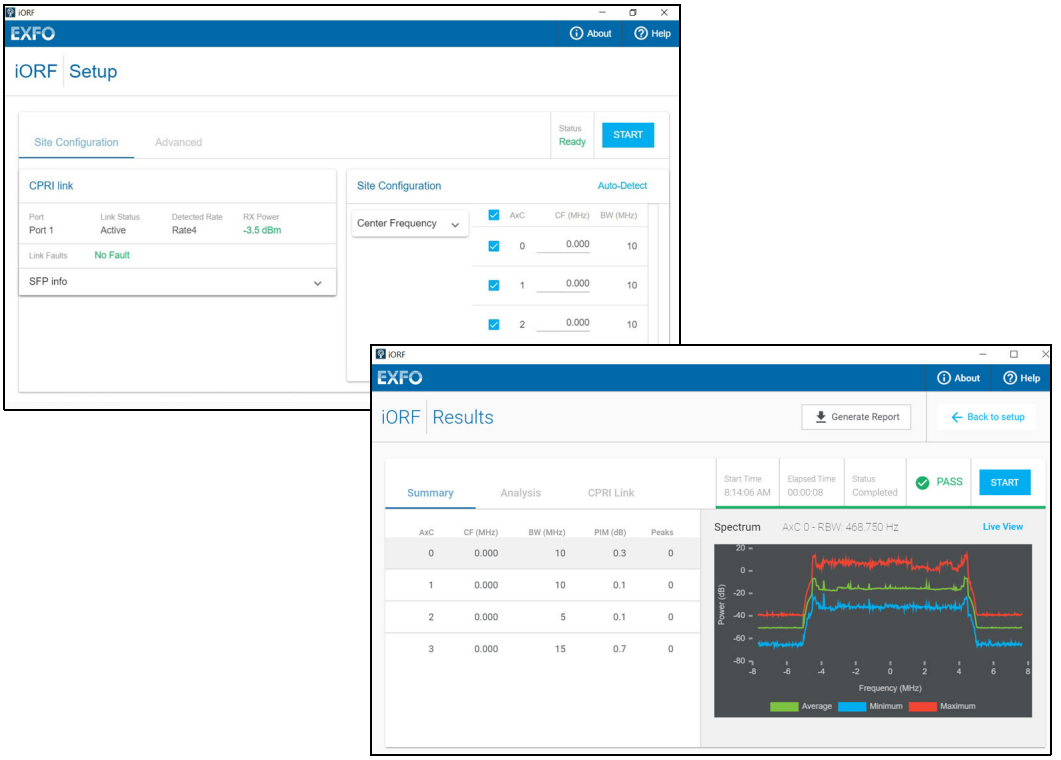
User Guide

iORF

Intelligent OpticalRF



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Patents

Feature(s) of this product is/are protected by one or more of: US pending patent(s).

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1 Introducing the iORF

iORF is an intelligent RF over CPRI application that auto-configures the CPRI link as soon as a fiber is inserted and auto-detects the mapping of the antenna connected to the Radio Head. Once the test is started, an automated analysis on all the antennas provides a clear indication on what issues are troubling the sector — and whether it is RF interference, internal or external passive intermodulation (PIM).

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.

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

Software Installation

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

Starting the iORF Application

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

Connecting to the RAN

The module's SFP+ P1 port (SFP28 A1 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 slot (A1 slot on 88260). Refer to the module user guide for connector/port location purposes.

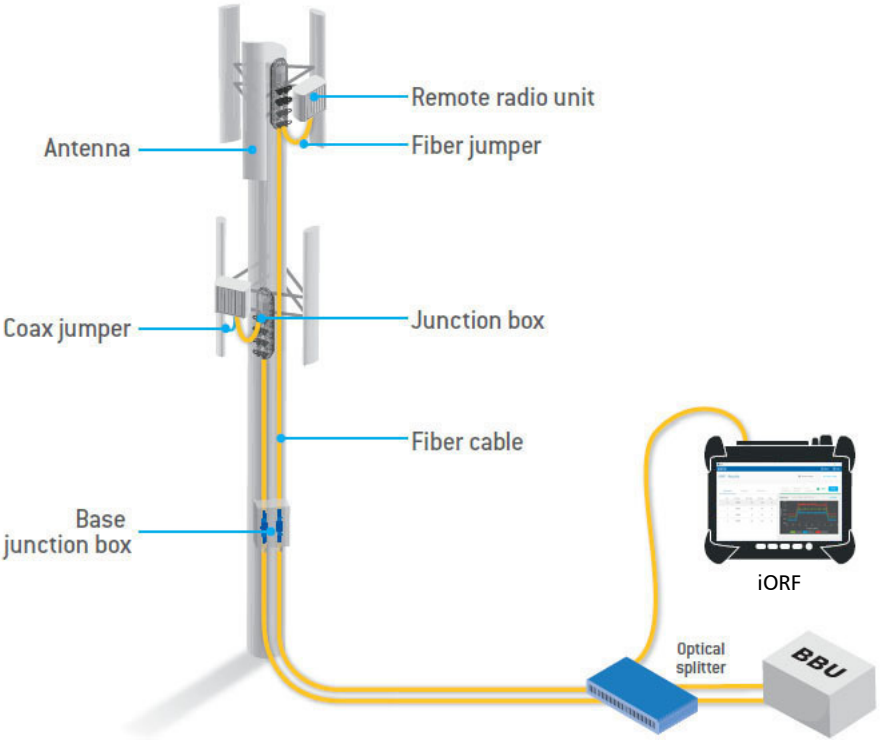
WARNING

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:

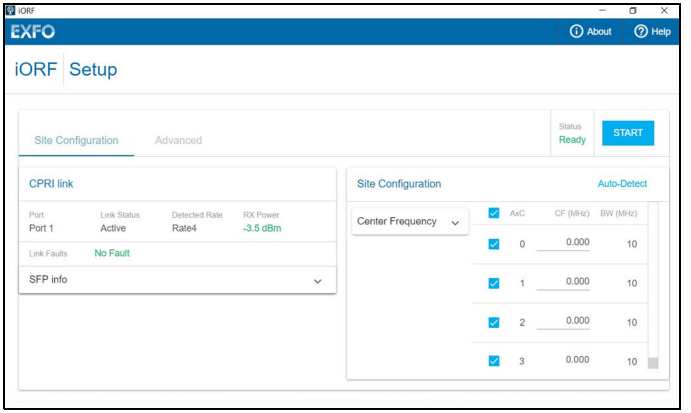
2a. To display the uplink, connect the A side of the splitter's AB port to the RX SFP+ P1 port (A1 port on 88260) of the module (generally marked with an in arrow).

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

4 Graphical User Interface Overview

This chapter describes the iORF graphical user interface.

The following main application window is displayed when the Intelligent OpticalRF application is started.



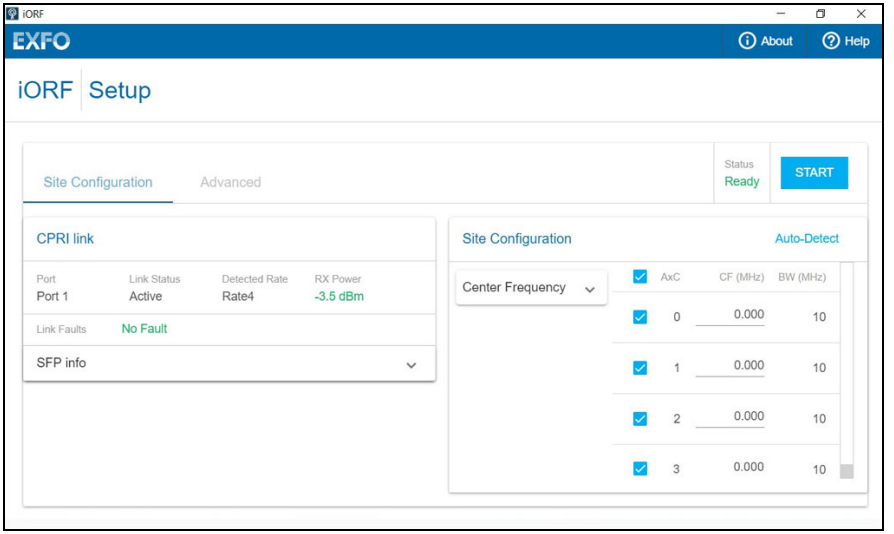
- **Title Bar** displays iORF related information and allows minimizing and closing the application.
- **About** (i) mainly displays the product version details, technical support information, and Sofware Options.

  Software Options button displays the list of software options. Refer to the NetBlazer or Power Blazer user guide for more information.
- **Help** (?) displays the help information related to the iORF application.
- **Setup** allows configuring the test. Refer to *Setup* on page 13 for more information.
- **Results Page** allows viewing test results. Refer to *Results* on page 19 for more information.

5 Setup

This section describes each item of the **Setup** page.

The application auto-detects and configures the CPRI link as soon as a fiber is inserted (see *CPRI Link* on page 14) and it auto-detects the bandwidth and mapping of the antenna connected to the CPRI link (see *Site Configuration* on page 16).



Results Page

Allows switching to the **Results** section (refer to *Results* on page 19).

START/STOP Button

Allows starting or stopping the test.

Status

Indicates the auto-detection status as follows:

- **Ready** indicates that the auto-detection completed successfully.
- **Link Down** indicates that the CPRI link is not active or rate scan not done.
- **Rate Scan in Progress** indicates that the detection of the CPRI link rate is in progress.
- **Auto-Detect in progress** indicates that the detection of the mapping from the live CPRI link is in progress.
- **Auto-Detect Failed** indicates that the detection of the mapping from the live CPRI link failed. In this case, the previously detected AxC list is retained.

Site Configuration

CPRI Link

The application automatically starts the rate scan process and configures the CPRI link as soon as the rate is discovered.

- **Port** indicates the NetBlazer or Power Blazer port used for the test.
- **Link Status** indicates the status of the CPRI link as follows:
  - **RateScan**: Scanning the CPRI link to discover its rate.
  - **Active**: CPRI link present on the input port.
  - **LOS** (Loss Of Signal)**:** Absence of an input signal or at least 16 8B/10B code violations occur in one hyperframe.
  - **BadSFP**: Bad or unsupported SFP.
  - **NoSFP**: No SFP detected.
  - **LossOfSync**: No Synchronization detected.

- **Detected Rate** indicates the detected CPRI link rate: **Rate2** (1.228 Gb/s), **Rate3** (2.456 Gb/s), **Rate4** (3.072 Gb/s), **Rate5** (4.915 Gb/s), **Rate6** (6.144 Gb/s), **Rate7** (9.830 Gb/s), or **Rate8** (10.1376 Gb/s).
- **RX Power** indicates the CPRI link RX power level in dBm as follows:

Color	Description
Green	Power level is within the power range (see *SFP Info* on page 15).
Yellow	Power level is out-of-range (see *SFP Info* on page 15).
Red	LOS or power level close-to-damage.
Gray	Pending state: --

- **Link Faults**
  - **LOF** (Loss Of Frame) indicates that the hyperframe alignment cannot be achieved or is lost.
  - **Sync Header**[1] error indicates sync header violations.
  - **66B Block**[1] error indicates that frames are received with errored block condition.
- **SFP Info** reports the following parameters retrieved from the transceiver: **Manufacturer**, **Model**, **Revision**, **Serial Number**, **Media**, **Nominal Bit Rate**, **Temperature**, **TX power**, **Wavelength**, **RX Power**, **Min RX Power**, **Max RX Power**, and **Power Range**.

1. Only available with Rate8.

Site Configuration

Once the CPRI link rate is discovered and configured, then the auto-detection of the bandwidth and mapping of the antenna connected to the CPRI link is started.

- **Auto-Detect** forces the auto-detection of the CPRI Link's antennas bandwidth and mapping.
- **Center Frequency** allows setting a center frequency for all/enabled/disabled AxCs at once.

  Center Frequency allows entering the center frequency value.

  To apply the center frequency, either tap on **Apply on all AxC**, **Apply on enabled AxC**, or **Apply on disabled AxC**.
- **AxC**
  - The global AxC check box allows enabling/disabling all AxC at once. A specific AxC check box when selected (default) includes the corresponding AxC in subsequent phases of the test sequencer.
  - **AxC** indicates the AxC number for each detected AxC.
  - **CF (MHz)** indicates and allows setting the center frequency for each AxC.
  - **BW (MHz)** lists the bandwidth in MHz for each AxC.

Advanced

Advanced Configuration

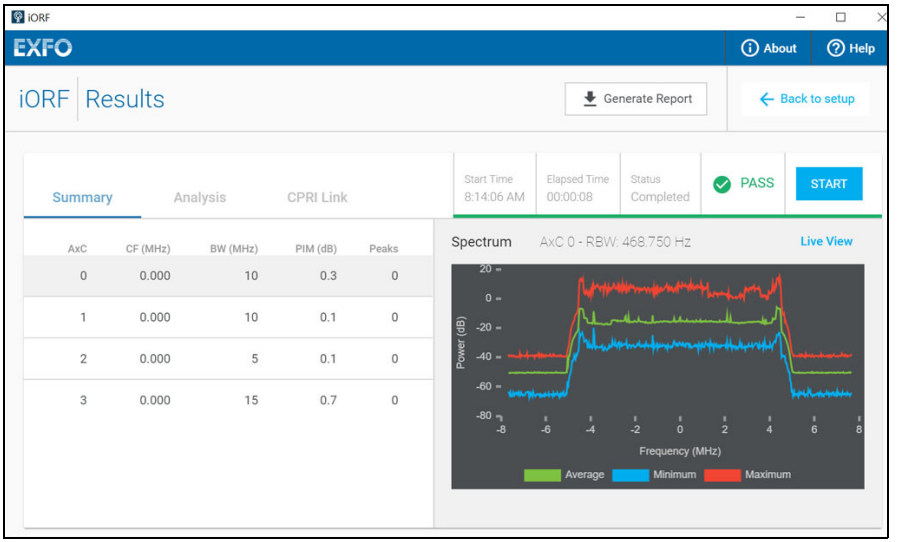
- **Peak Detector Sensitivity** allows setting the sensitivity of the peak detector: **1** (low) to **10** (high); default is **5**.
- **PIM Threshold** allows setting the PIM threshold absolute value (default is 6 dB).

Factory Default

Restore Default reverts the current test application to its default factory settings.

6 Results

This section describes each item of the **Results** page.



Generate Report

Allows generating a report containing all information about the current test including its setup and results.

The **Generate Report** button is available when the test is stopped. Tap on the **Report** button and enter the **Job Information** if required.

Job Information parameters, not mandatory, are used to identify the source of the report. 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 with the exception of **Comment** for which 256 characters are allowed.

Tap the **Generate** button to generate the report; the PDF file automatically opens.

Back to Setup

Allows returning to the setup section.

Test Statistics

- **Start Time** indicates at what time the test has started.
- **Elapsed Time** indicates the elapsed time since the beginning of the test.
- **Status** indicates the test status as follows:

Test Status	Description
In Progress	The test is running.
Completed	The test is completed.
Aborted [reason]	The test is interrupted. **No mapping detected** when the mapping auto-detection failed. **User Stopped** when the test is manually stopped. <Alarm/Error> when any alarm/error is detected.

- Verdict is as follows:

Verdict	Color	Description
PASS	Green	Indicates a healthy sector with no RF interference, no PIM, and no CPRI Link alarm condition.
FAIL	Red	Indicates either: - Internal or external PIM (passive intermodulation) detected - Detection of one or more RF Interferences - CPRI Link alarm condition detected

START/STOP Button

Allows starting or stopping the test.

Summary

Indicates the following for each AxC:

- **AxC** indicates the AxC number. Only enabled AxC are displayed.
- **CF (MHz)** indicates the center frequency in MHz.
- **BW (MHz)** indicates the bandwidth in MHz.
- **PIM (dB)** indicates the measured slope value in dB. A PIM value greater than the PIM threshold value is presented in red (refer to *Advanced Configuration* on page 17).
- **Peaks** indicates the number of peaks detected which are the RF interference encountered while the test is running. Peaks are listed with their frequency in MHz, relative power in dB, and the maximum power (amplitude) in dB. Relative power corresponds to the ratio (difference in dB) between the peak amplitude and the signal power surrounding the peak. Peaks are presented in increasing order of frequency.

  Tap on **View/Hide Peaks** to see or hide details of the peak(s).

  Tap on a peak option button to select a peak, a zoomed view of the selected peak is displayed on the graph. The white circle on the graph indicates the frequency position of the selected peak. To return to the full spectrum graph, either re-tap on the peak option button or tap on the insert in the top-right part of the peak detail graph.

Spectrum/Peak Graph

The spectrum graph is displayed across the full frequency span. The average, minimum, and maximum trace snapshots are displayed by default. Tap on any Average/Minimum/Maximum legend text/bar to display/hide it from the graph.

A yellow circle on the graph indicates the frequency position of a detected peak. Hovering on a peak displays its frequency, power, and relative power.

Live View opens the live view of the spectrum graph. Changes made within this view do not affect settings nor the results of the iORF test. From **Live View**, tap the following button to return to iORF:

Note: *For more information on **Live View**, refer to the OpticalRF user guide or help file. Some functionality described in OpticalRF has been adapted for iORF Live View but these changes are not reflected in the user guide neither in the help file.*

Analysis

The automated post analysis is performed on all antennas of the sector and provides a clear indication on what issues are troubling the sector. The issues are ordered as follows:

1. Internal or external PIM (passive intermodulation).
2. Known Interferers.
3. Peak detection of external RF inferences.

Tap on an issue option button to display the spectrum graph of the related AxC.

CPRI Link

The application updates the following CPRI link information when the test is started.

- **Port** indicates the NetBlazer or Power Blazer port used for the test.
- **Link Status** indicates the status of the CPRI link as follows:
  - **RateScan**: Scanning the CPRI link to discover its rate.
  - **Active**: CPRI link present on the input port.
  - **LOS** (Loss Of Signal)**:** Absence of an input signal or at least 16 8B/10B code violations occur in one hyperframe.
  - **BadSFP**: Bad or unsupported SFP.
  - **NoSFP**: No SFP detected.
  - **LossOfSync**: No Synchronization detected.
- **Detected Rate** indicates the detected CPRI link rate: **Rate2** (1.228 Gb/s), **Rate3** (2.456 Gb/s), **Rate4** (3.072 Gb/s), **Rate5** (4.915 Gb/s), **Rate6** (6.144 Gb/s), **Rate7** (9.830 Gb/s), or **Rate8** (10.1376 Gb/s).
- **RX Power** indicates the CPRI link RX power level in dBm as follows:

Color	Description
Green	Power level is within the power range (see *SFP Info* on page 15).
Yellow	Power level is out-of-range (see *SFP Info* on page 15).
Red	LOS or power level close-to-damage.
Gray	Pending state: --

➤ Alarms: If alarms or errors occur during the test, they are displayed, otherwise **No Alarms** is displayed.

Interface - Alarm

➤ **LOS** (Loss Of Signal) indicates absence of an input signal or at least 16 8B/10B code violations occur in one hyperframe.

Interface - Error

➤ **Sync Header**[1] indicates sync header violations.

➤ **66B Block**[1] indicates that frames are received with errored block condition.

CPRI - Alarm

➤ **Link Down** indicates that the CPRI link is not active due to the absence of an input signal (LOS) or presence of an LOF alarm condition.

➤ **LOF** (Loss Of Frame) indicates that the hyperframe alignment cannot be achieved or is lost.

1. Only available with Rate8.

7 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 iORF.	Ensure that the SFP/SFP+ is supporting the rate used by iORF.
	The SFP/SFP+ is not compatible with the iORF.	Ensure to use a compatible SFP/SFP+. Refer to **www.exfo.com**.
	Not connected to port P1.	Ensure that the fiber is connected to the SFP port labelled P1.

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.

8 Glossary

Acronym List

?	Help

A

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

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
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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