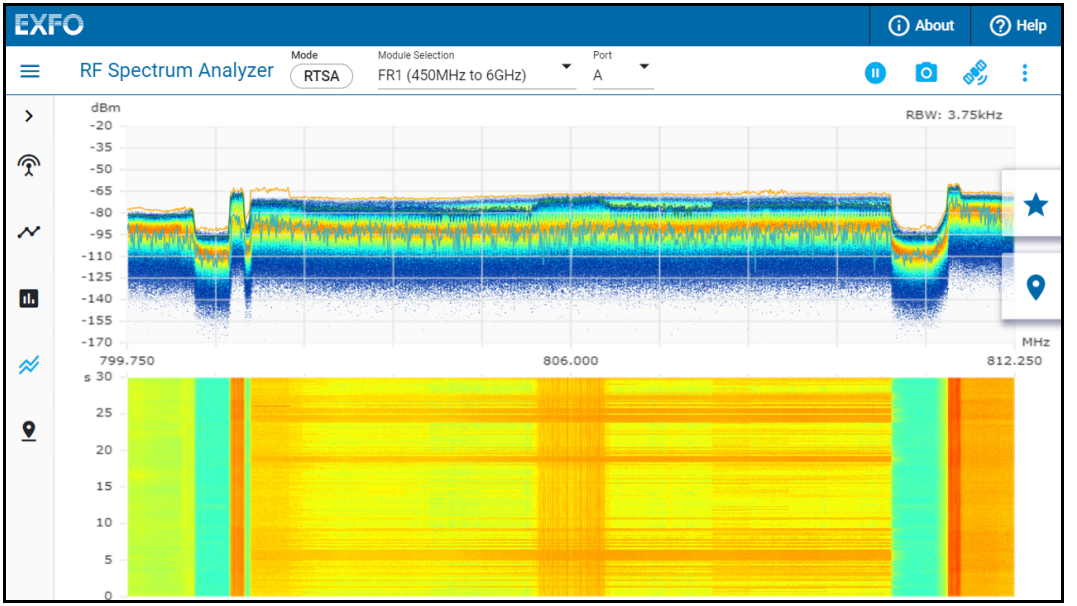
User Guide

# RFSA

## RF Spectrum Analyzer

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### *Patents*

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

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# Contents

# 1 Introducing RFSA

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. Absolute Time Error ($TE_{ant}$) measurements is also provided. 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 and **OTA-TE** software option for TE.

### 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 Web site 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, refer to 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**

For Time Error measurements ($|TE|_{ant}$), connect a GNSS antenna to the ANTENNA port of the TA-SYNC-PREMIUM.

***Note:*** *Refer to the NetBlazer user guide for more information on transceiver systems: TA-FR1, TA-FR2, TA-*SYNC-PREMIUM.

# 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 (refer to *Frequency* on page 19).
2. Tap **Amplitude** and select the to **Ref Level** and **Scale/Div** to fine tune the spectrum (refer to *Amplitude* on page 20).
3. Tap **Graph** to either fine tune the persistence graph or enable the display of the **Spectrogram** (refer to *Graph* on page 21).
4. Tap **Trace** to display different traces on the graph: **Max**, **Sample**, **Average**, **Max Hold**, or **Min Hold** (refer to *Trace* on page 22).
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** (refer to *Marker* on page 23).

***For Spectrum Analyzer:***

1. Tap **Frequency** and select the **Center Frequency** to center the graph on the screen (refer to *Frequency* on page 27).
2. Tap **Amplitude** and select the to **Ref Level** and **Scale/Div** to fine tune the spectrum (refer to *Amplitude* on page 28).
3. Tap **Graph** to enable and set the display of the **Spectrogram** (refer to *Graph* on page 29).
4. Tap **Bandwidth** to set the resolution bandwidth (**RBW**) and video bandwidth (**VBW**) (refer to *Bandwidth* on page 29).
5. Tap **Trace** to display different traces on the graph: **Max**, **Sample**, **Max Hold**, or **Min Hold** (refer to *Trace* on page 30).
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** (refer to *Marker* on page 31).

***For 5GNR Signal Analyzer:***

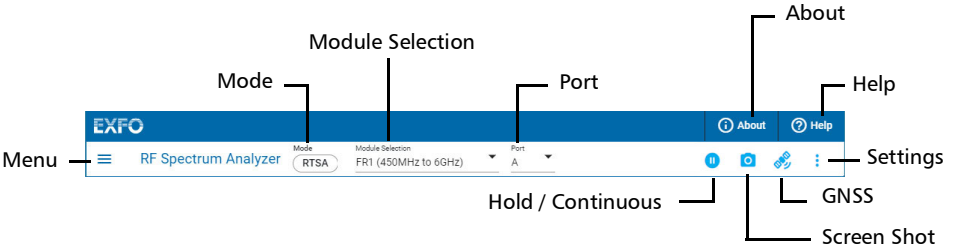
1. Tap **Frequency** and select the center frequency parameters (refer to *Frequency* on page 39).
2. Tap **Amplitude** and select the amplitude parameters if needed (refer to *Amplitude* on page 41). **Pre-Amp** may be enabled for better results.

***For LTE Signal Analyzer:***

1. Tap **Frequency** and select the center frequency parameters (refer to *Frequency* on page 47).
2. Tap **Amplitude** and select the amplitude parameters if needed (refer to *Amplitude* on page 41). **Pre-Amp** may be enabled for better results.

# 3 Graphical User Interface Overview

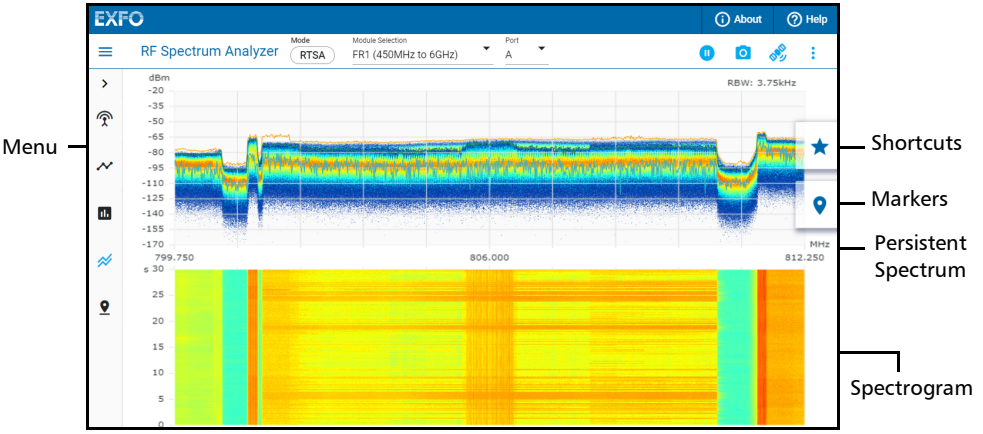
This chapter describes the RF Spectrum Analyzer graphical user interface. The following identifies the common main window settings and controls.



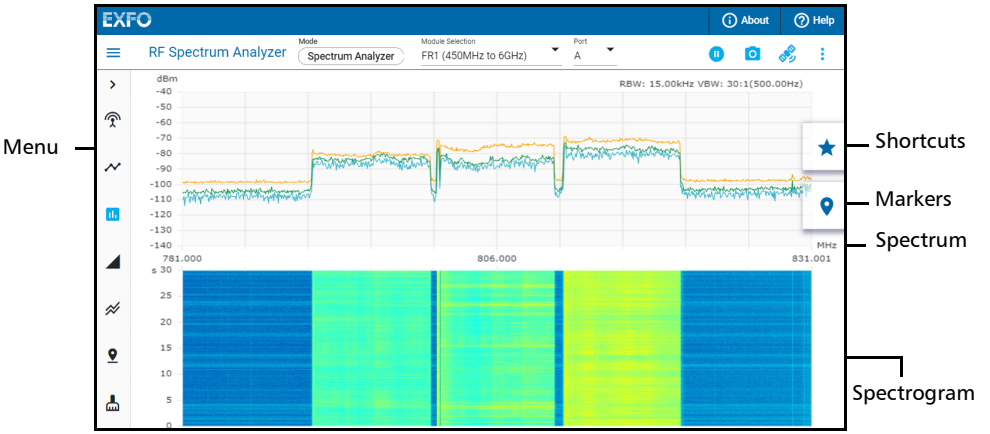

## Mode (Mode Selection)

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

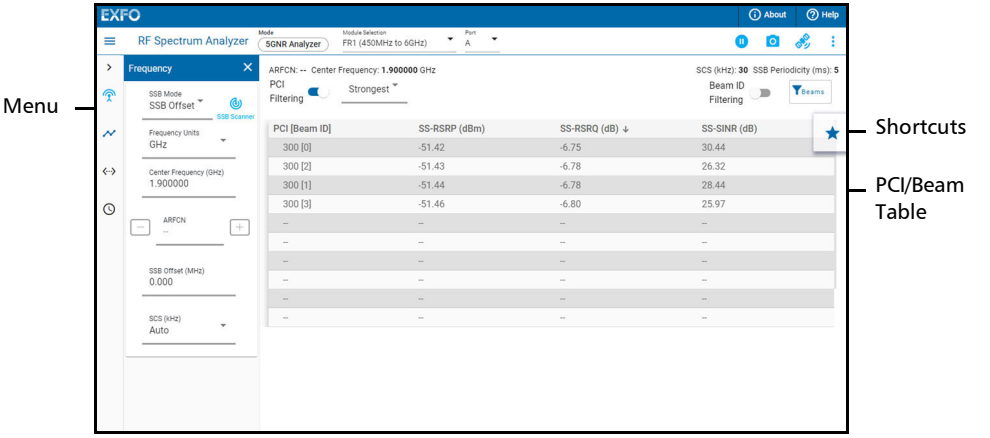
➤ **Real-Time Spectrum Analyzer (RTSA)**



## ➤ Spectrum Analyzer

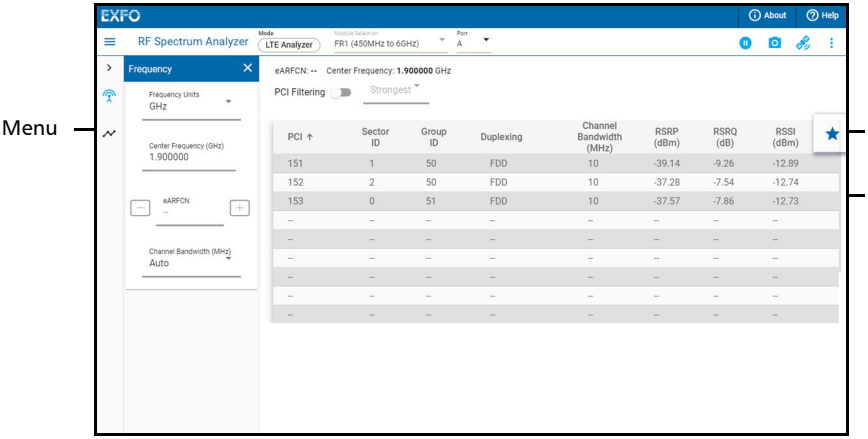



## ➤ 5GNR Signal Analyzer (5GNR Analyzer)[1]




1. Software option required.

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




## Module Selection

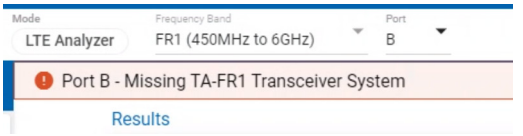
Allows selecting the module: **FR1 (450 MHz to 6 GHz)** or **FR2 (24.25 GHz to 40 GHz)**.

## 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: Missing or invalid transceiver based on the test configuration.
- 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, refer to *Solving Common Problems* on page 55 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.

# Hold / Continuous

Press on for hold and on for continuous as described below:

- 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.

## 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

## GNSS

Click on the GNSS icon to access the GNSS receiver configuration and status/statistics. Refer to *GNSS* on page 51. The GNSS icon color represents the GNSS status as follows:

When TE is disabled:

➤ Blue

When TE is enabled:

➤ Green: the GNSS is ready.

➤ Red: the GNSS is not ready.

# 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. Refer to 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 | - |
|  | Sync | - | - | X | - |

## Persistent Spectrum

For **Real-Time Spectrum Analyzer (RTSA)**, displays the persistent spectrum graph when **Persistent Spectrum** is enabled (refer to *Graph* on page 21 and *Spectrum Graph* on page 24) including traces when enabled.

## Spectrum

For **Spectrum Analyzer**, displays the spectrum graph of enabled traces (refer to *Trace* on page 30 and *Graph (Traces)* on page 35).

## Spectrogram

Displays the spectrogram graph when **Spectrogram** is enabled. For **Real-Time Spectrum Analyzer (RTSA)** refer to *Graph* on page 21 and *Spectrogram* on page 25. For **Spectrum Analyzer** refer *Graph* on page 29 and *Spectrogram* on page 36).

## 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) refer to *Marker* on page 23 and *Markers* on page 25. For Spectrum Analyzer, refer to *Marker* on page 31 and *Markers* on page 36.

## Shortcuts

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

- For **Real-Time Spectrum Analyzer (RTSA)**, refer to *Frequency* on page 19 and *Amplitude* on page 20.
- For **Spectrum Analyzer**, refer to *Frequency* on page 27 and *Amplitude* on page 28.

- For **5GNR Signal Analyzer**, refer to *Frequency* on page 39 and *Amplitude* on page 41.
- For **LTE Signal Analyzer**, refer to *Frequency* on page 47 and *Amplitude* on page 48.

## PCI/Beam Table

For **5GNR Signal Analyzer**, displays the 5G PCI/beam table (refer to *PCI/Beam Table* on page 43).

## PCI Table

For **LTE Signal Analyzer**, displays the LTE PCI table (refer to *PCI Table* on page 48).

# 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 | |
| 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 22* 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.*

- **Max Trace** check box when selected, cleared by default, displays a line representing the positive peak detector of the spectrum constantly refreshed.
- **Sample Trace** check box when selected, cleared by default, displays a line representing the power for each frequency at the same sample instance between 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** check box when selected, cleared by default, displays a line representing the maximum amplitude of the spectrum that were recorded over time.
- **Min Hold Trace** check box when selected, cleared 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.

## 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** allows, when enabled (disabled by default), 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 15.
  - **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 me 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 22* 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**, **Downlink/Uplink**, 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**.

## 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 23 and *Trace* on page 22 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 19 and *Amplitude* on page 20.

# 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 30* 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 (**100** 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.*

- **Max Trace** check box when selected, cleared by default, displays a line representing the positive peak detector of the spectrum constantly refreshed.
- **Sample Trace** check box when selected, cleared by default, displays a line representing the power for each frequency at the same sample instance between refresh interval.
- **Max Hold Trace** check box when selected, cleared by default, displays a line representing the maximum amplitude of the spectrum that were recorded over time.
- **Min Hold Trace** check box when selected, cleared 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** allows, when enabled (disabled by default), 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 15.
  - **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 me 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

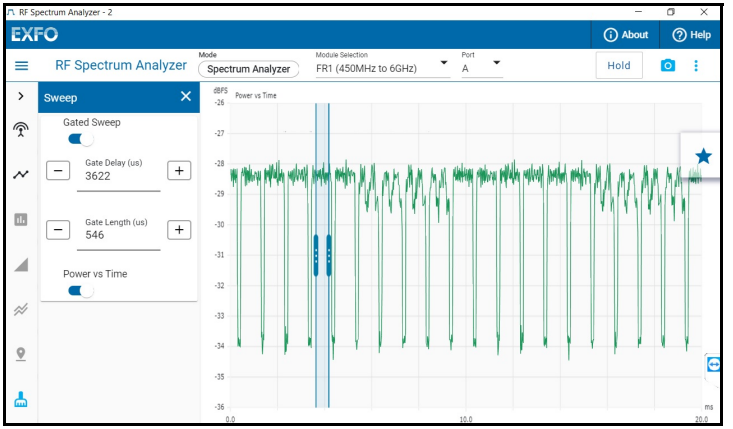
- **Marker 1** to **Marker 12** check boxes when selected (cleared by default) allow displaying the markers on the spectrum graph. An enabled marker is identified as M<*marker #*> on the graph. An enabled marker is only displayed when its trace is also enabled; selecting a trace for an enabled marker 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 30* 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), or either **5G** 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) enables 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.




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

***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** ( ), refer to **SSB Scanner** on page 39.
- **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**, **Downlink/Uplink**, 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**.

## 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 31 and *Trace* on page 30 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 27 and *Amplitude* on page 28.

# 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.

# Sync

***Note:*** *Available when the* ***OTA-TE*** *software option is enabled.*

- **TE** when enabled (disabled by default) allows antenna's Time Error measurements ($|TE|_{ant}$). A TA-SYNC-PREMIUM is required with a GNSS antenna connected to its ANTENNA port. Refer to *GNSS* on page 51.
- **Antenna Cable Delay** allows selecting the antenna cable delay compensation for the cable between the 5G antenna and TA-FRx antenna connector: **0** (default) to **1000 ns**.

- **Distance Compensation** allows specifying the distance compensation per PCI either by entering the distance manually or by using the satellite coordinates; this is the distance between the FTB and the Base Station Antenna. Press **Go Back** once the configuration is completed to exit the page.
  - **Add Single PCI** allows entering a single PCI to the list.
  - **Add Decoded PCIs** allows adding all decoded PCIs to the list.
  - **Delete** allows removing the selected PCIs from the list. Check each PCI check box or the global PCI check box to delete all PCIs, then press **Delete**.
  - **Distance Compensation** allows selecting how to define the distance compensation: **Distance** (default) or the base station antenna **Coordinates**.
  - **Unit** allows selecting the distance unit: **Meter** (default) or **Feet**.
  - **PCI** indicates the Physical Cell ID.
  - **Distance**

    When the **Distance Compensation** is set to **Distance**, it allows to manually enter the distance compensation.

    When the **Distance Compensation** is set to **Coordinates**, the FTB uses its own coordinate (after the GNSS lock is obtained) to automatically calculate the distance between the FTB and the base station antenna.
  - **Latitude**, **Longitude**, and **Altitude** allow specifying the PCI coordinates. Available when the **Distance Compensation** is set to **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**)
- **TE Details** displays detailed time error information on a specific PCI (see *TE Details* on page 45).

# 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 39) 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.

## TE Reset

**TE Reset** allows to clear the collected time error values. Available when **TE** is enabled.

## 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.
- **Max $|TE|_{ant}$ (ns)** indicates the antenna's maximum absolute time error value collected either since **TE** has been enabled or from the last reset. Available when **TE** is enabled. Use the magnifier icon to display TE details of a specific PCI (see *TE Details* on page 45).

# TE Details

***Note:*** *Press **Go Back** to exit the **TE Details** page.*

- **PCI** allows selecting a Physical Cell ID from the list or by entering its value.
- **GSCN/ARFCN** channel number is displayed when applicable.
- **Center Frequency** of the selected PCI.
- **SCS** (kHz) indicates the detected SCS.
- **SSB Periodicity** is the time it takes for the same beam index to be repeated.
- **TE Reset** allows to clear the collected time error values.
- **TE (ns)**: The following TE values are collected from the selected PCI either since **TE** has been enabled or from the last reset.
  - **$TE_{ant}$** indicates the last time error value collected in the last second.
  - **Max $TE_{ant}$** indicates the maximum time error value collected.
  - **Min $TE_{ant}$** indicates the minimum time error value collected.
  - **Max $|TE|_{ant}$** indicates the antenna's maximum absolute time error value collected.
- Time Error Graph dynamically displays the graph of time error values as a function of time. The dynamic view is a sliding window displaying the latest samples collected.

  Settings:

  - **Time Scale** allows the selection of the X-axis scale: **Seconds** (default), **dd HH:MM:SS**.
  - **Samples** indicates the number of samples collected.

Scaling the graph using the sliding bars:

➤ The time sliding bar allows adjusting:

time start/end window by dragging both edges of the sliding bar.

the defined window in time by dragging the sliding bar backward or forward.

➤ The TE sliding bar allows adjusting:

the time error minimum/maximum values by dragging both edges of the sliding bar.

the defined TE range of values by dragging the sliding bar up or down.

# Shortcuts

**Shortcuts** provides quick access to some **Frequency** and **Amplitude** configuration settings. See *Frequency* on page 39 and *Amplitude* on page 41.

# 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 47 and *Amplitude* on page 48.

# 8 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).

- **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**: Unites 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 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 **25 ns**).

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

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

## Statuses

- **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.
- **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.
- **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.
- **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

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

## 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.

# 9 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.

# 10 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 |
| TE | Time Error |

U

| | |
|---|---|
| USA | United States of America |

V

| | |
|---|---|
| VBW | Video Bandwidth |

# Index

## V

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www.EXFO.com · info@EXFO.com

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|---|---|---|
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