecting the channel number of the center frequency: Range 90000 to 800000 for FR1; Range 2016667 to 2279165 for FR2. The **Center Frequency** is automatically updated following the **ARFCN** selected.
- **SCS** defines the Sub Carrier Spacing of the SSB: **Auto** (default), **15**, **30** kHz for FR1; **Auto** (default), **120**, **240** kHz for FR2. When **Auto** is selected, the SCS of the SSB is automatically determined and its value is reported when succeeded.

LTE Sync Location

Allows using the LTE radio frame as a synchronization source. Available when **LTE Radio Frame** is selected as the **Gate Source**. The **Center Frequency** is decoupled from the **Frequency** menu.

- **Copy CF** allows copying the center frequency settings (from the **Frequency** menu) to be used for the synchronization source.
- **Frequency Unit** allows selecting the frequency unit: **MHz** or **GHz** (default).
- **Center Frequency** allows selecting the center frequency for the LTE signal: **450** MHz to **6** GHz for FR1 (default is **1.9** GHz).
  - **eARFCN** (E-ULTRA Absolute Radio Frequency Channel Number) defines the channel number of the center frequency:

Range (Downlink only)
0 to 5379
5730 to 7399
7500 to 10359
36000 to 60254
65536 to 70545

Graph (RMS Trace)

Displays the graph of the RMS Trace. The following information is reported on top-right of the graph:

- **RBW**
- **ARFCN** when defined
- **eARFCN** when defined, followed by the link direction: **Downlink**, or **Uplink**.

Adjusting the **Center Frequency**, **Ref Level**, **Span** and/or **Scale/Div** using the touch screen or a mouse. The following gestures may be combined.

- Press/click and drag horizontally to change the **Center Frequency**.
- Press/click and drag vertically to change the **Ref Level**.
- Press with two fingers and pinch horizontally to expand or reduce the **Span**.
- Press with two fingers and pinch vertically to expand or reduce the **Scale/Div**.

The following metrics are reported on bottom of the graph:

- **Integration Bandwidth** indicates the configured value (see *RF Measurement* on page 48).
- **Channel Power** reports the total power within the Integration Bandwidth in dBm. The channel power is also displayed on the graph.
- **Power Spectral Density** reports the density of the power spectrum within the integration bandwidth in dBm/Hz.

Shortcuts

Shortcuts provides quick access to some **Frequency** and **Amplitude** configuration settings. See *Frequency* on page 50 and *Amplitude* on page 51.

9 Coverage Map

The **Coverage Map** mode provides RF metric geolocation by collecting data at regular interval while on the go (driving/walking). The resulting breadcrumb map provides Channel Power and Power Spectral Density metrics, as well as color-indication to either find interferer or map the strength of the base station signal. Requires the **CoverageMap** software option.

Coverage Map

Display

- **Channel Power scale** allows adjusting the channel power mapping low (cool color) and high (hot color) scale values: -150 dBm to either 20 dBm for FR1 or 10 dBm for FR2.
- **Power Spectral Density scale** allows adjusting the power spectral density mapping low (cool color) and high (hot color) scale values in dBm/Hz
- **Displayed Metric** allows selecting the live metric and on what metric the colored breadcrumbs will be displayed on the map: **Channel Power** (default) and **Power Spectral Density**.

Integration

The integration defines the distance between the breadcrumbs (Metric Integration Range) and the method used to integrate the breadcrumbs on the map (Metric Integration Method).

- **Metric Integration Range**: 1 (default), 2, 5, or 10 m.
- **Metric Integration Method**: Average (default), Max or Min.

Map Settings

Offline Map

Load Offline Map allows downloading detailed maps of the selected areas. Once downloaded, maps are stored on the platform for offline availability.

- Downloaded indicates the total number of map available offline on the platform.
- Offline/Online indicates if the connection with the EXFO map server is established (Online) or not (Offline). An Internet connection must be enabled on the platform to be able to connect to the EXFO map server.

To download new detailed maps:

1. Select the Continent
2. Select the Country (when applicable)
3. Select the Region (when applicable)
4. Press Download

To delete a downloaded map:

1. Clear the check box of the map to be deleted
2. Press Yes to confirm

Note: *The number appearing beside the Continent/Country indicates the total number of maps downloaded.*

Measurement

Note: *See* Measurement *on page 48.*

Frequency

Note: *See* Frequency *on page 50.*

Amplitude

Note: *See* Amplitude *on page 51.*

Sweep (TDD Gated Sweep)

Note: *See* Sweep (TDD Gated Sweep) *on page 29.*

Map/Table Overview

The following metrics and controls are available at the bottom of the page:

- **RF Measurement** indicates the source of measurement used for coverage map.
- **Channel Power** reports the total power within the Integration Bandwidth in dBm.
- **Power Spectral Density** reports the power spectral density in dBm/Hz.
- **Start** button, available when the GNSS status is **Ready**, starts the measurement acquisition.
- **Stop** button, available when the measurement acquisition is running, stops the measurement acquisition.
- **Pause** button, available when the measurement acquisition is running, pauses the measurement acquisition.
- **Resume** button, available when the measurement acquisition is in
- **Pause**, continues the measurement acquisition.

Map View

The world map is centered by default (north on top) on the current position () and updated as the current position changes. The map auto centering is automatically disabled () when either zooming or dragging the map.

Press and drag on the touch screen to move on the map.

Press with two fingers on the touch screen and pinch to zoom in/out. The following buttons/icons are available:

Button / Icon	Description
	Indicates that the map is centered to the current position (default). Tap on this button to deactivate the centering to the current position.
	Indicates that the map is not centered to the current position. Tap on this button to activate the centering to the current position.
	Zoom in Zoom out. It is also possible to zoom in/out using the touch screen: press with two fingers and pinch in/out on the map.
	Indicates the map scale in m/Km and ft/mi.
	Indicates the current position. The arrow indicates the moving direction.

Channel Power / Power Spectral Density Breadcrumbs

For each integrated data, a colored dot is displayed on the map. The color of each dot indicates the measure of the selected metric: Channel Power or Power Spectral Density. Colors are from low (cool color) to high (hot color) metric value based on the defined scale limits.

Tapping on a dot displays the details of the data collected which include:

- Date and time
- Channel Power in dBm
- PSD (Power Spectral Density) in dBm/Hz

Table View

The coverage map table lists the data collected which include:

- Date & Time
- Latitude (deg)
- Longitude (deg)
- Channel Power (dBm)
- Power Spectral Density (dBm/Hz)

Note: *The last 10 collected data entries are listed. Use the page controls to navigate page up/down and top/end of the list.*

Export allows saving the data collected in a JSON file.

Shortcuts

Note: *See* Shortcuts *on page 54.*

10 GNSS

Allows configuring the internal GNSS receiver and reports its status/statistics. A TA-SYNC-PREMIUM is required with a GNSS antenna connected to its ANTENNA port. Press **Go Back** to exit the **GNSS** page.

Configuration

- **Constellation** allows selecting the constellation:

  GPS
  Galileo
  GLONASS
  BeiDou
  QZSS (available when the **GPS** check box is selected)

- **Band** allows selecting the band used by the GNSS receiver: **L1** or **L1 + L2** (default).

- **Cable Delay** allows selecting the signal propagation delay of the GNSS antenna and its cable: **0** to **32767** ns (default is **50** ns).

For timing mode only:

- **Time Source** allows selecting the time source based on the selected constellation(s):

  UTC (Default)
  GPS
  Galileo
  GLONASS
  BeiDou

- **Variant** allows selecting the UTC Variant based on the selected constellation(s):

  Auto (Default): Automatic selection
  USNO: United States Naval Observatory
  EUROPE: European Laboratory
  SU: Soviet Union
  NTSC: National Time Service Center

- **Position Mode** indicates how the position is acquired:

  Survey-In (Default): Once selected, starts the Survey-In process until the actual position accuracy is within the desired accuracy; the process last for at least 2 minutes (see **Status** - **Survey-In** for more information).

  Manual allows configuring the antenna coordinates manually.

  Coordinates (**Antenna Coordinates**), available with **Manual** position mode, allows selecting the WGS84 coordinates:

  Latitude: **-90** to **90** degrees (default is **0**)
  Longitude: **-180** to **180** degrees (default is **0**)
  Altitude: **-500** to **9999** meters (default is **0**)

- **Restart** performs a cold start of the GNSS receiver then, once booted, the Survey-In process starts automatically and runs until the desired accuracy is met. A restart is required each time the GNSS antenna is moved.

- **Cable Delay** allows selecting the signal propagation delay of the GNSS antenna and its cable: **0** to **32767 ns** (default is **50 ns**).

- **Desired Accuracy** allows selecting the required position accuracy:

  Very High (default): 1 meter
  High: 3 meters
  Medium: 10 meters
  Low: 30 meters

Statuses

For both timing and navigation mode:

GNSS:

- For timing, **GNSS** reports the GNSS global status as **Ready** when the GNSS status is in **Fixed Mode** and the GNSS Time Lock status is **Locked**; otherwise **Not Ready** is reported. The 1PPS signal is aligned with the Time Source and Variant when applicable.
- For navigation mode, GNSS reports the GNSS global status as Ready when the GNSS status is in 2D-Fix or 3D-Fix state; otherwise Not Ready is reported.
- **Jamming** reports position and jamming/interference status.
  - **--**: Unknown (disabled/uninitialized or antenna disconnected)
  - **OK**: Position OK and no jamming/interference detected
  - **Warning**: Position OK and jamming/interference detected
  - **Critical**: No Position and jamming/interference detected
- **Status** reports the current GNSS status:
  - **Acquiring** indicates that no position has been acquired yet or the GNSS receiver reports an invalid Fix.
  - **Survey-In** indicates that the Survey-In process is running. A circle is displayed indicating the remaining process then disappears once completed.
  - **Fixed Mode** indicates operating in timing mode and the GNSS receiver reports a valid Fix.

For navigation mode only:

- **2D-Fix** indicates operating in navigation mode and the GNSS receiver reports a valid 2D Fix.
- **3D-Fix** indicates operating in navigation mode and the GNSS receiver reports a valid 3D Fix.

- **# of Satellites** reports the number of satellites that are used by the GNSS receiver to determine the actual position and time.

For timing mode only:

- **Time Lock** reports Locked when the time source is known and confirmed, and when using UTC time source that the UTC Variant is known; otherwise Unlocked is reported.
- **UTC Variant** is reported when using an UTC time source:
- --: UTC Variant not known yet
- **USNO**: Unites States Naval Observatory
- **SU**: Soviet Union
- **NTSC**: National Time Service Center
- **Europe**: European Laboratory

Coordinates

- For timing mode: Coordinates reports the latitude, longitude, and altitude WGS84 coordinates determined by the Survey-In process. The coordinates are updated as soon as the first position is obtained, then throughout the survey-in process until it completes.
- For navigation mode: Coordinates indicates the latitude, longitude, and altitude of the present WGS84 coordinates. The coordinates are updated regularly.

Satellites Histogram

Reports each satellite seen by the GNSS receiver.

- X axis reports satellite ID: **G..** for GPS, **E..** for Galileo, **B..** for BeiDou, **R..** for GLONASS.
- Y axis reports satellite power: RX Power (C/No, in dBHz)
- Color: Green for used satellites and gray for those not used.

11 Troubleshooting

Solving Common Problems

Before calling EXFO's technical support, please read the following common problems that can occur and their respective solution.

Problem	Possible Cause	Solution
Power Overload Indication message displayed	RF input power is too high	Ensure the **Pre-Amp** setting is not enabled
		Apply an attenuation (10, 20, 30 dB)
		Go further distance from signal source (too close)
	Defective antenna	Replace the antenna
		Add an external filter
ADC Overrange Indication messge sisplayed	RF input power is too high	Apply an attenuation (10, 20, 30 dB)
		Ensure the **Pre-Amp** setting is not enabled
		Go further distance from signal source (too close)

Contacting the Technical Support Group

To obtain after-sales service or technical support for this product, contact EXFO at one of the following numbers. The Technical Support Group is available to take your calls from Monday to Friday, 8:00 a.m. to 7:00 p.m. (Eastern Time in North America).

Technical Support Group
400 Godin Avenue
Quebec (Quebec) G1M 2K2
CANADA

1 866 683-0155 (USA and Canada)
Tel.: 1 418 683-5498
Fax: 1 418 683-9224
support@exfo.com

For detailed information about technical support, and for a list of other worldwide locations, visit the EXFO Web site at www.exfo.com.

If you have comments or suggestions about this user documentation, you can send them to customer.feedback.manual@exfo.com.

To accelerate the process, please have information such as the name and the serial number (see the product identification label), as well as a description of your problem, close at hand.

Transportation

Maintain a temperature range within specifications when transporting the unit. Transportation damage can occur from improper handling. The following steps are recommended to minimize the possibility of damage:

- Pack the unit in its original packing material when shipping.
- Avoid high humidity or large temperature fluctuations.
- Keep the unit out of direct sunlight.
- Avoid unnecessary shocks and vibrations.

12 Glossary

Acronym List

?	Help

A

ARFCN	Absolute Radio Frequency Channel Number
AxC	Antenna System Container

B

BBU	Base-Band Unit
BW	Bandwidth

C

CF	Center Frequency
CPRI	Common Public Radio interface

D

dB	Decibels
dBFS	Decibels relative to Full Scale

E

eARFCN	E-ULTRA Absolute Radio Frequency Channel Number
EVM	Error Vector Magnitude

F

FCC	Federal Communications Commission
FDD	Frequency Division Duplex
FR	Radio Frequency

G

Gbps	Gigabit per second
GUI	Graphical User Interface

H

Hz	Hertz

I

ID	Identification
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical & Electronics Engineers

L

LOF	Loss Of Frame
LOS	Loss Of Signal
LTE	Long Term Evolution

M

MHz	Mega Hertz

N

NATO	North Atlantic Treaty Organization

O

OFDM	Orthogonal Frequency-Division Multiplexing
OTA	Over-The-Air

P

PCI	Physical Cell ID
PIM	Passive Intermodulation

R

RAN	Radio Access Network
RBW	Resolution Bandwidth
Ref	Reference
RF	Radio Frequency
RRH	Remote Radio Head
RSRP	Reference Signal Received Power
RSRQ	Reference Signal Received Quality
RSSI	Received Signal Strength Indicator
RTSA	Real Time Spectrum Analyzer
RX	Receive

S

SCS	Sub Carrier Spacing
SFP	Small Form Factor Pluggable
SNR	Signal to Noise Ratio
SS-RSRP	Secondary Synchronization Signal - Reference Signal Received Power
SS-RSRQ	Secondary Synchronization Signal - Reference Signal Received Quality
SS-SINR	Secondary Synchronization Signal - Signal-to-noise and Interference Ratio
SSB	Synchronization Signal Block

T

TDD	Time Division Duplexing

U

USA	United States of America

V

VBW	Video Bandwidth

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P

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S

T

V

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Printed in Canada (2025-11)