OpticalRF
Digital Spectrum Analyzer

EXFO

Trademarks

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.

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Contents

1 *Introducing the OpticalRF*

OpticalRF is a digital spectrum analyzer that displays power spectrum, persistence, and/or waterfall graphs derived from the IQ data carried over a CPRI link.

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 Safety Information

Laser Safety Information

WARNING

Do not install or terminate fibers while a light source is active. Never look directly into a live fiber and ensure that your eyes are protected at all times.

WARNING

The use of controls, adjustments and procedures, namely for operation and maintenance, other than those specified herein may result in hazardous radiation exposure or impair the protection provided by this unit.

WARNING

If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

WARNING

Use only accessories designed for your unit and approved by EXFO. For a complete list of accessories available for your unit, refer to its technical specifications or contact EXFO.

> **IMPORTANT**
> Refer to the documentation provided by the manufacturers of any accessories used with your EXFO product. It may contain environmental and/or operating conditions limiting their use.

> **IMPORTANT**
> When you see the following symbol on your unit ⚠️, make sure that you refer to the instructions provided in your user documentation. Ensure that you understand and meet the required conditions before using your product.

> **IMPORTANT**
> When you see the following symbol on your unit ☢️, it indicates that the unit is equipped with a laser source, or that it can be used with instruments equipped with a laser source. These instruments include, but are not limited to, modules and external optical units.

> **IMPORTANT**
> Other safety instructions relevant for your product are located throughout this documentation, depending on the action to perform. Make sure to read them carefully when they apply to your situation.

Additional Laser Safety Information

This product employs Class 1 Laser transceivers.

CLASS 1 LASER PRODUCT

WARNING

When the LASER LED is on or flashing, the module is transmitting an optical signal on the SFP+ transceiver ports.

Note: *Refer to the module user guide for additional test equipment safety information and ratings.*

3 *Getting Started*

Supported Modules and Software Option

The **OpticalRF** application is supported on the following modules having the **iORF** software option enabled: 720Gv2, 730Gv2, 870v2, 870Q, 880v2, 880Q, 890NGE, 88260, 8870, and 8880.

Software Installation

If the **OpticalRF** application is not already installed, refer to the platform user guide for more information on how to install this application through **Update Manager**.

Starting the OpticalRF Application

From **Mini ToolBox X** (NetBlazer) or **ToolBox X** (Power Blazer), tap the **OpticalRF** application button.

Connecting to the RAN

The module's SFP+ P1/P2 port (SFP28 A1/A2 port on 88260) is used to connect to the RAN (Radio Access Network) for uplink monitoring. Supported rates are: CPRI 1.2, 2.4, 3.1, 4.9, 6.1, 9.8, and 10.1 Gbit/s.

CAUTION

To prevent exceeding the maximum input/output power level, please refer to the module technical specifications at *www.exfo.com*.

Plug the SFP/SFP+ transceiver into the P1 or P2 slot (A1 or A2 slot on 88260). Refer to the module user guide for connector/port location purposes.

WARNING

Refer to *www.exfo.com* for the list of supported transceivers. Using non-supported transceivers can affect the performance and accuracy of the test.

Note: *In order to avoid signal corruption issues that might affect your results, it is strongly recommended that the SFP/SFP+ inserted into the module's port is identical to the one on the optical splitter side. Similarly, the specification of the optical splitter and optical cable should be identical to the ones used in the CPRI link.*

RF Spectrum Connection Diagram

The following connection diagram allows displaying power spectrum graph using a Passive Tap.
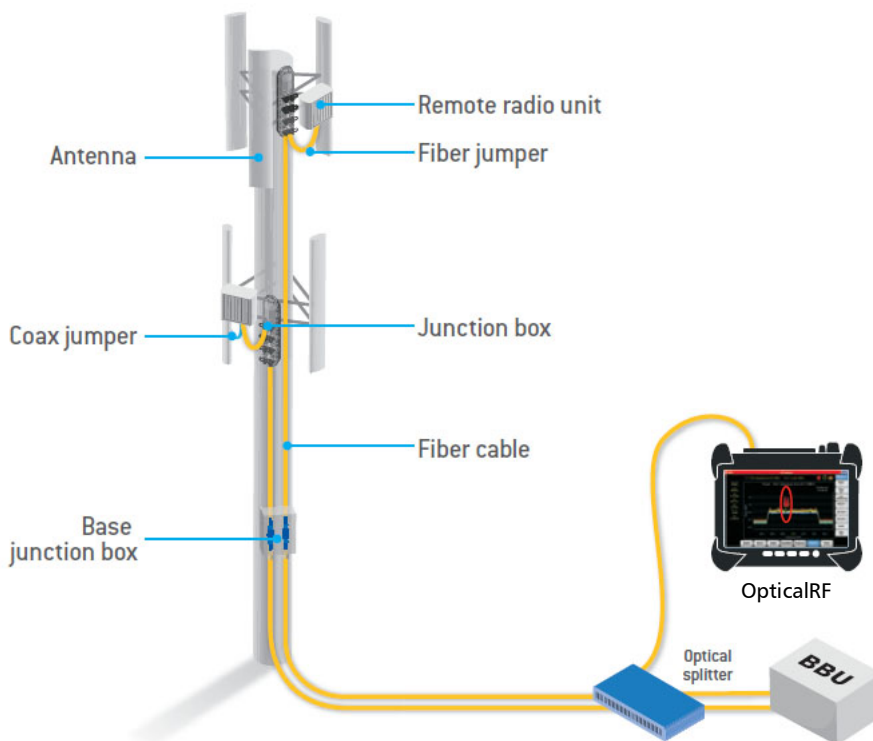
To connect to the RAN:

1. Install an optical splitter, if not already installed, as follows:

   1a. If required, lock down the sector to be tested.

   1b. Insert an optical splitter (it is recommended to connect RRH to port A and BBU to port B).

   1c. Ensure the sector is unlocked.

2. Connect the module to the optical splitter as follows:

    2a. To display the uplink, connect the A side of the splitter's AB port to the RX SFP+ P1 or P2 port (A1 or A2 port on 88260) of the module (generally marked with an in arrow).

    2b. To display the downlink, connect the B side of the splitter's AB port to the RX SFP+ P1 or P2 port (A1 or A2 port on 88260) of the module (generally marked with an in arrow).

4 *Graphical User Interface Overview*

This chapter describes the OpticalRF graphical user interface.
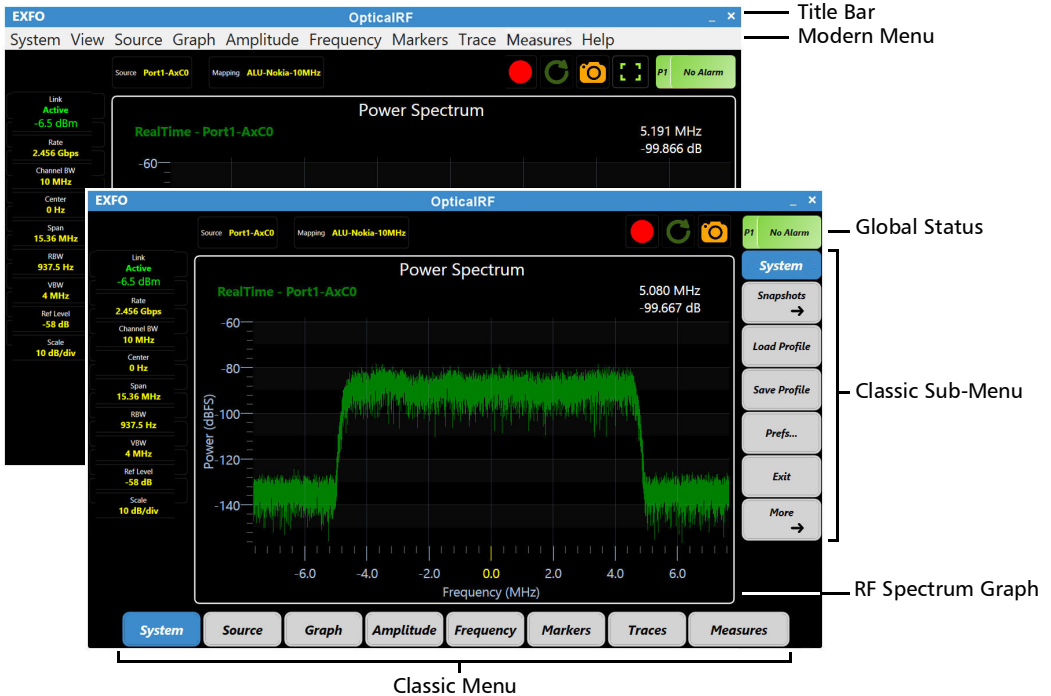
Title Bar

Displays OpticalRF related information and allows minimizing, maximizing, and closing the application.

Global Status

Indicates the current and history alarm status for each port when applicable. Tapping over the global status area gives access to the alarms and logger (refer to *Global Status, Alarms, and Logger* on page 51).

Modern Menu and Classic Menu / Sub-Menu

All menu items are described individually in the following chapters.

The OpticalRF can be configured to use either the classic (default) or modern view.

➤ The classic view has larger menus and is more suited to touch screen operation. Selecting an item from the classic menu affects the content of the sub-menu displayed on the right.

➤ The modern view is better suited to traditional mouse and keyboard operation.

To switch from one view to the other:

1. From the classic view, tap **System**, **Prefs...**, select **Modern**, and tap **Done**.

   OR

2. From the modern view, tap **System**, **Preferences**, select **Classic**, and tap **Done**.

Note: *Some menu contents differ between **Classic** and **Modern** views. In this user guide, the **Classic** menu is used by default unless otherwise specified.*

Note: *A **More** button appears when there is not enough room on the screen to display all sub-menu items giving access to these menu items.*

RF Spectrum Graph

Graph Tools

Graph Settings

RF Spectrum
Graph View

Overlay
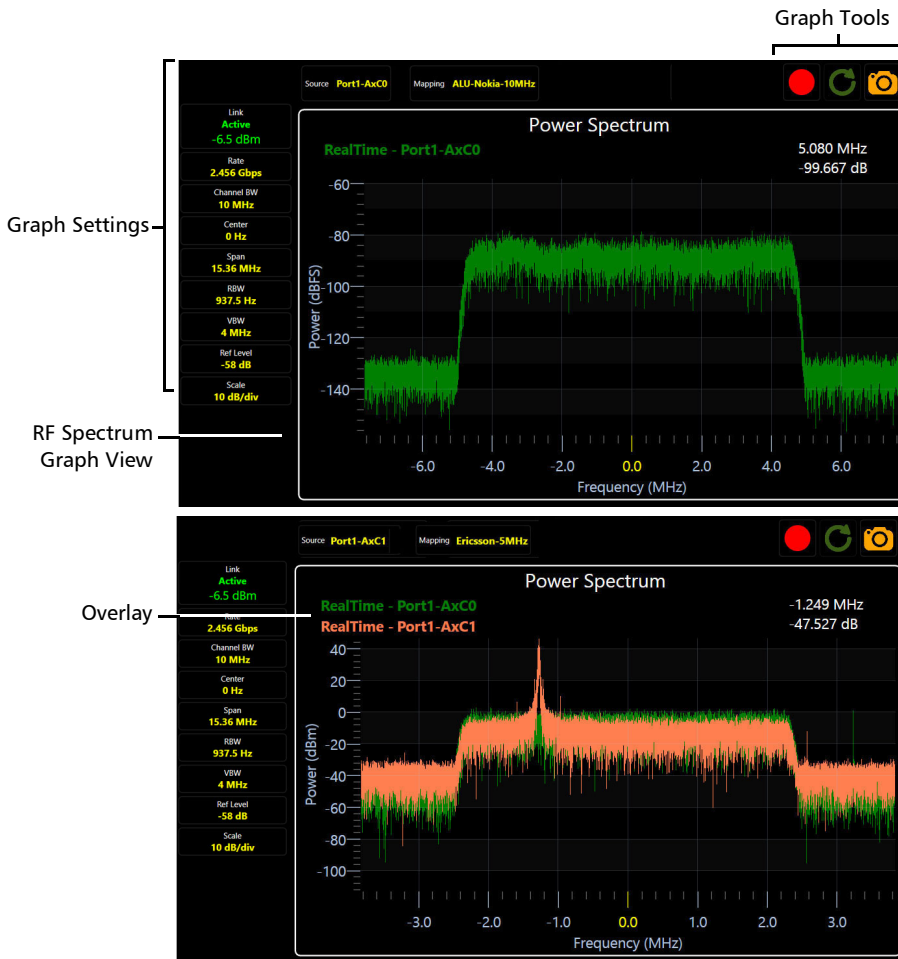
Graph Settings

The graph settings is a live area from which it is possible to set/change values by tapping on individual fields.

➤ **Source** indicates the selected trace and allows either setting the basic trace, replacing a trace, or adding an overlay. Choices are the live test ports-antennas ([port]-**AxCn**) or a playback file (**File1** or **File2**) It is possible to display multiple AxCn or playback files simultaneously as well as the average, minimum, and maximum values (refer to *Trace* on page 39 and *Overlay* on page 40).

   ➤ To display a single basic source, tap **Source**, tap **Basic**, and select the trace source. The basic trace is now displayed and all other overlays are deleted at the exception of **Minimum** and **Maximum**.

   ➤ To replace a source, tap the overlay to be replaced from the graph, tap **Source** > **Replace**, and select another trace.

   ➤ To add an overlay, tap **Source** > **Overlay**, and select the trace overlay.

➤ **Mapping** is the configuration (Manufacturer and Bandwidth) defining the parameters used by the application to decode and display the RF data. Clicking on this field allows the mapping selection and configuration; refer to *Mapping* on page 23.

➤ **Link**[1] indicates either if traffic is present on the input port
(**LossOfSignal** or **Active** with RX power), **RateScan** while detecting
the signal rate when **Link Rate** is set to **Auto**, or **NoSFP** (if the SFP is
not detected). Tapping on this field displays the SFP information, which
includes its power range and the measured RX optical power (current,
minimum, and maximum values).

The RX power is displayed using the following colors:

Color	Description
Green	Power level is within the power range.
Yellow	Power level is out-of-range.
Red	LOS or power level close-to-damage.
Gray	Pending state.

➤ **Rate**[1] indicates and allows selecting the CPRI link rate. Refer to *Link
Rate* on page 23.

➤ **AxCn** indicates and allows selecting the Antenna System Container
(AxC) to be monitored.

➤ **Channel BW** indicates the channel bandwidth based on the selected
mapping. Refer to *Mapping* on page 23.

➤ **Center** indicates and allows selecting the center frequency. Refer to
Center on page 33.

➤ **Span** indicates and allows selecting the frequency span. Refer to *Span*
on page 33.

➤ **RBW** indicates and allows selecting the resolution bandwidth. Refer to
RBW on page 34.

➤ **VBW** indicates and allows selecting the video bandwidth. Refer to *VBW*
on page 33.

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1. Only available when the graph is from a live input source.

➤ **Ref Level** indicates and allows selecting the position of the power maximum value on the screen. Refer to *Ref Level* on page 31.

➤ **Scale** indicates and allows selecting the spacing between power values on the screen. Refer to *Scale* on page 31.

Overlay

Displays real time or average overlays, antennas and/or playback files, simultaneously; refer to *Overlay* on page 40. **Hold** is displayed next to the RealTime overlay when the source is paused (**Hold**).

RF Spectrum Graph View

A traditional graph displaying amplitude against frequency for Spectrum, Waterfall, or Persistence type.

The following actions are available when right-tapping on a graph:

➤ **Barriers** mark indicates the upper and lower frequencies of the signal as defined by the selected mapping. Refer to *Barrier* on page 29.

➤ **Grid** displays the grid lines. Refer to *Grid* on page 29.

➤ **Snap Marker** finds a peak close to the current cursor location on the screen. Move the cursor close to the desired peak, right tap, select **Snap Marker,** and the marker number.

➤ **Enable Zoom** enables the capability to zoom the graph. Refer to *Enable Zoom* on page 30.

➤ **Crosshairs** draws a set of crosshairs on the screen centred on the cursor. Refer to *Crosshair* on page 30.

➤ **UnZoom** clears the zoomed view. Refer to *UnZoom* on page 30.

➤ **Type** allows selecting the graph type. Refer to *Type* on page 28.

➤ **PIM** allows enabling PIM measurement and pass/fail verdict. Refer to *Measures Menu* on page 43.

➤ **RSSI** allows enabling RSSI measurement. Refer to *Measures Menu* on page 43.

➤ **Close View** closes the current graph view. Only available when more than one graph is displayed.

➤ **Move View** allows repositioning any graph on the screen. Right-tap on the graph, select **Move View**, and tap on a docking bar where the graph will be moved in relation with the other graph(s). Only available when more than one graph is displayed.

➤ **Toggle Full Screen** allows displaying the selected graph in full screen or normal.

Graph Tools

Icon	Description
	Record the trace Record a trace file to be replayed later. Refer to *Record* on page 25.
	Load and replay Loads and replays a previously recorded graph. Refer to *Playback* on page 25.
	Take screen snapshot Takes and saves screen shots of values/graphs that can be viewed later. The icon briefly displays the number 1 to indicate a screen shot has been taken. Refer to *Snapshots* on page 17.
	Maximize current view This icon is displayed when multiple graphs are available on the screen. To view any of the individual graphs, select the graph then tap this icon. Double-tap a desired graph also maximize its view.
	Show all views This icon is displayed when multiple graphs are available while only one is displayed (maximized) and allows returning to multiple graphs view. Double-tap on the graph also returns to multiple graphs view.

Global Status

Indicates the current and history alarm status for each port when applicable. Tapping over the global status area gives access to the Logger (refer to *Global Status, Alarms, and Logger* on page 51).

5 System Menu

This section describes each item of the **System** menu.

Snapshots

➤ **Snap** allows capturing and saving screen shots of values/graphs that can be viewed later.

Tap **System** > **Snapshots** > **Snap**, the camera icon briefly displays the number **1** to indicate a screen shot has been taken. Alternatively, use the camera icon (**Take Screen Snapshot**) to do a snapshot (refer to *Graph Tools* on page 17).

Screen shot images are saved in JPEG (.jpg) format in the Documents\OpticalRF\ScreenCapture folder. File names start with SC followed by the date, an underscore, time, and 3-digit number (e.g. SC20160819_084539_695.jpg).

➤ **View** allows opening a previously saved screen shot.

Tap **System** > **Snapshots** > **View**, select a file, and tap **OK**.

➤ **Back**, available with classic view, closes the **Snapshots** sub-menu.

Load Profile

Allows opening a previously saved configuration profile.

Tap **System** > **Load Profile**, select a previously saved configuration file, and tap **OK**.

Save Profile

Allows saving the display settings that can be loaded later. This can save time by loading potentially complex screen configurations like multiple graphs and control panes.

Tap **System** > **Save Profile**, enter the name of the file or select an existing file, and tap **OK**.

Prefs.../Preferences...

Tap **System** > **Prefs/Preferences**.

Allows switching from Classic view to Modern view and vice-versa. Refer to *Modern Menu and Classic Menu / Sub-Menu* on page 12.

Exit

Closes the OpticalRF application.

Tap **System** > **Exit** (**Alt-F4**).

Restore Default

Returns the OpticalRF application to its factory default settings when the application is restarted. It is sometimes easier to reset the application to its defaults than work through a number of configuration settings.

Tap **System** > **Restore Default** and **Yes** to confirm; the OpticalRF returns to default settings once the application is closed and restarted.

Report

Generates a test report.

Modern view: Tap **Help** > **Report**. **Classic** view: Tap **System** > **Report**.

Note: *Refer to Report on page 49.*

Help

Note: *For modern view the help is available as an independent tab. Refer to Help Menu on page 49.*

6 *View Menu*

This section describes each item of the **View** menu that is only available with the modern view.

Layout

Allows changing the resolution of the **Modern** menu graph settings and all opened pop-up windows. This can be useful when operating the system remotely on a different resolution screen.

Tap **View** > **Layout**, and select the desired setting: **Extra_Large**, **Large**, **Normal**, **Small**, or **Extra_Small**.

Trace Config

Allows overlaying Maximum, Minimum, Real-Time, and Average spectra.

Tap **View** > **Trace Config**. Refer to *Traces Menu* on page 39.

Marker Config

Allows defining up to five optional markers that can be used to track frequency offsets on the spectrum.

Tap **View** > **Marker Config**. Refer to *Markers Menu* on page 35.

Ref Level

Sets the position of the power maximum value on the screen.

Tap **View** > **Ref Level**. Refer to *Ref Level* on page 31.

Scale

Sets the spacing between power values for the power spectrum.

Tap **View** > **Scale**. Refer to *Scale* on page 31.

Center

Sets the center frequency for the currently displayed spectrum.

Tap **View** > **Center**. Refer to *Center* on page 33.

Span

Sets the frequency span of the currently displayed spectrum.

Tap **View** > **Span**. Refer to *Span* on page 33.

Full Span

Returns the currently displayed spectrum span to maximum value.

Tap **View** > **Full Span**. Refer to *Full Span* on page 33.

VBW

Modifies the Video Bandwidth.

Tap **View** > **VBW**. Refer to *VBW* on page 33.

All Controls

Displays all control pop-up windows: **Traces**, **Markers**, **Ref Level**, **Scale**, **Center**, **Span**, **VBW**, and **CalLevel**.

Tap **View** > **All Controls**.

Toggle Full Screen

Allows displaying the selected graph in full screen or normal.

7   *Source Menu*

This section describes each item of the **Source** menu.

Calibrate

Allows setting the dBm scale (to the left of the power graph) to accurately reflect the power of the signals being displayed. Only available with the live port sources. Not available when full scale is enabled (refer to *Full Scale* on page 31).

Tap **Source** > **Calibrate**, and select the value.

Link Rate

Allows selecting the CPRI link rate.

Tap **Source** > **Link Rate**, and select **Auto**, **Rate2 -1.228 Gbps**, **Rate3 - 2.456 Gbps**, **Rate4 - 3.072 Gbps**, **Rate5 - 4.915 Gbps**, **Rate6 - 6.144 Gbps**, **Rate7 - 9.830 Gbps**, or **Rate8 - 10.1376 Gbps**. **Auto** automatically detects the CPRI link rate; the discovered link rate is displayed once detected.

Mapping

In order to extract RF data from a CPRI data stream, information for the specific manufacturer's equipment is required. RF Spectrum configuration mappings contain various parameters, such as bandwidth, used by the application to decode and display the RF spectrum from the CPRI data stream.

Tap **Source** > **Mapping**.

➤ **Description** displays and allows the edition of the mapping name. The mapping name is not editable for preset mappings.

➤ **AxC#** and **Bandwidth (MHz)** table lists each AxC number and its bandwidth in MHz. **All** is displayed when all AxC have the same bandwidth.

➤ **Auto-Detect** allows automatic detection of the mapping from the live CPRI link. The detected mapping information is displayed when the detection succeeded and a mapping description is automatically given but editable: *Auto-Detect_<date and time>*.

➤ **Preset** allows the selection of pre-defined mappings.

➤ **Aggregation**, available for auto-detected mappings, allows aggregating component carriers together.

➤ **Component Carriers** indicates the bandwidth of each individual carrier and allows aggregating carriers together.

Button	Description
⬇⬆	Aggregates two adjacent carriers having the same bandwidth together. Aggregation of several carriers is possible up to a maximum bandwidth of 20 MHz.
⬆⬇	Separates previously aggregated carriers.
⬇⬆	Aggregation is not possible between these two adjacent carriers since the bandwidth will exceed 20 MHz.
-	Absence of the button indicates that the two adjacent carriers cannot be aggregated together.

➤ **Resulting Bandwidth** indicates either the bandwidth of a single carrier or the total bandwidth of aggregated carriers (group of carriers).

➤ **AxC#** indicates the AxC number for either a single carrier or a group of carriers.

Record

Records graphs that can be replayed later. Record is only available when using the live source port.

Tap **Source** > **Record** then either use the auto-generated name or enter a new one, select the record duration in milliseconds (16, 32, ..., 2048), and tap **OK**.

Recordings are saved in the proprietary .iqs format to the Documents\OpticalRF\IqsTraces folder. File names start with the date, an underscore, and the time (e.g. 20160819_084539.iqs).

Note: *It is also possible to start a record using the **Record the trace** icon. Refer to Graph Tools on page 17.*

Playback

Allows associating a previously recorded data (iqs file) to **File1** or **File2**. Only available when **Source** > **Configure** is set to **File1** or **File2**.

Tap **Source** > **Configure**, select **File1** or **File2**, tap **Playback**, select an iqs file, and tap **OK**.

Hold

Allows pausing the selected trace. Only available for RealTime overlays.

Tap **Source** > **Hold**.

8 *Graph Menu*

This section describes each item of the **Graph** menu.

Source

Indicates the trace selected allowing its configuration. Tapping on the Source button, allows either setting the basic trace, replacing a trace, or adding an overlay. Choices are the live test port-antennas ([port]-**AxCn**) or a playback file (**File1** or **File2**). It is possible to simultaneously display AxCn and/or playback files overlays as well as the average, minimum, and maximum values (refer to *Trace* on page 39 and *Overlay* on page 40).

➤ To add a single basic source:
   Tap **Graph** > **Source**, tap **Basic**, and select the trace source. The basic trace is now displayed and all other overlays are deleted with the exception of **Average**, **Minimum**, and **Maximum**.

➤ To replace a source:
   Tap the overlay to be replaced from the graph, tap **Graph** > **Source**, tap **Replace**, and select another trace.

➤ To add an overlay:
   Tap **Graph** > **Source**, tap **Overlay**, and select the trace overlay.

Type

Allows selecting the graph type or a combination of graph types. Each type supports a different aspect of signal analysis.

Tap **Graph** > **Type**, and select the graph type.

➤ **Spectrum**: The power magnitude of the input signal is displayed across the set frequency range.

➤ **Waterfall**: Spectrogram giving 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.

To the top left of the graph, there is a scale indicating the power values related to each color on the waterfall.

To the right of the color chart is the current **Refresh** value setting in milliseconds (ms). The refresh rate sets the period between lines being added to the top of the waterfall. Reducing the period has the effect of speeding the waterfall up and can be useful when monitoring for short period interferers. Tap on this field to select a new value.

Moving the cursor over the waterfall displays at the top right of the screen the frequency offset at the current location. This gives a quick frequency reading for the current location and allows identifying short period or intermittent interferers.

➤ **Persistence**: Power magnitude is plotted against frequency, with color denoting the percentage of time a plot point is placed at the current location.

New

It is possible to display multiple live or recorded graphs on the same screen. This can be useful when comparing a live graph against saved examples, or inspecting different aspects of the same source.

To add a new graph:

1. Tap **Graph** > **New**.

2. Select the **Type**: **Spectrum**, **Waterfall**, or **Persistence**.

3. Select the **Source**, either the live test ports-antennas ([port]-**AxCn**) or a playback file (**File1** or **File2**).

4. Tap **OK**.

5. Tap on a docking bar where the new graph will be inserted in relation to the other graph(s).

Note: *A new button **Show all views** / **Maximize current view** is displayed. Refer to* Graph Tools *on page 17.*

Grid

Displays the grid lines when enabled (**On**).

Tap **Graph** > **Grid** to display/hide grid lines.

Barrier

Barrier, when enabled (On), marks the upper and lower frequencies of the signal as defined by the selected mapping. Only available with spectrum graph.

Tap **Graph** > **Barrier** to display/hide the barriers.

Crosshair

Draws a set of crosshairs on the screen centred on the cursor. Values for frequency and power are displayed at top right of the screen.

Tap **Graph** > **Crosshair** to enable/disable the crosshair.

Enable Zoom

Enables the capability to zoom the graph. Once enabled, point and drag the mouse pointer over the graph region to be zoomed. Only available with spectrum graph.

Tap **Graph** > **Enable Zoom** and drag the mouse pointer over the graph region to be zoomed.

UnZoom

Clears the zoomed view.

Tap **Graph** > **UnZoom**.

Close All

Closes all graphs.

Tap **Graph** > **Close All** and **Yes** to confirm.

Note: *To close a single graph, right-tap on the graph and select **Close View**.*

9   *Amplitude Menu*

This section describes each item of the **Amplitude** menu.

The spectrum graph can be set to display the aspect of the signal to observe.

Full Scale

On sets the currently displayed spectrum's amplitude to maximum (**dBFS**).

Off disables the full scale (**dB** or **dBm**).

Tap **Amplitude** > **Full Scale** to enable/disable full scale.

Ref Level

Ref Level sets the position of the power maximum value on the screen. This has the effect of moving the base of the graph vertically on the screen.

Tap **Amplitude** > **Ref Level** and select the reference level value.

Scale

Scale sets the spacing between power values for the power spectrum. This has the effect of condensing or expanding the graph vertically on the screen.

Tap **Amplitude** > **Scale** and select the scale value.

10 *Frequency Menu*

This section describes each item of the **Frequency** menu.

Center

Center sets the center frequency for the currently displayed spectrum.

Tap **Frequency** > **Center** and enter the center value.

Span

Span sets the frequency span of the currently displayed spectrum. It has the effect of expanding or contracting the width of the graph.

Tap **Frequency** > **Span** and select the frequency span value.

Full Span

Full Span returns the currently displayed spectrum span to maximum value.

Tap **Frequency** > **Full Span** to display the maximum frequency span value.

VBW

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.

Tap **Frequency** > **VBW** and select the video bandwidth.

RBW

RBW (Resolution Bandwidth) balances the amount of detail against the scan speed of the signal. On a signal that takes time to settle, increasing the resolution bandwidth reduces the number of points displayed allowing faster signal refresh.

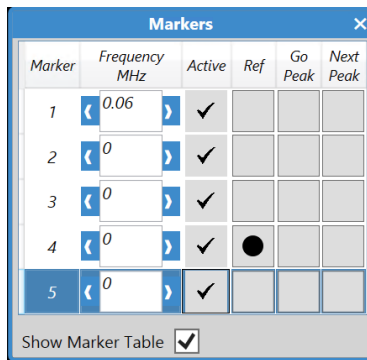Tap **Frequency** > **RBW** and select the resolution bandwidth value.

11 *Markers Menu*

This section describes each item of the **Markers** menu.

Up to five optional markers can be used to track frequency offsets on the spectrum. Only available with Power Spectrum graphs.

Configure

The **Configure** sub-menu is only available with the modern view and allows the configuration of the following marker parameters: **Marker**, **Frequency**, **Active**, **Ref**, **Go Peak**, and **Next Peak**.

Marker	Frequency MHz	Active	Ref	Go Peak	Next Peak
1	‹ 0.06 ›	✓			
2	‹ 0 ›	✓			
3	‹ 0 ›	✓			
4	‹ 0 ›	✓	●		
5	‹ 0 ›	✓			

Show Marker Table ✓

Tap **Markers > Configure** and select the marker parameters.

Marker

Classic view: Selects a marker number: **1** to **5**.

Modern view: Displays the marker number: **1** to **5**.

Tap **Markers > Marker** and select the marker value.

Active

Classic view: Activates/deactivates the selected marker: **On**/**Off**. When activating a new marker, a magenta marker arrow will appear on the graph at frequency zero (0.0 MHz).

Modern view: Activates/deactivates the corresponding marker.

Tap **Markers > Active** to activate/deactivate the selected maker.

Freq / Frequency

Classic view - **Freq**: Sets the frequency of the selected marker.

Modern view - **Frequency**: Sets the frequency of the corresponding marker. Setting the frequency of a marker automatically activates this marker.

Tap **Markers > Freq / Frequency** and enter the frequency of the selected marker.

Reference / Ref

Classic view (**Reference**) / **Modern** view (**Ref**): Selects the marker to be used as the reference in the marker table. See *Table / Show Table* on page 38.

Tap **Markers > Reference / Ref** and select the marker value.

Goto Peak / Go Peak

Classic view (**Goto Peak**): Moves the selected marker to the point of greatest amplitude.

Modern view (**Go Peak**): Moves the corresponding marker to the point of greatest amplitude.

Tap **Markers > Goto Peak / Go Peak** to move the selected marker to the point of greatest amplitude.

Next Peak

Classic view: Moves the selected marker to the next peak on the spectrum graph.

Modern view: Moves the corresponding marker to the next peak on the spectrum graph.

Tap **Markers > Next Peak** to move the selected marker to the next peak.

All Off

Deactivates all markers.

Tap **Markers > All Off** to deactivate all markers.

Table / Show Table

Classic view (**Table**) and Modern view (**Show Table**): Displays the marker table as follows:

Number	Active	Frequency	Power	Δ Power	Δ Frequency	Marker
1	Yes	0.45 MHz	-69.292 dB	12.424 dB	2.580 MHz	Marker 1
2	Yes	0.87 MHz	-74.883 dB	6.833 dB	3.000 MHz	Marker 2
3	Yes	-3.21 MHz	-89.770 dB	-8.053 dB	-1.080 MHz	Marker 3
4	Yes	-2.13 MHz	-81.717 dB	0.000 dB	0.000 MHz	Marker 4
5	Yes	0 MHz	-35.911 dB	45.806 dB	2.130 MHz	Marker 5

Tap **Markers > Table / Show Table** to display/hide the marker table.

The following information is displayed for each marker:

➤ **Number** indicates the marker number.

➤ **Active** indicates that the marker is activated (**Yes**) or not (**No**).

➤ **Frequency** indicates the current frequency value.

➤ **Power** indicates the current power values.

➤ Δ **Power** indicates the difference between the power value of the reference marker and the power value of this marker.

➤ The Δ **Frequency** displays the difference between the frequency of the reference marker (see *Reference / Ref* on page 36) and the frequency for this marker.
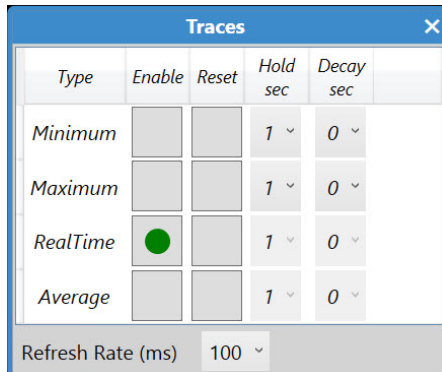
12 *Traces Menu*

This section describes each item of the **Traces** menu.

The OpticalRF can display more than just the default real-time spectrum. It is possible to overlay Maximum, Minimum, Real-Time, and Average spectra. Only available with **Spectrum** graph type.

Configure

The **Configure** sub-menu is only available with the **Modern** view and allows the configuration of the **Minimum**, **Maximum**, **RealTime**, and **Average** trace parameters.

Tap **Traces > Configure** and select the trace parameters.

Type	Enable	Reset	Hold sec	Decay sec	
Minimum			1 ˅	0 ˅	
Maximum			1 ˅	0 ˅	
RealTime	●		1 ˅	0 ˅	
Average			1 ˅	0 ˅	

Refresh Rate (ms)   100 ˅

Trace

Allows selecting an overlay in order to configure and enable it. **Minimum**, **Maximum**, and the **Source** traces are available by default. Use the **Overlay** button to manage overlays. When using overlay graphs, the **Minimum** and **Maximum** graphs report the values based on all active overlays.

Tap **Traces > Trace** and select an overlay.

Overlay

Allows setting real time or average overlays, antennas and/or files, to be displayed simultaneously.

To add a trace overlay on the graph:

1. Tap **Traces > Overlay**.

2. Select the signal source: [port]-**AxCn**, **File1**, or **File2**.

3. Select the **Type** as **RealTime** or **Average**.

4. Tap **Add**.

5. Repeat above steps to add additional trace overlays.

6. Tap **Done**.

To delete an overlay trace from the graph:

1. Select the check box of the trace overlay to be deleted.

2. Tap **Delete**.

3. Tap **Done**.

Enable

Allows displaying/hiding the current selected trace overlay on the graph.

On indicates that the current selected Trace overlay is displayed on the graph.

Off indicates that the current selected Trace overlay is not displayed on the graph.

Tap **Traces > Enable** to display/hide the selected trace overlay.

Refresh Rate

Sets the millisecond interval between the graph being redrawn on the screen: **0**, **25**, **50**, **100**, **200**, **500**, or **1000**.

Tap **Traces > Refresh Rate** and select the refresh rate.

Hold Time / Hold

The **Hold** control allows modifying the period of time plotted values are held on the graph before being allowed to **Decay**. The **Hold** and **Decay** setting allow intermittent signals to be seen more clearly, or low amplitude signals to be resolved when in the presence of more powerful ones. Only available for **Maximum** and **Minimum** traces.

Tap **Traces > Hold Time** / **Hold** and select the period value.

Decay Time / Decay

The **Decay** control allows modifying the period of time over which the plotted values fade. Only available for **Maximum** and **Minimum** traces.

Tap **Traces > Decay Time** / **Decay** and select the period value.

Clear

Clears the data of the currently selected trace.

Tap **Traces > Clear**.

All Off

**All Off** deactivates all spectra (**Minimum**, **Maximum**, **RealTime**, and **Average**).

Tap **Traces > All Off** to deactivate all spectra.

13 *Measures Menu*

This section describes each item of the **Measures** menu.

RF-PWR

The RF-PWR alarm monitors the signal and checks for power level spikes that could be interferences and compares them to a threshold mask. Power level spikes usually come from interference sources. The RF-PWR threshold is configurable individually for each monitored AxCn.
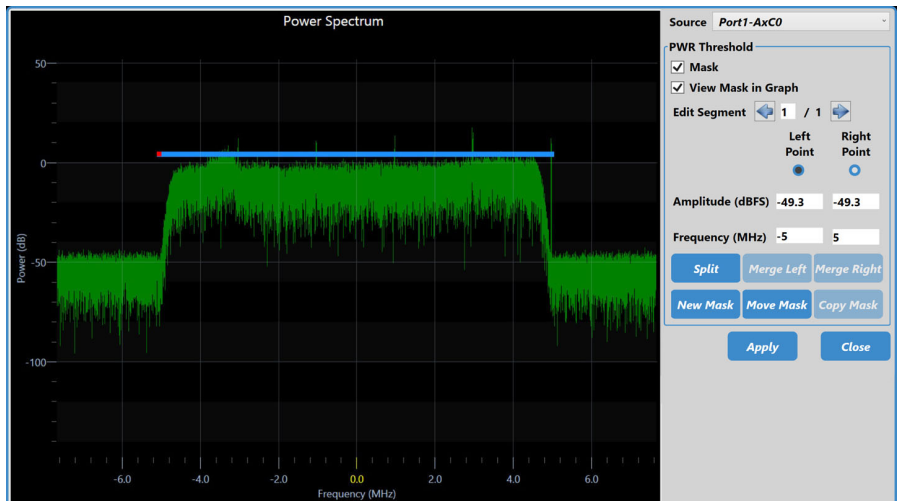
Power Spectrum Graph

The graph of the Source trace power versus frequency is displayed as well as the mask.

➤ **Amplitude** indicates the amplitude at the cursor point.

➤ **Frequency** indicates the frequency at the cursor point.

Source

Source allows selecting the source to apply the RF-PWR alarm to. Choices are the displayed AxCn graphs and overlays. Playback file (**File1** or **File2**) can be selected but it is not reporting any alarm.

PWR Threshold

The RF Power Threshold (PWR Threshold) is a mask that is formed from a single or multiple contiguous segments (up to 20) that encompass the RF signal mapping bandwidth. The RF signal power level is monitored and compared to the PWR threshold to declare an alarm when power level spikes are detected (refer to **RF-PWR on page 54**). The mask is compared with the live source graph only; not applicable for average, minimum, and maximum overlays.

➤ **Mask** check box when selected (cleared by default) enables and allows the configuration of the mask alarm threshold. A basic default mask is created based on the average of the signal.

➤ **View Mask in Graph** check box when selected (cleared by default) displays the defined mask on the graph of the selected source.

➤ **Edit Segment** allows choosing the mask segment for edition by either using the left and right arrows or directly selecting the segment. The chosen segment is highlighted in blue.

➤ **Left Point** selects the left-end point (highlighted in red) of the chosen segment for amplitude and frequency adjustments. Tapping on the left amplitude or frequency field automatically selects the **Left Point**.

➤ **Right Point** selects the right-end point (highlighted in red) of the chosen segment for amplitude and frequency adjustments. Tapping on the right amplitude or frequency field automatically selects the **Right Point**.

➤ **Amplitude (dB)** adjusts the left or right amplitude point of the chosen segment by either entering the amplitude value or using the slider to increase or decrease the amplitude value.

➤ **Frequency (MHz)** adjusts the left or right frequency point of the chosen segment by either entering the amplitude value or using the slider to increase or decrease the amplitude value.

➤ **Split** creates a new segment by splitting the chosen segment in two.

➤ **Merge Left** combines the chosen segment with the one to the left.

➤ **Merge Right** combines the chosen segment with the one to the right.

➤ **New Mask** restores the mask to its default settings with the ability to select the number of segments to be created.

➤ **Move Mask** allows moving the mask on the graph. Use the arrow keys to respectively move the mask up, down, left, or right.

➤ **Copy Mask** creates a mask based on another monitored source mask (**Source Mask**) while adapting the calibration and center frequency to the target source configuration parameters.

Apply

Applies the mask parameter changes for the selected source; the pop-up remains open.
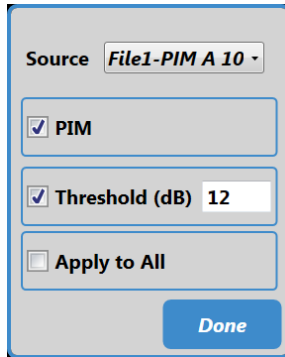
Close

Closes the pop-up. A confirmation is required when changes are unapplied.

PIM

PIM (Passive Intermodulation) measurement gives the value in dB of the flatness of the signal excluding the edges:
(rightmost value) - (leftmost value) = (PIM value)

Tap **Measures > PIM**.

| Source | *File1-PIM A 10* ▾ |

☑ **PIM**

☑ **Threshold (dB)** 12

☐ **Apply to All**

Done

➤ **Source** allows selecting a source [port]-AxCn for PIM measurement configuration. Not available when the **Apply to All** check box is selected.

➤ **PIM** check box when selected, measures the PIM value.

The PIM value is displayed in the top right corner of the graph using the following colors:

| Text Color	Description
White	No verdict: the threshold is not enabled.
Green	Pass verdict: the PIM value is within the defined threshold.
Red	Fail verdict: the PIM value is outside the defined threshold.

➤ **Threshold (dB)** check box when selected enables the PIM pass/fail verdict for the configured threshold absolute value (default is 6 dB).

➤ **Apply to All** check box when selected applies the PIM and Threshold settings to all active trace overlays.

➤ **Done** closes the pop-up menu.

RSSI

The RSSI (Received Signal Strength Indicator) measurement gives the power of the radio signal for the whole received frequency spectrum bandwidth.

Tap **Measures > RSSI**.
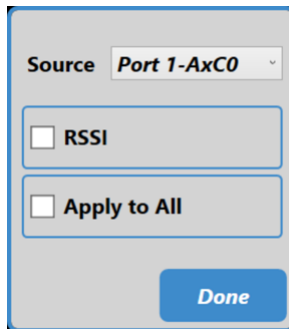
➤ **Source** allows selecting a source [port]-AxCn for RSSI measurement configuration. Not available when the **Apply to All** check box is selected.

➤ **RSSI** check box when selected, measures the RSSI value.

The RSSI value is displayed in the top right corner of the graph either in dB when uncalibrated, dBm when calibrated, or dBFS when in Full Scale.

➤ **Apply to All** check box when selected applies the RSSI setting to all active trace overlays.

➤ **Done** closes the pop-up menu.

Table / Show Table

Classic view (**Table**) and Modern view (**Show Table**): Displays the measures table as follows:

Source	PIM	RSSI
Port 1-AxC0	1.94 dB	47.00 dB
Port 1-AxC2	-9.84 dB	52.10 dB
Port 1-AxC3	-0.02 dB	45.96 dB
Port 1-AxC4	-2.19 dB	47.14 dB

Tap **Measures > Table / Show Table** to display/hide the measurement table.

The following information is displayed for each trace overlay having PIM and/or RSSI enabled:

➤ **Source** indicates the source of the signal.

➤ **PIM** indicates the measured slope value in dB. The PIM value is displayed using the following colors:

Text Color	Description
White	No verdict: the threshold is not enabled.
Green	Pass verdict: the PIM value is within the defined threshold.
Red	Fail verdict: the PIM value is outside the defined threshold.

➤ **RSSI** indicates the measured power value in dB/dBm/dBFS.

14 *Help Menu*

This section describes each item of the **Help** menu that is only available with the modern view.

Note: *For classic view the help is available under* ***System***.

View Help

View Help opens the OpticalRF application help information.

Tap **Help** > **View Help** (**F1**).

Report

Report is available with modern view and generates a test report. For classic view **Report** is available directly from the **System** menu.

➤ **Job Information** parameters are used to identify the source of the report and are not mandatory. Enter the following job information if required: **Job ID**, **Contractor Name**, **Customer Name**, **Operator Name**, **Circuit ID**, and **Comment**. Up to 30 characters are allowed for each parameter at the exception of Comment for which 256 characters are allowed.

➤ **Generate** creates, saves, and opens the report in PDF format.

➤ Reports are saved in PDF format in the Documents\OpticalRF\Reports folder. File names start with OpticalRFReport followed by the date, an underscore, and the time (e.g. OpticalRFReport_20160819_102314.pdf).

➤ **Send** uploads the report to EXFO Connect Server.

➤ **Close** exits the report window.

Save Logs

Tap **Help** > **Save Logs**.

Save Logs contains background information collected during the running of your system and can reveal underlying detail that will help diagnose problems or identify system components. If requested by EXFO technical support,

Tap **System** (Classic) / **Help** (Modern) > **Save Logs**, select a name or enter a name for the log and tap **OK**. A confirmation message is displayed indicating the location of the file on disk.

About

About displays the version of the OpticalRF application and software options.

Classic view: Tap **System** > **Help** > **About**.
Modern view: Tap **Help** > **About**.

➤ **Software Options** button displays the list of software options installed on the module.

Note: *For information on how to install and activate software options, refer to the platform User Guide. The OpticalRF application must be restarted once a new software option is installed in order to activate it.*

➤ **Done** closes the **About** page.

Back

Back, available with classic view, closes the **Help** sub-menu.

15 Global Status, Alarms, and Logger

This section describes the global status, alarms, and logger.

Note: *Alarms are reported for all monitored AxC sources; they are not reported against Minimum/Maximum/Average traces and playback files.*

Global Status
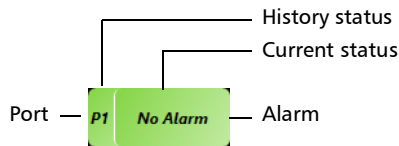
Current and history alarms are displayed using different background colors as follows:

Background color	Alarm	Description
Gray	Current	No test result available.
	History	
Green	Current	No alarm has occurred in the last second.
	History	No alarm has occurred during the monitoring period.
Red	Current	An alarm occurred in the last second.
	History	
Amber	History	At least one alarm has occurred during the monitoring period.

Note: *Global status are displayed individually for each port when applicable.*

Alarm and Logger

Tap over the global status area (Refer to *Global Status* on page 18) to open the alarms and logger pop-up.

➤ **Alarms** displays detailed alarm status, see *Alarms* on page 53.

➤ **Logger** lists the test events, see *Logger* on page 55.

➤ **Reset** clears the test alarms and logger events.

➤ **X** closes the alarms and logger pop-up.

Alarms

Current and history alarms are displayed using different background colors; see *Global Status* on page 51.

Note: *An alarm block title containing the magnifier (+) icon allows zooming this block which displays alarms for each AxC. To zoom-in, tap the magnifier (+) icon or anywhere on the title bar of the block. To zoom-out, tap on the magnifier (-) icon or anywhere on the title bar of the block.*

➤ **Interface**

➤ **LOS** (Loss Of Signal)

Absence of an input signal or at least 16 8B/10B code violations occur in one hyperframe.

➤ **Sync Header**

For rate 10.1G, indicates sync header violations.

➤ **66B Block**

For rate 10.1G, indicates that frames are received with errored block condition.

➤ **CPRI**

➤ **Link Down**

Absence of an input signal (LOS) or a LOF alarm.

➤ **LOF** (Loss Of Frame)

The hyperframe alignment cannot be achieved or is lost.

Note: *The following alarms that are based on a defined threshold are automatically re-evaluated upon changing any of the following parameters:* **PWR Threshold** *(Measures),* **Center** */* **RBW** */* **VBW** *(Frequency),* **Calibrate** *(Source), and* **Full Scale** *(Amplitude).*

➤ **RF-PWR**
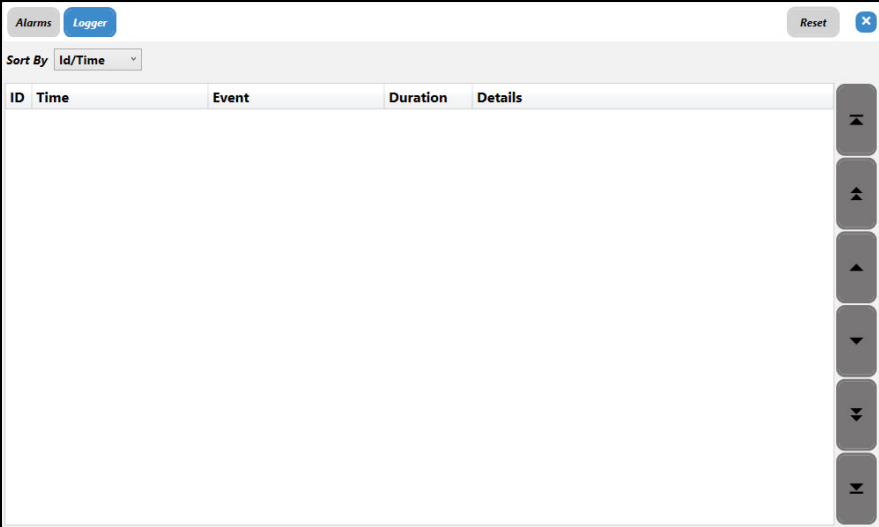
A RF-PWR alarm reports the highest event for each monitoring slice associated to the signal mapping, one event per 1 MHz is reported. The alarm is raised when interference(s) on a real-time trace cross the defined threshold mask, in the monitoring slice, for 70 percent of the monitoring interval. The alarm is cleared when the interference(s) on a real-time trace are below the threshold mask for more than 50 percent of the monitoring interval.

➤ **PIM**

Indicates that the measured PIM (Passive Intermodulation) absolute value is bigger than the defined threshold.

Logger

The **Logger** lists color-coded test events.

Sort By

Select the sorting order of the event logger entries:

➤ **ID/Time** (default) displays the event logger entries in numeric ascending order based on the **ID** number.

➤ **Event** displays the event logger entries in alphanumeric ascending order based on the **Event** type.

Logger Full

The logger table can display up to 5000 event entries. Once the logger table reports 5000 event entries, a log full indicator appears and no further entries are possible. However, the events in the Pending state will be updated while monitoring.

Table

The logger table provides the following event logger information.

➤ **ID**: Indicates the event identification number. The events are sequentially numbered.

➤ **Time**: Indicates when the event has been detected.

➤ **Event**: Provides the event type and threshold crossing information when applicable.

➤ **Duration**: Indicates the number of seconds within which the event occurred.

➤ **Details**: Provides additional information adapted to the event type.

The Event Logger information will be cleared when:

➤ the logger is reset.

➤ the unit is restarted.

Note: *An entry event remains in the Pending state as long as the event is not completed and is highlighted using a yellow background color.*

16 RF Spectrum Graph - Quick Test Setup Procedure

The following procedure is a simple test sequence using a live source and the **Classic** menu.

Quick Test Setup Procedure

To setup a quick test:

1. Connect the module to the radio access network (RAN). Refer to *Connecting to the RAN* on page 8.

2. Start the **OpticalRF** application.

3. Tap **Source** to select a port-antenna ([port]-**AxCn**).

4. Tap **Link Rate** from the **Source** menu and select either the link rate or **Auto** for automatic detection. The **Link** icon from graph settings displays **Active** if the link rate is active and matches the selection; **RateScan** indicates that the unit is scanning to discover the link rate when **Auto** is selected.

5. Tap **Select Mapping** from the **Source** menu and select the desired mapping for the system under test. RF Spectrum mappings contain information on frequency, bandwidth and other information required to decode the spectrum from the CPRI stream.

6. Tap **Graph** > **Type**, and select the desired graph type.

7. Tap **Amplitude** > **Full Scale** to center the spectrum. Use **Ref Level** and **Scale** and their sliders to manually fine tune the spectrum.

Now that the graph is visible on the screen, it is possible to set a marker to show values of the highest amplitude peak on the graph.

8. Tap **Markers** > **Marker** and select one of the five available markers.

9. Tap **Active**, from the **Marker** menu, to activate the selected marker. A small magenta marker will appear on the graph at frequency zero (0.0 MHz).

10. Tap **Goto Peak**, from the **Marker** menu, and the marker pointer will automatically seek the greatest amplitude point on the display.

11. Tap **Next Peak**, from the **Marker** menu, moves the current marker to the next highest peak on the graph.

RF-PWR Monitoring

To monitor and compare the RF power to a mask threshold:

1. Tap **Measures** > **RF-PWR**.

2. Select the source of the trace.

3. Select the **Mask** and **View Mask in Graph** check boxes.

4. Define the mask threshold. Refer to *PWR Threshold* on page 44 for more information.

5. Tap **Apply**.

6. Tap **Close**.

PIM Measurement

To measure the PIM value:

1. Tap **Measures** > **PIM**.

2. Select the source of the trace.

3. Select the **PIM** and **Threshold** check boxes.

4. Set the threshold value. Refer to *PIM* on page 46 for more information.

5. Tap **Done**.

RSSI Measurement

To measure the RSSI value:

1. Tap **Measures** > **RSSI**.

2. Select the source of the trace.

3. Select the **RSSI** check box.

4. Tap **Done**.

Record Traces

Tap **Back** > **Source** > **Record** and tap **OK** to start recording.

17 *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
Input signal not received or not compatible.	Dirty fiber connection.	Ensure that the fiber and SFP are clean. Refer to the module user guide for more information.
	There is a configuration mismatch between the inserted SFP/SFP+ and the rate selected in OpticalRF.	Ensure that the SFP/SFP+ is supporting the rate used by OpticalRF.
	The SFP/SFP+ is not compatible with the OpticalRF.	Ensure to use a compatible SFP/SFP+. Refer to **www.exfo.com**.

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	1 866 683-0155 (USA and Canada)
Quebec (Quebec) G1M 2K2	Tel.: 1 418 683-5498
CANADA	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.

18 Glossary

Acronym List

?	Help

A

AxC	Antenna System Container

B

BBU	Base-Band Unit
BW	Bandwidth

C

CPRI	Common Public Radio interface

D

dB	Decibels
dBFS	Decibels relative to Full Scale

E

EVM	Error Vector Magnitude

F

FCC	Federal Communications Commission

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

M

MHz	Mega Hertz

N

NATO	North Atlantic Treaty Organization

P

PIM	Passive Intermodulation

R

RAN	Radio Access Network
RBW	Resolution Bandwidth
Ref	Reference
RF	Radio Frequency
RRH	Remote Radio Head
RSSI	Received Signal Strength Indicator
RX	Receive

S

SFP	Small Form Factor Pluggable
SNR	Signal to Noise Ratio

U

USA	United States of America

V

VBW	Video Bandwidth

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ISO 9001 CE