User Guide

RTU-310/310G

RTU-310/310G IP Services Test Head

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Telecom Test and Measurement

EXFO
EXPERTISE REACHING OUT

EXFO's Commerce And Government Entities (CAGE) code under the North Atlantic Treaty Organization (NATO) is 0L8C3.

The information contained in this publication is subject to change without notice.

Trademarks

EXFO's trademarks have been identified as such. However, the presence or absence of such identification does not affect the legal status of any trademark.

Units of Measurement

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

January 31, 2012

Version number: 7.0.0

Contents

Certification Information

Federal Communications Commission (FCC) and Industry Canada (IC) Information

Electronic test and measurement equipment is exempt from FCC Part 15 compliance in the United States and from IC ICES 003 compliance in Canada. However, EXFO Inc. (EXFO) makes reasonable efforts to ensure compliance to the applicable standards.

The limits set by these standards are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the user guide, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

European Union (CE) Information

Electronic test and measurement equipment is subject to the EMC Directive in the European Union. The EN61326 standard prescribes both emission and immunity requirements for laboratory, measurement, and control equipment. For devices within the scope of information technology equipment (ITE) and complying with applicable ITE EMC standards, EN55022 and EN55024 can also be used for declaring conformance. This unit has been tested and found to comply with the limits for a Class A digital device. Please refer to the *CE Declaration of Conformity* on page xi.

Note: *If the equipment described herein bears the CE symbol, the said equipment complies with the applicable European Union Directive and Standards mentioned in the Declaration of Conformity.*

Laser

This product complies with 21 CFR 1040.10 and with EN 60825-1.

This product may employ a Class 1 or Class 1M laser SFP/XFP per IEC 60825-1. The laser classification is reproduced on the SFP/XFP.

CE Declaration of Conformity

EXFO CE **DECLARATION OF CONFORMITY**

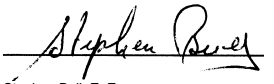
Application of Council Directives:	2006/95/EC - The Low Voltage Directive 2004/108/EC - The EMC Directive 2006/66/EC - The Battery Directive 93/68/EEC - CE Marking and their amendments
Manufacturer's Name:	EXFO Inc.
Manufacturer's Address:	400 Godin Avenue Quebec, Quebec Canada, G1M 2K2
Equipment Type/Environment:	Test & Measurement / Industrial
Trade Name/Model No.:	IP Services Test Head / RTU-310/310G

Standard(s) to which Conformity is Declared:

EN 55022: 2006 + A1: 2007	**Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement**
EN 60950-1 :2001 +A11 :2004 First Edition	**Information technology equipment – Safety – Part 1: General requirements**
EN 61326-1 :2006	**Electrical Equipment for Measurement, Control and Laboratory Use – EMC Requirements – Part 1: General Requirements.**
EN 61000 3-2 :2006	**Electromagnetic compatibility (EMC) – Part 3-2: Limits - Limits for harmonic current emissions (equipment input current ≤ 16 A per phase)**
EN 61000 3-3 :1995 +A1 :2001 +A2 :2005	**Electromagnetic compatibility (EMC) – Part 3-3: Limits - Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current ≤16 A per phase and not subject to conditional connection**

I, the undersigned, hereby declare that the equipment specified above conforms to the above Directives and Standards.

Manufacturer

Signature: 

Full Name:	Stephen Bull, E. Eng
Position:	Vice-President Research and Development
Address:	400 Godin Avenue, Quebec (Quebec), Canada, G1M 2K2
Date:	May 29, 2009

1 Introducing the RTU-310/310G

The RTU-310/310G is a powerful 24/7 network testing solution for IPTV and Ethernet services.

Features

- High-performance probe hardware supporting hundreds of simultaneous services
- Real-time measurement of over 35 IPTV metrics
- Detailed Ethernet statistics and error reporting
- Alarm reporting
- Complete EtherSAM™ (ITU-T Y.1564) test suite. EtherSAM is the new standard for testing Ethernet mobile backhaul and commercial services
- Throughput, back-to-back, latency and frame loss measurements as per RFC 2544 (bidirectional results)
- EtherBERT™ test functionality for assessing the integrity of Ethernet services running on WDM networks
- Multistream generation and analysis, allowing quality of service (QoS) verification through VLAN and TOS/DSCP prioritization testing
- True wire-speed, stateful TCP throughput test for undisputable SLA reinforcement for Ethernet services
- IPTV testing and analysis
- Complete carrier Ethernet services portfolio: PBB-TE (MAC-in-MAC), MPLS, 802.3ah and IPv4/6
- 1x and 2x Fibre Channel testing
- Interoperable with the FTB-8510B Packet Blazer Ethernet Test Module, FTB-8510G, and the AXS-200/850 Ethernet Test Set
- Full remote control capability through the EX-Vu software and VNC service

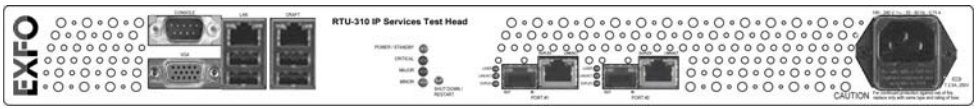
- Boot using USB drive
- RTU health diagnostics
- Remote restart
- NTP server support with daylight saving option
- Fully compliant with IEEE 802.3ae standard
- Pluggable XFP base optical module
- Capability to perform full-line-rate data capture and decode
- Capability to scan incoming live traffic and auto-discover all VLANID/Priority and MPLS ID/COS flows

Models

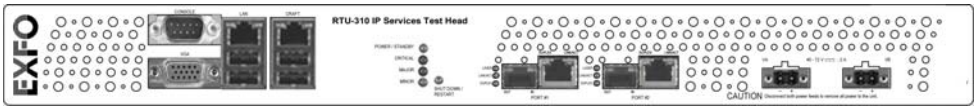
The RTU-310 is equipped with two electrical 10/1000/1000 Mbps Ethernet port and two optical 100/1000 Mbps Ethernet port. The RTU-310G is equipped with one optical 10 Gbps Ethernet port. The RTU-310/310G unit is available either with AC or DC power connector.

RTU-310

➤ AC version



➤ DC version

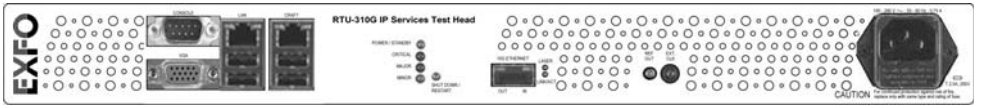


Note: *The 100 Mbps optical interface is available through a software option. Refer to Software Options* on page 347 *for more information.*

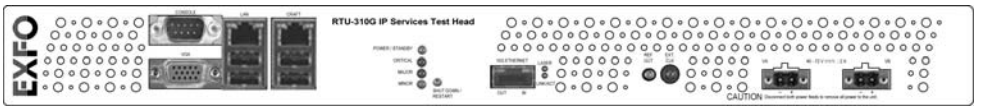
Note: *A LAN transceiver is required for the 100/1000 Mbps optical port. See Optical Transceivers (SFP)* on page 5 *for more information.*

RTU-310G

➤ AC version



➤ DC version



Option

Option	Description
RTU-8580	Software key that enables the 1000 Mbps electrical and optical interfaces on the RTU-310 model.
100M Optical	Software key that enables the 100 Mbps optical interface on the RTU-310.

Optical Transceivers (SFP)

Option	Description
FTB-8590	1000Base-SX (850 nm) LC connectors optical SFP transceiver module.
FTB-8591	1000Base-LX (1300 nm) LC connectors optical SFP transceiver module.
FTB-8592	1000Base-ZX (1550 nm) LC connectors optical SFP transceiver module.
FTB-85910	100Base-FX (1310 nm, MMF, 2 Km) LC connectors optical SFP transceiver module.
FTB-85911	100Base-LX10 (1310 nm, SMF, 15 Km) LC connectors optical SFP transceiver module.

Optical Transceivers (XFP)

Option	Description
FTB-85900	850 nm short-wave optics (10GBASE-SR/SW)
FTB-85901	1310 nm long-wave optics (10GBASE-LR/LW)
FTB-85902	1550 nm long-wave optics (10GBASE-ER/EW)

Conventions

Before using the product described in this manual, 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 Warnings

WARNING

Do not install or terminate fibres while a laser source is active. Never look directly into a live fibre, and ensure that your eyes are protected at all times.

WARNING

Use of optical instruments with this product will increase eye hazard.

WARNING

This product may employ a Class 1 or Class 1M SFP/XFP.

WARNING

When the LASER LED is on, the RTU-310/310G is receiving/emitting an optical signal.

Installation Instruction Warnings

CAUTION

No user serviceable parts are contained inside. Contact the manufacturer regarding service of this equipment.

CAUTION

Keep all ventilation openings clear and unobstructed.

IMPORTANT

All wiring and installation must be in accordance with local building and electrical codes acceptable to the authorities in the countries where the equipment is installed and used.

CAUTION

Electrostatic Discharge (ESD) Sensitive Equipment: Electronic equipment can be damaged by static electrical discharge. To minimize the risk of damage, dissipate static electricity by touching a grounded unpainted metal object before handling (or removing/inserting) an SFP/XFP.

CAUTION

All telecom (electrical) interfaces are SELV (Safety Extra Low Voltage) circuitry for intra-building use only.

IMPORTANT

Unauthorized modifications to this equipment shall void the user's authority to operate this equipment.

CAUTION

For DC version:
The RTU-310/310G must be installed in Restricted Access Locations.

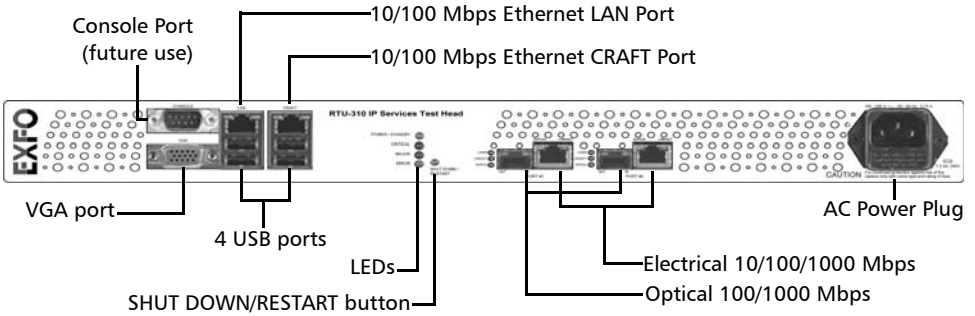
3 Getting Started

This chapter covers the description of the RTU-310/310G unit, the physical installation, all connections, LEDs, and the initial setup of the RTU-310/310G.

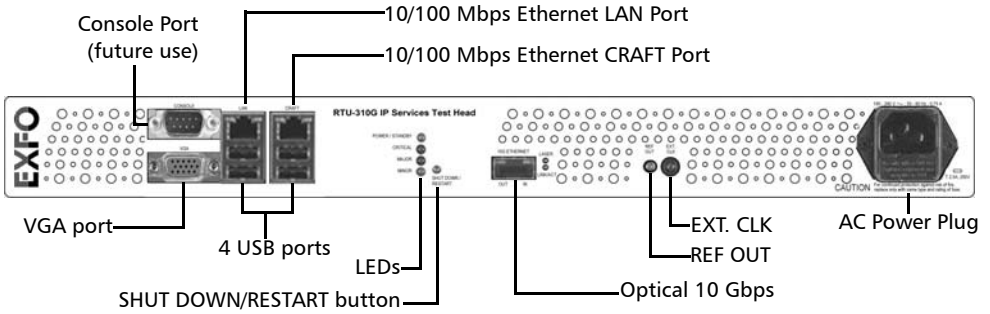
Front Panel Description

The following figure indicates the location of all connectors, ports, and LEDs available on the front panel of the RTU-310/310G unit.

For RTU-310 AC version



For RTU-310G AC version



SHUT DOWN / RESTART Button

The **SHUT DOWN/RESTART** button is used to either shut down or restart (shut down and restart) the unit.

To shut down the RTU-310/310G unit:

Press the **SHUT DOWN / RESTART** button once. The RTU-310/310G unit closes all applications and once done, the **POWER/STANDBY** LED will flash to indicate that it is safe to disconnect the AC or DC power.

To wake up the RTU-310/310G unit:

Press the **SHUT DOWN / RESTART** button once while in standby mode. The RTU-310/310G unit will restart. An LED sequence is displayed on the RTU-310/310G front panel indicating the booting process. Once powered up, the **POWER/STANDBY** LED turns on indicating that the RTU-310/310G is ready to be used.

To reset the RTU-310/310G unit:

Press the **SHUT DOWN / RESTART** button for 5 seconds. The RTU-310/310G unit will shut down without closing applications. Press the **SHUT DOWN / RESTART** once again, an LED sequence is displayed on the RTU-310/310G front panel indicating the booting process. Once powered up, the **POWER/STANDBY** LED turns on indicating that the RTU-310/310G is ready to be used.

RTU-310/310G LEDs

LED	Status	Description
POWER/STANDBY	On	Indicates that the RTU-310/310G unit is on and ready to be used.
	Flashing	Indicates that the RTU-310/310G unit is in standby mode. It is safe to turn the unit off.
CRITICAL[a]	On	Indicates current critical severity alarm.
	Off	Indicates no critical severity alarm.
MAJOR[a]	On	Indicates current major severity alarm.
	Off	Indicates no major severity alarm.
MINOR[a]	On	Indicates current minor severity alarm.
	Off	Indicates no minor severity alarm.

a. Alarm severity is configurable for certain alarms.

VGA Port

The VGA port is used to connect a monitor to access the EX-Vu application on the RTU-310/310G platform.

Console Port

The Console port is provided for future use.

USB Ports

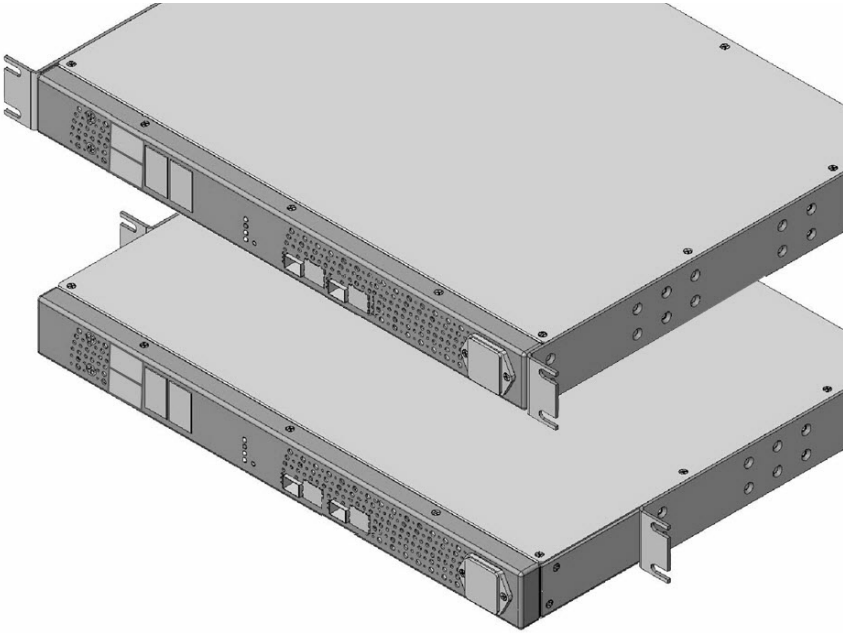
The RTU-310/310G provides four USB ports. These ports are used to connect keyboard, mouse, or to boot from a USB drive.

Installing the RTU-310/310G in a Rack

To install the RTU-310/310G in a rack:

1. Fix the supplied brackets on the RTU-310/310G with the supplied 8-32 x 5/16 in. screws.

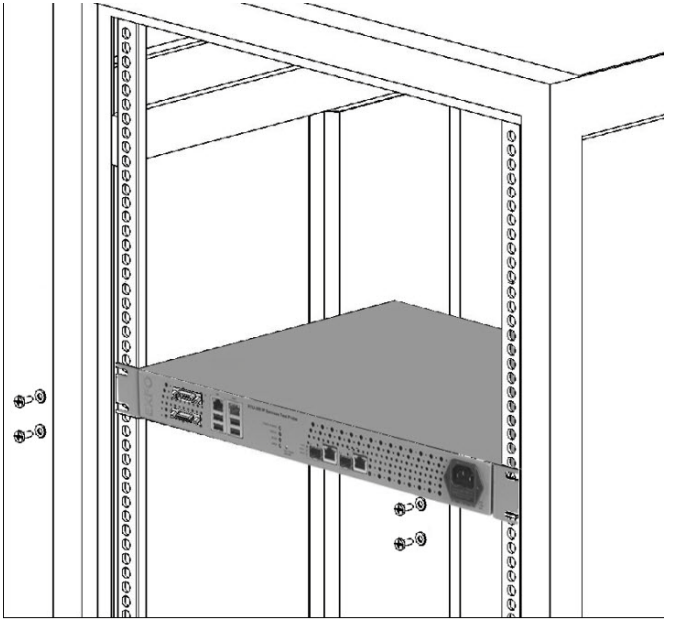
Bracket kits are available for 19 and 23 inch rack mount applications but only one kit is supplied with the unit.



Note: *The brackets allow the RTU-310/310G to be installed with its front panel flush or offset with the front of the rack.*

2. Place the unit in the rack at the desired height.

3. Fix the unit in place using four 10-32 x 1/2 in. screws and lock washers.



Connecting the Power

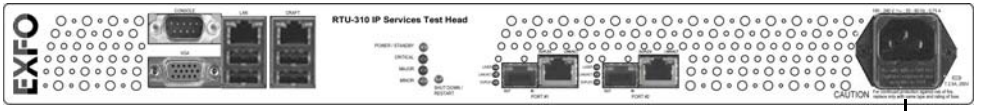
The RTU-310/310G is available with either an AC or DC integrated power supply.

Note: *The RTU-310/310G automatically powers up once connected to a live AC or DC power source.*

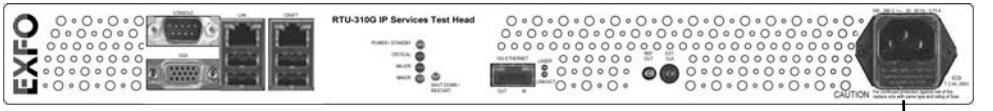
To connect the RTU-310/310G to an AC power source:

1. Connect the supplied AC power cord to the RTU-310/310G front panel.
2. Connect the other end to an AC power source.

For RTU-310



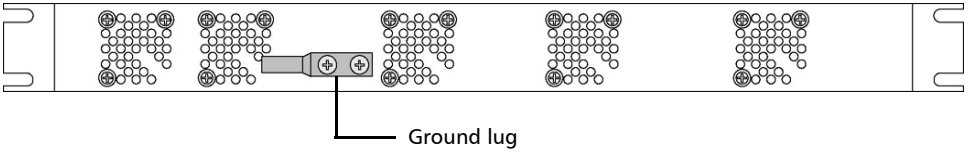
For RTU-310G



To connect the RTU-310/310G to a DC power source:

WARNING

The RTU-310/310G DC version is intended to be grounded. Ensure that the unit is connected to earth ground during normal use.

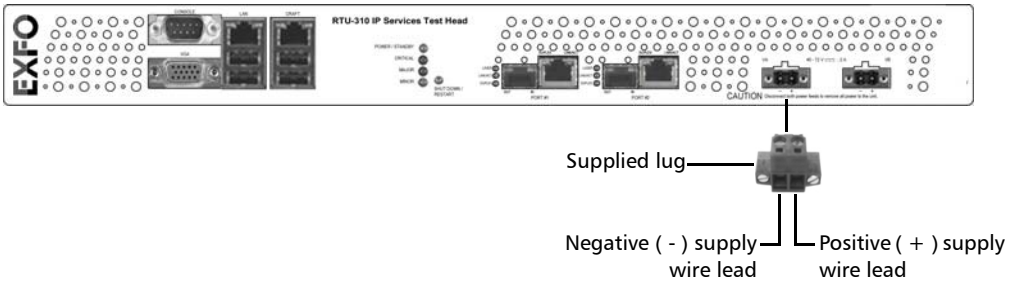


1. Remove the two Phillips flat screws, and remove the ground lug on the back panel of the RTU-310/310G unit.
2. Use a #6 AWG wire (not supplied) insert the wire into the lug and crimp it.
3. Use the two Phillips flat screws to attach the ground lug and wire assembly to the rear panel of the RTU-310/310G unit.
4. Connect the other end to the ground distribution network.

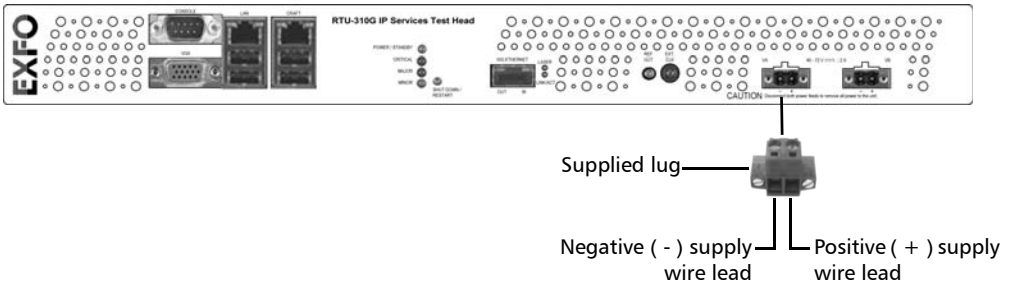
5. Using 14-16 AWG copper insulated wires and the supplied lug, insert the two stripped wires into the lug and tighten the screws firmly. Make sure to respect the polarity.

The positive supply wire lead (40-70V) must be on the right side of the lug and the negative supply wire on the left side.

For RTU-310



For RTU-310G



6. Connect the lug to one of the two DC input lugs on the RTU-310/310G unit and tighten the screws firmly.

7. Connect the other end of wires to the DC power source.

CAUTION

The DC input feeds to the equipment must be protected by 20A rated maximum breaker provided as part of the building installation.

8. To add a redundant DC source on the RTU-310/310G, repeat steps 5 to 7.

Turning the Unit On

To turn the unit on:

Connect the RTU-310/310G to a live AC or DC power source.

Note: *The RTU unit must be connected to monitor and keyboard before switching it on.*

An LED sequence is displayed on the RTU-310/310G front panel indicating the booting process. Once powered up, the **POWER/STANDBY** LED turns on indicating that the RTU-310/310G is ready to be used.

Automatic Power Failure Recovery

In the case of a power failure, the RTU-310/310G unit will recover automatically when the power is restored. The RTU-310/310G unit will return to the same state as before the power failure.

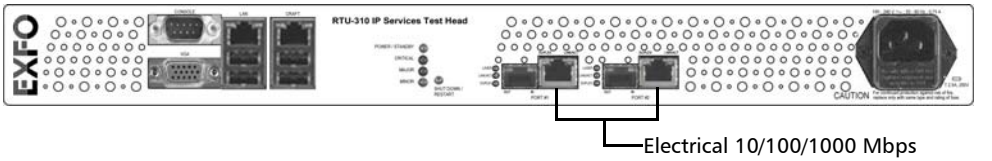
Connecting the Test Interface Ports

Connecting the Electrical 10/100/1000 Mbps Ethernet Test Interface

The RTU-310 unit provides two electrical RJ-45 ports for10Base-T, 100Base-T, or 1000Base-T testing capability.

Note: *1000Base-T is optional.*

For RTU-310



To use the electrical 10/100/1000 Mbps Ethernet interface for testing:

Connect the 10/100/1000 Mbps electrical signal using a CAT 5 unshielded cable (with an RJ-45 connector) to the 10/100/1000 Mbps port of the RTU-310 unit.

Note: *Port connector type is RJ-45 for category 5 unshielded twisted pair (UTP) connection. Refer to Ethernet Cables* on page 455 *for cable specifications.*

Electrical Port LEDs

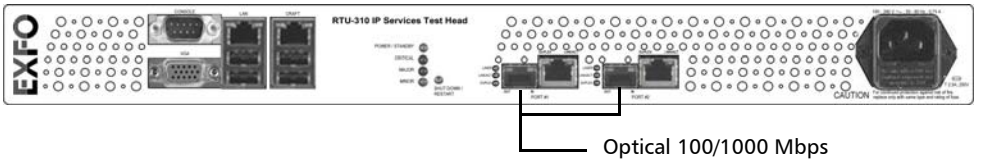
LED	Status	Description
LINK/ACT	On	Ethernet link up
	Off	Ethernet link down
	Flashing	TX/RX activity
DUPLEX	On	Full Duplex mode
	Off	Half Duplex mode
	Flashing	Collisions detected

Connecting the Optical 100/1000 Mbps and 10 Gbps Ethernet Test Interfaces

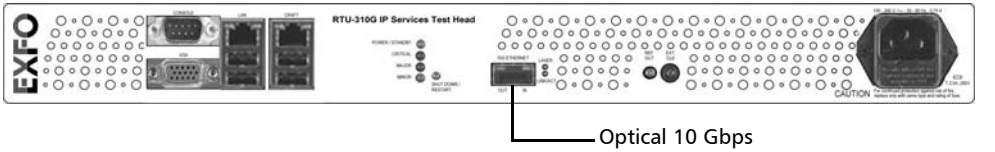
The RTU-310 unit provides two optical ports for 100Base-FX or 1000Base-X whereas the RTU-310G provides one optical port for 10 Gbps Ethernet testing capability. The optical port for RTU-310 is Small Form Factor Pluggable (SFP) slot type (LC connector) and the optical port for RTU-310G is Extended Small Form Pluggable (XFP) slot type.

Note: *100Base-FX and 1000Base-X are optional.*

For RTU-310



For RTU-310G



To use the optical 100/1000 Mbps Ethernet interface for testing:

1. Insert one of the following SFP modules into the optical slot.

Rate	Description
1000Base-X	850 nm SFP module for 1000Base-SX short wavelength laser connection.
	1300 nm SFP module for 1000Base-LX long wavelength laser connection.
	1550 nm SFP module for 1000Base-ZX extended wavelength laser connection.
100Base-FX	1310 nm SFP module for 100Base-FX, MMF, 2 Km.
	1310 nm SFP module for 100Base-LX10, SMF, 15 Km.

2. Carefully connect optical fiber cables to the SFP's or XFP's IN and OUT ports.

   To ensure good signal quality, make sure that the optical fibre connector is fully inserted into the optical connector port.

Note: *In order not to exceed the maximum receiver power level before damage, an attenuator must be used. Refer to Maximum RX before damage (dBm)* on page 453 *for more information.*

Optical Port LEDs for RTU-310

LED	Status	Description
LASER	On	An optical signal is generated
	Off	No optical signal is generated
LINK/ACT	On	Ethernet link up
	Off	Ethernet link down
	Flashing	TX/RX activity
DUPLEX	On	Full Duplex mode
	Off	Half Duplex mode
	Flashing	Collisions are detected in half duplex mode

Optical Port LEDs for RTU-310G

LED	Status	Description
LASER	On	An optical signal is generated
	Off	No optical signal is generated
LINK/ACT	On	Ethernet link up
	Off	Ethernet link down
	Flashing	TX/RX activity

Connecting the Management Interfaces

Connecting the Ethernet CRAFT Port

Connecting a PC to the Ethernet **CRAFT** port is required to access the user interface and configure the RTU-310/310G the very first time.

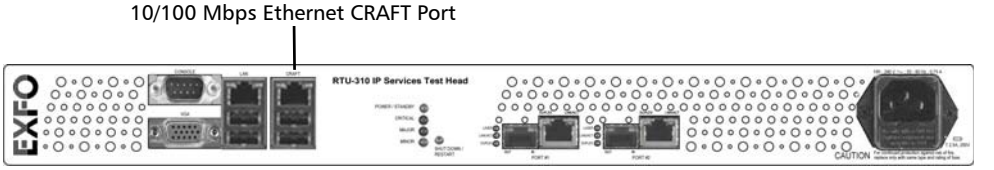
Note: *The CRAFT port is for access using a Static configured IP.*

To connect locally to the RTU-310/310G using the CRAFT port:

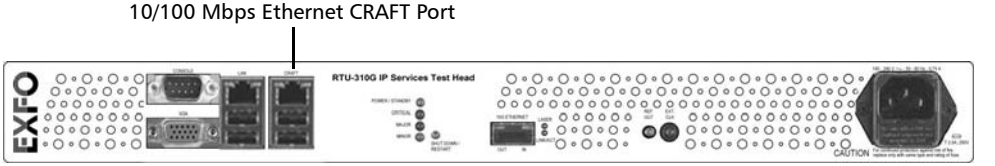
Connect a PC (running the Ex-Vu application) to the CRAFT port using a standard straight through Ethernet cable with an RJ-45 connector. Refer to *Ethernet Cables* on page 455 for more information.

The CRAFT port is configured with a static IP address 10.10.10.10. Local connectivity (LAN IP Address, unit clock, etc.) to the unit is required to configure the RTU-310/310G settings for the first time. Using Ex-Vu connect locally to the RTU-310/310G provides you full access to all the test and configuration functions to the unit. Refer to *To log on to the RTU-310/310G interface using SUI:* on page 37, for more information.

For RTU-310



For RTU-310G



CRAFT Port Embedded LEDs

LED	Status	Description
LINK/ACT (Green)	On	Ethernet link up
	Off	Ethernet link down or no activity
	Flashing	TX/RX activity
SPEED (Yellow)	On	100 Mbps
	Off	10 Mbps

Connecting the Ethernet LAN Port

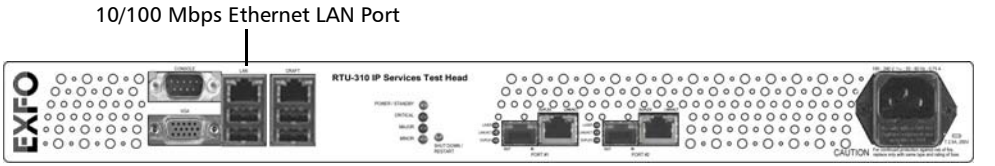
The RTU-310/310G LAN interface is designed to provide remote connectivity to the unit through a typical management network.

To connect remotely to the RTU-310/310G:

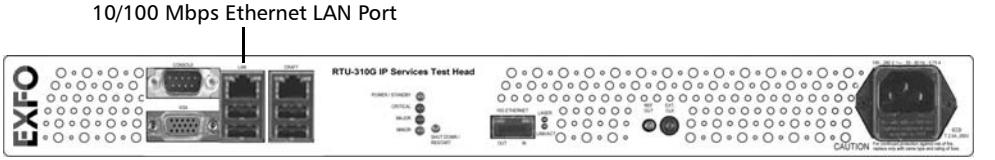
Both the RTU-310/310G unit and remote PC must be connect to the same management network using standard straight through Ethernet cables with RJ-45 connectors. Refer to *Ethernet Cables* on page 455 for more information.

The remote PC must be running the EX-Vu remote application. Refer to *To log on to the RTU-310/310G interface using SUI:* on page 37 or *Connect to the RTU-310/310G using TightVNC:* on page 474 for more information.

For RTU-310



For RTU-310G



Note: *The **LAN** port is by default set to acquire the IP address from a DHCP network device. It can alternatively be configured to use a static IP address if required.*

LAN Port Embedded LEDs

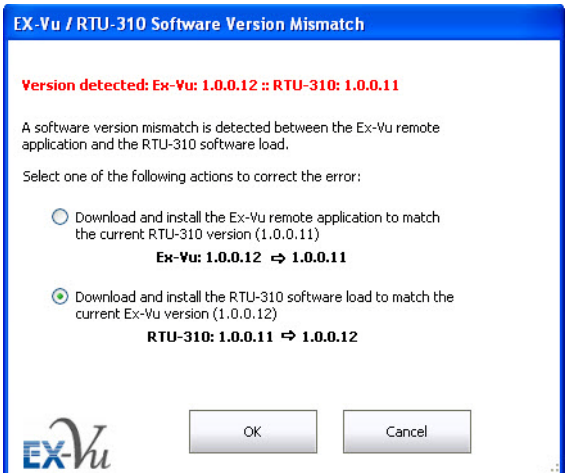
LED	Status	Description
LINK/ACT (Green)	On	Ethernet link up
	Off	Ethernet link down or no activity
	Flashing	TX/RX activity
SPEED (Yellow)	On	100 Mbps
	Off	10 Mbps

Software Management

Software management functionality ensures that the version of EX-Vu running on the RTU-310/310G unit and the client machine is the same.

Software Version Management using EX-Vu

When the version of EX-Vu remote application does not match with the RTU-310/310G software load, options to download and match the software version are displayed.



You can choose the following options:

- Match the version of EX-Vu remote application to the current version of RTU-310/310G software load
- Match the version of RTU-310/310G software load to the current version of EX-Vu remote application

To match the version of Ex-Vu to the current version of the RTU-310/310G software load:

1. Select **Download and install the EX-Vu remote application to match the current RTU-310 version** and click **OK**.

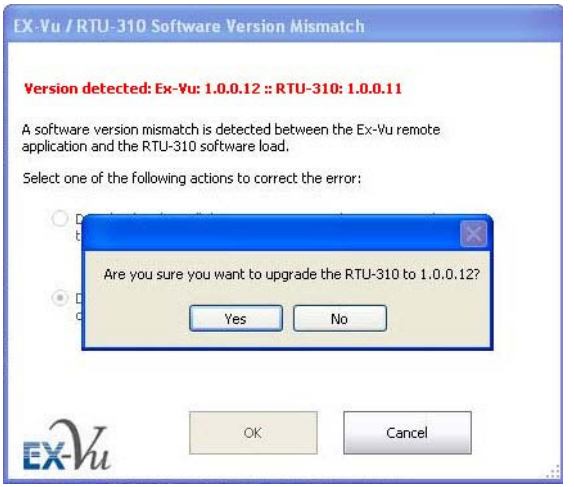
   The current EX-Vu remote application is uninstalled and the other version of EX-Vu application is downloaded from the RTU-310/310G and installed on the client machine to match the version of the RTU-310/310G software load.

2. Click **Next** and follow the instruction on the screen to complete the installation of the EX-Vu remote application.

To match the version of RTU-310/310G software load to the current version of EX-Vu remote application:

1. Select **Download and install the RTU-310 software load to match the current EX-Vu version** and click **OK**.

   A message is displayed to confirm that you want to download the RTU-310/310G software load.



2. Click **Yes** to confirm the download

   The current RTU-310/310G software load is uninstalled and the other version of the software is downloaded from the client machine and installed on the RTU-310/310G unit.

Note: *If the version of RTU-310/310G software load (that needs to be installed to match the EX-Vu version) is not available on the client machine, a rollback is initiated by the RTU-310/310G unit. In the rollback process, the uninstalled version of the RTU-310/310G software load is reinstalled.*

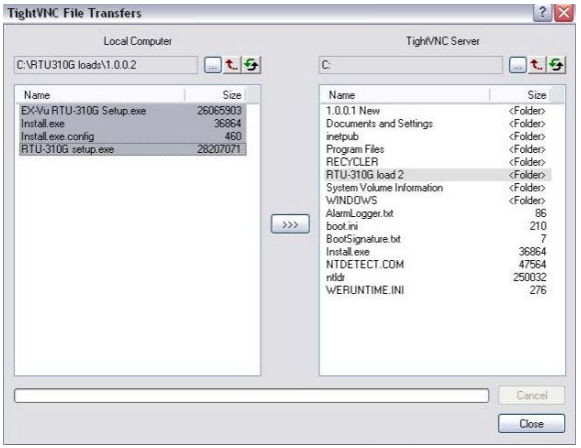
Software Version Management using TightVNC

The TightVNC service is provided as a part of the RTU-310/310G software package. In addition to EX-Vu, the TightVNC service can be used to control the RTU-310/310G. It is used to transfer files from the client machine to the RTU-310/310G and vice versa. To connect to the RTU-310/310G unit using TightVNC, the client machine must have TightVNC service installed. Refer *Remote Connection using TightVNC* on page 474, for more information.

Note: *Unlike EX-Vu, installation of the newly transferred software on the RTU and the client machine must be done manually. After the installation, when the software versions of the RTU-310/310G and the client machine match, then the remote EX-Vu session can be launched. Alternatively, the RTU-310/310G can be controlled from the Client machine by the TightVNC Service.*

To transfer files to the RTU-310/310G:

1. Create a folder on the local drive of the RTU-310/310G.
2. Right-click the task bar of the TightVNC Viewer screen and select **Transfer files**.



3. Select the setup files on the local drive of your computer and click the >>> button.

   The files are transferred to the local drive of the RTU-310/310G.

4. Double-click the setup file **RTU-310/310G setup.exe**. Click **Next** to start the installation and follow the on-screen instructions. You can also refer the release notes that came with your product for more information.

4 Introducing the Smart User Interface

To Start the RTU-310/310G Application:

1. Once your RTU-310/310G module is installed, turn on the RTU-310/310G.
2. In the main window, under **Modules**, press RTU-310/310G once to select the module.
3. start the Smart User Interface (SUI).

Login

Ensure that the RTU-310/310G is connected to the management network or you are locally connected to the RTU-310/310G.

To log on to the RTU-310/310G interface using SUI:

1. Double-click the RTU-310 or RTU-310G icon on the desktop.

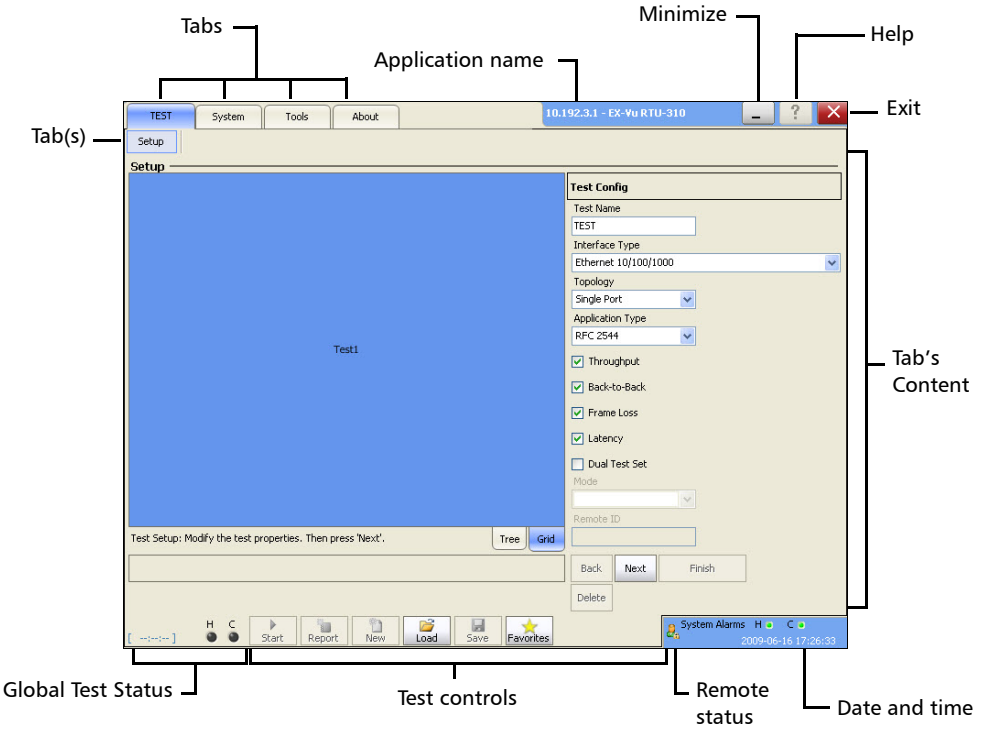
2. Enter the **IP address or Hostname** for the RTU platform.
3. Click **Connect**.

Note: *An error is displayed when the connection to the RTU-310/310G unit is not established, the initialization of the SUI software fails, or due to an unexpected loss of connection.*

Note: *Alternatively, you can connect to the RTU-310/310G using the TightVNC service. Refer Remote Connection using TightVNC* on page 474*, for more information.*

A check is performed to ensure that the version of SUI software on the RTU-310x and client machine match. Refer to Software Management on page 32 *for more information.*

Main Window


Tabs
Application name
Minimize
Help
Exit
Tab(s)
Tab's Content
Global Test Status
Test controls
Remote status
Date and time
TEST
System
Tools
About
10.192.3.1 - EX-Vu RTU-310
Setup
Test Config
Test Name
TEST
Interface Type
Ethernet 10/100/1000
Topology
Single Port
Application Type
RFC 2544
Throughput
Back-to-Back
Frame Loss
Latency
Dual Test Set
Mode
Remote ID
Test1
Test Setup: Modify the test properties. Then press 'Next'.
Tree
Grid
Back
Next
Finish
Delete
Start
Report
New
Load
Save
Favorites
System Alarms

Tabs

The SUI application contains the following four main application tabs that contain other tabs.

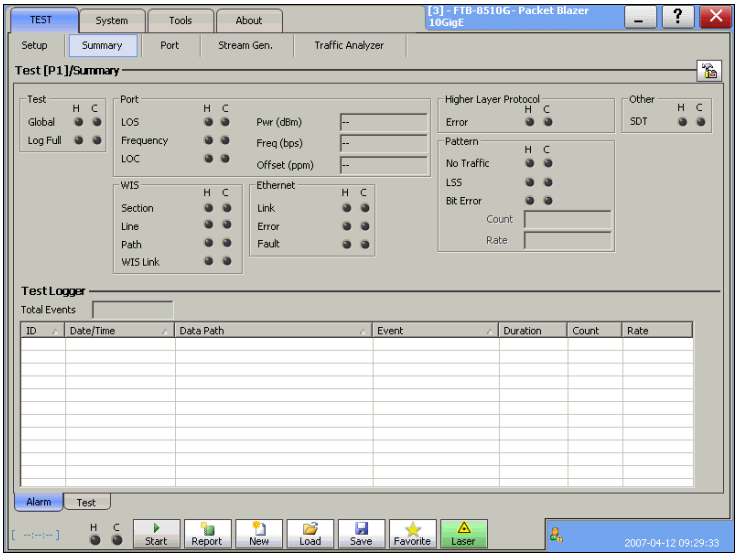
➤ **TEST** Tab

The **TEST** tab gives access to the test creation, configuration, and results.

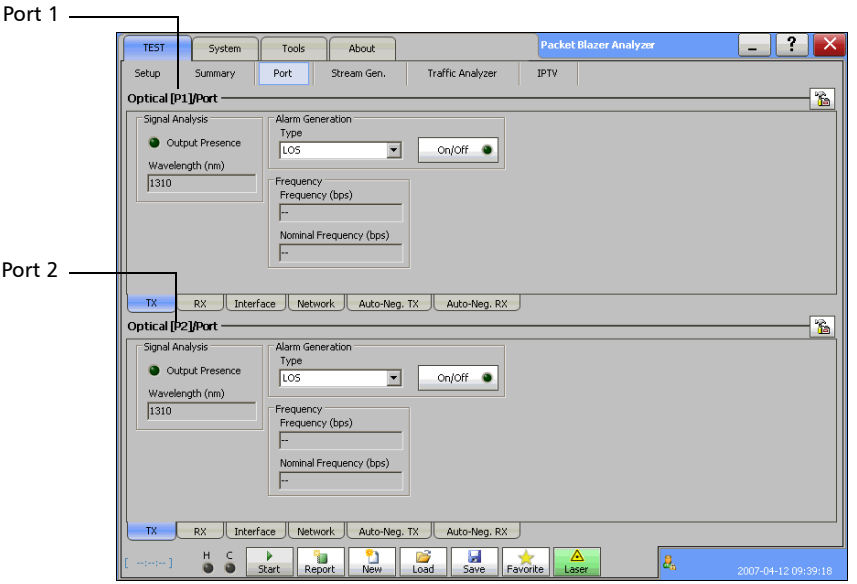
Note: *Only the **Setup** tab is available when there is no test created.*

Setup tab is part of the **TEST** tab and allows setting up the test. Refer to page 68 for more information.

Once the test is created, other tabs containing one or two tabs are enabled allowing configuration of test parameters and viewing of the test status and results.



For Dual ports (RTU-310 only), see the figure below for the localization of the port number on each tabs.



In this user guide, the tabs are grouped as shown below:

- *Summary Tabs* on page 121
- *Port Tabs* on page 133
- *Stream Generation Tabs* on page 161
- *Stream Analyzer Tabs* on page 195
- *Traffic Analyzer Tabs* on page 199
- *IPTV Tabs* on page 249 (RTU-310)
- *Pattern Tabs* on page 289
- *RFC 2544 Tabs* on page 295
- *EtherSAM Tabs* on page 321

- *TCP Throughput Tabs* on page 349RTU-310)
- *Advanced Tab* on page 355
- *WIS Tabs* on page 239 (RTU-310G)
- *Common Tab* on page 359
- *Expert Mode Tabs* on page 363

- **System** tab; refer to page 333 for more information.
- **Tools** tab; refer to page 407 for more information.
- **About** tab; gives information on EXFO company, contact, and product software release version.

Application Title

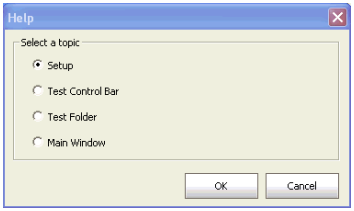
Displays the software application title.

Minimize

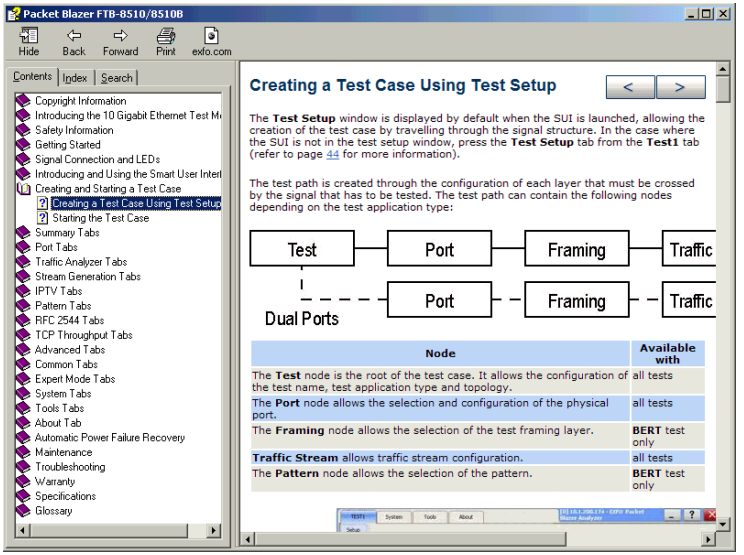
The minimize button (_) allows minimization of SUI application.

Help

The help button (?) displays the help information on the current window. A window pops up to select the area of the application where help is required. Click **OK** and the help information is immediately displayed.



It is also possible to navigate through the help information once the help window is open.



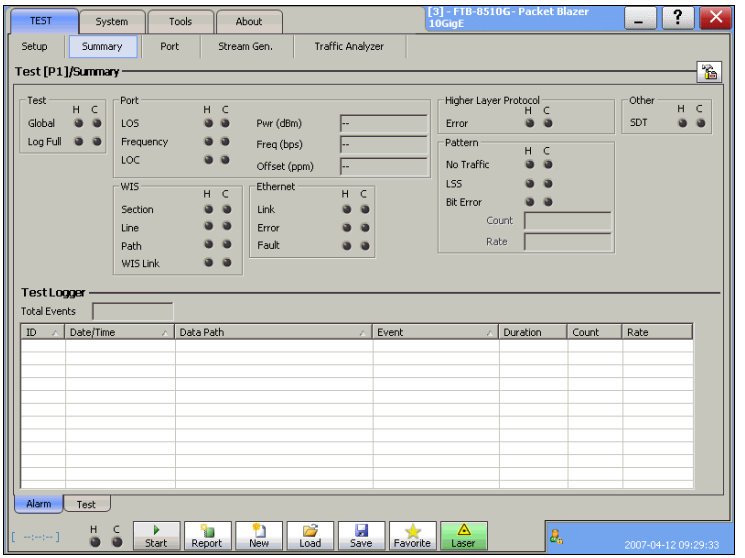
Exit

The exit button (X) closes the current application.

Global Test Status and Controls

Global Test Status

The global test status area displays the alarm, verdict, and test timer. Clicking on this area maximizes the view of these status. The maximized view is useful to facilitate distant viewing of these status.



To minimize the view, either click on the global test status area or click anywhere on the maximized status area.

- **H** (History): Indicates that alarms/errors occurred in the past. A grey background indicates that the test did not run yet, a green background indicates that no alarm/error has occurred, while a red background indicates that at least one alarm/error has occurred.

➤ Current status: Indicates the current alarm/error status of the test. A grey background indicates that the test is not running (**--**), a green background indicates that there is no alarm/error (**NO ALARM**), while a red background indicates that at least one alarm/error condition has occurred in the last second (**ALARM**).

Note: *The history and current alarm/error status are monitored once the test is started.*

➤ **Verdict**: Gives the verdict, **PASS** (green background) or **FAIL** (red background) of the test according to the defined threshold settings. Verdict is only displayed with EtherSAM, RFC 2544, and BERT tests. For RFC 2544 and BERT tests, at least one of the **Enable criteria** check boxes must be selected. Refer to *EtherSAM Tabs* on page 321 or to *Expert Mode Tabs* on page 363 (RFC 2544 and BERT tests) for more information.

➤ The test timer indicates the time elapsed since the beginning of the test. The test timer format is *day hour:minute:second*.

Test Controls

Button	Description
	**Start**: Starts the test. Start is available when the test is created and not running.
	**Stop**[a]: Stops the test.
	**H. Reset**[a]: Resets the history (H) alarm and error LEDs.
	**Reset**[a]: Resets counters (seconds, count, and rate), test timer and both history (H) and current (C) LEDs for the entire test case. Also resets the logger.
	**Report**[b]: Generates a report of the current test. See *Test Report Generation* on page 50 for more information.
	**New**[b]: Clears the current test. A user's confirmation is required before clearing the test.

Button	Description
	**Load**[b]: Loads a previously saved configuration. Select an existing file and click **Open** to confirm. The default directory is C:\ProgramFiles\EXFO\Applications\RTU\310\UserFiles\Configuration or C:\ProgramFiles\EXFO\Applications\RTU\310G\UserFiles\Configuration. The configuration file extension is **cfg**. An error message is displayed and the configuration is not loaded when the file is corrupted, the module is not properly installed, the hardware or software options are not compatible, or when the resources or power are not sufficient.
	**Save**[b]: Saves the current test configuration. Select an existing file, or type a new name in the **File name** field, and click **Save**. The default directory is C:\ProgramFiles\EXFO\Applications\RTU\310\UserFiles\Configuration or C:\ProgramFiles\EXFO\Applications\RTU\310G\UserFiles\Configuration.
	**Send**[a]: Generates pattern bit error according to the amount selected on the **Pattern TX** tab. Refer to *Pattern Error Injection* on page 292. This button is only available with **BERT** test.
	**Set**[a]: Allows selecting the port that will be used for pattern bit error injection. See **Send** button for error injection. This button is only available with **BERT** test in **Dual Ports** topology. Available with RTU-310 only.
	**Laser** Off (grey): Indicates that the laser control is off. Clicking this button will activate the laser immediately by emitting an optical laser signal. This button is only available for optical interfaces. The laser is On by default when the test is created unless otherwise set from the *Default/Ethernet Test Preferences* on page 336.
	**Laser** On (green): Indicates that the laser control is on. Clicking this button will turn off the laser. This button is only available for optical interfaces. The laser is On by default when the test is created unless otherwise set from the *Default/Ethernet Test Preferences* on page 336. The laser control button is not affected when turning off the laser by generating a LOS for example.
	**Favorites**[b]: Provides access to 10 default or customer defined test case configurations. See *Favorites* on page 48 for more information.

a. Only available when the test is running.
b. Only available when the test is not running (Stop).

Date and Time

Indicates the date (YYYY-MM-DD) and time (HH:MM:SS).

Refer to *Time Options* on page 334 for more information on time format and time zone.

System Alarms

The System alarms provide a quick indication about the alarm status of the RTU-310/310G unit.

- **H (History) LED**: Indicates the alarms/errors that occurred in the past. A green LED indicates that no alarm/error has occurred, while a red LED indicates that at least one alarm/error has occurred.
- **C (Current) LED**: Gives the current status of the alarm/error. A green LED indicates that there is no alarm/error, while a red LED indicates that at least one alarm/error condition has occurred in the last second.

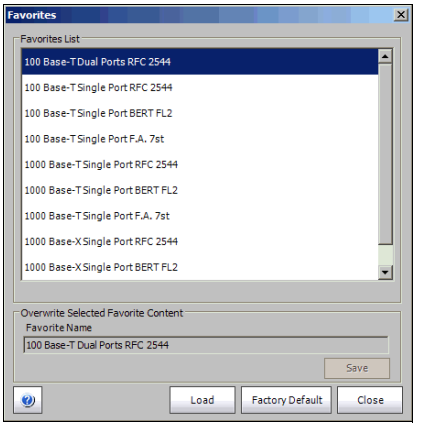
Refer to *System Alarms* on page 367 , for more information on the type of alarms/errors encountered on the RTU-310/310G unit.

Favorites

Favorites gives access to 10 factory test case configurations. Favorites is available when no test is running.

Click 

.



Favorites List

Allows to select a test case configuration. The test case configuration selected by default is the first one in the list.

Note: *Test cases not supported by the current RTU-310/310G model and its options will not be created.*

Note: *Favorites may or may not be compatible from one version of software to another.*

Overwrite Selected Favorite Content

The factory test case configurations can be modified as well as their default names.

- **Favorite Name**: Allows changing the name of the test case configuration file. A maximum of 32 characters are allowed in the name.
- **Save**: Saves the current test case configuration using the specified favorite name.

Load

Loads the selected test case configuration. Loading a favorite configuration automatically clears the current test case.

Factory Default

Restores the factory default favorites list based on the enabled options.

Note: *The favorites list is not updated when a new software option is installed. For this reason, the **Factory Default** button allows to recreate the favorites list based on the current options.*

Close

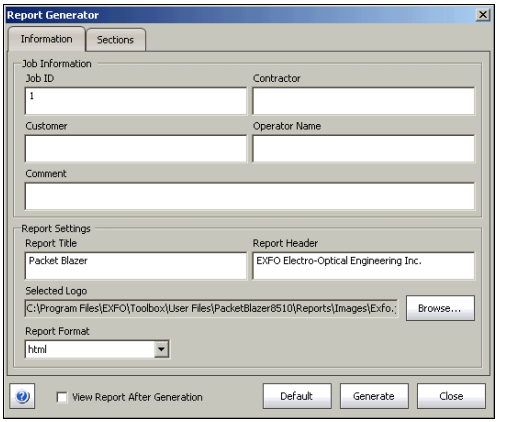
Closes the **Favorites** window.

Test Report Generation

Click **Report** from the *Global Test Status and Controls* to generate a report for the current test. The report contains all the information about the test including the job information, system information, interface setup, test summary, test configuration, results, etc.

Note: *Nothing prevents the configuration and alarm/error injection setup while the test has been stopped; thus, the report should be saved before changing any test parameters to avoid discrepancy between the configuration and results.*

Information Tab



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

- **Report Settings**: These parameters are used to identify the report and are not mandatory. Enter the following report information if needed: **Report Title**, **Report Header, Selected Logo**, and **Report Format**.

  Click **Browse** to select a different logo, then click **Open**.

  Report Format: Select the report file format. Choices are **html**, **csv**, **pdf**, and **txt**. The **CSV** format (comma separated file format) generates a report with comma delimiter for English OS and semicolon for other OS languages. The default setting is **html**..

- **View Report After Generation**: Allows displaying the report once it is generated. However, the report can only be displayed when the Windows application supporting the selected **Report Format** is installed. The **View Report After Generation** check box is not selected by default.

Note: *Once generated, the report file can manually be opened typically using Windows Explorer. The default directory is* C:\ProgramFiles\EXFO\Applications\RTU\310\UserFiles\Reports or C:\ProgramFiles\EXFO\Applications\RTU\310G\UserFiles\Reports.

Note: *If the html report contains special characters, please make sure that the encoding in your Web browser is set to Western European ISO. To set the encoding to Western European ISO, right click the report from Internet Explorer, select Encoding, and select Western European ISO.*

- **Default** button: Click **Default** to restore the default report settings.

- **Generate** button: Allows generating and saving the report. Select an existing file, or type a new name in the **File name** field and click **OK**. The default directory is C:\ProgramFiles\EXFO\Applications\RTU\310\UserFiles\Reports or C:\ProgramFiles\EXFO\Applications\RTU\310G\UserFiles\Reports.

  The report file can be saved on the following locations:

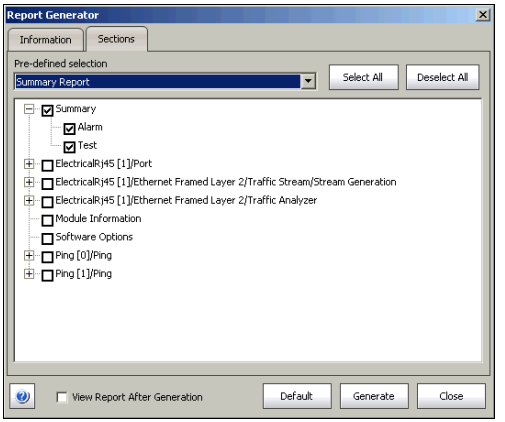
  Local memory (RTU-310/310G): The file is saved locally on the RTU-310/310G memory.

  Network drive: The file is saved on a network drive.

  USB drive or Compact Flash: The file is saved on a removable drive.

- **Close** button: Closes the report generation settings window.

Sections Tab



➤ **Pre-defined selection**: Allows selecting the type of report, and the window underneath allows selecting what will be part of the report. The default setting is **Summary Report**. Choices are:

Summary Report selects the **Summary** report section only.

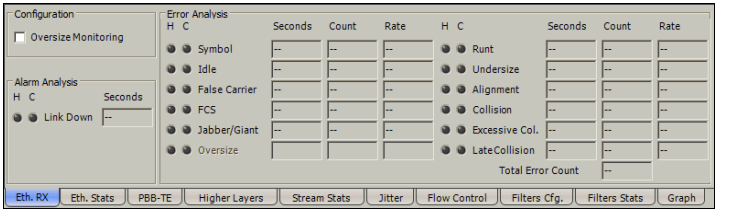
Test Case Report selects all the report sections.

Note: *Once the report type is selected, each section can be selected to customize the report.*

The **Select All** and **Deselect All** buttons are used to respectively select or deselect all the report sections.

Typical Tab Elements

Once the test is created, different tabs are available allowing test configuration and monitoring. The following section describes usual elements appearing on those tabs.



Status LEDs

- ***H*** (History) LED: Indicates that alarms/errors occurred in the past. A grey LED indicates that the test did not run yet, a green LED indicates that no alarm/error has occurred, while a red LED indicates that at least one alarm/error has occurred in the test.
- **C** (Current) LED: Gives the current status of the alarm/error. A grey LED indicates that the test is not running, a green LED indicates that there is no alarm/error, while a red LED indicates that at least one alarm/error condition has occurred in the last second.

Note: *The H and C LEDs are updated every second.*

Alarm/Error Measurements

Note: *Alarms/Errors are only monitored once the test is started.*

- **Seconds**: Gives the total number of the seconds in which one or more alarm/error occurred.
- **Count**: Gives the number of occurrences of a specific error. The count is displayed using integer value; exponential value (1.00000E10) is used when the count is bigger than the field display capacity.
- **Rate**: Calculates and displays the error rate. The rate is expressed using the exponential format with two decimal digits (example: 1.23E-04).

Arrow Buttons

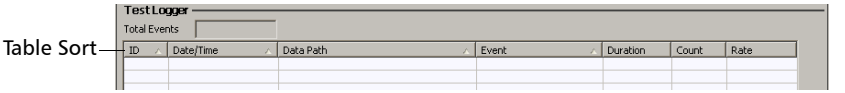
Button	Description
	Top arrow: Moves to the top of the list.
	Page up arrow: Moves one page up.
	Up arrow: Moves one event up.
	Down arrow: Moves one event down.
	Page down arrow: Moves one page down.
	End arrow: Moves to the end of the list.

Table Sorting

Tables offer sorting capabilities on one or more columns.

An arrow next to the column label name, indicates the sorting column field and the sorting order. Clicking again on the selected sort column label will change the sort order.

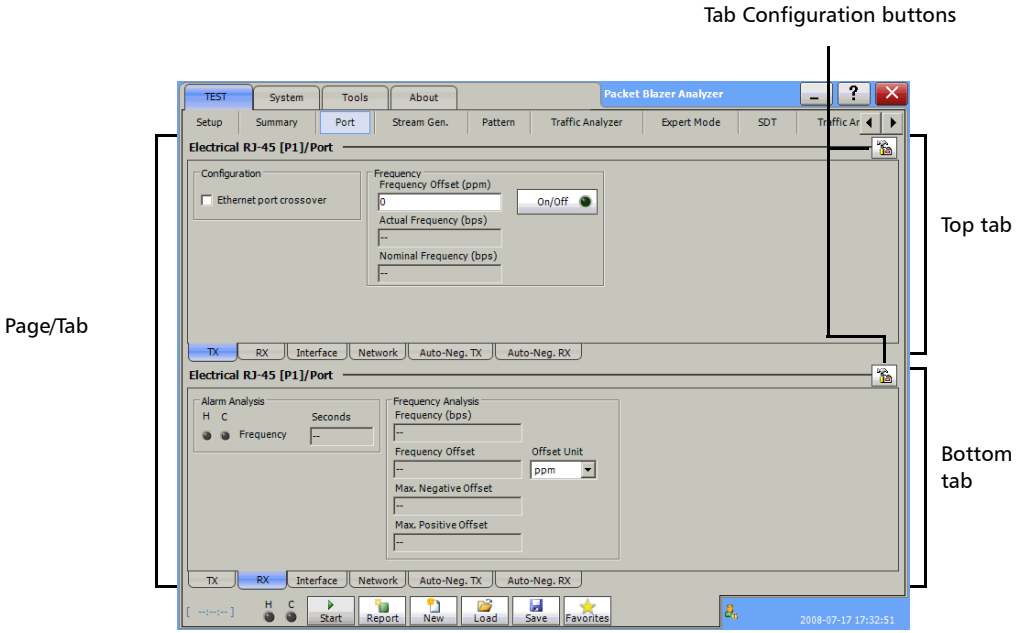
Clicking another column label allows to sort using a different field.



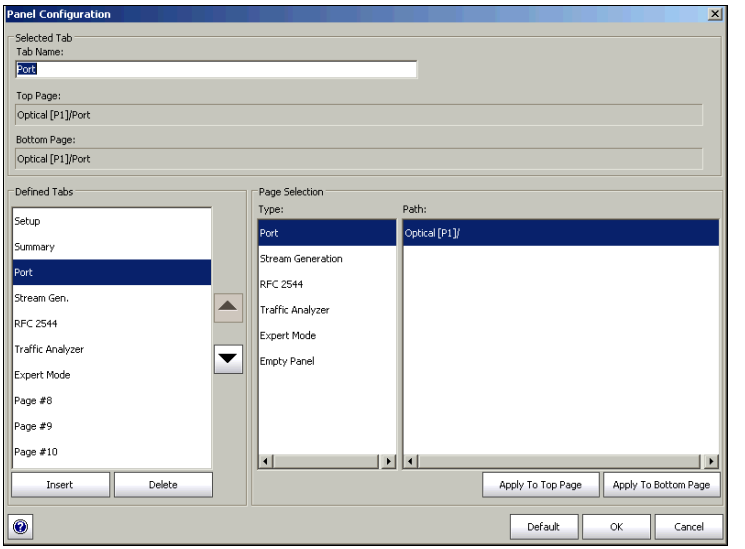
Tab Configuration

Once the test is created, other tabs next to the Test tabs are enabled allowing configuration of test parameters and viewing of the test status and results.

A tab configuration button is available at the top-right part of each tab.



This tab configuration window allows configuration of all tabs on any page except for the **Test Setup**, and **Summary** tabs. The tab configuration allows also to jump directly to the desired page by selecting it from the *Defined Tabs* list and then clicking **OK**.



Selected Tab

- **Tab Name** indicates the name of the tab containing the two tabs (top and bottom page). Clicking this field allows changing the tab name. Tab name can be up to 35 characters long including the "/" and spaces.
- **Top Page** indicates the tab displayed at the top of the tab.
- **Bottom Page** indicates the tab displayed at the bottom of the tab.

Defined Tabs

Allows the selection of a tab.

Up and down arrows are used to respectively move the selected page up or down in the list.

Insert button allows the insertion of a new tab after the selected tab (the one highlighted) A maximum of 30 tabs can be displayed.

Delete button allows the deletion of the selected tab.

Page Selection

- **Type**: Allows the selection of a tab that will be assigned to the selected tab when clicking either **Apply to top page** or **Apply to bottom page**.
- **Path**: Indicates the test signal structure (layers/nodes of the test case) corresponding to the selected tab. Refer to *Introducing the Test Setup* on page 68 for more information on test layers/nodes.
- **Apply To Top Page**: Applies the selected tab as top of page for the selected tab.
- **Apply To Bottom Page**: Applies the selected tab as bottom of page for the selected tab.

Note: *The available tabs listed are a function of the test path activated **Empty Tab** displays a blank tab (Tabs that are not populated are left blank). **Test Setup** and **Summary** tabs cannot be duplicated, deleted, or renamed.*

Help Button (?)

Displays the help information related to the tab configuration. It is also possible to navigate through the remainder of the help information.

Default Button

Return to the default page configuration layout.

OK Button

Accepts the page layout changes and jumps to the selected page (Defined tabs).

Cancel Button

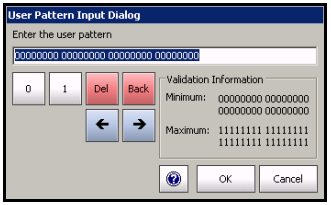
Cancels the changes and returns to the page from where the tab configuration was launched.

Keyboard Usage

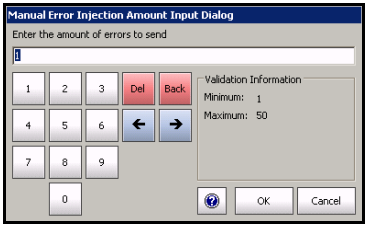
The SUI pops up different keyboards to modify data. Following are the usual keyboard keys:

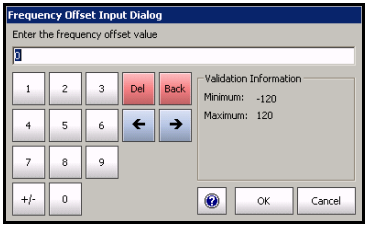
- Left arrow: Moves the cursor one position to the left.
- Right arrow: Moves the cursor one position to the right.
- **Del**: Deletes the value at the cursor position.
- **Back**: Deletes the value preceding the cursor position.
- **Help**: Displays the help information related to the keyboard usage. It is also possible to navigate through the help information.
- **OK** and **Enter**: Completes data entry.
- **Cancel**: Closes the keyboard and discards the keyboard entry.

- Binary keyboard: Allows entering 0 and 1 values.

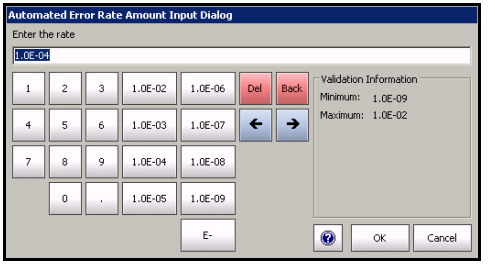


- Numerical keyboards: Allows entering integer/decimal values.
  - For integer unsigned or signed values

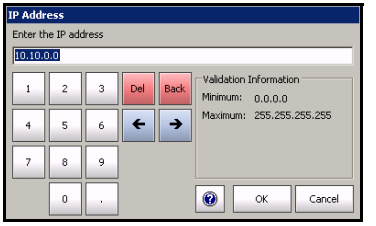




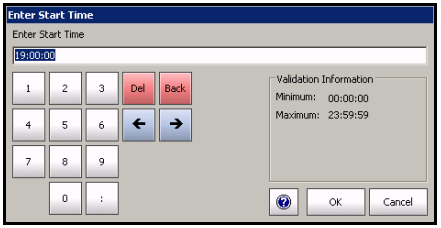
  - For rate values: Allows entering the rate values (0 through 9, and exponent)



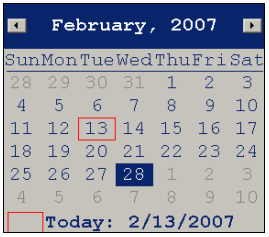
  - For IP address, Subnet Mask and Default Gateway values



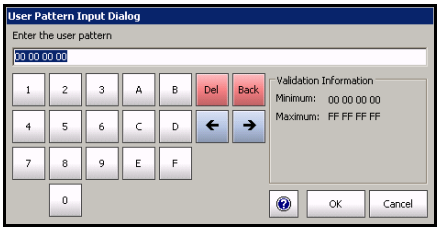
➤ Time Keyboard: Allows entering a time value.



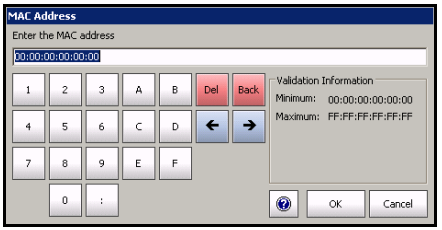
➤ Date keyboard: Allows selecting a date by clicking the date on the calendar. Use the left and right arrow to switch from one month to another or Click the month area for quick month selection. Click the year area for quick year selection.



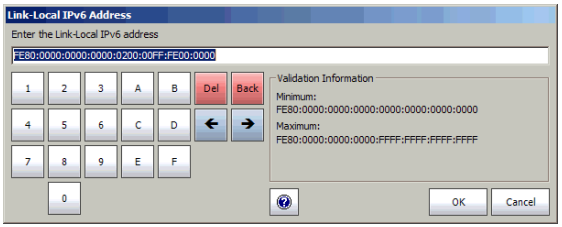
➤ Hexadecimal keyboards: Allows entering hexadecimal values (0 through 9 and A through F)



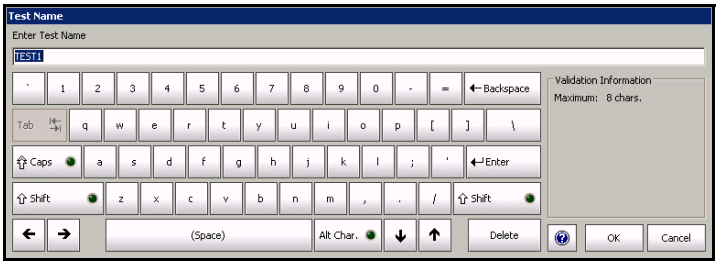
For MAC address



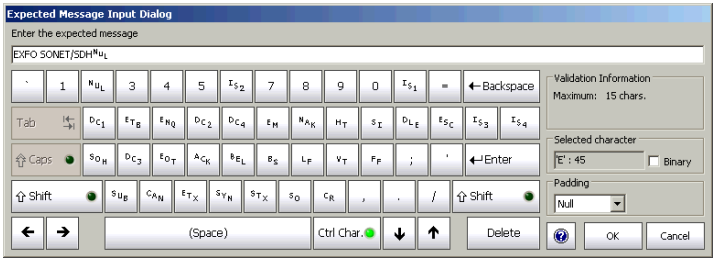
For IPv6 address



➤ Full keyboard: Allows entering numbers, letters and some other characters. The **Back**, **Del**, **Shift** and space bar keys have the same functionality as a regular PC keyboard.



➤ Trace message keyboard (WAN): Allows entering alphanumerical characters (ITU T.50) required for J0 and J1 Trace fields. Click the **Ctrl Char** button to access these characters.



ITU T.50 Characters

b7 to b1	Character	Description	b7 to b1	Character	Description
000 0000	NUL	Null	001 0000	DLE	Data Link Escape
000 0001	SOH	Start Of Heading	001 0001	DC1	Device Control 1
000 0010	STX	Start of Text	001 0010	DC2	Device Control 2
000 0011	ETX	End of Text	001 0011	DC3	Device Control 3
000 0100	EOT	End Of Transmission	001 0100	DC4	Device Control 4
000 0101	ENQ	Enquiry	001 0101	NAK	Negative Acknowledge
000 0110	ACK	Acknowledge	001 0110	SYN	Synchronous idle
000 0111	BEL	Bell	001 0111	ETB	End of Transmission Block
000 1000	BS	Backspace	001 1000	CAN	Cancel
000 1001	HT	Horizontal Tabulation	001 1001	EM	End of Medium
000 1010	LF	Line Feed	001 1010	SUB	Substitute character
000 1011	VT	Vertical Tabulation	001 1011	ESC	Escape
000 1100	FF	Form Feed	001 1100	IS4	Information Separator 4
000 1101	CR	Carriage Return	001 1101	IS3	Information Separator 3
000 1110	SO	Shift-Out	001 1110	IS2	Information Separator 2
000 1111	SI	Shift-In	001 1111	IS1	Information Separator 1

5 Creating and Starting a Test Case

A test case can be created using one of the following methods:

- **Test Setup** allows the creation of the test case by travelling through the signal structure. See *Introducing the Test Setup* on page 68.

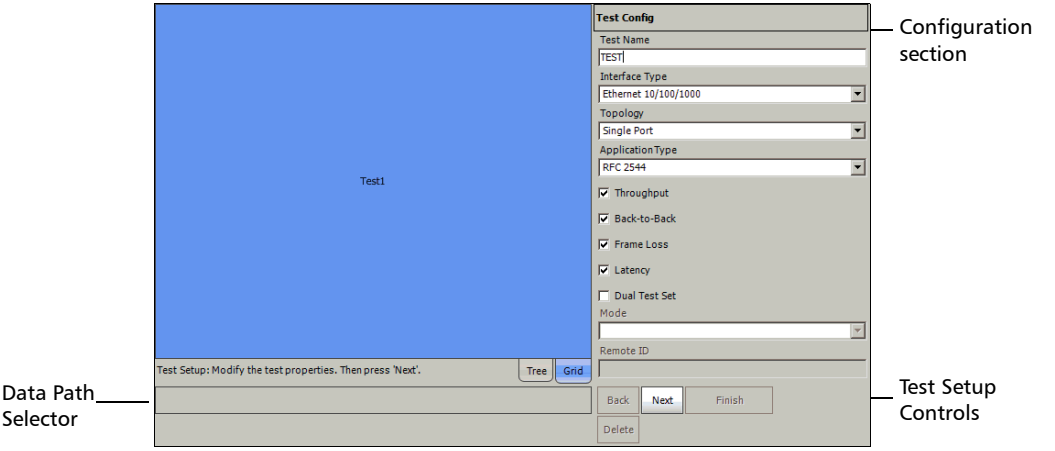
  See *Test Case Availability* to determine the test cases supported by the unit.

- **Load** allows setting up the test case by loading a previously saved configuration. Refer to **Load** on page 46 for more information.

- **Script** allows running a script that creates the test case. Refer to *Script* on page 408.

Introducing the Test Setup

The **Test Setup** window is displayed by default when the SUI is started. In the case where the SUI is not in the test setup window, click the **Test Setup** from the *TEST Tab* on page 40.



- **Tree** allows seeing the configuration test structure (data path).
- **Grid** is used for test case direction (decoupled test mode).
- **Data Path Selector** is used to select the datapath structure (for example: port, signal, Pattern, etc.) of the test case.
- **Configuration section a**llows parameters configuration for each node of the test.

  Test Name represents the name of the test connection used to identify the test. The default setting is **TEST**.

Note: *The other configuration section parameters are described for each specific test.*

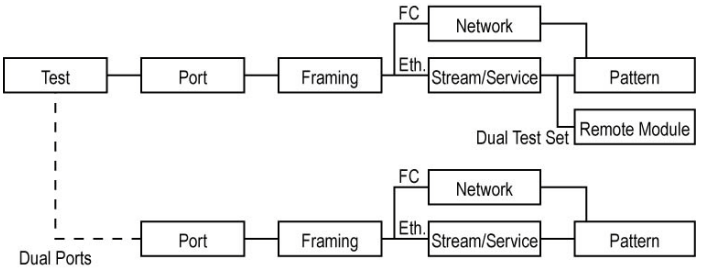
- **Test Setup Controls**:
  - **Back** returns to the previous configuration step allowing to see, change or delete what had been selected.
  - **Next** switches to the next configuration step. The **Next** button is only available when selection(s) from the Data Path Selector and/or the Grid has been made.
  - **Delete** deletes the current path node.
  - **Finish/Setup**:

    Finish completes the configuration and creates the test case. The current window settings are only accepted if the selection has been made from the **Grid** view. Default parameters will be used for the remaining wizard steps. Thus, clicking **Finish** for BERT test will automatically add a pattern at the end of the test case structure if not already selected.

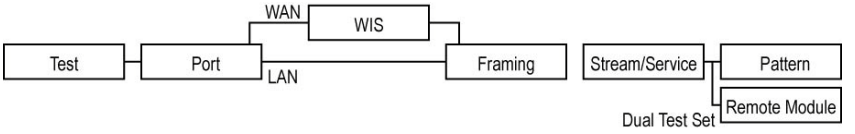
    Setup is displayed instead of **Finish** once the test is created allowing to return in setup mode. **Setup** is not available when the test is started (running).

The test path is created through the configuration of each layer that must be crossed by the signal under test. The test path can contain the following steps depending on the test application type:

For RTU-310:



For RTU-310G:



Steps	**Available with**
The **Test** step is the root of the test case. It allows the configuration of the test name, test application type, Interface Type, topology, and Clock Mode. For RFC 2544, the selection of the sub tests and dual test set are also available.	All tests
The **Port** step allows the selection and configuration of the physical portand for 10Gig-E interface the configuration of the transceiver mode (LAN or WAN). For WAN transceiver mode, the WIS step will be inserted in front of the Framing step.	All tests
The **WIS** step indicates that the WAN transceiver mode is selected.Available with 10Gig-E interface only.	**WAN** transceiver mode only
The **Framing** step allows the selection of the test framing layer.	All tests
The **Network** step allows the selection of the network Ethernet/Fibre Channel parameters for the port.	All test at the exception of **BERT Unframed**, **Framed Layer1** and Fibre Channel
The **Traffic Stream** step allows traffic stream configuration.	All Ethernet tests except **Smart Loopback**
The **Remote Module** step allows the selection of a remote compatible module (FTB-8510B, FTB-8510G, FTB-8525/FTB-8535, FTB-8120NGE/FTB-8130NGE, and RTU-310/RTU-310G).	**EtherSAM** and **RFC 2544 Dual Test Sets** tests only
The **Pattern** step allows the selection of the pattern.	**BERT** test only

Test Case Availability

The remaining of this chapter describes how to create the following typical Ethernet and Fibre Channel test cases. The available test cases depend on the model and activated options.

Test Case	Supported on		Page
	RTU-310	RTU-310G	
EtherSAM (Y.1564) Test Case	X	X	73
Ethernet EtherSAM (Y.1564) and RFC 2544 Dual Test Set Test Cases	X	X	80
Ethernet RFC 2544 Test Case	X	X	89
Ethernet BERT Test Case	X	X	95
Ethernet Frame Analyzer Test Case including Multiple-Stream, **IPTV**, **Through Mode**, **MPLS** and **PBB-TE** testing.	X	X[a]	102
Ethernet Smart Loopback Test Case	X	X	109
Ethernet TCP Throughput Test Case	X		113
Fibre Channel BERT Test Case	X		116

a. **IPTV** and **Through Mode** are only available on the RTU-310.

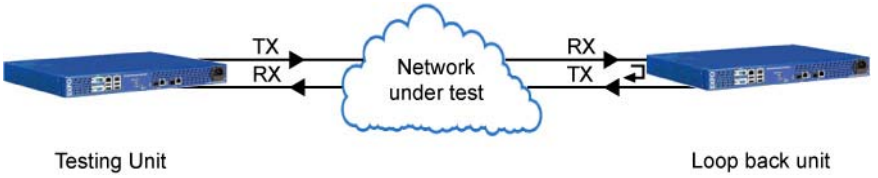
EtherSAM (Y.1564) Test Case

ITU-T Y.1564 is the newly introduced standard for turning-up and troubleshooting carrier Ethernet services. This new methodology is completely adapted to today's Ethernet services especially mobile backhaul and commercial services.

Contrary to other methodologies, EtherSAM supports new multiservice offerings. It can simulate all types of services that will run on the network and simultaneously qualify all key SLA parameters for each of these services. Moreover, it validates the QoS mechanisms provisioned in the network to prioritize the different service types, resulting in more accurate validation and much faster deployment and troubleshooting.

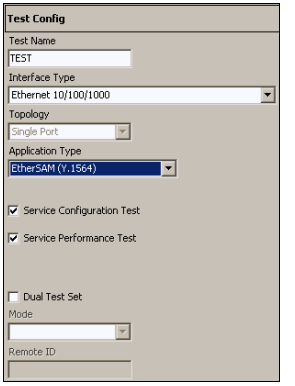
Typical **EtherSAM (Y.1564)** application:

Note: *For bi-directional (Dual Test Set) test, see Ethernet EtherSAM (Y.1564) and RFC 2544 Dual Test Set Test Cases* on page 80.



To create an EtherSAM (Y.1564) test case:

1. Test configuration:



1a. Select **Ethernet 10/100/1000** as the **Interface Type**. **Interface Type** is not available with RTU-310G.

1b. Select **Single Port** as the **Topology**. Topology is only available with RTU-310.

1c. Select the source **Clock Mode**. Available with RTU-310G only. Refer to *Clock Synchronization* on page 352 for more information.

1d. Select **EtherSAM (Y.1564)** as the **Application Type**.

1e. Select the desired **EtherSAM** sub test(s). All **EtherSAM** sub tests are selected by default. Refer to *Overview (Configuration)* on page 322 and *Services (Configuration)* on page 327 for more information.

Service Configuration Test consists in sequentially testing each service. It validates that the service is properly provisioned and that all specific KPIs or SLA parameters are met.

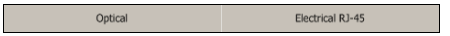
Service Performance Test simultaneously validates the quality of all the services over time.

1f. Leave the **Dual Test Set** check box cleared. For Dual Test Set test case, refer to *Ethernet EtherSAM (Y.1564) and RFC 2544 Dual Test Set Test Cases* on page 80.

1g. Click **Next**.

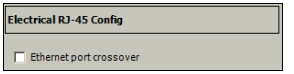
2. Port configuration:

2a. RTU-310Select the port **Connector Type (Optical** or **Electrical RJ-45**). **Optical** is automatically selected for the **Ethernet 10G** interface.



2b. For RTU-310select the port number by clicking on **Port 1** or **Port 2**.

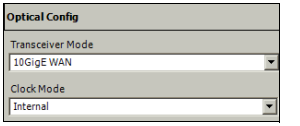
2c. For Electrical RJ-45, if required, select the **Ethernet port crossover** check box to inverse the pin-to-pair assignment of the UTP cable used.



Note: *At this point you should have a link up indicated in the **Tree** view tab. A green LED indicates a link up while a red LED indicates a link down. For electrical port, if the link is down, make sure that the **Ethernet port crossover** setting is correct.*

2d. Click **Next**.

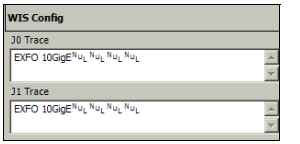
3. Optical configuration for **Ethernet 10G** interface only:



3a. Select the **Transceiver Mode** Choices are Local Area Network (LAN) for regular Ethernet interface (10.31250Gb/s) and Wide Area Network (WAN) for Ethernet stream encapsulated inside a SONET/SDH frame structure (9.95328Gb/s). Choices availability depend on the unit model and options refer to *Software Options* on page 347 for more information.

3b. Select the source Clock Mode (WAN transceiver mode only). Refer to *Clock Synchronization* on page 352 for more information.

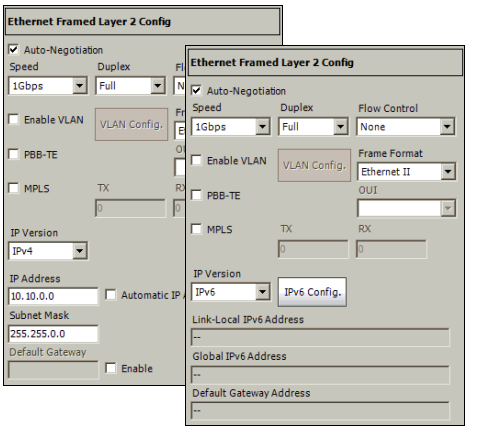
3c. Click **Next**.



3d. Enter the J0 Trace and J1 Trace messages (WAN transceiver mode only). Refer to *WIS TX* on page 239 for more information.

3e. Click **Next**.

4. **Port and framing configuration:**



4a. Set the **Auto-Negotiation**, **Speed**, **Duplex**, and **Flow Control** parameters. Not available with Ethernet 10G. Refer to *Interface Setup (Ethernet)* on page 142 for more information.

4b. Set the **VLAN** parameters when required. Refer to *Network* on page 150 for more information.

4c. Select the **Frame Format**. Choices are **Ethernet II** and **802.3 SNAP**. For **802.3 SNAP**, select the Organizationally Unique Identifier (OUI). Refer to *Network* on page 150 for more information.

4d. Select the **PBB-TE** check box to enable the capability to generate and analyze streams with PBB-TE data traffic including configuration of B-MAC (source and destination), B-VLAN and I-tag, and to filter received traffic by any of these fields. **PBB-TE** is a software option and needs to be enabled to give access to the PBB-TE testing capability (refer to *Software Options* on page 347). PBB-TE is not available when the **MPLS** check box is selected. Refer to *PBB-TE Interface configuration* on page 487 for more information.

Select the **MPLS** check box to enable the capability to generate and analyze streams with up to two layers of MPLS labels and to filter received traffic by MPLS label or COS. **MPLS** is a software option and needs to be enabled to give access to the MPLS testing capability (refer to *Software Options* on page 347). MPLS is not available when the **PBB-TE** check box is selected. Refer to *MPLS Configuration* on page 503 for more information.**TX** and **RX**: Allows the selection of the interface MPLS TX and RX labels (**0** to **1048575**). The default label value is **16** for both TX and RX. The TX and RX labels are available when the **MPLS** check box is selected. Refer to *Network* on page 150 for more information.

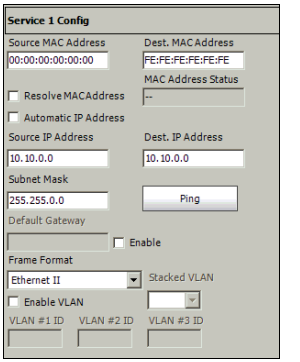
4e. Set the **IP Version** (IPv4 or IPv6). **IP Version** is only available when the IPv6 software option (SK-IPV6) is enabled.

4f. For IPv4, select the **Automatic IP Address** check box to dynamically obtain an IP address from a DHCP (Dynamic Host Configuration Protocol) server or set the source and destination IP addresses, **Subnet Mask**, and the **Default Gateway**. Refer to *IPv4 Configuration* on page 489 for more information.

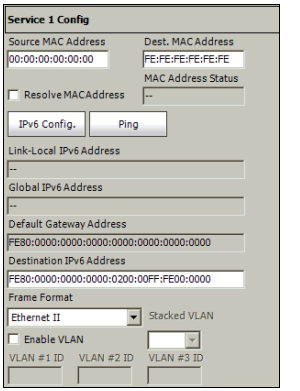
4g. For IPv6, click the **IPv6 Config** button to set the IPv6 settings. Refer to *IPv6 Address Configuration* on page 491 for more information.

4h. Click **Next**.

5. Service configuration



5a. For IPv4, select the **Automatic IP Address** check box to dynamically obtain an IP address from a DHCP (Dynamic Host Configuration Protocol) server or set the source and destination IP addresses, **Subnet Mask**, and the **Default Gateway**. Refer to *IPv4 Configuration* on page 489 for more information.



5b. For IPv6, set the destination IP address and if required, click the **IPv6 Config** button for additional IPv6 settings. Refer to *IPv6 Address Configuration* on page 491 for more information.

5c. If required, set the source and destination MAC addresses, and select the **Resolve MAC Address** check box when required. Refer to page 328 for more information.

5d. Select the **Frame Format**. Choices are **Ethernet II** and **802.3 SNAP**. Refer to *Framing Configuration* on page 498 for more information.

5e. Set the **VLAN** parameters when required. Refer to *VLAN Configuration* on page 486 for more information.

5f. Click **Finish** to complete the test setup.

6. Services must be enabled before starting the test. For enabling Services and for additional configuration parameters, refer to *EtherSAM Tabs* on page 321.

7. Click the **Start** button to start the test.

   At least one of the EtherSAM (Y.1564) sub tests (**Configuration Test** or **Performance Test**) has to be enabled to start the test. The sub-tests that are enabled will be performed following this order: **Configuration Test** and **Performance Test**.

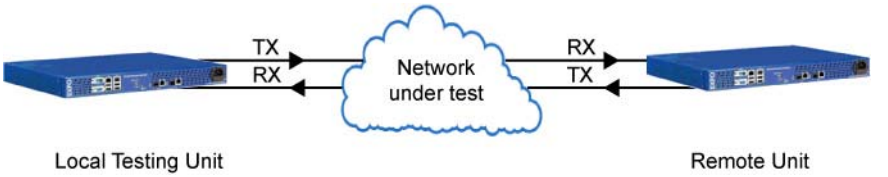
8. For additional results, refer to *EtherSAM Tabs* on page 321.

Ethernet EtherSAM (Y.1564) and RFC 2544 Dual Test Set Test Cases

The **EtherSAM (Y.1564)** test allows to validate the key performance indicators of Carrier Ethernet-based services.

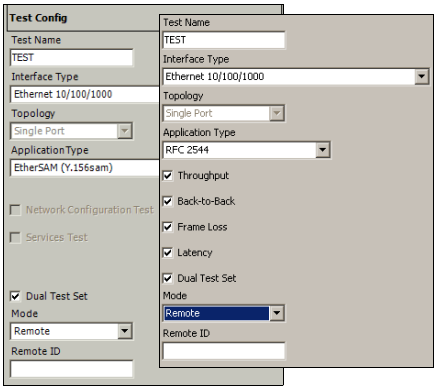
The **RFC 2544** test allows Ethernet **Throughput**, **Back-to-Back**, **Frame Loss**, and **Latency** performance tests in accordance with **RFC 2544** specifications.

Dual Test Set test allows bi-directional test between two compatible modules providing independent results for each test direction. Compatible modules are FTB-8510B, FTB-8510G, FTB-8525/FTB-8535, FTB-8120NGE/FTB-8130NGE, or RTU-310/RTU-310G. A Dual Test Set test case must be first created on the remote module then on the local module as described in the following procedure. The results from local-to-remote and remote-to-local are available on the local testing unit.



To create an EtherSAM (Y.1564) or RFC 2544 Dual Test Set test case, first create the test on the remote module as follow:

1. Test configuration:



1a. Select **Ethernet 10/100/1000** as the **Interface Type**. **Interface Type** is not available with RTU-310G.

1b. Select **Single Port** as the **Topology**. Topology is only available with RTU-310.

1c. Select **EtherSAM (Y.1564)** or **RFC 2544** as the **Application Type**.

1d. Select the **Dual Test Set** check box to enable the control of a remote compatible module (FTB-8510B, FTB-8510G, FTB-8525/FTB-8535, FTB-8120NGE/FTB-8130NGE, or RTU-310/RTU-310G). For RTU-310, **Dual Test Set** is only available in Single Port **Topology**. This setting is not selected by default.

1e. Select the **Remote** test **Mode**.

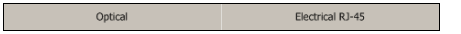
1f. Type an ID for this remote unit. Up to 16 characters are allowed.

1g. Click **Next**.

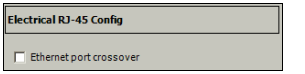
2. Port configuration:

Port 1 (RTU-310 only) is automatically selected.

2a. Select the port **Connector Type (Optical** or **Electrical RJ-45**). **Optical** is automatically selected for the **Ethernet 10G** interface.



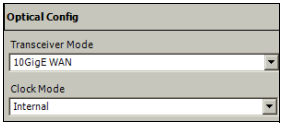
2b. For Electrical RJ-45, if required, select the **Ethernet port crossover** check box to inverse the pin-to-pair assignment of the UTP cable used.



Note: *At this point you should have a link up indicated in the **Tree** view tab. A green LED indicates a link up while a red LED indicates a link down. For electrical port, if the link is down, make sure that the **Ethernet port crossover** setting is correct.*

2c. Click **Next**.

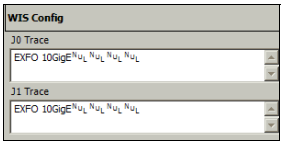
3. Optical configuration for **Ethernet 10G** interface only:



3a. Select the **Transceiver Mode** Choices are Local Area Network (LAN) for regular Ethernet interface (10.31250Gb/s) and Wide Area Network (WAN) for Ethernet stream encapsulated inside a SONET/SDH frame structure (9.95328Gb/s). Choices availability depend on the unit model and options refer to *Software Options* on page 347 for more information.

3b. Select the source Clock Mode (WAN transceiver mode only). Refer to *Clock Synchronization* on page 352 for more information.

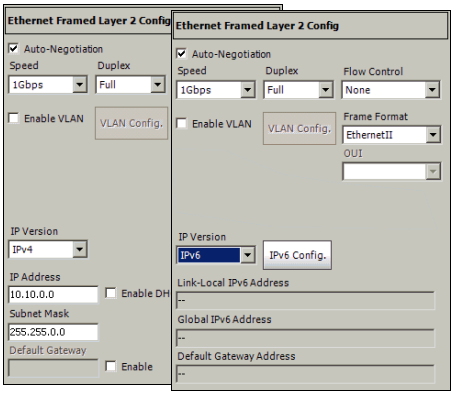
3c. Click **Next**.



3d. Enter the J0 Trace and J1 Trace messages (WAN transceiver mode only). Refer to *WIS TX* on page 239 for more information.

3e. Click **Next**.

4. Framing configuration.



4a. Set the **Auto-Negotiation**, **Speed**, **Duplex**, and **Flow Control** parameters. Not available with Ethernet 10G. Refer to *Interface Setup (Ethernet)* on page 142 for more information.

4b. Set the **VLAN** parameters when required. Refer to *MAC* on page 177 for more information.

4c. Select the **Frame Format**. Choices are **Ethernet II** and **802.3 SNAP**. Refer to *Network* on page 150 for more information.

4d. Set the **IP Version** (IPv4 or IPv6). **IP Version** is only available when the IPv6 software option (SK-IPV6) is enabled.

4e. For IPv4, select the **Automatic IP Address** check box to dynamically obtain an IP address from a DHCP (Dynamic Host Configuration Protocol) server or set the source and destination IP addresses, **Subnet Mask**, and the **Default Gateway**. Refer to *IPv4 Configuration* on page 489 for more information.

4f. For IPv6, click the **IPv6 Config** button to set the IPv6 settings. Refer to *IPv6 Address Configuration* on page 491 for more information.

4g. Click **Finish** to complete the test setup on this remote module. The **RFC 2544**'s **Global** tab is automatically displayed.

When the test is created as remote on a unit or on a compatible unit (FTB-8510B, FTB-8510G, FTB-8525/FTB-8535, FTB-8120NGE/FTB-8130NGE, or RTU-310/RTU-310G), the SUI is limited to the following: Test Setup, Tools, System, and About tabs; favorites, save, load, and report functionality. No test configuration and results are available.

Create the test on the local module as follow:

1. On the local module, proceed with the test creation as described above (starting with step 1 on page 81) at the exception of the following parameters:

1a. Select the desired **EtherSAM (Y.1564)** or **RFC 2544** sub test(s). All sub tests are selected by default.

For **RFC 2544**:

Throughput: Gives the maximum throughput of the device under test for which there is no frame loss. Refer to *Throughput* on page 299 for more information.

Back-to-Back: Gives the maximum number of frames that can be sent at maximum throughput. Refer to *Back-to-Back* on page 304 for more information.

Frame Loss: Gives the percentage of frames that are lost. Refer to *Frame Loss* on page 308 for more information.

Latency: Gives the time required for the sent frame to go through the device under test. Refer to *Latency* on page 312 for more information.

For **EtherSAM (Y.1564)**:

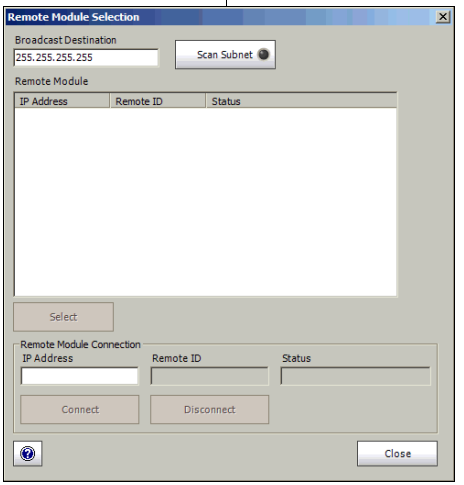
Service Configuration Test consists in sequentially testing each service. It validates that the service is properly provisioned and that all specific KPIs or SLA parameters are met.

Service Performance Test simultaneously validates the quality of all the services over time.

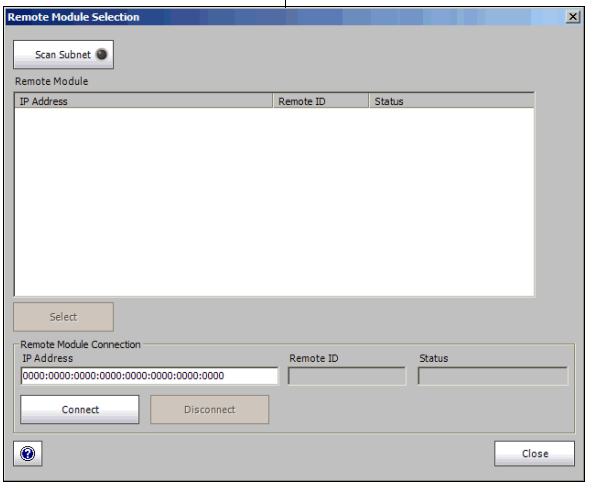
1b. For **Dual Test Set Mode** (see step 1e on page 81), select the **Local** test mode.

1c. From the **Remote Module** page, click the **Remote Selection** button.

IPv4



IPv6



1d. If both modules (remote and local) are on the same subnet, select the subnet mask (**Broadcast Destination**) of the network to be scanned, based on the IP address and subnet of its interface. Available with IPv4 only.

If the remote and local modules are not on the same subnet, like when connected through a Router, enter the remote module IP address in the **IP Address** field of the **Remote Module Connection** section. For IPv6, entering a Global IPv6 destination address requires that the interface **Global IPv6 Address** is defined. The **Remote ID** and its **Status** are displayed if the module is detected. Skip to step 1g.

1e. Click **Scan Subnet** to scan the subnet to find remote compatible modules (FTB-8510B, FTB-8510G, FTB-8525/FTB-8535, FTB-8120NGE/FTB-8130NGE, AXS-850 Series (RFC 2544 only), FTB-860 Series, FTB-810/880 Series, or RTU-310/RTU-310G). The subnet scan will work only when both remote and local modules are on the same subnet. Only modules running the same test (RFC 2544 or EtherSAM) and having the **Remote Dual Test Set** mode enabled will be listed.

The detected remote compatible module are listed with their **IP Address**, **Remote ID**, and **Status** information.

Status	Description
Not Connected	The remote module is not connected to another module.
Busy	The remote module is connected to another module.
Connected	The remote module is connected to the current module.
Remote IP not found	The local module didn't receive any reply from the selected remote module IP address.

1f. Select a detected module from the list by clicking on it, and click **Select**. The connection is possible with a module having its status **Not Connected** or **Busy**. A confirmation is required when selecting a remote module having its status **Busy** since the remote unit may be connected to another module.

1g. Click the **Connect** button to establish the connection with the remote module. The connection is possible with a module having its status **Not Connected** or **Busy**. A confirmation is required when selecting a remote module having its status **Busy** since the remote unit may be connected to another module.

Disconnect allows to disconnect from the remote module.

1h. Click **Finish** to complete the test setup on this local module. For RFC 2544, the **RFC 2544**'s **Global** tab is automatically displayed.

2. For additional configuration parameters, refer to *EtherSAM Tabs* on page 321 or *RFC 2544 Tabs* on page 295.
3. On the local module, click the **Start** button to start the test. The **Start** button will be available only when the connection between the two RTU-310/310G units is established.

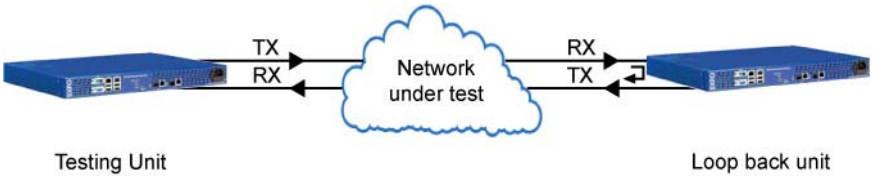
   At least one of the test procedures (For EtherSAM (Y.1564): **Service Configuration Test** or **Service Performance Test**; For RFC 2544: Throughput, Back-to-Back, Frame Loss or Latency) has to be enabled to start the test. Test procedures that are enabled will be performed following this order:
   Service Configuration Test and **Service Performance Test** for E**therSAM (Y.1564)**
   Throughput, **Back-to-Back**, **Frame Loss**, and **Latency** for **RFC 2544**.
4. For additional results, refer to *EtherSAM Tabs* on page 321 or *RFC 2544 Tabs* on page 295.

Ethernet RFC 2544 Test Case

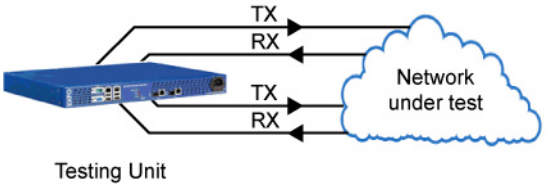
RFC 2544: Allows Ethernet **Throughput**, **Back-to-Back**, **Frame Loss**, and **Latency** performance tests in accordance with **RFC 2544** specifications.

Note: *For bi-directional (Dual Test Set) test, see Ethernet EtherSAM (Y.1564) and RFC 2544 Dual Test Set Test Cases* on page 80.

Typical **RFC 2544** application in **Single Port**:

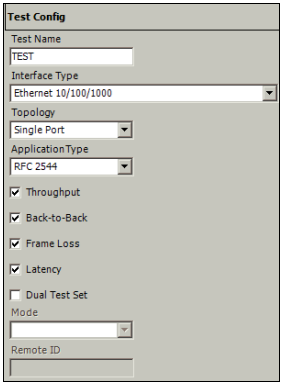


Typical **RFC 2544** application in **Dual Ports** (RTU-310 only):



To create an RFC 2544 test case:

1. Test configuration:



1a. Select **Ethernet 10/100/1000** as the **Interface Type**. **Interface Type** is not available with RTU-310G.

1b. For RTU-310: Select the **Topology** test type: **Single Port** or **Dual Ports**.

1c. Select **RFC 2544** as the **Application Type**.

1d. Select the desired RFC 2544 sub test(s). All RFC 2544 sub tests are selected by default.

Throughput: Gives the maximum throughput of the device under test for which there is no frame loss. Refer to *Throughput* on page 299 for more information.

Back-to-Back: Gives the maximum number of frames that can be sent at maximum throughput. Refer to *Back-to-Back* on page 304 for more information.

Frame Loss: Gives the percentage of frames that are lost. Refer to *Frame Loss* on page 308 for more information.

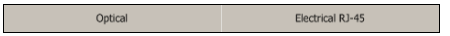
Latency: Gives the time required for the sent frame to go through the device under test. Refer to *Latency* on page 312 for more information.

1e. Leave the **Dual Test Set** check box cleared. For Dual Test Set test case, refer to *Ethernet EtherSAM (Y.1564) and RFC 2544 Dual Test Set Test Cases* on page 80.

1f. Click **Next**.

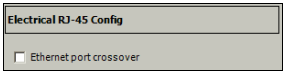
2. Port configuration:

2a. RTU-310Select the port **Connector Type (Optical** or **Electrical RJ-45**). **Optical** is automatically selected for the **Ethernet 10G** interface.



2b. For RTU-310select the port number by clicking on **Port 1** or **Port 2**.

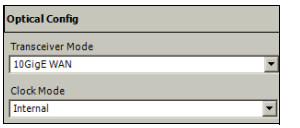
2c. For Electrical RJ-45, if required, select the **Ethernet port crossover** check box to inverse the pin-to-pair assignment of the UTP cable used.



Note: *At this point you should have a link up indicated in the **Tree** view tab. A green LED indicates a link up while a red LED indicates a link down. For electrical port, if the link is down, make sure that the **Ethernet port crossover** setting is correct.*

2d. Click **Next**.

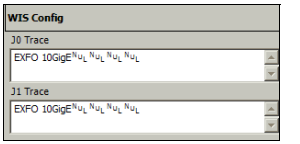
3. Optical configuration for **Ethernet 10G** interface only:



3a. Select the **Transceiver Mode** Choices are Local Area Network (LAN) for regular Ethernet interface (10.31250Gb/s) and Wide Area Network (WAN) for Ethernet stream encapsulated inside a SONET/SDH frame structure (9.95328Gb/s). Choices availability depend on the unit model and options refer to *Software Options* on page 347 for more information.

3b. Select the source Clock Mode (WAN transceiver mode only). Refer to *Clock Synchronization* on page 352 for more information.

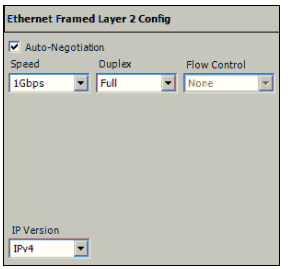
3c. Click **Next**.



3d. Enter the J0 Trace and J1 Trace messages (WAN transceiver mode only). Refer to *WIS TX* on page 239 for more information.

3e. Click **Next**.

4. **Framing configuration:**

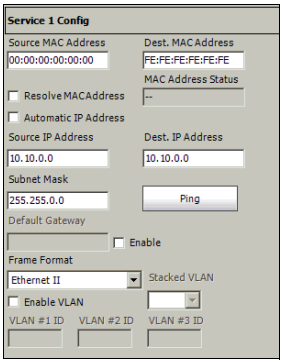


4a. Set the **Auto-Negotiation**, **Speed**, **Duplex**, and **Flow Control** parameters. Not available with Ethernet 10G. Refer to *Interface Setup (Ethernet)* on page 142 for more information.

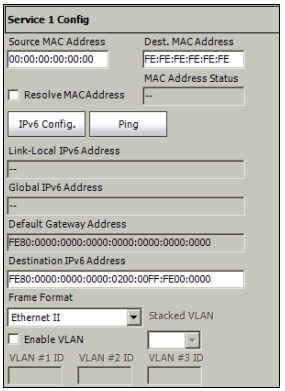
4b. Set the **IP Version** (IPv4 or IPv6). **IP Version** is only available when the IPv6 software option (SK-IPV6) is enabled.

4c. Click **Next**.

5. Traffic stream configuration



5a. For IPv4, select the **Automatic IP Address** check box to dynamically obtain an IP address from a DHCP (Dynamic Host Configuration Protocol) server or set the source and destination IP addresses, **Subnet Mask**, and the **Default Gateway**. Refer to *IPv4 Configuration* on page 489 for more information.



5b. For IPv6, set the destination IP address and if required, click the **IPv6 Config** button for additional IPv6 settings. Refer to *IPv6 Address Configuration* on page 491 for more information.

5c. If required, set the network source MAC Address. Select the **Resolve MAC Address** check box or set the destination MAC address. Refer to *MAC* on page 177 for more information.

5d. Select the **Frame Format**. Choices are **Ethernet II** and **802.3 SNAP**. Refer to *Frame Format* on page 177 for more information.

5e. Set the **VLAN** parameters when required. Refer to *MAC* on page 177 for more information.

5f. Click **Finish** to complete the test setup. The **RFC 2544**'s **Global** tab is automatically displayed.

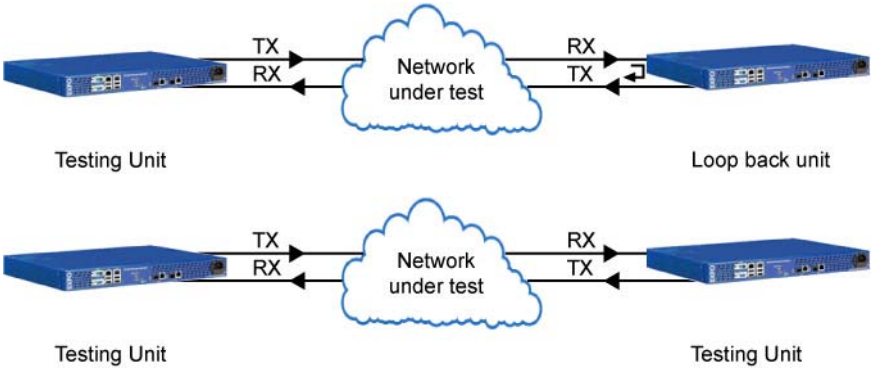
6. For additional configuration parameters, refer to *RFC 2544 Tabs* on page 295.
7. Click the **Start** button to start the test.

   At least one of the RFC 2544 test procedures (Throughput, Back-to-Back, Frame Loss or Latency) has to be enabled to start the test. Test procedures that are enabled will be performed following this order: Throughput, Back-to-Back, Frame Loss, and Latency.
8. For additional results, refer to *RFC 2544 Tabs* on page 295.

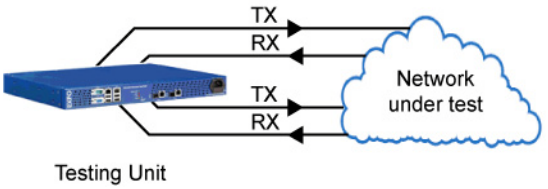
Ethernet BERT Test Case

Allows Ethernet unframed and Layer 1 up to Layer 4 traffic generation with specific test pattern for Bit Error Rate analysis.

Typical **BERT** applications in **Single Port**:

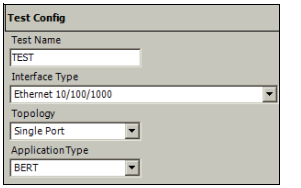


Typical **BERT** application in **Dual Ports** (RTU-310 only):



To create a BERT test case:

1. Test configuration:



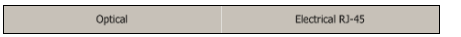
1a. Select **Ethernet 10/100/1000** as the **Interface Type**. **Interface Type** is not available with RTU-310G.

1b. For RTU-310: Select the **Topology** test type: **Single Port** or **Dual Ports**.

1c. Select **BERT** as the **Application Type**.

1d. Click **Next**.

2. Port configuration:



2a. Select the port **Connector Type (Optical** or **Electrical RJ-45**). **Optical** is automatically selected for the **Ethernet 10G** interface.

2b. For RTU-310select the port number by clicking on **Port 1** or **Port 2**.

For RTU-310**Dual Ports**, select the first port and proceed with the rest of the configuration for the first port. However, before clicking **Finish**, click **Back** several times to return to the port setup window, select the second port and proceed with the rest of the configuration for the second port.

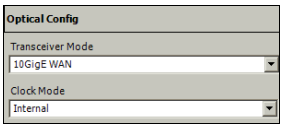
2c. For Electrical RJ-45, if required, select the **Ethernet port crossover** check box to inverse the pin-to-pair assignment of the UTP cable used.

Note: *At this point you should have a link up indicated in the **Tree** view tab. A green LED indicates a link up while a red LED indicates a link down. For electrical port, if the link is down, make sure that the **Ethernet port crossover** setting is correct.*

2d. Click **Next**.

3. Optical configuration for **Ethernet 10G** interface only:

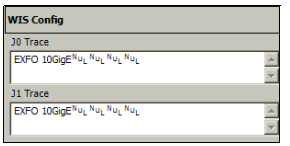
3a. Select the **Transceiver Mode** Choices are Local Area Network (LAN) for regular Ethernet interface (10.31250Gb/s) and Wide Area Network (WAN) for Ethernet stream encapsulated inside a SONET/SDH frame structure (9.95328Gb/s). Choices availability depend on the unit model and options refer to *Software Options* on page 347 for more information.



3b. Select the source Clock Mode (WAN transceiver mode only). Refer to *Clock Synchronization* on page 352 for more information.

3c. Click **Next**.

3d. Enter the J0 Trace and J1 Trace messages (WAN transceiver mode only). Refer to *WIS TX* on page 239 for more information.



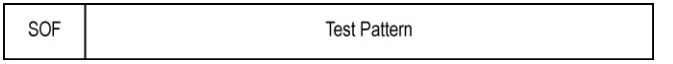
3e. Click **Next**.

4. Framing configuration:

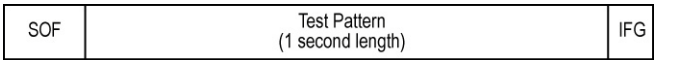
4a. Select the test framing mode.

Ethernet Unframed: Consists in sending a frame without EOF (End Of Frame). Ethernet Unframed is only available for optical interfaces excluding 10Gig-E WAN.

Enable Sync disabled:

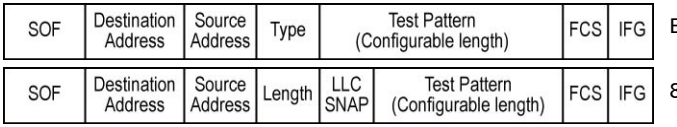


Enable Sync enabled:



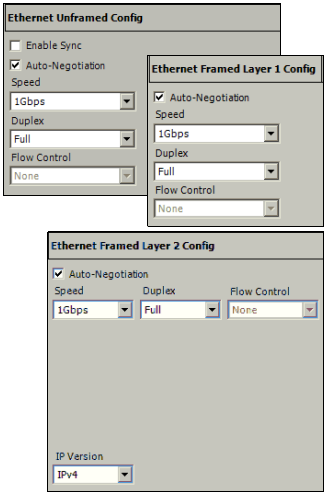
Ethernet Framed Layer 1: Consists in sending a frame of x bytes specified from the frame size field; refer to frame **Size** on page 168 for more information. This framing type allows the connection to any interface that complies with 802.3 Ethernet PHY or DWDM fibre.

Ethernet Framed Layer 2: Consists in sending a frame of x bytes specified from the frame size field; refer to frame **Size** on page 168 for more information. This framing type allows the connection to any EtherType interface (10/100/1000Mbps) or Ethernet network (10GigE) that complies with 802.3 Ethernet Layer 2 (valid MAC address, type/length, and FCS bytes).



Note: *For Layer 3 and Layer 4, choose **Ethernet Framed Layer 2** and refer to Stream Generation Tabs - Overview* on page 162 *once the test is created.*

4b. For **Ethernet Unframed**, select the **Enable Sync** check box to allow any receiver to bit-sync every second by inserting an IFG of 12 bytes with SOF. The **Enable Sync** check box is not selected by default.



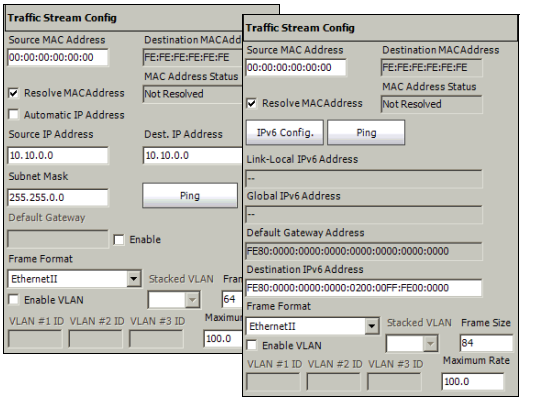
4c. Set the **Auto-Negotiation**, **Speed**, **Duplex**, and **Flow Control** parameters. Not available with Ethernet 10G. Refer to *Interface Setup (Ethernet)* on page 142 for more information.

4d. Set the **IP Version** (IPv4 or IPv6). **IP Version** is only available with **Framed Layer 2** when the IPv6 software option (SK-IPV6) is enabled.

4e. Click **Next**.

5. Traffic stream configuration:

Only **Frame Size** and **Maximum** Rate are configurable with Framed Layer 1.



5a. For IPv4, select the **Automatic IP Address** check box to dynamically obtain an IP address from a DHCP (Dynamic Host Configuration Protocol) server or set the source and destination IP addresses, **Subnet Mask**, and the **Default Gateway**. Refer to *IPv4 Configuration* on page 489 for more information.

5b. For IPv6, set the destination IP address and if required, click the **IPv6 Config** button for additional IPv6 settings. Refer to *IPv6 Address Configuration* on page 491 for more information.

5c. If required, set the network source MAC Address. Select the **Resolve MAC Address** check box or set the destination MAC address. Refer to *MAC* on page 177 for more information.

5d. Select the **Frame Format**. Choices are **Ethernet II** and **802.3 SNAP**. Refer to *Frame Format* on page 177 for more information.

5e. Select the Enable **VLAN** check box when required and set the number of stacked VLAN and its parameters (**VLAN Config** button). For more information on **VLAN** refer to *MAC* on page 177.

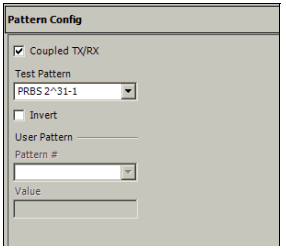
5f. Enter the **Frame Size**. For more information on **Frame Size** refer to *Size* on page 168.

5g. Enter the **Maximum Rate (%)**, the default setting is **100%** for all speeds except for 10Gbps WAN which is **92.3076923076923%**. Refer to *Traffic Shaping* on page 172 for more information.

5h. Click **Next**.

6. Pattern configuration:

6a. Set the pattern parameters. Refer to *Pattern TX* on page 290 for more information.



6b. Click **Finish** to complete the test setup. The **Alarm** summary tab is automatically displayed.

7. For additional configuration parameters, refer to *Stream Generation Tabs* on page 161.

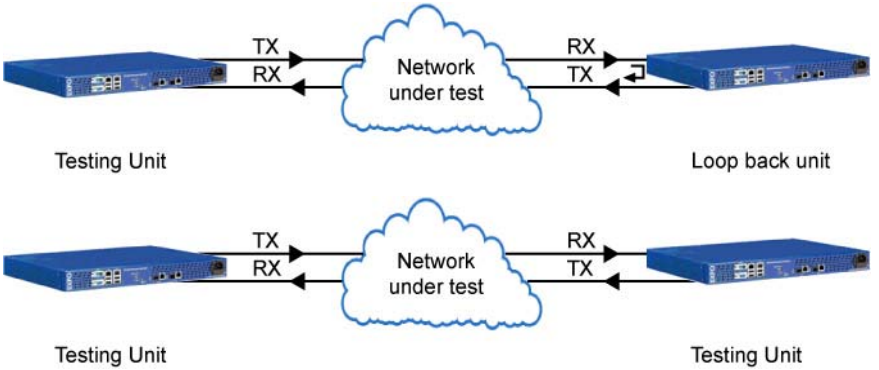
8. Click the **Start** button to start the test.

9. For additional results, refer to *Traffic Analyzer Tabs* on page 199 and *Pattern Tabs* on page 289.

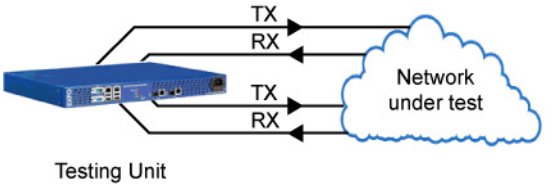
Ethernet Frame Analyzer Test Case

Allows Ethernet traffic generation and analysis of up to 10 streams. The **Frame Analyzer** test allows also to perform **IPTV**, **Through Mode**, **MPLS** and **PBB-TE** testing. **IPTV** and **Through Mode** are only available with RTU-310.

Typical **Frame Analyzer** application in **Single Port**:



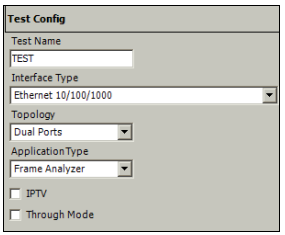
Typical **Frame Analyzer** application in **Dual Ports** (RTU-310 only):



Typical **Frame Analyzer** application in **Through Mode**:

To create a Frame Analyzer test case:

1. Test configuration:



1a. Select **Ethernet 10/100/1000** as the **Interface Type**. **Interface Type** is not available with RTU-310G.

1b. For RTU-310: Select the **Topology** test type: **Single Port** or **Dual Ports**.

1c. Select **Frame Analyzer** as the **Application Type**.

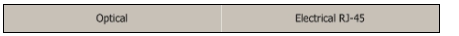
1d. Select the **IPTV** (Internet Protocol Television) check box to give access to the IPTV testing capability. **IPTV** is a software option available on RTU-310 only and needs to be enabled to be available (refer to *Software Options* on page 347). IPTV testing is always performed on **Port 1**. **PBB-TE** and **MPLS** testing capabilities are not available when the **IPTV** check box is selected and vice versa. The **IPTV** check box is cleared by default.

1e. Select the **Through Mode** check box to enable Ethernet bi-directional in-line traffic monitoring between two end points in a non-intrusive manner using both RTU-310 test ports. Stream, alarm and error generation as well as Ping and Trace Route capabilities are not supported. **Through Mode** is a software option available on RTU-310 only and needs to be enabled to be available (refer to *Software Options* on page 347). Through Mode testing is only available in **Dual Ports** topology. The **Through Mode** check box is cleared by default.

1f. Click **Next**.

2. Port configuration:

2a. Select the port **Connector Type (Optical** or **Electrical RJ-45**). **Optical** is automatically selected for the **Ethernet 10G** interface.

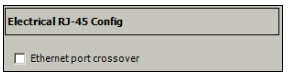


2b. For RTU-310select the port number by clicking on **Port 1** or **Port 2**.

Port 1 (RTU-310 only) is automatically selected when **IPTV** is selected.

For RTU-310**Dual Ports**, select the first port and proceed with the rest of the configuration for the first port. However, before clicking **Finish**, click **Back** several times to return to the port setup window, select the second port and proceed with the rest of the configuration for the second port.

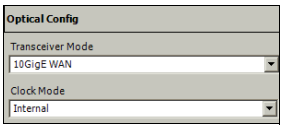
2c. For Electrical RJ-45, if required, select the **Ethernet port crossover** check box to inverse the pin-to-pair assignment of the UTP cable used.



Note: *At this point you should have a link up indicated in the **Tree** view tab. A green LED indicates a link up while a red LED indicates a link down. For electrical port, if the link is down, make sure that the **Ethernet port crossover** setting is correct.*

2d. Click **Next**.

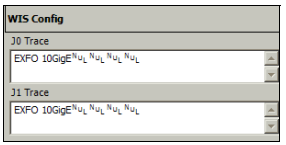
3. Optical configuration for **Ethernet 10G** interface only:



3a. Select the **Transceiver Mode** Choices are Local Area Network (LAN) for regular Ethernet interface (10.31250Gb/s) and Wide Area Network (WAN) for Ethernet stream encapsulated inside a SONET/SDH frame structure (9.95328Gb/s). Choices availability depend on the unit model and options refer to *Software Options* on page 347 for more information.

3b. Select the source Clock Mode (WAN transceiver mode only). Refer to *Clock Synchronization* on page 352 for more information.

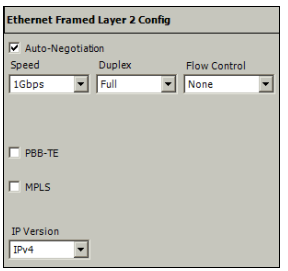
3c. Click **Next**.



3d. Enter the J0 Trace and J1 Trace messages (WAN transceiver mode only). Refer to *WIS TX* on page 239 for more information.

3e. Click **Next**.

4. Framing configuration:



4a. Set the **Auto-Negotiation**, **Speed**, **Duplex**, and **Flow Control** parameters. Not available with Ethernet 10G. Refer to *Interface Setup (Ethernet)* on page 142 for more information.

4b. Set the **IP Version** (IPv4 or IPv6). **IP Version** is only available when the IPv6 software option (SK-IPV6) is enabled.

4c. Select the **PBB-TE** check box to enable the capability to generate and analyze streams with PBB-TE data traffic including configuration of B-MAC (source and destination), B-VLAN and I-tag, and to filter received traffic by any of these fields. **PBB-TE** is a software option and needs to be enabled to give access to the PBB-TE testing capability (refer to *Software Options* on page 347). PBB-TE is not available when the **MPLS** or **IPTV** (**RTU-310**) check box is selected. Refer to *PBB-TE* on page 175 for more information.

4d. Select the **MPLS** check box to enable the capability to generate and analyze streams with up to two layers of MPLS labels and to filter received traffic by MPLS label or COS. **MPLS** is a software option and needs to be enabled to give access to the MPLS testing capability (refer to *Software Options* on page 347). MPLS is not available when the **PBB-TE** or **IPTV** (**RTU-310**) check box is selected. Refer to *MPLS* on page 180 for more information.

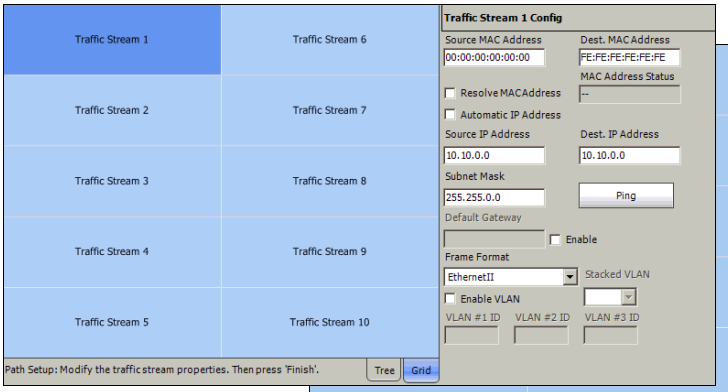
Note: *For dual ports, if **PBB-TE** or **MPLS** feature has been enabled on the first port, only the same feature may be enabled on the second port.*

Note: *For **IPTV** and **Through Mode** tests click **Finish**, otherwise click **Next**.*

5. Traffic stream configuration:

5a. Select the traffic stream to be configured, then set its parameters. Up to 10 streams can be configured with **Frame Analyzer** test.

IPv4



IPv6

5b. For IPv4, select the **Automatic IP Address** check box to dynamically obtain an IP address from a DHCP (Dynamic Host Configuration Protocol) server or set the source and destination IP addresses, **Subnet Mask**, and the **Default Gateway**. Refer to *IPv4 Configuration* on page 489 for more information.

5c. For IPv6, set the destination IP address and if required, click the **IPv6 Config** button for additional IPv6 settings. Refer to *IPv6 Address Configuration* on page 491 for more information.

5d. If required, set the network source MAC Address. Select the **Resolve MAC Address** check box or set the destination MAC address. Refer to *MAC* on page 177 for more information.

5e. Select the **Frame Format**. Choices are **Ethernet II** and **802.3 SNAP**. Refer to *Frame Format* on page 177 for more information.

5f. Set the **VLAN** parameters when required. Refer to *MAC* on page 177 for more information.

5g. Click **Finish** to complete the test setup. The **Alarm** summary tab is automatically displayed.

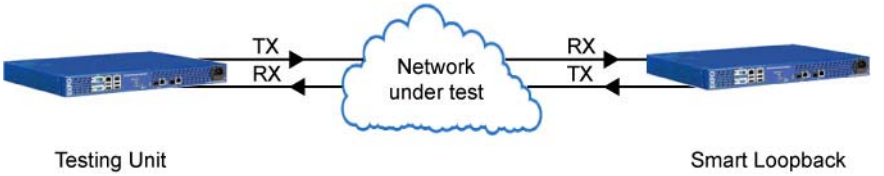
6. For additional configuration parameters like setting Framed Layer 3 and Layer 4, refer to *Stream Generation Tabs* on page 161.

7. Click the **Start** button to start the test.

8. For additional results, refer to *Traffic Analyzer Tabs* on page 199 and *Stream Analyzer Tabs* on page 195.

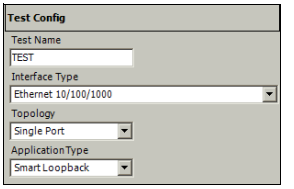
Ethernet Smart Loopback Test Case

Allows transmitting back the received Ethernet stream of data while interchanging the source and destination addresses of the **MAC** and **IP**, in addition to the source and destination ports for **UDP** and **TCP** layers.



To create a Smart Loopback test case:

1. Test configuration:



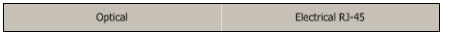
1a. Select **Ethernet 10/100/1000** as the **Interface Type**. **Interface Type** is not available with RTU-310G.

1b. Select **Single Port** as the **Topology**. Topology is only available with RTU-310.

1c. Select **Smart Loopback** as the **Application Type**.

1d. Click **Next**.

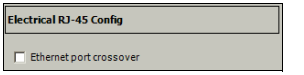
1e. Select the port **Connector Type (Optical** or **Electrical RJ-45**). **Optical** is automatically selected for the **Ethernet 10G** interface.



1f. For RTU-310select the port number by clicking on **Port 1** or **Port 2**.

For RTU-310**Dual Ports**, select the first port and proceed with the rest of the configuration for the first port. However, before clicking **Finish**, click **Back** several times to return to the port setup window, select the second port and proceed with the rest of the configuration for the second port.

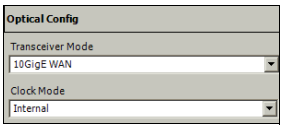
1g. For Electrical RJ-45, if required, select the **Ethernet port crossover** check box to inverse the pin-to-pair assignment of the UTP cable used.



Note: *At this point you should have a link up indicated in the **Tree** view tab. A green LED indicates a link up while a red LED indicates a link down. For electrical port, if the link is down, make sure that the **Ethernet port crossover** setting is correct.*

1h. Click **Next**.

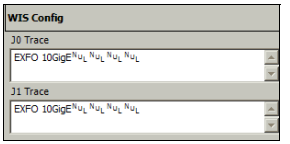
2. Optical configuration for **Ethernet 10G** interface only:



2a. Select the **Transceiver Mode** Choices are Local Area Network (LAN) for regular Ethernet interface (10.31250Gb/s) and Wide Area Network (WAN) for Ethernet stream encapsulated inside a SONET/SDH frame structure (9.95328Gb/s). Choices availability depend on the unit model and options refer to *Software Options* on page 347 for more information.

2b. Select the source Clock Mode (WAN transceiver mode only). Refer to *Clock Synchronization* on page 352 for more information.

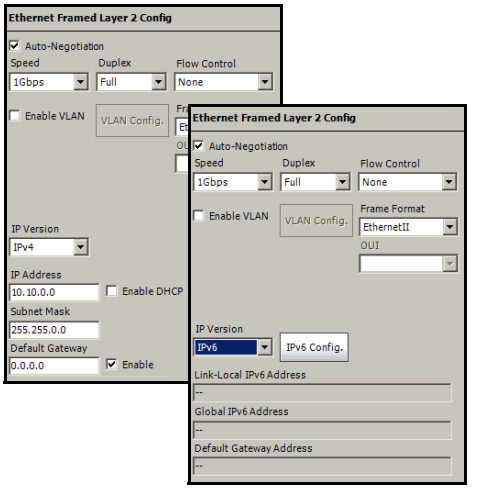
2c. Click **Next**.



2d. Enter the J0 Trace and J1 Trace messages (WAN transceiver mode only). Refer to *WIS TX* on page 239 for more information.

2e. Click **Next**.

3. Framing configuration:



3a. Set the **Auto-Negotiation**, **Speed**, **Duplex**, and **Flow Control** parameters. Refer to *Interface Setup (Ethernet)* on page 142 for more information.

3b. Select the **Frame Format**. Choices are **Ethernet II** and **802.3 SNAP**. Refer to *Network* on page 150 for more information.

3c. Set the **IP Version**(IPv4 or IPv6) **IP Version** is only available when the IPv6 software option (SK-IPV6) is enabled.

3d. Set the **IP Address**, **Enable DHCP**, **Subnet Mask**, and **Default Gateway** parameters. Refer to *Source IP Configuration* on page 152 for more information.

3e. Click **Finish** to complete the test setup. The **Alarm** summary tab is automatically displayed.

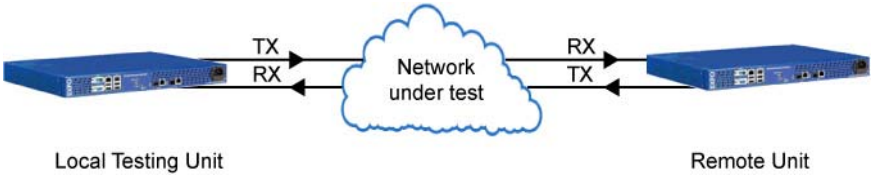
4. Click the **Start** button to start the test.

5. For additional results, refer to *Traffic Analyzer Tabs* on page 199.

Ethernet TCP Throughput Test Case

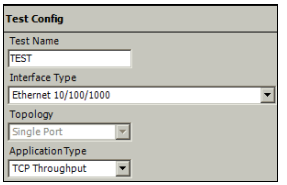
TCP Throughput *(not available with Ethernet 10G interface)*: Allows sending TCP/IP traffic to the network and provides an average of the TCP Throughput based on the successfully transported bytes over the test time. Two units running a **TCP Throughput** test are required. One unit will act as the source (Local) and the other one as the destination (Remote).

Note: ***TCP Throughput*** *software option needs to be enabled to be available. Refer to* Available Options *on page 348.*



To create a TCP Throughput test case, first create the test on the remote module as follow:

1. Test configuration:



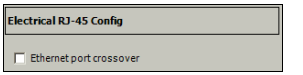
- ***1a.*** Select **Ethernet 10/100/1000** as the **Interface Type**.
- ***1b.*** Select **Single Port** as the **Topology**. Topology is only available with RTU-310.
- ***1c.*** Select **TCP Throughput** as the **Application Type**.
- ***1d.*** Click **Next**.

2. Port configuration:

Port 1 (RTU-310 only) is automatically selected.

2a. Select the port **Connector Type (Optical** or **Electrical RJ-45**). **Optical** is automatically selected for the **Ethernet 10G** interface.

2b. For Electrical RJ-45, if required, select the **Ethernet port crossover** check box to inverse the pin-to-pair assignment of the UTP cable used.



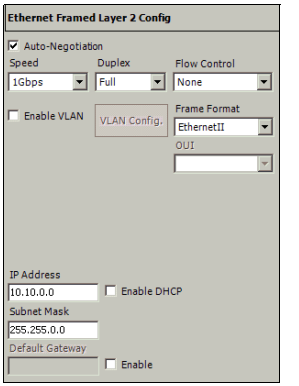
Note: *At this point you should have a link up indicated in the **Tree** view tab. A green LED indicates a link up while a red LED indicates a link down. For electrical port, if the link is down, make sure that the **Ethernet port crossover** setting is correct.*

2c. Click **Next**.

3. Framing configuration:

3a. Set the **Auto-Negotiation**, **Speed**, **Duplex**, and **Flow Control** parameters. Refer to *Interface Setup (Ethernet)* on page 142 for more information.

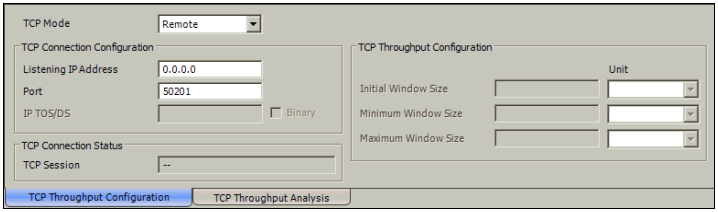
3b. Select the **Frame Format**. Choices are **Ethernet II** and **802.3 SNAP**. Refer to *Network* on page 150 for more information.



3c. Set the **IP Address** (IPv4), **Automatic IP address**, **Subnet Mask**, and **Default Gateway** parameters. Refer to *Source IP Configuration* on page 152 for more information.

3d. Click **Finish** to complete the test setup. The **Alarm** summary tab is automatically displayed.

4. Click the **TCP Throughput** tab and **TCP Throughput Configuration** tab.



4a. Select **Remote** as the **TCP Mode**.

4b. Enter the IP address of the local module in the **Listening IP Address** field.

Create the test on the local module as follow:

1. On the local module, proceed with the test creation as described above (start with step 1 on page 113 up to step 4 inclusively). However, in step 4 do the following:

1a. Select **Local** as the **TCP Mode**.

1b. Enter the IP address of the remote module in the **Remote IP Address** field.

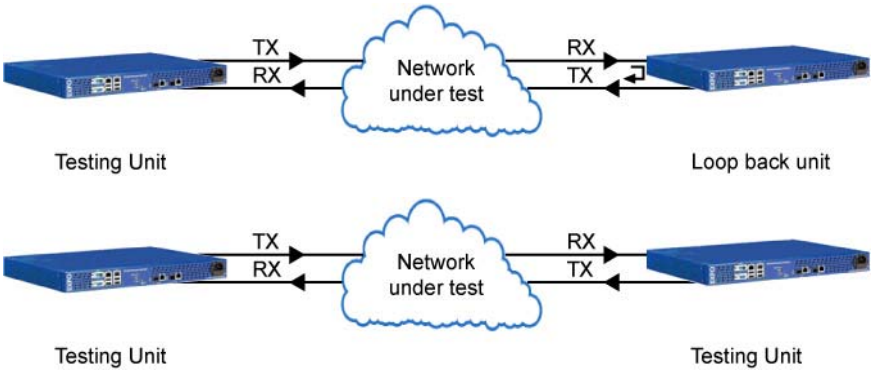
2. For additional configuration parameters, refer to *TCP Throughput Configuration* on page 349.

3. Click the **Start** button to start the test.

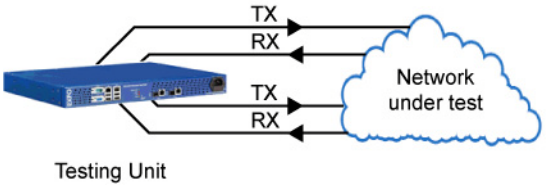
4. For additional results, refer to *TCP Throughput Analysis* on page 353.

Fibre Channel BERT Test Case

Typical Fibre Channel BERT application in **Single Port**:

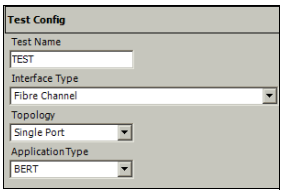


Typical **BERT** application in **Dual Ports**:



To create a Fibre Channel test:

1. Test configuration:



1a. Select **Fibre Channel** as the **Interface Type**. **Fibre Channel** is only available with **BERT** test.

1b. For RTU-310: Select the **Topology** test type: **Single Port** or **Dual Ports**.

1c. Select **BERT** as the **Application Type**.

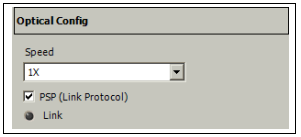
1d. Click **Next**.

2. Port configuration:

2a. For RTU-310select the port number by clicking on **Port 1** or **Port 2**.

For RTU-310**Dual Ports**, select the first port and proceed with the rest of the configuration for the first port. However, before clicking **Finish**, click **Back** several times to return to the port setup window, select the second port and proceed with the rest of the configuration for the second port.

Select the Fibre Channel speed. Choices are **1X**, and **2X**.



2b. Select the PSP check box when a series of handshakes (status machine) is necessary to have a link up status. When the PSP check box is cleared, no handshaking is done and only bit synchronization is necessary to have a link up status. The **PSP (Link Protocol)** check box is selected by default.

Link indicates the link status at the input port of the Fibre Channel interface. A green LED indicates a link up while a grey LED indicates a link down or disabled. The **Tree** view also displays respectively **Link up** in green or **Link down** in red.

2c. Click **Next**.

3. Framing selection:

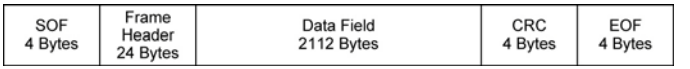
3a. Select the test framing mode.

FC Unframed consists in sending a frame without EOF (End Of Frame).

FC Unframed with the **Enable Sync** check box selected consists of continuously sending frames that last approximately 1 sec. Thus sending a sync pattern that regularly keeps the link synchronized. Frames are separated by the minimum Inter-Frame Gap (IFG).

FC Framed Layer 1 consists of sending a valid frame (8 to 2148 bytes) without Header, and CRC (Cyclic Redundancy Check). Refer to **Size** on page 188 for more information on the frame size.

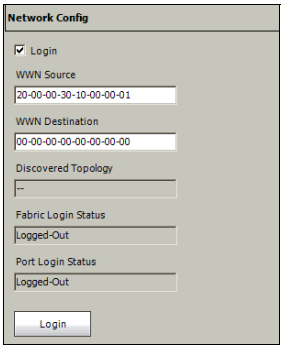
FC Framed Layer 2 consists of sending a valid frame (36 to 2148 bytes) including Header and CRC. Refer to **Size** on page 188 for more information on the frame size.



Note: *There is nothing to configure for **FC Framed Layer 1** and **FC Framed Layer 2**.*

3b. Click **Next**.

4. Framing configuration (available with **FC Framed Layer 2** only):



4a. Set the network parameters. Refer to *Interface Setup (Fibre Channel)* on page 146 for more information.

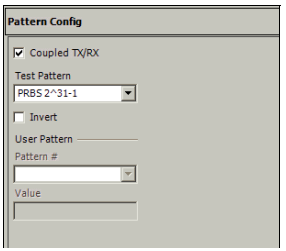
4b. Select the **Login** check box to generate a login process when clicking on the **Login** button.

4c. Select the source and destination World Wide Name (WWN) addresses. WWN is only available when the Enable login check box is selected.

4d. Click the **Login** button to initiate the Login process with the selected Advertised BB_Credit (refer to page 147). The capability to log in is available only with **Framed Layer 2** when a successful link has been established.

4e. Click **Next**.

5. Pattern configuration:



5a. Set the pattern parameters. Refer to *Pattern TX* on page 290 for more information.

5b. Click **Finish** to complete the test setup. The **Alarm** summary tab is automatically displayed.

6. For additional configuration parameters, refer to *Stream Generation Tabs* on page 161.

7. Click the **Start** button to start the test.

8. For additional results, refer to *Traffic Analyzer Tabs* on page 199 and *Pattern Tabs* on page 289.

6 Summary Tabs

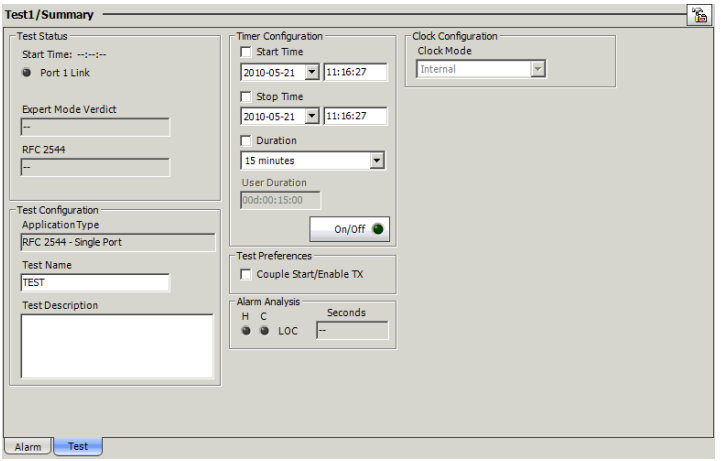
The summary tabs allow to configure the test parameters and to view the test status and results.

Tab	Available with		Page
	Ethernet	Fibre Channel	
Test Summary	X	X	121
Alarm Summary	X	X	128

Test Summary

Gives the test configuration, status, and timer configuration.

Click **TEST, Summary,** and **Test**.



Test Status

- **Start Time**: Indicates the date and time the test has been started. The date and time reset every time the test is restarted. The default time format is ISO (yyyy-mm-dd hh:mm:ss) unless otherwise set from the *Application Preferences* on page 334.
- **Port Link**: Indicates the link status at the input port of the Ethernet/Fibre Channel interface. A green LED indicates that the link is up while a grey LED indicates a link down.
- **Expert Mode Verdict**: Indicates the status of the expert mode. This information is only available with **RFC 2544** and **BERT** Ethernet tests.

  Pass is declared if all results values meet the configured criteria.

  Fail is declared if any result value does not meet the configured criteria.

  -- is displayed when at least one of the following conditions is met:

  - the **Expert Mode** is disabled.
  - there is no defined criterion.
  - for **RFC 2544** test, when the specific test did not run yet.
  - for **BERT** test, when the test is still running or didn't run yet.

  Disabled is displayed with **RFC 2544** test when a specific test (**Throughput**, **Back-to-Back**, **Frame Loss**, or **Lantency**) has its Expert mode's **Enable Criteria** check box cleared.
- **Global Verdict** for **EtherSAM** test: Indicates the actual test **PASS** or **FAIL** verdict. A **FAIL** verdict is declared when a **Link Down**, **LOS**, or any SLA parameter fails during the test.

➤ **SAM Test Status**: Indicates the EtherSAM test status message.

Test Status	Desciption
Pending (--)	No sub test is started.
Running...	A sub test is currently running.
Data Transfer...	A sub test is running but no test traffic is being transmitted.
Completed, <Verdict>	A sub test has completed. <Verdict> represents the test global verdict upon completion of the sub test.
Aborted, <Reason>	A sub test has been aborted either manually (Stop) or by an alarm. <Reason> represents the reason why the test has been aborted. Possible reasons are: ➤ Link down alarm ➤ LOS alarm ➤ DTS connection failed ➤ Timeout during execution (DTS) ➤ Unresolved addresses ➤ No test enabled ➤ Stopped.

- **RFC 2544**: Indicates the status of the running **RFC 2544** test. This setting is only available with **RFC 2544** test. Possible status are:

  --: Indicates that the test did not run yet.

  Throughput/Back-to-Back/Frame Loss/Latency - In Progress: Indicates that either the **Throughput**, **Back-to-Back**, **Frame Loss**, or **Latency** test is running.

  None - In Progress: Indicates that the link is down and no test is performed.

  Completed: Indicates that all selected tests are completed.

  Aborted: Indicates that the test has been interrupted (stopped).

Test Configuration

- **Interface Type**: Indicates the test interface type: **Ethernet 10/100/1000**, or **Fibre Channel**. Not available with RTU-310G.
- **Application Type**: Indicates the test application type:**EtherSAM (Y.1564)**, **Frame Analyzer**, **BERT**, **RFC 2544**, **Smart Loopback**, or **TCP Throughput (**RTU-310**)**. Only **BERT** is available with Fibre Channel.
- **Test Name**: The name of the test connection is used to identify the test. A maximum of 8 characters are allowed. The default setting is **TEST**.

Clock Configuration

➤ **Clock Mode** indicates the clock mode selected during the test setup. Available with 10Gig-E WAN interface only. Possible choices are:

Clock Mode	LAN	WAN
Internal: Internal clock of the unit (STRATUM 3). Internal is the only available clock when 10GigE LAN transceiver mode is selected with **Frame Analyzer**, **BERT**, or **RFC 2544** test.	X	X
External: Clock from the connected **DS1/E1/2M** external clock signal (**For RTU-310G: EXT. CLK DS1/2M IN port;**). Once the test is created, refer to *Clock Synchronization - RX* to complete the external clock settings.	-	X
Recovered: Live clock from the optical port input signal involved in the test. Recovered is the only available clock when 10GigE WAN transceiver mode is selected with **Smart Loopback** test. **Recovered** is only available for Smart Loopback test.	X	X

Timer Configuration

Allows to automatically start and/or stop a test case at a given time or for a specific duration.

Note: *For EtherSAM test, only the* **Start Time** *is configurable.*

➤ **Start Time**: Allows the selection of the specific time the created test case will automatically start. The start time check box has to be checked to be included in the test timer.

Note: *A valid start time has to be subsequent to the current time.*

➤ **Stop Time**: Allows the selection of the specific time the test case will automatically stop. The stop time check box has to be checked to be included in the test timer.

Note: *A valid stop time has to be subsequent to the current time or to the start time, when enabled. The Stop Time must not exceed 30 days based on the start time. Stop Time cannot be enabled while Duration is enabled.*

➤ **Duration**: Allows the selection of the test duration based on the test case start time. The test case start time can be the time when clicking the start button or the time the test is automatically started when the Start Time has been enabled. The Duration check box has to be checked to be included in the test timer. Choices are **15 minutes**, **1**, **2**, **24**, **48**, **72 hours**, **7 days**, or **User Defined** (see User Duration below). The default setting is 15 minutes.

Note: *Duration cannot be enabled while Stop Time is enabled. When the test is started while duration is enabled, the stop time is calculated and the Stop Time field is updated to indicate the time the test will stop.*

➤ **User Duration**: Allows the selection of the test duration when **User Defined** has been selected for duration. Choices are from **1** second to **30 days**. The default setting is **15 minutes**.

➤ **On/Off** button allows enabling the test timer. An error message is displayed and the test timer is not enabled when the provided start time or stop time is not valid. It is not possible to enable the test timer while the test is running. When the timer is enabled (On), it is possible to disable it even when the test is running. This setting is disabled (Off) by default.

When test timer is enabled, it is possible to manually stop a test case using the main test case Stop button. However, it is not possible to start the test case when the **Start Time** is enabled.

The test timer is automatically disabled either when the user manually stops the test, or when the given stop time or duration has expired.

Note: *When using Visual Guardian Lite for remote control, the timer configuration values will be based on the PC clock and not on the RTU-310/310G. Make sure to consider the time zone differential if it exists between the PC and the RTU-310/310G.*

Alarm Analysis

LOC indicates that the RTU-310G is unable to synchronize with the selected test clock.

Test Preferences

Couple Start/Enable TX allows to automatically enable the stream transmission when the test is started. The stream transmission stops when the test is stopped. This setting is disabled by default. Refer to *Enable TX - On/Off button* on page 164 for more information.

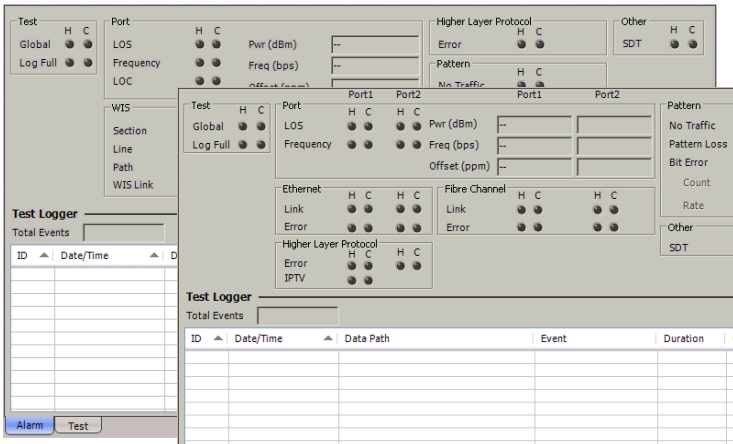
Alarm Summary

Click **TEST, Summary,** and **Alarm**.

The **Alarm** summary tab gives access to the alarm summary including the test logger. See *Test Logger* on page 131.

Alarm Summary

The alarm summary gives current and history summary of alarms and errors encountered during the test.



Single port test

Dual ports test (RTU-310)

Note: *The list of available alarms and errors depends on the test case. For **Dual Ports** test, available with RTU-310, the alarms and errors are independently displayed for **Port 1** and **Port 2** when applicable.*

➤ **Test**

Global: Indicates the presence of any alarms/errors related to the test such as **Port**, **WIS**, **Ethernet**, **Pattern**, **High Layer Protocol**, **Fibre Channel**, and **Other**. **Fibre Channel** *is not available with RTU-310G.*

Log Full: Indicates that the logger exceeds it maximum capacity of 5000 events.

➤ **Port**: Indicates the presence of any alarms/errors related to the physical port such as **LOS**, **Frequency**, and **LOC (Ethernet 10G WAN)**. Also indicates port power measurement **Pwr (dBm)**for optical port, frequency **Freq (bps)**, and **Offset (ppm)**for all interfaces at the exception of 10 Mbps.

➤ **WIS**: Indicates the presence of any alarms/errors related to Ethernet 10G WAN testing such as **Section/RS** (**B1**, **LOF** or **SEF**), **Line/MS** (**B2**, **REI-L**, **AIS-L**, or **RDI-L**), **High Order Path** (**B3**, **REI-P**, **AIS-P**, **RDI-P**, **LCD-P**, **LOP-P**, **PLM-P**, **UNEQ-P**, **ERDI-PSD**, **ERDI-PCD**, or **ERDI-PPD**), and **WIS Link**. **WIS** *is not available with RTU-310.*

➤ **Ethernet**: Indicates the presence of any alarms/errors related to Ethernet testing such as **Errors** (**FCS**, **Jabber**, **Runt**, **Oversize** when enabled (refer to *Oversize Monitoring on page 203*), **Undersize**, **Idle**, **Symbol**, **Collisions**, **Alignment**, **False Carrier, Out-of-sequence**, or **Frame Loss**), **LinkIdle**, **Symbol**, **Collisions**, **Alignment**, and **False Carrier** are not available with RTU-310G. **Block Error** and **Fault** are not available with RTU-310.

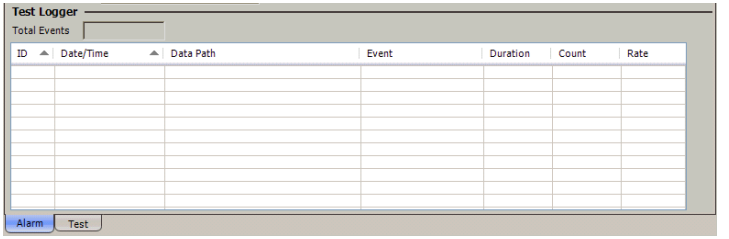
➤ **Fibre Channel**: Indicates the presence of any alarms/errors related to the Fibre Channel testing such as **Errors** (**FCS**, **Oversize**, **Undersize**, **Symbol**), and **Link**. Not available with RTU-310G.

- **Higher Layer Protocol** (Ethernet): Indicates the presence of any error related to the HLP over Ethernet (**IP header checksum**, **UDP checksum**, **TCP Checksum (RTU-310)**, and **IPTV (RTU-310)**).
- **Pattern** (BERT): Indicates the presence of any alarms/errors related to pattern testing such as **No Traffic**, **Pattern Loss**, and **Bit Error**. Indicates also the **Bit Error** rate and count.
- **Other**: Indicates all other alarms/errors such as **SDT** (Available with Ethernet BERT test only).

Test Logger

Click **TEST, Summary,** and **Alarm**.

The **Test Logger** lists the test status/events.



Total Events

Indicates the total number of recorded events.

Note: *The Logger lists a maximum of 5000 events, over that amount the logger stops recording and the log full alarm is activated.*

Logger Table

An event is automatically listed in the logger and saved on the hard drive in case a power failure condition occurs.

The logger is cleared when one of the following conditions is met:

- A test case is stopped and restarted.
- The test case is cleared.
- When clicking 

.

Events are listed by **ID - Date/Time** by default. Events can also be sorted by **Data Path** or **Event** by clicking on the corresponding column title.

- **ID**: Indicates the Event number. Events are sequentially numbered.
- **Date/Time**: Indicates the date and time the Alarm/Error condition has been detected.
- **Data Path**: Indicates the origin of the alarm/error. [P1] in the data path represent the Port 1. Port 2 is only available with RTU-310.
- **Event**: Indicates the alarm/error type.
- **Duration**: Indicates the number of seconds (day:hour:minute:second format) within which the alarm/error occurred.
- **Count**: Indicates the number of occurrences of the error.
- **Rate**: Indicates the error rate.

Note: *In the Duration, Count and Rate columns,* ***Pending*** *indicates that the alarm/error condition persists or was persisting when the test was stopped.*

7 Port Tabs

The port tabs allow to configure different port parameters and to view the port analysis.

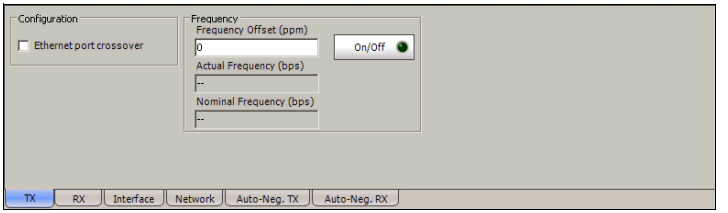
Note: *The available tabs listed depend on the activated test path.*

Tab	Available with		Page
	Ethernet	Fibre Channel[a]	
Electrical TX[a]	X		134
Electrical RX[a]	X		136
Optical TX	X	X	138
Optical RX	X	X	140
Interface Setup (Ethernet)	X		142
Interface Setup (Fibre Channel)[a]		X	146
Network	X		150
Advanced Auto-Neg. TX[a]	X		154
Advanced Auto-Neg. RX[a]	X		159

a. Not available on the RTU-310G.

Electrical TX

Click **TEST**, **Port**, and **Electrical TX**.



Configuration

Ethernet port crossover: Allows selecting the type of cable used.

- When disabled, the cable used should be straight through.
- When enabled, the cable used should be crossover.

Frequency

Note: *Frequency offset generation is not available for 10Base-T test and when* ***Through Mode*** *is selected.*

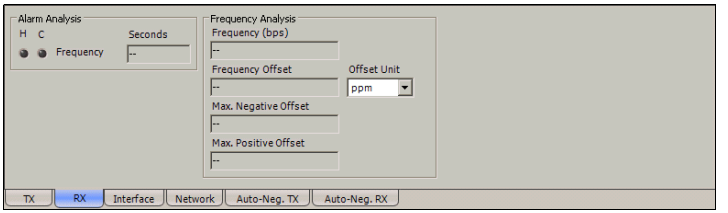
- **Frequency Offset (ppm)**: Allows entering a positive or a negative frequency offset in ppm. Choices are listed in the table below. The default setting is **0**. The frequency offset value can be changed on the fly even when activated (On).
- **Actual Frequency (bps)**: Indicates the frequency (actual frequency + Frequency offset) that will be used for transmission.
- **Nominal Frequency (bps)**: Indicates the nominal frequency of the signal. The nominal frequencies are listed in the table below.
- **On/Off** button: Allows enabling the frequency offset generation. This setting is disabled (Off) by default.

Interface	Frequency Offset[a]	Nominal Frequency
100Base-T	±120 ppm	125000000 bps
1000Base-T	±120 ppm	1250000000 bps

a. The frequency offset range is guaranteed for a source signal at 0 ppm. In the event that the source signal already has an offset then, the output signal may exhibit an offset larger than the range specified.

Electrical RX

Click **TEST**, **Port**, and **Electrical RX**.



Alarm Analysis

Frequency: The frequency alarm indicates if the received signal rate meets the standard rate specifications (green) or not (red).

Interface	Standard Rate Specification
100Base-T	125000000 bps ±12500 bps (±100 ppm)
1000Base-T	1250000000 bps ±125000 bps (±100 ppm)

Frequency Analysis

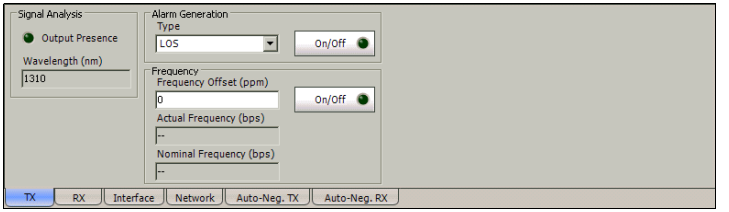
Note: *Frequency Analysis is not available for 10Base-T test.*

- **Frequency (bps)**: Indicates the frequency of the input signal.
- **Frequency Offset**: Indicates the offset between the standard rate specification and the rate of the input signal.
- **Max. Positive Offset**: Indicates the offset between the standard rate specification and the largest rate recorded from the received signal.
- **Max. Negative Offset**: Indicates the offset between the standard rate specification and the smallest rate recorded from the received signal.

Offset Unit: Allows the selection of the frequency offset unit. Choices are **bps** and **ppm**. The default setting is **ppm**.

Optical TX

Click **TEST**, **Port**, and **Optical TX**.



Signal Analysis

- **Output Presence**: Indicates the presence of a signal at the output port (green) or not (grey). The output presence LED is grey when there is no SFP/XFP.
- **Wavelength (nm)**: Indicates the detected SFP/XFP wavelength. Possible values are **850**, **1310**, **1550 nm**, or **unknown** if the SFP/XFP is missing or not recognized.

Alarm Generation

Note: *Alarm generation is not available with RFC 2544 test.*

- **Type**

  LOS (Loss Of Signal): Turns off the output port laser signal.

- **On/Off** button: Allows enabling the alarm generation. This setting is disabled (Off) by default.

Frequency

Note: *Frequency offset is not available when **Through Mode** (RTU-310 only) is selected.*

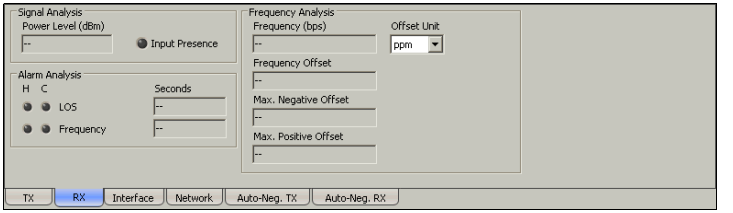
- **Frequency Offset (ppm)**: Available with FC 1x/2x, and 10 Gig-E interfaces only. Allows entering a positive or a negative frequency offset in ppm. The default setting is **0**.
- **Actual Frequency (bps)**: Available with FC 1x/2x, and 10 Gig-E interfaces only. Indicates the frequency (actual frequency + Frequency offset) used for transmission.
- **Nominal Frequency (bps)**: Indicates the nominal frequency of the signal.
- **On/Off** button: Allows enabling the frequency offset generation. This setting is disabled (Off) by default.

Interface	Frequency Offset[a]	Nominal Frequency
100 Mbps	± 120 ppm	125000000 bps
1000 Mbps	± 120 ppm	1250000000 bps
10 Gig-E LAN	± 120 ppm (RTU-310G)	10312500000 bps
10 Gig-E WAN	± 120 ppm (RTU-310G)RTU-310G	9953280000 bps
FC 1x	± 50 ppm	1062500000 bps
FC 2x	± 50 ppm	2125000000 bps

a. The frequency offset range is guaranteed for a source signal at 0 ppm offset. In the event that the source signal already has an offset then, the output signal may exhibit an offset larger than the range specified.

Optical RX

Click **TEST**, **Port**, and **Optical RX**.



Signal Analysis

- **Power Level (dBm)**: Indicates the power level of the input signal in dBm.
- **Input Presence**: Indicates if there is a valid signal at the input port (green) or not (grey).

Alarm Analysis

- **LOS** (Loss Of Signal): A **LOS** indicates that there is no input signal.
- **Frequency**: The frequency alarm indicates that the received signal rate meets the standard rate specifications (green) or not (red).

Interface	Standard Rate Specification
100 Mbps	0.125 Gbps ± 12.5 Kbps (±100 ppm)
1000 Mbps	1.25 Gbps ± 125 Kbps (±100 ppm)
10 Gig-E LAN	10.3125 Gbps ± 1031.25 Kbps (±100 ppm)
10 Gig-E WAN	9.95328 Gbps ± 995.33 Kbps (±100 ppm)
FC 1x	1.0625 Gbps ± 127.5 Kbps (±120 ppm)
FC 2x	2.125 Gbps ± 255 Kbps (±120 ppm)

Frequency Analysis

Frequency (bps): Indicates the frequency of the input signal in bps.

Frequency Offset: Indicates the offset between the standard rate specification and the rate of the input signal.

Max. Negative Offset: Indicates the offset between the standard rate specification and the smallest rate recorded from the received signal.

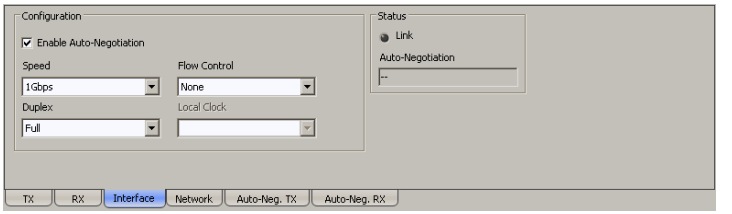
Max. Positive Offset: Indicates the offset between the standard rate specification and the largest rate recorded from the received signal.

Offset Unit: Allows the selection of the frequency offset unit. Choices are **bps** and **ppm**. The default setting is **ppm**.

Interface Setup (Ethernet)

Note: *For Fibre Channel test case, see Interface Setup (Fibre Channel)* on page 146.

Click **TEST**, **Port1/2**, and **Interface**.



Configuration

Note: *The port configuration parameters are disabled when Advanced Auto-Neg. TX* on page 154 *is enabled. For RTU-310, all port 1 and port 2 configuration parameters are coupled when* ***Through Mode*** *is selected.*

➤ Auto-Negotiation (Not available on RTU-310G)

The Auto-Negotiation should be selected if the remote connected port is also set to Auto-Negotiation, otherwise it should be deactivated. When selected, the RTU-310/310G will indicate to the remote port which parameters to use. **Auto-Negotiation** is not available with the optical 100Mbps and 10Gbps interfaces. The Auto-Negotiation check box is selected by default.

When the **Auto-Negotiation** check box is cleared, the port **Speed**, **Duplex** and **Flow Control** can be set to specific values. Those values are applied immediately to the port.

When the **Auto-Negotiation** check box is selected, the port **Speed**, **Duplex** and **Flow Control** can be set. Those settings are not applied immediately to the port, they will be used only when the negotiation process is started and will take effect only when the auto-negotiation succeeds. However current settings are applied immediately to the port when the **Auto-Negotiation** check box is cleared.

➤ Speed (Not available on RTU-310G)

Select the speed of the connected interface. Choices are:

For electrical port: **10Mbps**, **100Mbps**, and **1Gbps**.

For optical port: **100Mbps**, and **1Gbps**. **Auto-Negotiation** is not supported when 100Mbps optical speed is selected.

Note: *Only enabled speeds are listed. Refer to Software Options* on page 347 *for more information.*

➤ Duplex (Not available on RTU-310G)

Select the duplex mode for the selected port. Choices are **Full** and **Half**. However, **Half** duplex is only available for **RFC 2544**, **Frame Analyzer**, and **TCP Throughput** tests on the 10 Mbps and 100 Mbps interfaces.

➤ Flow Control

Available with **Frame Analyzer**, **RFC 2544**, and **TCP Throughput** stest only. **Flow control** is not supported (set to **None**) for **EtherSAM**, **BERT** and **Smart Loopback** tests. When **Flow Control** is enabled, the RTU-310/310G will stop transmitting for the requested time value specified by the valid flow control frame received. Choices are **None**, **Enable RX**, **Enable TX**, and **Enable RX and TX**. Only **None** and **Enable RX** are available on RTU-310G. **Enable TX** and **Enable RX** are only available when **Auto-Negotiation** is disabled.

None (RTU-310): pause frame received are ignored and no pause frame are transmitted.

Note: *__Flow Control__ should be set to __None__ with __Half Duplex__ mode.*

➤ **Local Clock** Only available for 1Gbps electrical when auto-negotiation is disabled. Choices are **Local**, **Remote**, and **Automatic**. The default setting is **Automatic**.

Status

- **Link**: A green Link LED indicates that there is a link at the input port of the corresponding Ethernet interface. A grey LED indicates that there is no link at the input port of the corresponding Ethernet interface.
- **Auto-Negotiation**: Indicates the auto-negotiation status (Not available on RTU-310G).

  "- -" indicates that the auto-negotiation process is not enabled.

  Negotiating: indicates that the auto-negotiation process is running and not completed yet.

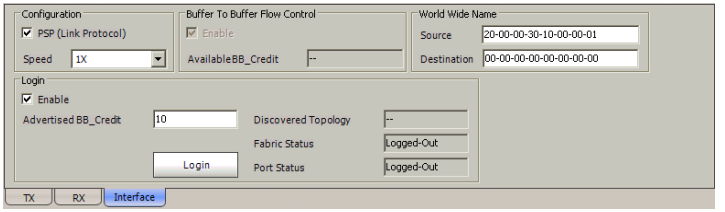
  Completed: indicates that the auto-negotiation process has been completed successfully.

  Parallel Detect Fail: indicates that the auto-negotiation has failed through the parallel detection process while negotiating in 10/100Base-T.

Interface Setup (Fibre Channel)

Note: *For Ethernet test case, see Interface Setup (Ethernet)* on page 142.

Click **TEST**, **Port1/2**, and **Interface**.



Configuration

➤ **PSP (Link Protocol)**

The Primitive Sequence Protocol (PSP) allows link management when the **PSP (Link Protocol)** check box is selected and forces the port in **Active** mode when the **PSP (Link Protocol)** check box is cleared. The **PSP (Link Protocol)** check box is selected by default.

➤ **Speed**

Select the speed of the connected FC interface. Choices are **1X**, and **2X**.

Login

The capability to log in is available only if a successful link has been established with **Framed Layer 2**.

- **Enable**: Allows, when the **Enable** check box is selected, to either generate a login process when clicking on the **Login** button, or to accept a remote **Login** command.
- **Advertised BB_Credit**: Advertised BB_Credit is the number of frame buffers that a local port has available to receive frames from another port. Advertised BB_Credit is advertised to the remote port through the login process. Choices are from **1** to **65535**. The default setting is **10**.
- **Discovered Topology**: Indicates the discovered FC topology which can be :

  Fabric: N_Ports interconnected to a Fabric switching network.

  Point-to-Point: link between two N_Ports.

  " - " : When login is disabled.
- **Fabric Status**: Indicates the status of the Fabric switching network. The status is not available when the topology is **Point-to-Point**. Possible status are:

  Logged-in: The login process has completed successfully.

  Failed: The login process has not been able to complete the login process or an error has been detected. However, traffic can still be transmitted.

  In Progress: The login process is running (not completed yet).

  Logged-out: The system has not logged in yet, has received a valid Logout command from the remote port, or the **Login** check box has been cleared.

- **Port Status**: Indicates the status of the port login process. Possible status are:

  Logged-in: The login process has completed successfully.

  Failed: The login process has not been able to complete the login process or an error has been detected. However, traffic can still be transmitted.

  In Progress: The login process is running (not completed yet).

  Logged-out: The system has not logged in yet, has received a valid Logout command from the remote port, the **Login** check box has been cleared, or the **Fabric Status** is either **Failed**, **In Progress**, or **Logged Out**.

- **Login** button: Allows the initiation of the Login process with the selected Advertised BB_Credit when the **Enable** Login check box is selected. Changing the Advertised BB_Credit requires to manually re-send a login using the **Login** button. The capability to log in is available only with Framed Layer 2 when a successful link has been established.

Buffer-to-Buffer Flow Control

- **Enable**: The **Enable** check box is forced selected when **Login** is selected. The RTU-310/310G will send a Received Ready (R_RDY) automatically after receiving a frame when the Enable check box is selected.

Note: *Since R_RDY are inserted between frames and have higher priority, in certain condition they may affect the TX throughput.*

- **Available BB_Credit** is the number of frame buffers that the remote port has available to receive frames from the local port. **Available BB_Credit** is not editable when either the **Enable** or **Enable** login check box is selected. Choices are from **1** to **65535**. The default setting is **10**.

Note: *After a Login process, the Available BB_Credit displays the value received from the remote interface through the login process.*

World Wide Name

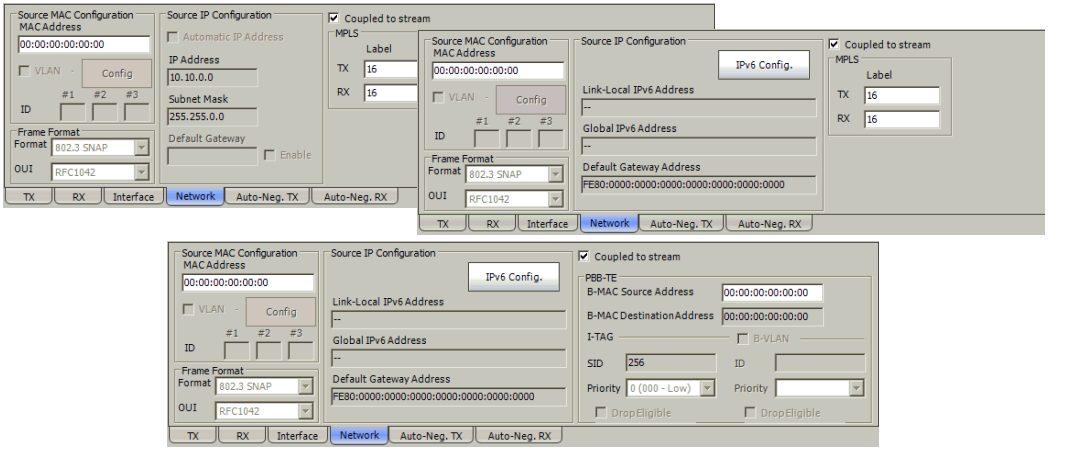
Only available when Enable Login is enabled.

- **Source**: Enter the World Wide Name source address.
- **Destination**: The destination Worldwide Name will be displayed and grayed-out after the Login process when Point-to-Point is selected. Enter the Worldwide name destination address.

Network

Note: ***Network*** *is only available with* ***Framed Layer 2*** *and when* ***Through Mode*** *(RTU-310) is not selected.*

Click **TEST**, **Port**, and **Network**.



Coupled to stream

For **BERT** and **Frame Analyzer** test, the port's VLAN, IP, and PBB-TE parameters are coupled to the stream (**Stream 1** for **Frame Analyzer**) when the **Coupled to stream** check box is selected. Thus only the source **MAC Address**, and **MPLS** parameters are configurable. The **Coupled to stream** check box is selected by default. The **Coupled to stream** check box is not available with **RFC 2544**, **Smart Loopback**, and **TCP Throughput** tests.

Source MAC Configuration

MAC Address: A default and unique Media Access Control (MAC) address is automatically given to the Ethernet port. Select the **MAC Address** field if the MAC address has to be changed for this port and enter the new MAC address.

Note: *This MAC address will be used as the source MAC address for all streams.*

VLAN

- **VLAN**: When selected, allows the configuration of VLAN. The **VLAN** check box is not selected by default.
- **Config** button: Allows VLAN parameters configuration. Refer to *VLAN Configuration* on page 486 for more information.

Source IP Configuration

For IPv4:

- **Automatic IP Address**: Allows to dynamically obtain an IP address from a DHCP (Dynamic Host Configuration Protocol) server.
- **IP Address**: Enter the IP address for the Ethernet port. The default IP address is the address set from the *Default/Ethernet Test Preferences* on page 336. The default factory IP address from the **Default Test Preferences** is **10.10.x.y**, where **x** and **y** are respectively the two least significant bytes of the port default factory MAC address.
- **Subnet Mask**: Enter the Subnet Mask for the Ethernet port. The default setting is **255.255.0.0**.
- **Default Gateway**: Enter the default gateway address for the Ethernet port. The default setting is **0.0.0.0**.

  Enable: Allows enabling and editing the default gateway IP address. This setting is disabled by default.

Note: ***IP Address*** *and* ***Subnet Mask*** *are not available when the Automatic IP Address check box is selected. However, the IP Address obtained from the DHCP server will be displayed in the* ***IP Address*** *field.*

For IPv6:

- Displays the **Link-Local IPv6 Address**, **Global IPv6 Address**, and **Default Gateway Address**.
- **IPv6 Config** button allows to configure the IPv6 addresses. Refer to *IPv6 Address Configuration* on page 491 for more information.

Frame Format

- **Frame Format** allows to select **Ethernet II** or **802.3 SNAP** frame format.
- **OUI** is available when the frame format 802.3 SNAP is selected and it allows the selection of the Organizationally Unique Identifier (OUI). Choices are **RFC1042**, and **802.1H**. The **OUI** selection is not coupled when the **Coupled to stream** check box is selected.

MPLS

MPLS settings are only available when MPLS is enabled from the test setup and allow to transmit and receive management frames (ex: PING) inside a core MPLS network.

- **Label TX** and **RX**: Allows the selection of the interface MPLS TX and RX labels (**0** to **1048575**). The default label value is **16** for both TX and RX. The TX and RX labels are available when the **MPLS** check box from the test setup is selected.

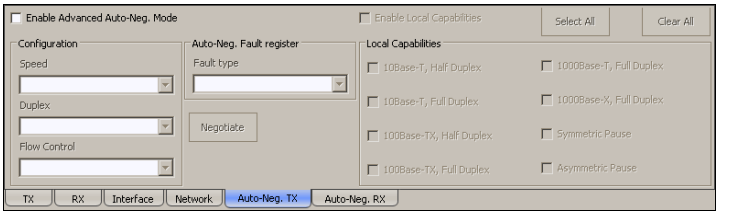
PBB-TE

PBB-TE settings are only available when PBB-TE is enabled from the test setup and allow to configure the interface source and destination parameters allowing to exist on a PBB-TE network. Refer to *PBB-TE Interface configuration* on page 487 for more information.

Advanced Auto-Neg. TX

Note: *Advanced auto-negotiation is not available with the optical 100 Mbps and 10 Gig-E interfaces or when **Through Mode** (RTU-310) is selected.*

Click **TEST**, **Port**, and **Advanced Auto-Neg TX**.



Advanced Auto-Neg. Mode

The Auto-Negotiation should be activated if the remote connected port is also set to Auto-Negotiation, otherwise should be deactivated. When activated, the RTU-310/310G will indicate to the remote port which parameters to use. This setting is disabled by default.

The negotiation process is not immediately started when enabling the auto-negotiation, the Negotiate button is used to start the process.

The Auto-Negotiation will use either the Configuration (**Speed**, **Duplex** and **Flow Control**) settings, or the **Local Capabilities** when enabled.

The port configuration settings from the are disabled when **Advanced Auto-Neg. Mode** is enabled.

Configuration

The **Speed**, **Duplex**, and **Flow Control** can be modified only when the **Enable Local Capabilities** is disabled.

➤ **Speed**: Select the speed of the connected interface. Choices are:

For electrical port: **10Mbps**, **100Mbps**, **1Gbps**, and **Auto**.

For optical port: **1Gbps**.

➤ **Duplex**: Select the duplex mode for the selected port. Choices are:

For 10 Mbps and 100 Mbps speeds (except for **BERT** and **Smart Loopback** tests): **Full**, **Half**, and **Auto**.

For 1Gbps speed, **BERT** or **Smart Loopback**: **Full**.

➤ **Flow Control**: Select the flow control of the connected interface. The default setting is **None**. Choices are:

None: Pause frame received are ignored and no pause frame are transmitted. **None** is the only choice for **BERT** and **Smart Loopback** tests.

Asymmetrical: Pause frame can be transmitted but not received.

Symmetrical: Pause frame can be received and transmitted depending on the link partner (L. P.) flow type (see table below).

Asym. and Sym. (Asymmetrical and Symmetrical): pause frame can be received and/or transmitted depending on the link partner (L. P.) flow type (see table below).

Auto: Allows the negotiation of the flow control with the partner port.

Local	Link Partner	Description
Asym.	**Asym. & Sym.**	Local: Only the TX Pause is enabled. L. P.: Only the RX pause is enabled. Backpressure is only performed on the L. P. side.
Sym.	**Sym.**	On both sides the RX and TX pause is enabled. Backpressure is performed on both sides.
Sym.	**Asym. & Sym.**	On both sides the RX and TX pause is enabled. Backpressure is performed on both sides.
Asym. & Sym.	**Asym.**	Local: Only the RX pause is enabled. Backpressure is only performed on the local side. L. P.: Only the TX pause is enabled.
Asym. & Sym.	**Sym.**	On both sides the RX and TX pause is enabled. Backpressure is performed on both sides.
Asym. & Sym.	**Asym. & Sym.**	On both sides the RX and TX pause is enabled. Backpressure is performed on both sides.

Note: *Only **None** is available for **BERT** analyzer test.*

Note: ***Flow Control** should be set to **None** with **Half Duplex** mode.*

Auto-Neg. Fault Register

➤ **Fault Type**: Allows the generation of a fault during the negotiation process. Changing the fault type, while enabled, will automatically restart the negotiation process. The fault condition will be generated only once when clicking on the **Negotiate** button. The default setting is **No Error**. Choices are:

For electrical port: **No Error** and **Auto-Negotiation Error**.

For 1000Mbps optical port: **No Error**, **Off-line**, **Link Failure**, and **Auto-Negotiation Error**.

Local Capabilities

Allows enabling the local port capabilities by checking all supported predefined speed, duplex and flow control combination. This setting is disabled by default.

Note: *The available port capabilities are based on the physical port selected for the test, which is either electrical or optical.*

Local Capabilities

When the local capabilities is enabled, select the supported port capabilities. Local capabilities are disabled by default. Choices are:

10Base-T, Half Duplex
10Base-T, Full Duplex
100Base-TX, Half Duplex
100Base-TX, Full Duplex
1000Base-T, Full Duplex
1000Base-X, Full Duplex
Symmetric Pause
Asymmetric Pause

Negotiate Button

The **Negotiate** button allows starting the auto-negotiation process. The auto-negotiation process last until the auto-negotiation has succeeded (completed) or the auto-negotiation is manually disabled.

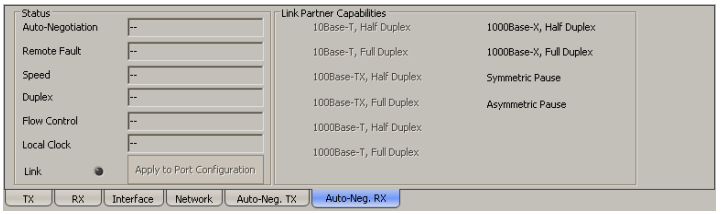
When **Automatic** is selected as speed, the auto-negotiation uses the following prioritization scheme to ensure that the highest common denominator ability is chosen (electrical interfaces)

1 1000Base-T full duplex
2 1000Base-T half duplex
3 100Base-TX full duplex
4 100Base-TX half duplex
5 10Base-T full duplex
6 10Base-T half duplex

Advanced Auto-Neg. RX

Note: *Advanced auto-negotiation is not available with the optical 100 Mbps and 10 Gig-E interfaces.*

Click **TEST**, **Port1/2**, and **Advanced Auto-Neg RX**.



Status

- **Link**: A green Link LED indicates that there is a link at the input port of the corresponding Ethernet interface. A red LED indicates that there is no link at the input port of the corresponding Ethernet interface.
- **Auto-Negotiation**: Indicates the auto-negotiation status. Possible values are:

  Negotiating: indicates that the auto-negotiation process is running and not completed yet.

  Completed: indicates that the auto-negotiation process has completed successfully.

  Parallel Detect Fail: indicates that auto-negotiation has failed through the parallel detection process while negotiating in 10/100Base-T.
- **Remote Fault**: Indicates the remote fault error. Possible values are **Error-Offline** (1000Base-X only) , **Error-Link Fault** (1000Base-X only), and **Error-Auto-Negotiation error**.
- **Speed**: Indicates the negotiated speed. Possible values are 10, 100, and 1000.

- **Duplex**: Indicates the negotiated duplex mode. Possible values are **Half**, and **Full**.
- **Flow Control**: Indicates the negotiated flow control. Possible values are **None**, **Enable TX**, **Enable RX**, and **Enable RX and TX**.
- **Local Clock**: Indicates the negotiated clock source. The local clock is negotiated only in 1000Base-T (electrical). Possible values are **Local**, and **Remote**.

Note: *(--) indicates a link down condition.*

Apply to Port Configuration

Applies the detected auto-negotiation parameters to the port setup configuration.

Link Partner Capabilities

Indicates the detected link partner capabilities.

Note: *Only the capabilities based on the RTU-310/310G's physical port selected for the test will be displayed.*

8 Stream Generation Tabs

Note: *Stream generation is not available with Smart Loopback and TCP Throughput (RTU-310) tests. When IPTV is enabled (RTU-310), the stream Configuration is only available in* ***Dual Ports*** *topology on* ***Port 2****. Stream generation tabs are not available when* ***Through Mode*** *is selected.*

Tab	Page	Available with			
		Ethernet			Fibre Channel[a]
		Frame Analyzer	BERT	RFC 2544	BERT
Overview	162	X	X	X	
Stream Configuration	166	X	X		
PBB-TE	175	X			
MAC	177	X	X[b]	X	
MPLS	180	X			
IP/UDP/TCP	182	X	X	X	
Payload	185	X		X	
Frame Configuration (Fibre Channel)[a]	186				X

a. Not available with RTU-310G.
b. Available with Framed Layer 2 only.

Overview

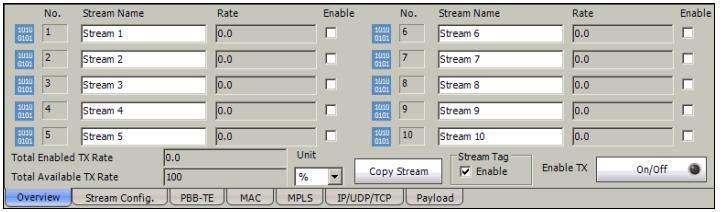
The **Overview** tab allows configuration and activation of up to 10 streams for **Frame Analyzer** test, and only one for **RFC 2544** and **BERT** Ethernet tests.

Click **TEST**, **Stream Gen**, and **Overview**.

➤ For **Frame Analyzer** test, see below.

➤ For **BERT** and **RFC 2544** tests, see page 165.

For Frame Analyzer test



Note: *The stream configuration is reset when the test is cleared.*

➤ The icon in front of the stream **No** indicates the selected stream profile; for voice, for video, or for data.

➤ **No**: Indicates the stream identification number.

➤ **Stream Name**: Shows the stream name. Click the stream name field to change the name of the stream. Up to 16 characters are allowed. The default stream names are **Stream 1** to **Stream 10**.

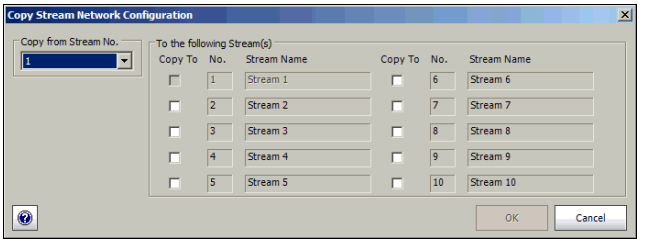
➤ **Rate**: Indicates the stream rate. The rate is calculated according to the configured traffic shaping (from **Transmit Mode** and **TX Rate** fields on page 172).

➤ **Enable**: Allows enabling the corresponding stream. However, the stream will be generated only when the **Enable TX - On/Off** button is at the **On** position when the test is started.

Note: *The Individual stream can be enabled/disabled even when the test is started and running. The streams can be enabled one after the other, up to 10, as long as the maximum rate is not reached. For example, if the first stream is using the full rate available, then no other stream can be enabled. However, if the first enabled stream uses half rate, then at least another stream can be enabled using up to half rate. Thus, to enable a second stream, first set the Maximum or TX rate value within the non-used rate, then enable it. A stream cannot be enabled if its MAC address is not valid, it can be either not resolved or wrongly entered.*

- **Total Enabled TX Rate**: Displays the total enabled rate that will be generated by the selected streams.
- **Total Available TX Rate**: Displays the total rate available for traffic generation.
- **Unit** choices are **%**, **bps**, **Kbps**, **Mbps**, **Gbps**, **Bps**, **KBps**, **MBps**, and **GBps**. The default setting is **%**.

➤ **Copy Stream** button



To copy the stream configuration to one or several streams.

➤ In the **Copy from Stream No** list, select the stream number the configuration will be copied from.

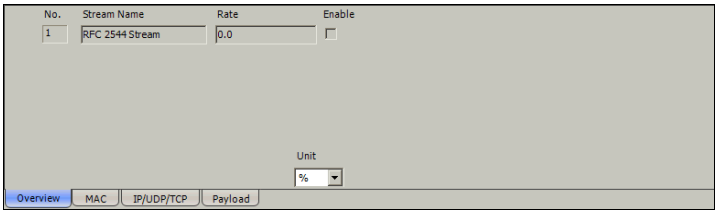
➤ Check all stream check boxes that will inherit the configuration from the selected stream.

➤ Click on **OK** to confirm the stream configuration copy for all selected streams.

➤ **Stream Tag** allows to automatically add a stream analysis tag containing Jitter, Latency, Throughput, and sequence tags in all frames that will be generated. However, only the Jitter and Throughput tags will be generated when the voice codec **VoIP G.723.1** or **VoIP G.729** is selected. The **Stream Tag** setting apply to all streams, for this reason its check box is only available when no stream is enabled. This setting is selected by default unless otherwise set in the *Default/Ethernet Test Preferences* on page 336.

➤ **Enable TX - On/Off**: Click the **On/Off** button to enable the traffic generation as well as the analysis tests when the test is started. Some conditions, such as ARP not resolved, link down, etc., may prevent the stream to be transmitted. The **Enable TX - On/Off button** is not available when **Coupled Start/Enable TX** (refer to *Default/Ethernet Test Preferences* on page 336) is selected.

For BERT and RFC 2544

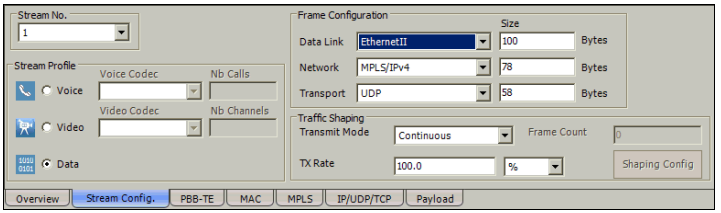


- **No**: Indicates the stream identification number. Only one stream is available with BERT and RFC 2544.
- **Stream Name**: Indicates the stream name and is not editable. The default stream names are: **RFC 2544 Stream** for **RFC 2544** test, and **BERT Stream** for **BERT** test.
- **Rate**: Indicates the stream rate. The rate is calculated according to the configured traffic shaping (from **Transmit Mode** and **TX Rate** fields on page 172).
- **Enable**: Allows enabling the corresponding stream. However, the stream will be generated only when the test is started.
- **Unit** choices are **%**, **bps**, **Kbps**, **Mbps**, **Gbps**, **Bps**, **KBps**, **MBps**, and **GBps**. The default setting is **%**.

Note: *The stream can be enabled/disabled even when the test is started and running.* ***Enable Stream*** *is not available for* ***RFC 2544*** *test. A stream cannot be enabled if its MAC address is not valid, it can be either not resolved or wrongly entered.*

Stream Configuration

Press **TEST**, **Stream Gen**, and **Stream Config.**



Stream No.

For **Frame Analyzer**, select the stream number from the list. Only stream number 1 is available for **BERT** test.

Stream Profile

Note: *For **Frame Analyzer** test only, allows to emulate **Voice** ( ), **Video** ( ), or **Data** ( ) streams. The default setting is **Data**.*

For **Voice**:

- **Voice Codec**: Choices are **VoIP G.711**, **VoIP G.723.1**, and **VoIP G.729**. The default setting is **VoIP G.711**.
- **Nb Calls**: Allows the selection of the equivalent number of calls that will be generated for the selected stream. The default setting is **1**.

For **Video**:

- **Video Codec**: Choices are **SDTV (MPEG-2)**, **HDTV (MPEG-2)**, and **HDTV (MPEG-4)**. Only **SDTV (MPEG-2)** is available with the 10 Mbps interface. The default setting is **SDTV (MPEG-2)**.
- **Nb Channels**: Allows the selection of the equivalent number of channels that will be generated for the selected stream. The default setting is **1**.

Frame Configuration

Note: *Only data link frame size is available with **BERT - Framed Layer 1** test.*

- **Data Link**: Select the data link type (layer 2). Choices are **Ethernet II**, **PBB-TE/Ethernet II**, **802.3 SNAP**, and **PBB-TE/802.3 SNAP**.

Note: ***Network**, and **Transport** are not available with **RFC 2544** test. Only data link frame size is available with **BERT - Framed Layer 1** test.*

- **Network**: Select the network traffic type (layer 3). Choices are:
  - When the test interface is set to IPv4: **IPv4**, **MPLS/None**, **MPLS/IPv4**, and **None**. **MPLS/None**, and **MPLS/IPv4** are only available when **MPLS** is enabled. The default setting is **IPv4** when MPLS is not enabled and **MPLS/IPv4** when MPLS is enabled.
  - When the test interface is set to IPv6: **IPv6, MPLS/None**, **MPLS/IPv6**, and **None**. **MPLS/None**, and **MPLS/IPv6** are only available when **MPLS** is enabled. The default setting is **IPv6** when MPLS is not enabled and **MPLS/IPv6** when MPLS is enabled.

Note: *When the stream profile is set to either voice or video, Network is automatically set to **IPv4** or **IPv6**.*

- **Transport**: Select the transport traffic type (layer 4). Choices are **UDP**, **TCP**, and **None**. The default setting is **UDP**. Transport is automatically set to **None** when **Network** is set to **None**. Transport is automatically set to **UDP** when the stream profile is set to either voice or video.
- **Size**: Select the frame size for each traffic type. Only configurable when the stream profile is set to **Data**. Choices are:
  - For Frame Analyzer test:

Traffic Type	Frame Size		
	Minimum	Maximum	
		10 Mbps	100/1000 Mbps and 10 Gbps
Data Link	48[a]	10000	16000
Network	30[a]	9982	15982
Transport UDP TCP	 10[a] 22[a]	9962	15962

a. The minimum frame size will be adjusted according to the frame structure and components selected.

The following table lists each component that may affect the minimum size values.

Component	Description
VLAN	4 bytes per VLAN (up to 3 VLAN)
PBB-TE	18 bytes
B-VLAN	4 bytes
MPLS	4 bytes per label (up to two labels)
Stream Tag	50 bytes
UDP	8 bytes
TCP	20 bytes
Ethernet Header	14 bytes
LLC and SNAP Headers	8 bytes
IPv4	20 bytes
IPv6	40 bytes

➤ For BERT test:

For **Framed Layer 1**, only the Data Link (Ethernet) is configurable from **48** to **10000** for 10Mbps, and **16000** for 100Mbps/1000Mbps/10Gbps.

For **Framed Layer 2**, choices are:

Traffic Type	Frame Size		
	Minimum	Maximum	
		10 Mbps	100/1000 Mbps and 10 Gbps
Data Link	48[a]	10000	16000
Network	46[a]	9982	15982
Transport UDP TCP	 26[a] 38[a]	9962	15962

a. The minimum frame size will be adjusted according to the frame structure and components selected.

The following table lists each component that may affect the minimum size values.

Component	Description
VLAN	4 bytes per VLAN (up to 3 VLAN)
UDP	8 bytes
TCP	20 bytes
Ethernet Header	14 bytes
LLC and SNAP Headers	8 bytes
IPv4	20 bytes
IPv6	40 bytes

Note: *Changing one of the traffic type value will affect the two other traffic type values.*

Note: *Sending traffic with frame size >1518 in switched network may result in losing all frames.*

Traffic Shaping

➤ **Transmit Mode**: Allows the selection of the Transmit Mode for **Stream 1** only. Choices are **Continuous**, **Burst**, **Ramp**, **n-Frame**, **n-Burst**, and **n-Ramp**. The default setting is **Continuous**.

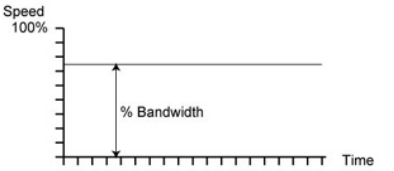
Note: *Stream 2 to 10 are not configurable and set to **Continuous**.*

Note: ***Transmit Mode*** *is forced to **Continuous** with **BERT** test or with Frame Analyzer when the stream profile is set to either **Voice** or **Video**.*

Continuous transfers the selected frame continuously according to the selected % of bandwidth.

n-Frame transfers the selected number of frames.

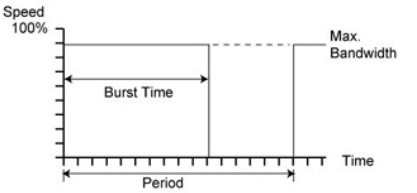
Continuous Transmit Mode



Burst transfers the selected frame at maximum bandwidth according to the selected % of duty cycle and burst time. The **Period** equals the **Burst Time** divided by the **Duty Cycle**.

n-Burst transfers the selected number of Burst.

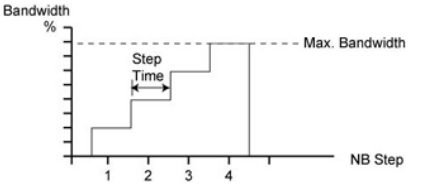
Burst Transmit Mode



Ramp transfers the selected bandwidth in a stair shape according to the selected step time, number of steps, and the maximum bandwidth.

n-Ramp transfers the selected number of Ramp.

Ramp Transmit Mode



➤ **TX Rate**: Enter the transmission rate. The available stream transmission rate will be calculated according to the selected Transmit Mode. The default setting is **100% for 10/100/1000Mbps and** 10Gig-E LAN, and **92.8%** for 10Gig-E WAN.

Unit choices are **%**, **bps**, **Kbps**, **Mbps**, **Gbps**, **Bps**, **KBps**, **MBps**, **GBps**, **fps**, and **IFG**. The default setting is **%**.

Note: *TX Rate is not configurable when the stream profile is set to either **Voice** or **Video**. The TX rate is calculated according to the number of calls (voice) or channels (video) of the selected codec.*

➤ **Frame Count**: Available with n-Frame Transmit Mode only. Enter the frame count number. Choices are **1** to **26785714285**. The default setting is **1**.

➤ **Shaping Config** button

For Burst Traffic Shaping

Note: *Available for Stream 1 with Burst and n-Burst transmit modes.*

➤ **Bandwidth (Duty Cycle)**: Enter the Bandwidth (Duty Cycle). Choices are **1** to **100%**. The default setting is **50%**.

➤ **Burst Time**: Enter the Burst Time. Choices are **1** to **8000** milliseconds. The default setting is **1000** milliseconds.

Unit choices are **ms** (milliseconds) and **s** (seconds). The default setting is **ms** (milliseconds).

➤ **Burst Count**: Available with n-Burst transmit mode only. Enter the Burst Count. Choices are **1** to **225**. The default setting is **1**.

For Ramp Traffic Shaping

Note: *Available for Stream 1 with Ramp and n-Ramp transmit modes.*

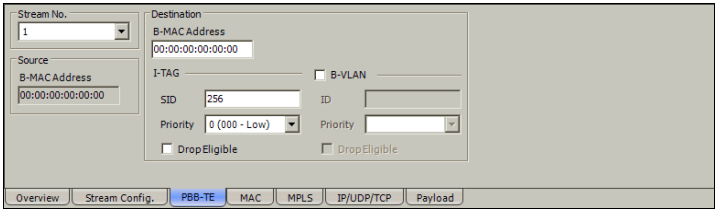
- **Number of Steps**: Enter the number of steps. Choices are **2** to **100**. The default setting is **10**.
- **Step Time**: Enter the time duration of each step. Choices are **100** to **8000** milliseconds. The default setting is **1000** milliseconds.
- **Unit** choices are **ms** (milliseconds) and **s** (seconds). The default setting is **ms** (milliseconds).
- **Ramp Cycle Count**: Available with n-Ramp transmit mode only. Enter the number of ramp cycle count. Choices are **1** to **225**. The default setting is **1**.

PBB-TE

Allows configuration of PBB-TE streams including B-MAC (source and destination), B-VLAN and I-Tag (as per 802.1ah).

Note: ***PBB-TE*** *has to be enabled during the test setup (refer to PBB-TE on page 106) and the* ***Data Link*** *set to* ***Ethernet****/****PBB-TE*** *(see Stream Configuration* on page 166*) to give access to the PBB-TE configuration for the selected stream.*

Click **TEST**, **Stream Gen**, and **PBB-TE**.



Stream No.

Select the stream number from the list.

Source

B-MAC Address: Indicatesthe source Backbone MAC address for the selected stream. The source **B-MAC Address** is only configurable through the *Network* tab on page 150.

Destination

➤ **B-MAC Address**: Enter the destination Backbone MAC address for the selected stream. The default setting is **00:00:00:00:00:00**.

➤ **I-TAG** (Backbone Service Instance Tag)

SID (Service Instance Identifier): Enter the I-TAG SID which identifies the backbone service instance of the selected stream. Choices are **0** through **16777215**. The default setting is **256**.

Priority: Select the B-VLAN user Priority Code Point (PCP). Choices are **0** to **7**. The default setting is **0** (**000** - Low).

Drop Eligible: When the **Drop Eligible** check box is selected (DEI = 1), these transmitted frames will be dropped first on receipt when congestion occurs under test. This setting is disabled by default.

➤ **B-VLAN** (Backbone Virtual Local Area Network)

ID: Enter the B-VLAN identifier. Choices are **0** through **4095**. Refer to *VLAN/B-VLAN* on page 464 for more information.

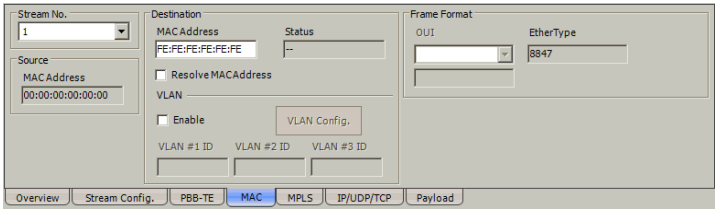
Priority: Select the B-VLAN user Priority Code Point (PCP). Choices are **0** to **7**; refer to *VLAN/B-VLAN* on page 464 for more information. The default setting is **0** (**000** - Low).

Drop Eligible: When the **Drop Eligible** check box is selected (DEI = 1), these transmitted frames will be dropped first on receipt when congestion occurs under test. This setting is disabled by default.

MAC

Note: *Only available with **Framed Layer 2**.*

Click **TEST**, **Stream Gen**, and **MAC**.



Stream No.

For **Frame Analyzer** test, select the stream number from the list. Only stream number 1 is available for **RFC 2544** and **BERT** tests.

Frame Format

- **OUI** is available when the **Data Link** is set to **802.3 SNAP** and allows the selection of the Organizationally Unique Identifier (OUI). Choices are **RFC1042**, **802.1H**, and **User Defined** (when **Network** is set to **None**).

  When **User Defined** is selected, enter the **OUI** hexadecimal value (**000000** to **FFFFFF**).

- **EtherType** is available when **Network** is set to **None** and allows to enter the EtherType hexadecimal value (**0000** to **FFFF**).

Note: *Refer to* Stream Configuration *on page 166 for more information.*

Source

MAC Address: Indicates the MAC address of the selected stream.

Note: *The source **MAC Address** is only configurable through the Network* on page 150.

Destination

MAC Address: Enter the destination MAC address for the selected stream. The default setting is **FE:FE:FE:FE:FE:FE**.

Note: *The destination MAC Address field is not accessible when Resolve MAC Address is enabled.*

Resolve MAC Address: When enabled, will send a request to the network to retrieve the MAC address corresponding to the selected destination IP address. This setting is disabled by default.

Status: Indicates the Resolve MAC address status. Possible status are:

Status	Description
--	The **Resolve MAC address** is not enabled.
Resolving	The MAC address is being resolved.
Resolved	The MAC address is resolved and for IPv6, the next-hop reachability is confirmed.
Unreachable	For IPv6 only, the MAC address is resolved and the next-hop is unreachable.
Failed	The MAC address cannot be resolved.

VLAN

Note: *For **RFC 2544** test, VLAN is only configurable through the Network* on page 150.

Note: *Enabling/disabling VLAN will affect the Data Link value (see* Overview *on page 162).*

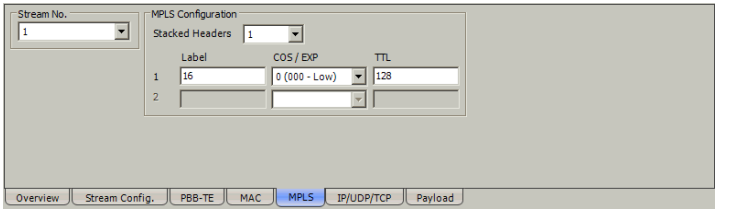
- **Enable**: When enabled, allows the configuration of VLAN. This setting is disabled by default.
- **VLAN #1** (C-VLAN) / **#2** (S-VLAN) / **#3 ID** (E-VLAN): Indicates the VLAN ID for each enabled VLAN layer. Possible values are **0** through **4095**. The value **4095** is reserved while **0** and **1** have specific utility.
- **VLAN Config.**: Allows VLAN parameters configuration. Refer to *VLAN Configuration* on page 486 for more information.

MPLS

Allows MPLS configuration of streams with up to two layers of MPLS labels, COS/EXP and TTL parameters.

Note: ***MPLS*** *has to be enabled during the test setup (refer to MPLS on page 106) and the* ***Network*** *set to* ***MPLS/IPv4****,* ***MPLS/IPv6****, or* ***MPLS/None*** *(see Stream Configuration* on page 166*) to gives access to the MPLS configuration for the selected stream.*

Click **TEST**, **Stream Gen**, and **MPLS**.



Stream No.

Select the stream number from the list.

MPLS Configuration

- **Stacked Headers**: Allows the activation of up to two MPLS headers. The default setting is **1**.
- **Label**: Allows the selection of the MPLS TX labels (**0** to **1048575**). The default label value is **16**.
- **COS/EXP** (Class Of Service / Experimental): Select the class of service. The default value is **0 (0000 - Low)**.

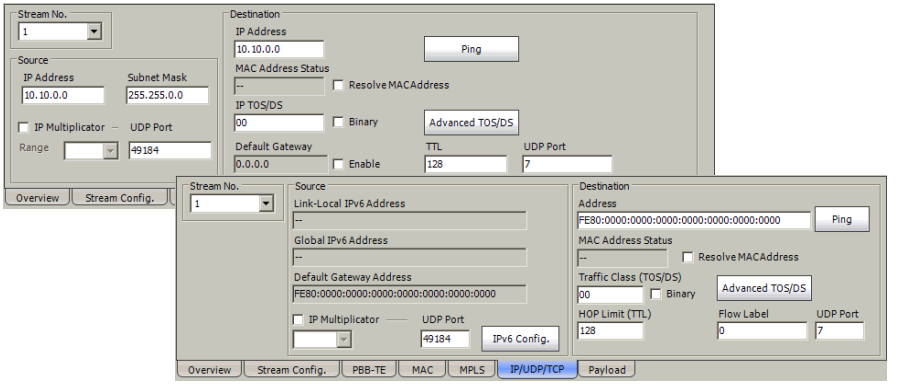
  0 (000 - Low)
  1 (001 - Low)
  2 (010 - Low)
  3 (011 - Low)
  4 (100 - High)
  5 (101 - High)
  6 (110 - High)
  7 (111 - High)

- **TTL** (Time To Live): Select the TTL value. Choices are **0** to **255**. The default setting is **128**.

IP/UDP/TCP

Note: *Only available when the network stream configuration is set to IPv4, MPLS/IPv4, IPv6, or MPLS/IPv6.*

Click **TEST**, **Stream Gen**, and **IP/UDP/TCP**.



Stream No.

For **Frame Analyzer** test, select the stream number from the list. Only stream number 1 is available for **RFC 2544** and **BERT** tests.

Source

For **IPv4**:

- **IP Address**: Enter the IP address for the selected stream. The default setting is **10.10.x.x**, where **x** and **y** are respectively the two least significant bytes of the port default MAC address.
- **Subnet Mask**: Enter the Subnet Mask for the selected stream. The default setting is **255.255.0.0**.

For **IPv6**:

Displays the **Link-Local IPv6 Address**, **Global IPv6 Address**, and **Default Gateway Address**.

IPv6 Config button allows to configure the IPv6 addresses. Refer to *IPv6 Address Configuration* for more information.

For both **IPv4** and **IPv6**:

- **IP Multiplicator:**Allows changing the 7 LSB (Least Significant bit) of the source IP address as specified in the range. This setting is disabled by default.

  Range: Select the IP Multiplicator Range. Choices are **1-128** and **0-127**. The default setting is **1-128**.

- **UDP/TCP - Port**: Allows the selection of the source port number. Choices are **0** to **65535**. The default setting is **49184** (public port number).

Destination

- **Address**: Enter the destination IP address for the selected stream.
- **Ping** button: Click **Ping** to automatically start the quick Ping utility for the stream destination IP address using the Ping parameters from the *Setup* on page 412. Refer to *Ping* on page 508 for more information.
- **MAC Address Status**: Indicates the resolve MAC address status when the **Resolve MAC Address** check box is selected. See page 178 for the list of possible status.
- **Resolve MAC Address**: When enabled, will send a request to the network to retrieve the MAC address corresponding to the selected destination IP address. This setting is disabled by default.
- **UDP/TCP Port**: Allows the selection of the destination port number. Choices are **0** to **65535**. The default setting is **7 (echo)**.

- **IP TOS/DS** for IPv4 or **Traffic Class (TOS/DS) for IPv6**
  Enter the user defined value. Changing the TOS/DS value will affect the Advanced TOS/DS settings and vice versa. Choices are **00** to **FF**. The default setting is **00**.

  Binary: Displays the user defined IP TOS/DS in binary when enabled.

- **Advanced TOS/DS** button: Allows the configuration of the TOS/DS settings. Changing the **Advanced TOS/DS** settings will affect the IP TOS/DS value and vice versa. Refer to *Advanced TOS/DS* on page 506 for more information.

- **TTL** (Time To Live) for IPv4
  HOP Limit (TTL) for IPv6
  Select the TTL value. Choices are **0** to **255**. The default setting is **128**.

- **Flow Label** (IPv6 only): Enter the **Flow Label** number that will be used to identify a series of related packets from a source to a destination. Choices are **0** to **1048575**. The default setting is **0**.

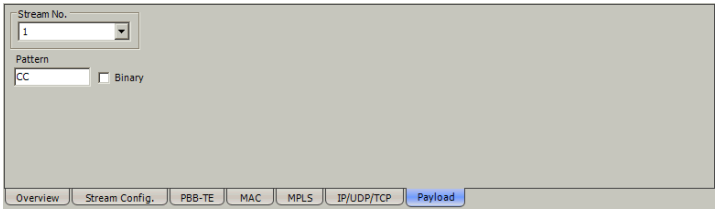
- **Default Gateway** (IPv4 only): Enter the default Gateway IP address. Enable Default Gateway must be activated to enable the Default Gateway IP address field. The default setting is **0.0.0.0**.

  Enable: Allows enabling the **Default Gateway**.

Payload

Note: *Not available with **BERT** test.Not available when the **Stream Tag** (Frame Analyzer) check box is selected; in this case a PRBS is used as the payload..*

Click **TEST**, **Stream Gen**, and **Payload**.



Stream No.

For **Frame Analyzer** test, select the stream number from the list. Only stream number 1 is available for **RFC 2544** and **BERT** tests.

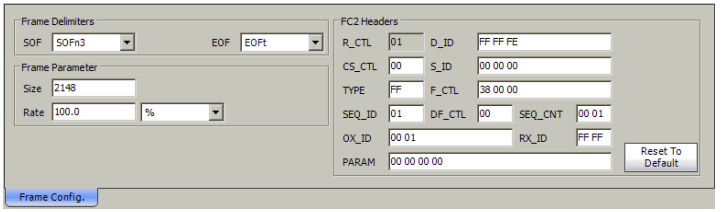
Pattern

- **Pattern**: Allows the selection of the test pattern that will be repeated inside the entire data payload. Choices are **00** to **FF**. The default setting is **CC**.
- **Binary**: The pattern will automatically be converted in binary or in hexadecimal when enabling/disabling **Binary**.

Frame Configuration (Fibre Channel)

Note: *Frame Configuration is only available with Fibre Channel* ***Framed Layer 1*** *or* ***Framed Layer 2****.*

Click **TEST**, **Stream Gen**, and **Frame Config.**



Frame Delimiters

➤ **SOF**: The **SOF** represents the Start Of Frame delimiter. The default setting is **SOFn3** for **Framed Layer 1** and is the only choice for **Framed Layer 2**. Choices for **Framed Layer 1** are:

SoF	Description	SoF	Description
SOFc1	SOF - Connect Class 1	SOFi3	SOF - Initiate Class 3
SOFi1	SOF - Initiate Class 1	SOFn3	SOF - Normal Class 3
SOFn1	SOF - Normal Class 1	SOFc4	SOF - Activate Class 4
SOFi2	SOF - Initiate Class 2	SOFi4	SOF - Initiate Class 4
SOFn2	SOF - Normal Class 2	SOFn4	SOF - Normal Class 4
		SOFf	SOF - Fabric

➤ **EOF**: The EOF represents the End Of Frame delimiter. The default setting is **EOFt** for **Framed Layer 1** and is the only choice for **Framed Layer 2**. Choices for **Framed Layer 1** are:

EOF	Description
EOFt	EOF - Terminate
EOFdt	EOF - Disconnect-Terminate Class 1 or EOF - Deactivate-Terminate Class 4
EOFa	EOF - Abort
EOFn	EOF - Normal
EOFni	EOF - Normal-Invalid
EOFdti	EOF - Disconnect-Terminate-Invalid Class 1 or EOF - Disconnect-Deactivate-Invalid Class 4
EOFrt	EOF - Remove-Terminate Class 4
EOFrti	EOF - Remove-Terminate-Invalid Class 4

Frame Parameter

➤ **Size**: Allows the selection of the frame size. The default setting is **2148** bytes. The frame size is configurable by 4 byte steps. Choices are:

Framing	Frame Size (bytes)		
	From		To
	Latency Tag not enabled	Latency Tag enabled	
Framed Layer 1	12	36	2148
Framed Layer 2	40	64	2148

➤ **Rate**: Allows the selection of the frame rate. Choices are from **0.1** to **100%** when the selected rate unit is percentage. The default setting is **100%**.

➤ **Unit**: Allows the selection of the transmission rate unit. Choices are **%**, **MBps**, and **Mbps**. The default setting is **%**.

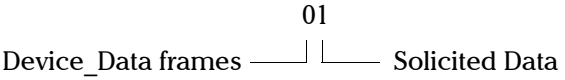
FC Header

Note: ***FC Header*** *is only available with Fibre Channel* ***Framed Layer 2*** *only.*

The frame header structure of a **Framed Layer 2** is presented in the following table.

Word	Bits			
	31 ... 24	23 ... 16	15 ... 8	7 ... 0
0	R_CTL	D_ID		
1	CS_CTL	S_ID		
2	TYPE	F_CTL		
3	SEQ_ID	DF_CTL	SEQ_CNT	
4	OX_ID		RX_ID	
5	PARAM			

➤ **R_CTL**: The Routing Control is set to hexadecimal 01.



➤ **D_ID**: The Destination Identifier specifies the location (address) where an N-Port can find common services. The default setting is hexadecimal **FFFFFE**. Possible values are:

D_ID	Description
000000 to FFFC00	N_Port Identifier
FFFC01 to FFFCFE	Reserved for domain controllers
FFFFF0 to FFFFF4	Reserved
FFFFF5	Multicast server
FFFFF6	Clock synchronization server
FFFFF7	Security key distribution server
FFFFF8	Alias server
FFFFF9	Quality of service facilitator - Class 4 (QoSF)
FFFFFA	Management server
FFFFFB	Time server
FFFFFC	Directory server
FFFFFD	Fabric Controller
FFFFFE	Fabric F_Port
FFFFFF	Broadcast Alias_ID

Note: *The destination identifier address may be affected by the login process.*

➤ **CS_CTL**: The Class Specific Control field contains management information for the class of service identified by the SOF. The default setting is hexadecimal **00** corresponding to no preference and no specific DSCP. Possible values for Class 3 service are:

Bit	Description
31	PREF (Preference) 0 = Frame is delivered with no Preference 1 = Frame may be delivered with Preference
30	Reserved for additional Preference function
29-24	DSCP (Differentiated Services Code Point)

➤ **S_ID**: The source identifier specifies the source port address. Choices are listed in the D_ID table. Refer to D_ID for more information. The default setting is hexadecimal **000000**.

Note: *The source identifier address may be affected by the login process.*

➤ **TYPE**: The Data Structure Type indicates the type of data contained in the data field. The default value is **FF** corresponding to Vendor specific.

➤ **F_CTL**: The Frame Control contains control information related to the frame content. The default setting is hexadecimal **380000**. Possible values are:

Bit	Field	Description
23	Exchange Context	**0** = Originator of Exchange 1 = Responder of Exchange
22	Sequence Context	**0** = Sequence Initiator 1 = Sequence Recipient
21	First Sequence	0 = Sequence other than first of Exchange **1** = First Sequence of Exchange
20	Last_Sequence	0 = Sequence other than last of Exchange **1** = Last Sequence of Exchange
19	End_Sequence	0 = Data frame other than last of Sequence **1** = Last frame of Sequence
18	End_Connection (Class 1 or 6) or Deactivate Class 4 circuit	**0** = Connection active 1 = End of connection pending (Class 1 or 6) or End of live Class 4 circuit
17	CS_CTL/Priority Enable	**0** = Word 1, Bits 31-24 = CS_CTL 1 = Word 1, Bits 31-24 = Priority
16	Sequence Initiative	**0** = Hold Sequence initiative 1 = Transfer Sequence initiative
15	X_ID reassigned	Obsolete
14	Invalidate X_ID	Obsolete
13 12	ACK_Form	**00** = No assistance provided 01 = Ack_1 Required 10 = Reserved 11 = Ack_0 Required
11	Data Compression	Obsolete
10	Data Encryption	Obsolete

Bit	Field	Description
9	Retransmitted Sequence	**0** = Original Sequence transmission 1 = Sequence retransmission
8	Unidirectional Transmit (Class 1) or Remove Connection (Class 4 only)	**0** = Bi-directional transmission (Class 1), or Retain or deactivate circuit (Class 4) 1 = Unidirectional Transmission (Class 1), or Remove circuit (Class 4)
7 6	Continue Sequence Condition	Last Data frame - Sequence initiator **00** = No information 01 = Sequence to follow-immediately 10 = Sequence to follow-soon 11 = Sequence to follow-delayed
5 4	Abort Sequence Condition	ACK frame - Sequence Recipient **00** = Continue sequence 01 = Abort Sequence, Perform ABTS 10 = Stop Sequence 11 = Immediate Sequence retransmission requested Data frame (1st of Exchange) - Sequence initiator 00 = Abort, Discard multiple Sequences 01 = Abort, Discard a single Sequence 10 = Process policy with infinite buffers 11 = Discard multiple Sequences with immediate retransmission
3	Relative offset present	**0** = Parameter field defined for some frames 1 = Parameter Field = relative offset
2	Exchange reassembly	Reserved for Exchange reassembly
1 0	Fill Data Bytes	End of Data Field - bytes of fill **00** = 0 Bytes of fill 01 = 1 Byte of fill (last byte of Data Field) 10 = 2 Bytes of fill (last 2 bytes of Data Field) 11 = 3 Bytes of fill (last 3 bytes of Data Field)

- **SEQ_ID**: The Sequence Identifier specifies the sequence to which the frame belongs. Choices are from **00** to **FF**. The default setting is hexadecimal **01**.
- **DF_CTL**: Data Field Control indicates whether any optional headers are included at the start of the data field and what the format is if there are any. The default setting is hexadecimal **00** (no optional headers present).

Note: *No optional headers are supported.*

- **SEQ_CNT**: The Sequence Count indicates the sequential order of the frame in the sequence. Possible values are from **0** (hex 0000) to **65535** (hex FFFF). The default setting is hexadecimal **0001** (Unique Sequence Identifier).
- **OX_ID**: The Originator Identifier is the exchanged ID assigned by the originator of the exchange. Possible values are from **0** (hex 0000) to **65535** (hex FFFF). The default setting is hexadecimal **0001** (only one frame to count in each sequence).
- **RX_ID**: The Responder Identifier is the exchange ID assigned by the responder to the exchange. The default is hexadecimal **FFFF** (unassigned).
- **PARAM**: The Parameter (PARAM) in data frames is the relative offset, which is the relative displacement of the first byte of the data field (payload) from a base address specified by the Upper Layer Protocol (ULP). Possible values are from hexadecimal **00000000** to **FFFFFFFF**. The default setting is hexadecimal **00000000**.

Reset To Default button: Allows to revert the **FC2 Headers** fields to their default values.

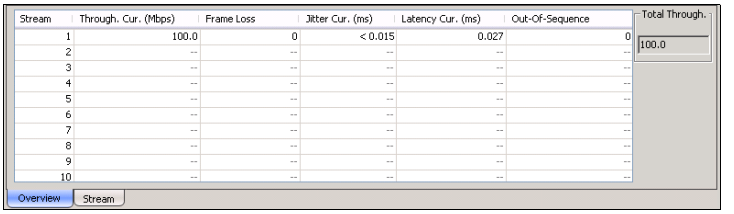
9 Stream Analyzer Tabs

Note: *Stream analyzer is only available with Frame Analyzer test. Stream analyzer tabs are not available when* ***Through Mode*** *(RTU-310) is selected.*

Overview

For **Frame Analyzer** test only, the **Overview** tab gives stream analysis statistics and throughput for all streams.

Click **TEST**, **Stream Analyzer**, and **Overview**.



- **Stream**: Indicates the stream identification number.
- **Throughput Cur. (Mbps)** indicates for each stream the current measured utilization throughput in Mbps of all valid frames (valid Throughput tag with no FCS error) received in the last second.
- **Frame Loss** indicates for each stream the total count of frames that are lost.
- **Jitter Cur. (ms)** indicates for each stream the current measured delay variation for all valid frames (in-sequence frames, valid Jitter tag, and no FCS error) received in the last second.

- **Latency Cur. (ms)** indicates for each stream the current measured round trip latency (delay) for all valid frames (valid Latency tag, expected originator identifier value, and no FCS error) received in the last second.
- **Out-Of-Sequence** (OOS) indicates for each stream the total count of valid packets having its sequence number smaller than the previously received packet. Seconds, count, rate and percentage values are reported.
- **Total Throughput** indicates the total measured throughput in Mbps of all valid frames (valid Throughput tag with no FCS error).

Stream

Click **TEST**, **Stream Analyzer**, and **Stream.**

Note: *Available with **Frame Analyzer** test only.*

Stream No.

Select the stream number from the list.

RX Frame Count

Indicates the number of frame received matching the selected stream ID.

Stream Errors Analysis

- **Out-Of-Sequence** (OOS) is declared when a packet has its sequence number smaller than the previously received packet.
- **Frame Loss** is declared when missing frames are detected.

Throughput

The throughput is measured for each stream on all valid frames (valid Throughput tag with no FCS error). The maximum, minimum, current, and average throughput results are reported.

Unit choices are **%**, and **Mbps**. The default setting is **%**.

Note: *For the **Current** value, **0** is displayed when no RX rate has been measured in the last second.*

Round Trip Latency

The round trip latency (delay) is measured for each stream on all valid frames (valid Latency tag, expected originator identifier value, and no FCS error). The maximum, minimum, current, and average delay values are reported.

Note: ***Round Trip Latency** statistics are only available in loopback test topology.*

Note: *Delay measurements smaller than 15 µs will be discarded, not used for the sampling process, and "< 0.015" will be displayed. For the **Current** value, **Not measurable** is displayed when no delay has been measured in the last second.*

Jitter

The Jitter is measured for each stream on all valid frames (in-sequence frames, valid Jitter tag, and no FCS error). The estimated Jitter, maximum, minimum, current, and average delay values are reported.

Note: *Delay variation measurements smaller than 15 µs will be discarded, not used for the sampling process, and "< 0.015" will be displayed as the minimum value. For the **Current** value, **Not measurable** is displayed when no delay has been measured in the last second.*

10 Traffic Analyzer Tabs

Note: *The available* ***Traffic Analyzer*** *tabs depend on which test path is activated.*

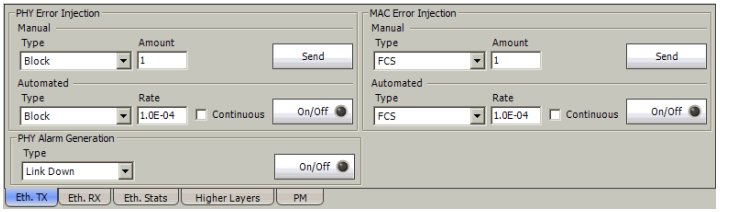
Test	Tab	Page	Available with				
			Frame Analyzer	BERT	RFC 2544	Smart Loopback	TCP Throughput[a]
Ethernet	*Ethernet TX*	200		X			
	Ethernet RX	203	X	X	X	X	X
	Ethernet Statistics	206	X	X	X	X	X
	PBB-TE	208	X				
	Higher Layers	210	X	X	X	X	X
	Flow Control	212	X		X		X
	Traffic Filters	215	X				
	Traffic Filter Configuration	220	X				
	Traffic Filter Stats	222	X				
	Capture	224	X				
	Graph	229	X				
	Performance Monitoring (PM)	359		X[b]			
Fibre Channel[c]	*FC TX*	230		X			
	FC RX	233		X			
	FC Latency	235		X			
	FC Statistics	237		X			
	Performance Monitoring (PM)	359		X			

a. Only available with RTU-310
b. For RTU-310: Available with **Framed Layer 2**, and **Frame Layer 1** with **xPAT** pattern (Ethernet 1000Mbps and Fibre Channel interface only).
For RTU-310G: Available for Framed Layer 2 with LAN transceiver mode.
c. Not available with RTU-310G.

Ethernet TX

Note: *Available with **BERT** test with **Framed Layer 1** and **Framed Layer 2** only.*

Click **TEST**, **Traffic Analyzer**, and **Eth. TX**.



PHY Alarm Generation

Note: *Available with 10Gig-E interface only.*

- **Type**: The following alarms are available:

  Link Down: Generates a continuous PCS error (block error).

  Local Fault: Generates a local fault sequence.

  Remote Fault: Generates a remote fault sequence.

- **On/Off** button: The **On/Off** button is used to activate/deactivate the selected alarm. This setting is disabled (Off) by default.

PHY Error Injection

- **Type**: The following error is available with both manual and automated injection modes: **Symbol (100/1000Mbps) or Block (10Gbps)**.
- **Amount**: Allows the selection of the amount of manual error to be generated. Choices are **1** through **50**. The default setting is **1**.
- **Send** button: Click **Send** to manually generate error(s) according to the error type and the amount of error.
- **Rate**: Click the **Rate** field to select the rate for the automated error. Choices are: **1.0E-02**, **1.0E-03**, **1.0E-04**, **1.0E-05**, **1.0E-06**, **1.0E-07**, **1.0E-08**, **1.0E-09** or user definable from **1.0E-09** to **1.0E-02**. The default setting is **1.0E-04**.
- **Continuous**: Generates the selected error for each generated frame when the **Continuous** check box is selected while the **On/Off** button is enabled (On). The **Continuous** check box is cleared by default.
- **On/Off** button: The **On/Off** button is used to activate/deactivate the selected automated error at the rate specified or continuously. This setting is disabled (Off) by default.

MAC Error Injection

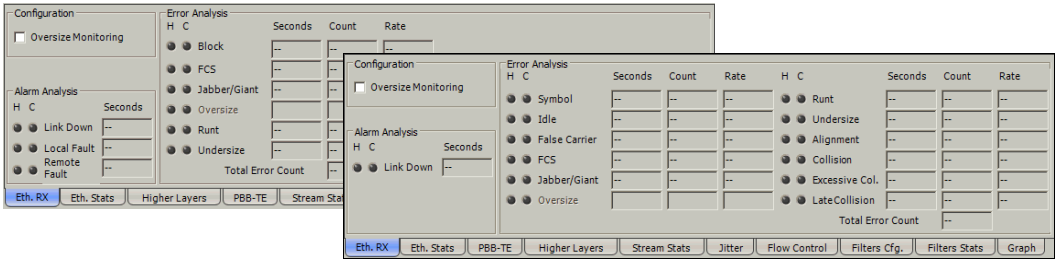
Note: *MAC Error Injection is available with Framed Layer 2 only.*

- **Type**: The following error is available with both manual and automated injection modes: **FCS**.
- **Amount**: Allows the selection of the amount of manual error to be generated. Choices are **1** through **50**. The default setting is **1**.
- **Send** button: Click **Send** to manually generate error(s) according to the error type and the amount of selected error.

- **Rate**: Click the **Rate** field to select the rate for the automated error. Choices are: **1.0E-02**, **1.0E-03**, **1.0E-04**, **1.0E-05**, **1.0E-06**, **1.0E-07**, **1.0E-08**, **1.0E-09** or user definable from **1.0E-09** to **1.0E-02**. The default setting is **1.0E-04**.
- **Continuous**: Generates the selected error for each generated frame when the **Continuous** check box is selected while the **On/Off** button is enabled (On). The **Continuous** check box is cleared by default.
- **On/Off** button: The **On/Off** button is used to activate/deactivate the selected automated error at the rate specified or continuously. This setting is disabled (Off) by default.

Ethernet RX

Click **TEST**, **Traffic Analyzer**, and **Eth. RX**.



Configuration

Oversize Monitoring

Enables the monitoring of the **Oversize** error.

Alarms Analysis

- **Link Down**: Indicates that the Ethernet connection is down. The Ethernet connection is down when there is a local or a remote fault condition.
- **Local Fault** (10Gig-E): Indicates that at least one of the following events is detected: **LOS**, **Loss of bit synchronization**, **Loss of Block synchronization**, **WIS Link down**, or **High BER** (High BER is true when the bit error ratio $> 10^{-4}$ on a fixed 125 μs time period).
- **Remote Fault** (10Gig-E): Indicates that a Remote Fault event is detected.

Note: *Alarms/Errors are updated only during test execution.*

Errors Analysis

- **Block** (10Gig-E): The number of frames received with an errored block condition.
- **Symbol** (100/1000 Mbps): A Symbol Error is declared when an invalid code-group in the transmission code is detected.
- **Idle** (100/1000Mbps): An Idle Error is declared when an error is detected between the end of a frame and the beginning of the next frame.
- **False Carrier** (100/1000Mbps): A False Carrier is declared when data is being received with no valid start of frame.

The following errors are only available with **Framed Layer 2** or **Framed Layer 1** with **xPAT** pattern (10/100/1000Mbps).

- **FCS**: The number of received frames with an invalid FCS.
- **Alignment** (10/100 Mbps): Indicates the number of received frames without an integral number of octets in length.

The following errors are only available with Framed Layer 2.

- **Jabber/Giant**: The number of received frames larger than 1518 (no VLAN), 1522 (C-VLAN), 1526 (S-VLAN), or 1530 (E-VLAN) bytes with an invalid FCS.
- **Oversize**: The number of received frames larger than 1518 (no VLAN), 1522 (C-VLAN), 1526 (S-VLAN), or 1530 (E-VLAN) bytes with a valid FCS. **Oversize** error analysis is only available when **Oversize Monitoring** is enabled (see page 203)
- **Runt**: The number of received frames that are smaller than 64 bytes with an invalid FCS.
- **Undersize**: The number of received frames smaller than 64 bytes with a valid FCS.

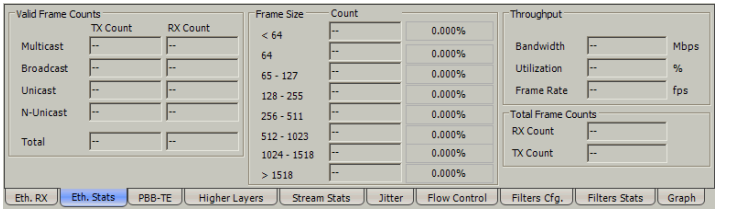
The following errors are only available with **Half Duplex** mode. Not available when **Through Mode** (RTU-310) is selected. Not available with RTU-310G.

- **Collision** (10/100/1000Mbps): Indicates the number of collisions on the link.
- **Late Collision** (10/100/1000Mbps): Indicates the number of collisions that have occurred after a 64 bytes transmission.
- **Excessive Collision** (10/100/1000Mbps): Indicates the number of frames that were sent 16 times unsuccessfully due to consecutive collisions.

Total Error Count: Indicates the total number of errors including all the above errors.

Ethernet Statistics

Click **TEST**, **Traffic Analyzer**, and **Eth. Stats**.



Valid Frame Counts

Note: ***Valid Frame Counts*** *is only available with* ***Framed Layer 2****.*

- **Multicast**: The number of Multicast frames transmitted/received without any FCS errors. Broadcast frames are not counted as multicast frames.
- **Broadcast**: The number of Broadcast frames transmitted/received without any FCS errors. Broadcast frames have a MAC address equal to **FF-FF-FF-FF-FF-FF**.
- **Unicast**: The number of Unicast frames transmitted/received without any FCS errors.
- **N-Unicast (Non-Unicast)**: The sum of Multicast and Broadcast frames transmitted/received without any FCS errors.
- **Total**: The number of frames transmitted/received without any FCS error.

Frame Size

- **Count**: Gives the count of each received frame size (valid and invalid).
- **Total**: Gives the percentage ratio of each received frame size based on the total count of frames.
- **< 64**: frames with less than 64 bytes.
- **64**: frames equal to 64 bytes.
- **65 - 127**: frames from 65 to 127 bytes.
- **128 - 255**: frames from 128 to 255 bytes.
- **256 - 511**: frames from 256 to 511 bytes.
- **512 - 1023**: frames from 512 to 1023 bytes.
- **1024 - 1518**: frames from 1024 to 1518, or 1522 (C-VLAN), 1526 (S-VLAN), or 1530 (E-VLAN) bytes.
- **> 1518**: frames with more than 1518, or 1522 (C-VLAN), 1526 (S-VLAN), or 1530 (E-VLAN) bytes.

Throughput

- **Bandwidth**: Gives the receiving data rate expressed in Mbps.
- **Utilization**: Gives the percentage of line rate utilization.
- **Frame Rate**: Gives the receiving number of frames (including bad frames, Broadcast frames and Multicast frames) in fps (Frame Per Second).

Total Frame Counts

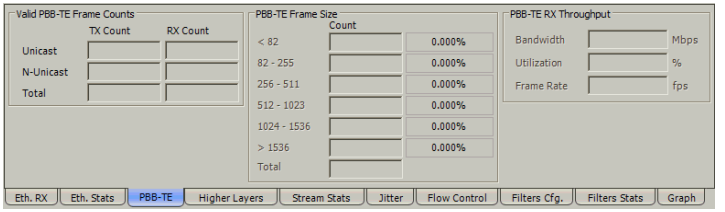
- **RX/TX Count**: Gives the total of all received/transmitted valid and invalid frames.

PBB-TE

Analyzes streams with PBB-TE data traffic.

Note: *The **PBB-TE** check box has been selected during the test setup to give access to the PBB-TE analysis. Refer to PBB-TE on page 106 for more information.*

Click **TEST**, **Traffic Analyzer**, and **PBB-TE**.



Valid PBB-TE Frame Counts

Note: ***TX Count** is not available when **Through Mode** is selected.*

- **Unicast**: The number of PBB-TE Unicast frames transmitted/received without any FCS errors.
- **N-Unicast (Non-Unicast)**: The sum of PBB-TE frames transmitted/received without any FCS errors.
- **Total**: The number of PBB-TE frames transmitted/received without any FCS error.

PPB-TE Frame Size

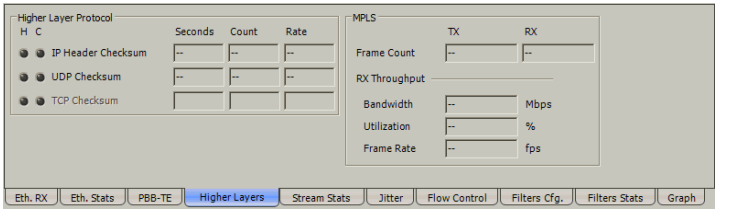
- **Count**: Gives the count of each received PBB-TE frame size (valid and invalid).
- **Total**: Gives the percentage ratio of each received PBB-TE frame size based on the total count of frames.
- **< 82**: PBB-TE frames with less than 82 bytes.
- **82 - 255**: PBB-TE frames from 82 to 255 bytes.
- **256 - 511**: PBB-TE frames from 256 to 511 bytes.
- **512 - 1023**: PBB-TE frames from 512 to 1023 bytes.
- **1024 - 1536**: PBB-TE frames from 1024 to 1536 bytes.
- **> 1536**: PBB-TE frames with more than 1536 bytes.

PBB-TE RX Throughput

- **Bandwidth**: Gives the receiving PBB-TE data rate expressed in Mbps.
- **Utilization**: Gives the percentage of PBB-TE line rate utilization.
- **Frame Rate**: Gives the receiving number of PBB-TE frames (including bad frames) in fps (Frame Per Second).

Higher Layers

Click **TEST**, **Traffic Analyzer**, and **Higher Layers**.



Higher Layer Protocol

Note: *When MPLS is enabled, the following statistics does not include the MPLS frames.*

IP Header Checksum: Indicates that IP datagrams received have invalid IP header checksum. **IP Header Checksum** is only available with IPv4.

UDP Checksum: Indicates that the UDP segments received have invalid UDP checksum. UDP Checksum is not available with TCP Throughput test (RTU-310)

TCP Checksum (RTU-310): Indicates that the TCP segments received have invalid TCP checksum. TCP Checksum is only available with TCP Throughput test.

MPLS

Note: *MPLS is only availabe when enabled from the test setup.*

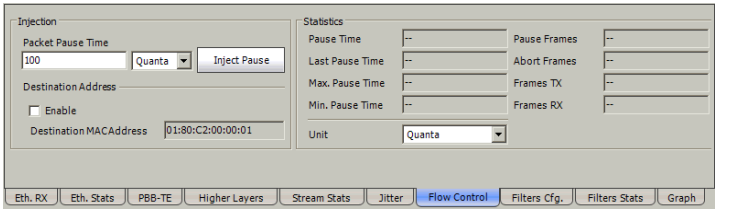
Frame Count: Indicates repectively the count of transmitted (TX) and received (RX) MPLS EtherType (0x8847 or 0x8848) frames regardless if FCS is good or not.

RX Throughput

- **Bandwidth**: Gives the receiving MPLS data rate expressed in Mbps.
- **Utilization**: Gives the percentage of MPLS line rate utilization.
- **Frame Rate**: Gives the receiving number of MPLS frames (including bad frames, in fps (Frame Per Second).

Flow Control

Click **TEST**, **Traffic Analyzer**, and **Flow Control**.



Note: *One Quanta equals 512 bits-time. For 1 Gbps interface, one Quanta equal 0.512 µs; for 10 Gbps interface, one Quanta equal 51.2 ns.*

Injection

Note: *Flow Control Injection is available with **Frame Analyzer** test only. Not available when **Through Mode** (RTU-310) is selected.*

➤ **Packet Pause Time**: Enter the pause time value to be transmitted. The default setting is **100** Quanta. Choices are:

Interface	Range	
	Quanta	*µs/ns*
10 Mbps	**0** to **65535**	**0** to **3355392** *µs*
100 Mbps	**0** to **65535**	**0** to **335539.2** *µs*
1000 Mbps	**0** to **65535**	**0** to **33553.92** *µs*
1 Gbps	**0** to **65535**	**0** to **3355.392** *µs*
10 Gbps	**0** to **65535**	**0** to **3355392** *ns*

Note: *When entering a value in μs/ns it will be rounded to the closest multiple of 0.512 μs for 1000 Mbps, 5.12μs for 100 Mbps, 51.2μs for 10 Mbps, and 51.2 ns.*

Unit: Select the measurement unit. Choices are **Quanta** and *μsns* (nanoseconds). The default setting is **Quanta**.

Inject Pause button: Injects the defined packet pause time.

➤ **Destination MAC Address**

Enable: Allows enabling the destination MAC address. This setting is disabled by default.

Destination MAC Address: Allows entering the destination MAC address once enabled. The default setting is the control protocol multicast address: **01:80:C2:00:00:01**.

Statistics

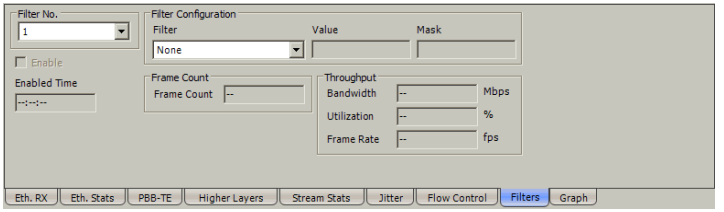
- **Pause Time**: Indicates the total number of pause time received from the link partner.
- **Last Pause Time**: Indicates the last pause time received from the link partner.
- **Max. Pause Time**: Indicates the maximum pause time received from the link partner.
- **Min. Pause Time**: Indicates the minimum pause time received from the link partner.
- **Unit**: Allows the selection of the measurement unit. Choices are **Quanta**, **ns**, **µs**, **ms**, and **s**. The default setting is **Quanta**.
- **Pause Frame**: The number of received valid flow-control frames. Frames that have a type/length field equal to 8808h will be counted as a pause frame.
- **Abort Frames**: Indicates the number of received pause frames with a Quanta equal to zero; cancelling the pause frames.
- **Frames TX**: Indicates the number of transmitted flow control pause frames.
- **Frames RX**: Indicates the number of received flow control frames having a MAC address equal to 01:80:C2:00:00:01 or equal to the MAC address of the receiving port.

Traffic Filters

Allows gathering statistics according to the programmed filters. Up to 10 filters can be enabled and defined.

Note: *The **Filters** tab is only available when the Advanced Traffic Filtering software option (SK-ADV-FILTERS) is not enabled. Refer to Software Options* on page 347.

Click **TEST**, **Traffic Analyzer**, and **Filters**.



Filter Number (Filter No.)

Allows the selection of the filter number (**1** to **10**). A filter used (enabled) for data capture will not be configurable and the message **Filter in use for data capture** is displayed; refer to *Filter* on page 224.

Filter Configuration

Allows to configure the criteria for the selected filter. The configuration is only possible when the **Enable** check box is not selected.

➤ **Filter**

Allows the selection of the filter to be used. The default setting is **None**. Choices are **None** and:

Category	Filter	Comment
Ethernet	**MAC Destination Address**	
	MAC Source Address	
	EtherType	Apply only to the last **EtherType** occurrence when VLAN is used.
	Frame Format	Choices are **Ethernet II**, **802.3 LLC**, and **802.3 SNAP**.
	VLAN #1 ID	C-VLAN ID
	VLAN #2 ID	S-VLAN ID
	VLAN #3 ID	E-VLAN ID
	VLAN #1 Priority	C-VLAN Priority
	VLAN #2 Priority	S-VLAN Priority
	VLAN #3 Priority	E-VLAN Priority
IPv4	**IPv4 Destination Address**	
	IPv4 Source Address	
	IPv4 TOS	
	IPv4 Precedence	
	IPv4 Protocol	
	IPv4 DiffServ	

Category	Filter	Comment
IPv6[a]	**IPv6 Destination Address**	
	IPv6 Source Address	
	IPv6 Flow Label	
	IPv6 Next Header	Apply only to the last next header occurrence when extension headers are used.
	IPv6 Traffic Class	
	IPv6 Precedence	
	IPv6 DiffServ	
Higher Layer	**TCP Destination Port**	Apply to IPv4 and IPv6.
	TCP Source Port	
	UDP Destination Port	
	UDP Source Port	
MPLS[a]	**MPLS Label 1**	
	MPLS Label 2	
	MPLS COS 1	
	MPLS COS 2	
PBB-TE[a]	**PBB-TE-MAC Source**	
	PBB-TE B-MAC Destination	
	PBB-TE B-VLAN ID	
	PBB-TE B-VLAN Priority	
	PBB-TE I-TAG SID	
	PBB-TE I-TAG Priority	

a. These filters are only available when the corresponding software option is enabled. Refer to *Software Options* on page 347.

➤ **Value**

Allows entering the value associated to the selected filter. See *Overview* on page 162 for more information on possible values.

➤ **Mask**

Allows masking the defined filter value. A bit mask of **1** indicates that the corresponding bit in the value is compared for the match. A bit mask of **0** indicates that the corresponding bit in the value is ignored.

- ➤ For binary values, enter the mask value in binary format.
- ➤ For decimal values, enter the mask value in hexadecimal format.
- ➤ For IPv4 address field, enter the mask in decimal format.
- ➤ For IPv6 address field, enter the mask in hexadecimal format.
- ➤ For MAC address, enter the mask value in hexadecimal format.

Enable

Once the filter is configured, select the **Enable** check box to enable the current filter. A filter can be enabled or disabled even when the test is running.

Enabled Time

Indicates the time during which the filter is enabled (see *Enable* on page 218).

Filter in use for data capture

The message, **Filter in use for data capture**, is displayed to indicate that the selected filter is in use by the capture tool. See *Filter* on page 224 for more information.

Note: *It is not possible to modify or disable a filter that is already in use for capture.*

Frame Count

Indicates the number of frame matching the configured filter's criteria.

Throughput

Indicates throughput statistics of frame matching the configured filter's criteria.

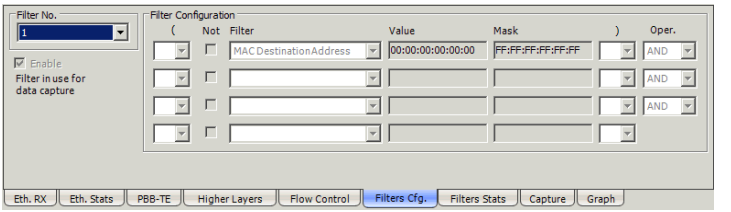
- **Bandwidth**: Gives the receiving data rate expressed in Mbps.
- **Utilization**: Gives the percentage of line rate utilization.
- **Frame Rate**: Gives the receiving number of frames (including bad frames) in fps (Frame Per Second).

Traffic Filter Configuration

Allows gathering statistics according to the programmed filters. Up to 10 filters having up to four operands each can be defined and enabled.

Note: *The **Filter Cfg** tab is only available when the Advanced Traffic Filtering software option (SK-ADV-FILTERS) is enabled. Refer to Software Options* on page 347.

Click **TEST**, **Traffic Analyzer**, and **Filters Cfg**.



Filter Number (Filter No.)

Allows the selection of the filter number (**1** to **10**).A filter used (enabled) for data capture will not be configurable and the message **Filter in use for data capture** is displayed; refer to *Filter* on page 224.

Filter Configuration

The filter configuration section allows to configure the filter criteria for the selected filter. The configuration is only possible when the **Enable** check box is not selected.

"**(**" and "**)**": The open and close parenthesis may be useful to control the precedence of operands when more than two operands are used. Only one level of parenthesis is supported. When no parenthesis are used, a logical **AND** will have precedence over a logical **OR**.

Not: When selected, add the logical negation (not equal) operator for the operand filter defined at its right.

Filter: Allows the selection of the filter to be used. The default setting is **None**. See *Filter* on page 216 for the filter list.

Value: Allows entering the value associated to the selected filter. See *Overview* on page 162 for more information on possible values.

Mask: Allows masking the defined filter value. A bit mask of **1** indicates that the corresponding bit in the value is compared for the match. A bit mask of **0** indicates that the corresponding bit in the value is ignored.

- For binary values, enter the mask value in binary format.
- For decimal values, enter the mask value in hexadecimal format.
- For IP address field, enter the mask in decimal format.
- For MAC address, enter the mask value in hexadecimal format.

Oper.: Allows the selection the logical operator (**AND** or **OR**) between two operands.

Enable

Once the filter is configured, select the **Enable** check box to enable the current filter. However, if the filter configuration contains errors, it will not be possible to enable it. A filter can be enabled or disabled even when the test is running.

Filter in use for data capture

The message, **Filter in use for data capture**, is displayed to indicate that the selected filter is in use by the capture tool. See *Filter* on page 224 for more information.

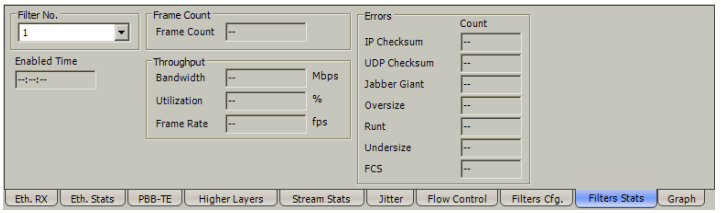
Note: *It is not possible to modify or disable a filter that is already in use for capture.*

Traffic Filter Stats

Allows gathering statistics according to the programmed filters (see *Traffic Filters* on page 215).

Note: *The **Filter Stats** tab is only available when the Advanced Traffic Filtering software option (SK-ADV-FILTERS) is enabled. Refer to Software Options* on page 347.

Click **TEST**, **Traffic Analyzer**, and **Filters Stats**.



Filter Number (Filter No.)

Allow the selection of the filter number (**1** to **10**).

Enabled Time

Indicates the time during which the filter is enabled (see *Enable* on page 221).

Frame Count

Indicates the number of frame matching the configured filter's criteria.

Throughput

Indicates throughput statistics of frame matching the configured filter's criteria.

- **Bandwidth**: Gives the receiving data rate expressed in Mbps.
- **Utilization**: Gives the percentage of line rate utilization.
- **Frame Rate**: Gives the receiving number of frames (including bad frames) in fps (Frame Per Second).

Errors

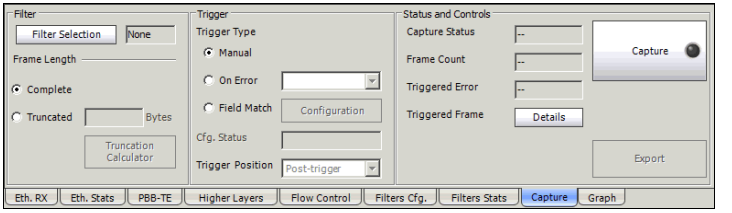
Indicates respectively the number of frames matching the configured filter's criteria having **IP Header Checksum**, **UDP Checksum**, **Jabber/Giant**, **Oversize**, **Runt**, **Undersize**, or **FCS** errors. See *Ethernet RX* on page 203 and *Higher Layers* on page 210 for more information on errors.

Capture

Capture is a troubleshooting tool used to capture received data traffic and save complete or truncated frames into a file. It allows to precisely observe network data, to understand errors, and unwanted behavior.

Note: *The Capture tab is only available with Frame Analyzer application type on* ***Port 1*** *when the data capture software option (SK-DATA-CAPTURE) is enabled. Refer to Software Options* on page 347*. Not supported in through mode.*

Click **TEST**, **Traffic Analyzer**, and **Capture**.



Filter

Allows to select the criteria of the frames to be captured.

➤ **Filter Selection** allows the selection of the filter number that will be used as the criteria for the frame capture. Refer to *Filter Selection* on page 510 for more information. **None** indicates that there is no filter selected meaning that all received frames will be captured.

Note: *The selected filter will be reserved for data capture and will not be available for filter configuration.*

➤ **Frame Length**

Allows to select the length of the frame that will be saved in the capture buffer.

➤ **Complete** captures the entire frames.

➤ **Truncated** captures only the first specified number of bytes per frame. Use either the **Bytes** field to manually enter the number of bytes per frame or click on the **Truncation Calculator** button for automatic bytes per frame calculation.

Bytes allows the selection of the number of bytes that will be saved in the capture buffer for each frame captured. Choices are from **14** to **1023** bytes. The default value is 18 bytes.

Truncation Calculator allows to define the frame length in bytes by selecting the Header layer, IP version, encapsulation, and additional payload length of the frame. Refer to *Truncation Calculator* on page 511 for more information.

Trigger

➤ **Trigger Type**: Allows to define the trigger source criterion that will be used to automatically start/stop the capture when a received frame matches the filter and the trigger criteria.

➤ **Manual**: Automatically start the frame capture when the **Capture** button is on (green LED) and the test is started (see *Global Test Status and Controls* on page 44).

➤ **On Error**: Select the error that will be used as the trigger to start the frame capture.

FCS
Jabber
Oversize (Available when **Oversize Monitoring** is enabled. See *Oversize Monitoring* on page 203)
Runt
Undersize
IP Checksum
UDP Checksum
TCP Checksum
Any Type (Any of the above errors).

➤ **Field Match**: Select the field match that will be used as the trigger to start the frame capture. Refer to *Field Match Configuration* on page 512 for more information.

Cfg. Status: Indicates the status of the configured field match configuration: **Valid** or **Invalid**. A valid status is required to be able to start the capture.

- **Trigger Position**: Allows the selection of the triggered frame position within the buffer.
  - **Post-Trigger**: The trigger frame is located at the beginning of the buffer meaning that the buffer will contain the triggered frame with the following frames.
  - **Mid-Trigger**: The trigger frame is located at the middle of the buffer meaning that the buffer will contain the triggered frame with the preceding and following frames.
  - **Pre-Trigger**: The trigger frame is located at the end of the buffer meaning that the buffer will contain the triggered frame with the preceding frames.

Status and Controls

- **Capture Status**: Indicates the status of the data capture:
  - **"--"**: The capture is not started and has not run yet.
  - **Armed...**: The capture is started but waiting for the trigger event.
  - **Capturing...**: The capture is in progress. For **Post-Trigger** and **Mid-Trigger** mode, the trigger event has been captured and the buffer is filling up.
  - **Completed**: The capture is completed.
- **Frame Count**: Indicates the number of frames captured that matches the selected filter criteria. However, for **Mid-trigger** and **Pre-Trigger**, the frame counter will only be available when the capture is completed.
- **Triggered Error**: When trigger on error is selected, it indicates the error that activated the trigger.
- **Triggered Frame - Details**: Gives details on the triggered frame. Refer to *Triggered Frame Details* on page 514 for more information.

- **Capture** button: Allows to start/stop the data capture. The test must be running (refer to *Global Test Status and Controls* on page 44) in order to start capturing and recording data into the buffer. The **Capture** button is not available when the trigger on field match is selected while its trigger parameters are not valid.

  No data will be recorded in the buffer if no frame matches the filter and the trigger criteria during the data capture.

  The data capture stops automatically once the buffer is full. The maximum buffer capacity is 65 KBytes for FTB-8510B and 256 MBytes for FTB-8510G.

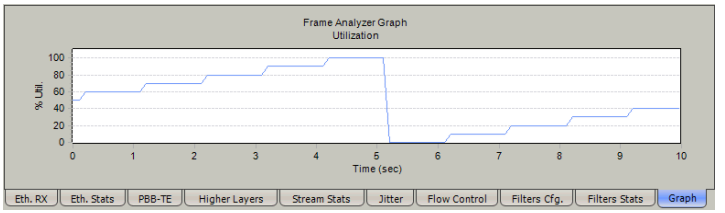
  When the capture stops or is manually stopped, the following message is displayed: **Capture completed. Press Export to save captured data (the test must be stopped)**. To avoid losing the captured data, the data must be exported and saved into a file before restarting the test or creating a new test.

- **Export** button: Allows to export the data capture into a .pcap file format and to view the file using **Wireshark**. Refer to *Data Capture Export* on page 515 for more information.

Graph

Gives the graph showing the test measurement results.

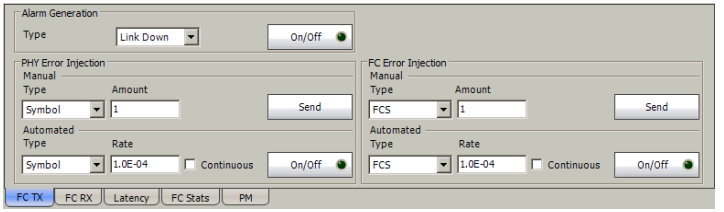
Click **TEST**, **Traffic Analyzer**, and **Graph**.



The X axis shows the time in seconds while the Y axis shows the percentage utilization.

FC TX

Click **TEST**, **Traffic Analyzer**, and **FC TX**.



Alarm Generation

- **Type**: The following error is available: **Link Down**. Note that a **Pattern Loss** alarm will be detected when injecting a **Link Down** while the **PSP (Link Protocol)** check box is selected (Refer to *PSP (Link Protocol)* on page 146).
- **On/Off** button: The **On/Off** button is used to activate/deactivate the selected automated error continuously. This setting is disabled (Off) by default.

PHY Error Injection

- **Type**: The following errors are available with both manual and automated injection modes: **Symbol Error**.
- **Amount**: Allows the selection of the amount of manual error to be generated. Choices are **1** through **50**. The default setting is **1**.
- **Send** button: Click **Send** to manually generate error(s) according to the error type and the amount of error.
- **Rate**: Click the **Rate** field to select the rate for the automated error. Choices are: **1.0E-02**, **1.0E-03**, **1.0E-04**, **1.0E-05**, **1.0E-06**, **1.0E-07**, **1.0E-08**, **1.0E-09** or user definable from **1.0E-09** to **1.0E-02**. The default setting is **1.0E-04**.
- **Continuous**: Generates the selected error for each generated frame when the **Continuous** check box is selected while the **On/Off** button is enabled (On). The **Continuous** check box is cleared by default.
- **On/Off** button: The **On/Off** button is used to activate/deactivate the selected automated error at the rate specified or continuously. This setting is disabled (Off) by default.

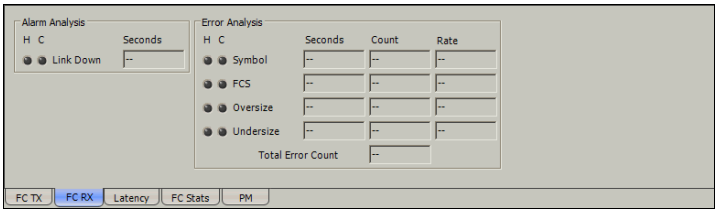
FC Error Injection

Note: *FC Error Injection is available with Framed Layer 2 only.*

- **Type**: The following errors are available with both manual and automated injection modes: **FCS (RTU-310)**, **C**, **Oversize**, and **Undersize**.
- **Amount**: Allows the selection of the amount of manual error to be generated. Choices are **1** through **50**. The default setting is **1**.
- **Send** button: Click **Send** to manually generate error(s) according to the error type and the amount of selected error.
- **Rate**: Click the **Rate** field to select the rate for the automated error. Choices are: **1.0E-02**, **1.0E-03**, **1.0E-04**, **1.0E-05**, **1.0E-06**, **1.0E-07**, **1.0E-08**, **1.0E-09** or user definable from **1.0E-09** to **1.0E-02**. The default setting is **1.0E-04**.
- **Continuous**: Generates the selected error for each generated frame when the **Continuous** check box is selected while the **On/Off** button is enabled (On). The **Continuous** check box is cleared by default.
- **On/Off** button: The **On/Off** button is used to activate/deactivate the selected automated error at the rate specified or continuously. This setting is disabled (Off) by default.

FC RX

Click**TEST**, **Traffic Analyzer**, and **FC RX**.



Alarm Analysis

➤ **Link Down**: Indicates that the fibre channel connection is down. The fibre channel connection is down if there is a local or a remote fault condition including LOS, loss of code-group synchronization, and PSP failure (when enabled).

Note: *Alarms/Errors are updated only during test execution.*

Error Analysis

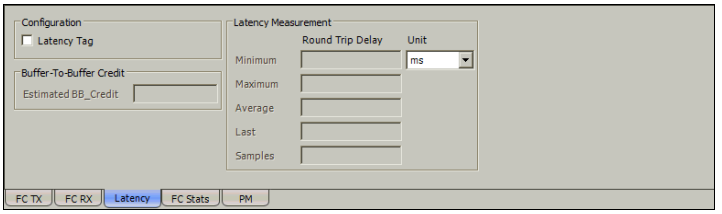
- **Symbol** (FC 1x, and 2x): A **Symbol** error is declared when an invalid symbol excluding the SOF and EOF is detected.
- **FCS**: The number of received **Framed Layer 2** or **Framed Layer 1** (with xPAT) having an invalid FCS.
- **Oversize**: An Oversize error is declared when a Framed Layer 2 with a valid FCS exceeds 2148 bytes in length.
- **Undersize**: An Undersize error is declared when a Framed Layer 2 with a valid FCS is smaller than 36 bytes in length.

Total Error Count: Indicates the total number of errors including all the above errors.

FC Latency

Note: *Available with **FC Framed Layer 1** and **FC Framed Layer 2** only.*

Click**TEST**, **Traffic Analyzer**, and **Latency**.



Latency is only available when the two following conditions are met:

- Framed Layer 1 or Framed Layer 2 has been selected from the BERT Configuration panel on both TX and RX Configuration.
- The test pattern should be different than CRPAT, CSPAT, and CJTPAT.

Configuration

Latency Tag: Allows Latency and Buffer-to-Buffer Credit measurements when the **Latency Tag** check box is selected. The **Latency Tag** check box is cleared by default.

Latency Measurements

Round Trip Delay

- **Maximum**: Indicates the maximum time taken for a bit to travel from the RTU-310/310G transmitter back to its receiver after crossing a far-end loopback test set.
- **Minimum**: Indicates the minimum time taken for a bit to travel from the RTU-310/310G transmitter back to its receiver after crossing a far-end loopback test set.
- **Average**: Indicates the average time taken for a bit to travel from the RTU-310/310G transmitter back to its receiver after crossing a far-end loopback test set.
- **Last**: Indicates the last time taken for a bit to travel from the RTU-310/310G transmitter back to its receiver after crossing a far-end loopback test set.
- **Samples**: Indicates the number of samples used for the Round Trip Delay test.
- **Unit**: Allows the selection of the unit for the Latency measurement values. Choices are **s**, **ms**, and **µs**. The default setting is **ms**.

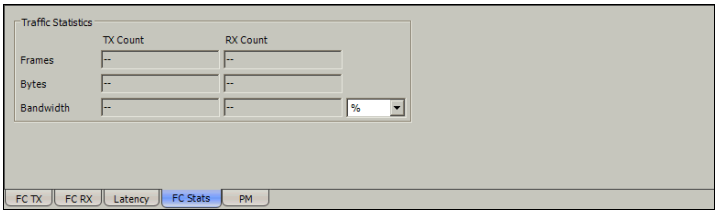
Buffer-to-Buffer Credit

Estimated BB_Credit: Estimated BB_Credit indicates the estimated number of frame buffers that the remote port has available to receive frames based on the round trip latency measurements.

FC Statistics

Note: *Available with **FC Framed Layer 1** and **FC Framed Layer 2** only.*

Click**TEST**, **Traffic Analyzer**, and **FC Stats**.



Traffic Statistics

- **TX Frames**: Indicates the number of Fibre Channel frames transmitted including frames with errors and aborted frames.
- **RX Frames**: Indicates the number of Fibre Channel frames received including frames with errors and aborted frames.
- **TX Bytes**: Indicates the number of Fibre Channel bytes transmitted including the frame delimiters.
- **RX Bytes**: Indicates the number of Fibre Channel bytes received including the frame delimiters.
- **TX Bandwidth**: Displays the average traffic being transmitted.
- **RX Bandwidth**: Displays the average traffic being received.
- In the unit list, select the **TX** and **RX bandwidth** unit. Choices are **%**, **Mbps**, **MBps**, and **fps**. The default setting is **%**.

11 WIS Tabs

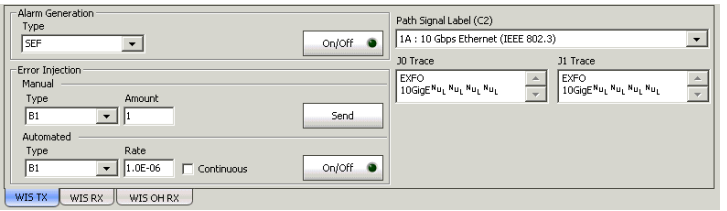
Note: *The **WIS** tabs are only available with 10 GigE WAN transceiver mode. Not available with **Smart Loopback** test. Not available with RTU-310.*

Tab	Available with		Page
	Ethernet	Fibre Channel[a]	
WIS TX	X		239
WIS RX	X		243
WIS OH RX	X		246

a. Not available with RTU-310G.

WIS TX

Press **TEST**, **WIS**, and **WIS TX**.



Alarm Generation

Note: *Alarm generation is available with BERT test only.*

- **Type**: The following alarms are available. The default setting is **SEF**.
  - **SEF** (Severely Errored Framing): Generates more than four consecutive errored framing patterns.
  - **LOF** (Loss Of Frame): Generates a non-valid framing pattern.
  - **AIS-L** (Alarm Indication Signal - Line): Generates a “111” pattern for the bits 6, 7 and 8 of the K2 byte.
  - **RDI-L** (Remote Defect Indication - Line): Generates a “110” pattern for the bits 6, 7 and 8 of the K2 byte.
  - **LOP-P** (Loss Of Pointer): Generates a non-valid pointer.
  - **AIS-P** (Alarm Indication Signal - Path): Generates an all-ones pattern for H1 and H2 bytes.
  - **LCD-P** (Loss of Code-Group Delineation - Path): Generates a PCS link down.
  - **UNEQ-P** (Unequipped - Path): Generates samples of unequipped STS signal labels (C2 is set to “00 H”).
  - **RDI-P** (Remote Defect Indication - Path): Generates a “100” pattern for bits 5, 6 and 7 of the G1 byte.
  - **ERDI-PSD** (Enhanced RDI - Path Server Defect): Generates a “101” pattern for bits 5, 6 and 7 of the G1 byte.

- **ERDI-PCD** (Enhanced RDI - Path Connectivity Defect): Generates a "110" pattern for bits 5, 6 and 7 of the G1 byte.
- **ERDI-PPD** (Enhanced RDI - Path Payload Defect): Generates a "010" pattern for bits 5, 6 and 7 of the G1 byte.

- **On/Off** button: The On/Off button is used to activate/deactivate the selected alarm. This setting is disabled (Off) by default.

Note: *For the **SEF** alarm, the On/Off button turns Off automatically once the **SEF** alarm has been sent.*

Error Injection

Note: *Error injection is available with BERT test only.*

- **Type**: The following errors are available with both **Manual** and **Automated** injection modes: **B1**, **B2**, **B3**, **REI-L**, and **REI-P**.
- **Amount**: Select the amount of manual error to be generated.

  Choices are **1** to **50**. The default setting is **1.**
- **Send** button: Press **Send** to manually generate error(s) according to the error type and the selected amount of errors.
- **Rate**: Press the Rate field to select the rate for the automated error. Choices are: **1.0E-2**, **1.0E-3**, **1.0E-4**, **1.0E-5**, **1.0E-6**, **1.0E-7**, **1.0E-8**, **1.0E-9**, or user definable from **1.0E-09** to **6.4E-06**. The default setting is **1.0E-06**.
- **Continuous**: Generates the selected error for each generated frame when the **Continuous** check box is selected while the **On/Off** button is enabled (On). The **Continuous** check box is cleared by default.
- **On/Off** button: The On/Off button is used to activate/deactivate the selected automated error at the rate specified or continuously. This setting is disabled (Off) by default.

Path Signal Label (C2)

The C2 byte is allocated to indicate the content of the STS SPE, including the status of the mapped payload. The default setting is **1A** : **10 Gbps Ethernet (IEEE 802.3)**.

J0 Trace

Message: Enter the J0 trace value in 16 bytes format. The default message is **EXFO 10GigE**.

J1 Trace

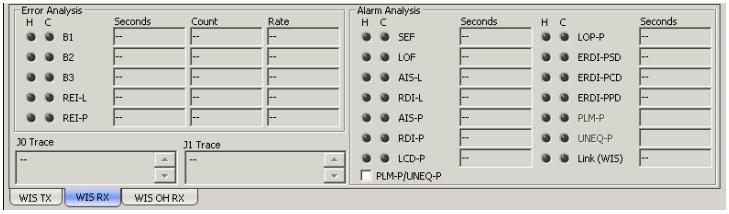
Message: Enter the J1 trace value in 16 bytes format. The default message is **EXFO 10GigE**.

Note: *16-bytes selection allows typing up to 15 bytes (a CRC-7 byte will be added in front for a total of 16 bytes).*

Note: *J0 and J1 values should be 7-bit ASCII suitable characters including the ITU T.50 Characters* on page 66.

WIS RX

Click **TEST**, **WIS**, and **WIS RX**.



Error Analysis

- **B1** (BIP-8, Bit-Interleave Parity - 8 bits): The B1 (BIP-8) error indicates a Section parity error by performing a routine even-parity check over all Section bits of the previous frame of a composite signal (located in the first STS-1 of an STS-n signal).
- **B2** (BIP-1536, Bit-Interleave Parity - 1536 bits): The B2 error indicates a Line parity error by performing a routine even-parity check over all Line bits of the LOH and STS-1 frame capacity of the previous frame of a composite signal (located in every STS-1 of an STS-n signal).
- **B3** (BIP-8, Bit-Interleave Parity - 8 bits): The B3 (BIP-8) error indicates a Path parity error by performing a routine even-parity check over all Path bits of the previous SPE excluding the LOH and SOH.

- **REI-L** (Remote Error Indicator - Line): The REI-L error is declared when bits 5 through 8 of the M0 byte contain one pattern from the following binary range: “0001” through “1000” (1 to 8) (located in the first STS-1 of an STS-n signal).
- **REI-P** (Remote Error Indicator - Path): The REI-P error is declared when bits 1 through 4 of the G1 byte contain one pattern from the following binary range: “0001” through “1000” (1 to 8) (located in every STS-1 of an STS-n signal).

Alarm Analysis

- **SEF** (Severely Errored Framing): A SEF defect indicates that a minimum of four consecutive errored framing patterns are received.
- **LOF** (Loss Of Frame): A Loss Of Frame alarm indicates that a Severely Error Framing (SEF) defect on the incoming SONET signal persists for at least 3 milliseconds.
- **AIS-L** (Alarm Indication Signal - Line): The AIS-L alarm is declared when bits 6, 7 and 8 of the K2 byte contain the “111” pattern in five consecutive frames.
- **RDI-L** (Remote Defect Indication - Line): The RDI-L alarm is declared when bits 6, 7, and 8 of the K2 byte contain the “110” pattern in five consecutive frames.
- **AIS-P** (Alarm Indication Signal - Path): The AIS-P alarm is declared when the H1 and H2 bytes for a STS path contain an all-ones pattern in three consecutive frames or more.
- **RDI-P** (Remote Defect Indication - Path): The RDI-P alarm is declared when bits 5, 6 and 7 of the G1 byte contain the “100” or “111” pattern in ten consecutive frames.
- **LCD-P** (Loss of Code-Group Delineation - Path): Indicates that the signal synchronization has been lost and valid code-groups are no longer being delineated from the received payload stream being passed to the PCS.

- **LOP-P** (Loss Of Pointer - Path): For non-concatenated payloads, the LOP-P alarm indicates that a valid pointer is not found in N consecutive frames (where $8 \leq N \leq 10$), or N consecutive NDFs (“1001” pattern) are detected.
- **ERDI-PSD** (Enhanced RDI - Path Server Defect): The ERDI-PSD alarm is declared when bits 5, 6 and 7 of the G1 byte contain the “101” pattern in five to ten consecutive frames.
- **ERDI-PCD** (Enhanced RDI - Path Connectivity Defect): The ERDI-PCD alarm is declared when bits 5, 6 and 7 of the G1 byte contain the “110” pattern in five to ten consecutive frames.
- **ERDI-PPD** (Enhanced RDI - Path Payload Defect): The ERDI-PPD alarm is declared when bits 5, 6 and 7 of the G1 byte contain the “010” pattern in five to ten consecutive frames.
- **PLM-P** (Payload Label Mismatch - Path): The PLM-P is declared upon receipt of five consecutive frames with mismatched STS signal labels.
- **UNEQ-P** (Unequipped - Path): UNEQ-P is declared when the C2 byte contains “00 H” in five consecutive frames.
- **Link (WIS)**: Link (WIS) is declared when at least one of the following errors is present: **AIS-P**, **LOF**, **PLM-P**, **SEF**, **LOP**, or **AIS-L**.
- **Enable PLM-P/UNEQ-P** (Payload Label Mismatch - Path / Unequipped - Path): Allows enabling the Signal Label Mismatch for the expected message defined as well as UNEQ-P monitoring.

J0 Trace

Displays the J0 value in 16-bytes format.

J1 Trace

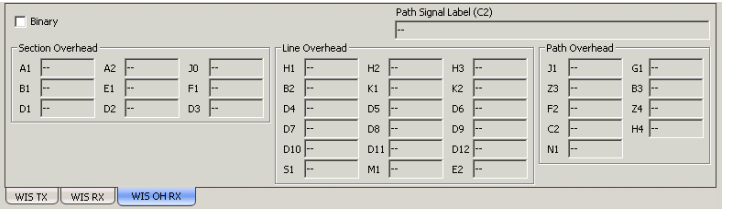
Displays the J1 value in 16-bytes format.

Note: *The <crc7> represents the CRC-7 for a 16-bytes format.*

WIS OH RX

Allows verification of the transport overhead information received.

Click **TEST**, **WIS**, and **WIS OH RX**.



Binary

Allows displaying all overhead values either in binary (when enabled) or hexadecimal (when disabled). This setting is disabled by default.

Section Overhead

Note: *Monitor the first timeslot only.*

- **A1** and **A2**: Framing. The value should be hexadecimal **F6** for A1 and **28** for A2.
- **J0**: Trace: STS-1 #1 of an electrical or OC-N signal.
- **B1**: BIP-8.
- **E1**[1]: Orderwire.
- **F1**[1]: User.
- **D1**[1], **D2**[1] and **D3**[1]: Data Communications Channel (DCC).

Line Overhead

Note: *Monitor the first timeslot only.*

- **H1** and **H2**: Pointer
- **H3**: Pointer Action
- **B2**: BIP-1536
- **K1** and **K2**: Automatic Protection Switching (APS)
- **D4** through **D12**: Data Communications Channel (DCC)
- **S1**[1]: Synchronization Status (STS-1 #1 of an electrical or OC-N signal)
- **M1**: REI-L
- **E2**[1]: Orderwire

1. Not supported in 10GigE standard.

Path Overhead

- **J1**[1]: Trace.
- **B3**[1]: BIP-8
- **C2**: Signal Label
- **G1**: Status
- **F2**: User Channel
- **H4**[1]: Multiframe Indicator
- **Z3** and **Z4**: Growth
- **N1**: Tandem Connection

Path Signal Label (C2)

The C2 byte is allocated to indicate the content of the STS SPE, including the status of the mapped payloads.

1. Not supported in 10GigE standard..

12 IPTV Tabs

Note: *The IPTV tabs are available with Frame Analyzer application type on the RTU-310 module only. IPTV testing is supported on* ***Port 1*** *only. In order to operate the IPTV functionality, the IPTV software option must be enabled. Refer to* Available Options *on page 348. IGMP is not available when* ***Through Mode*** *is selected.*

IPTV Testing with the RTU-310

The RTU-310 module provides the capability to monitor 10 (default) streams in parallel when the **SK-IPTV-MON** option is enabled. The IPTV monitoring capacity can be increased to 100 streams when the **SK-IPTV-MAXSTREAM** is also enabled.

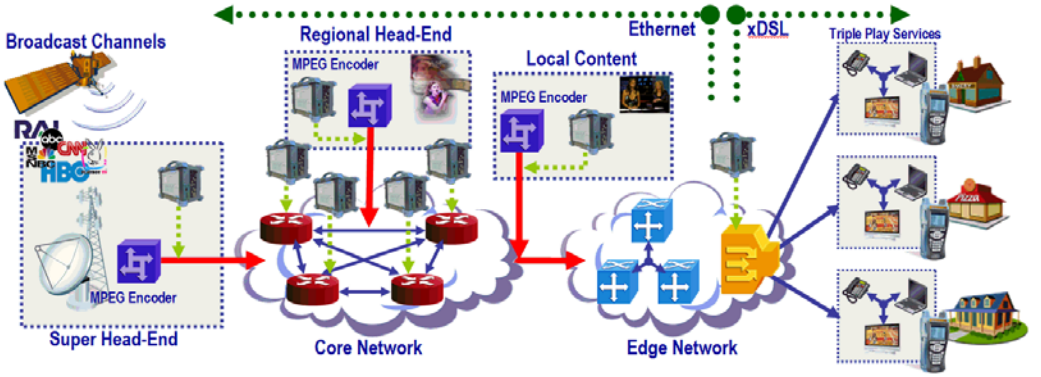
The RTU-310 IPTV software option provides over 45 different metrics and statistics including Media Delivery Index (MDI) and TR 101 290 metrics. The TR 101 290 includes PCR jitter and Priority 1 metrics. In addition, other key statistics such as IP packet metrics, stream rate, presence measurements and bandwidth utilization are available. These are necessary to correctly characterize an IPTV stream. MDI and TR 101 290 Priority 1 metrics are only available for Single Program Transport Stream (SPTS) MPEG-2 TS streams. Additionally, configurable alarm thresholds are provided on selected metrics for customized testing applications.

Important usability features include the auto-discovery of all valid media streams and user-definable stream labels for easy identification. The Auto–Discovery feature will automatically scan the network test point and display all IPTV streams carrying MPEG-2 TS traffic. Selecting which streams to monitor is accomplished by automatically adding the streams from the auto-discovery pool or by manually selecting them.

The Internet Group Management Protocol (IGMP) is a communication protocol used to manage the membership of Internet Protocol multicast groups. Depending on the location in the network and intended measurements, the IPTV streams may not be directly available. For a network element port, IGMP join requests must be used to access the stream. Up to one hundred IGMP requests (join/leave) can be issued at once.

For example when connecting on a switch port an IGMP join request may be required to access each multicast streams. When connecting to a SPAN or TAP port, the auto-discovery and auto-add features allow to add stream as they are discovered.

The RTU-310 module equipped with the IPTV option can be used at different points in the network to collect data and help isolate a fault affecting the IPTV service quality as described in the figure below.

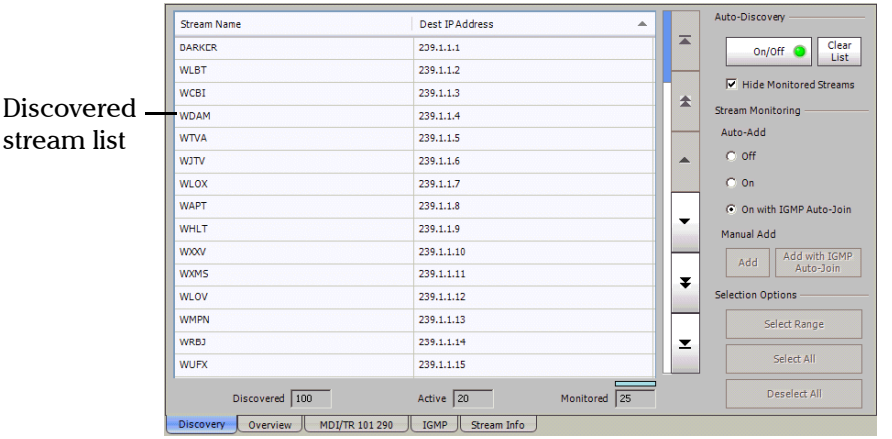


While monitoring the selected stream (via its IP address) in the IPTV network, all the functions supported via the **Frame Analyzer** application are also simultaneously available. This provides additional resources facilitating the troubleshooting of network issues that could provide an insight to IPTV detected problems.

Discovery

The **Discovery** page allows the auto-discovery function to automatically scans the network test point and displays a real-time list of all valid IPTV streams carrying MPEG-2 TS traffic. From the discovered stream list, the user can add the streams to collect statistics from.

To access the **Discovery** tab, click **TEST**, **IPTV**, and **Discovery**.



Each discovered stream is represented by its IP Address and stream name. Stream names are displayed only if an Alias Map is available. See for more details. Streams can be sorted using **IP address** or **Stream Name**.

The status of each stream, active or inactive, is visually presented as follow:

- Active: Streams on which MPEG-2 TS data is currently being received. Active streams are listed using black characters.
- Inactive: Streams that are no longer receiving MPEG-2 TS data. Inactive streams are listed using grey characters.

Monitored streams are streams that have been added for IPTV monitoring in the overview page. Monitored streams are highlighted with a light blue background.

Selected streams are highlighted with a dark blue background.

Auto-Discovery

- **On/Off** button: Scans the network test point to automatically identify IPTV and/or VoD streams that conform to the MPEG-2 transport stream format. Newly detected streams are appended to the discovery list. This setting is **Off** by default. Turning **Auto-Discovery Off** and **On** will not clear the previously discovered streams. The discovery process is independent from the test case start/stop status or the **Reset** function.
- **Clear List** button: Resets the list of discovered streams. If the Auto-Discovery is **On**, after clicking **Clear List**, the discovery list is refreshed. The clear operation doesn't affect the streams that are monitored.
- **Hide monitored Streams**: Filters out all the monitored streams from the discovered stream list. This option is selected by default.

Stream Monitoring

The **Add** function adds the streams to the stream monitoring list in the overview page. The **IGMP Auto-Join** function configures the system to issue join request to join a multicast group once a stream is added while the test is running or when the test will be started.

- **Auto-Add** automatically adds all active streams present in the discovered list to the stream monitoring list. This includes all the streams already in the discovered list and the incoming streams. It excludes the streams that are already in the monitoring list. The **Auto-Add** process is initiated when the test is started, and terminates when the test stops. The stream addition is suspended when the maximum number of monitored streams is reached.
  - **Off**: Select the **Off** option to disable the **Auto-Add** stream.
  - **On**: Select the **On** option to enable the **Auto-Add** to automatically add all the active streams.
  - **On with IGMP Auto-Join:** Select the **On with IGMP Auto-Join** option to enable the **Auto-Add** and to automatically issue a join request once the stream is added. This option should not be selected when connected to a SPAN or TAP port as no transmission to the network can be initiated through these type of ports.
- **Manual Add** buttons adds individual streams to the stream monitoring list. The **Add** and **Add with IGMP Auto-Join** buttons are disabled when the maximum number of monitored stream is reached. The **Add** and **Add with IGMP Auto-Join** buttons are only available when **Auto-Add** is **Off**.
  - **Add** Button: Clicking the **Add** button adds the selected streams to the stream monitoring list.
  - **Add with IGMP Auto-Join** button: Clicking the **Add with IGMP Auto-Join** button adds the selected streams and issues a join request.

Selection Options

Note: ***Selection Options*** *is not available when Auto-Add is selected. Only non-monitored streams can be selected.*

- **Select Range** selects all streams located between two selected streams including the boundaries. To select a range, select a first stream from the list, select a second stream from the list, and click **Select Range** to complete the selection.
- **Select All** selects all the non-monitored streams in the list.
- **Deselect All** deselects all the non-monitored streams in the list.

Statistics

The following statistics are reset when clicking on the **Clear List** button.

- **Discovered** indicates the number of streams on which MPTEG-2 TS data was detected.
- **Active** indicates the number of streams on which MPTEG-2 TS data is currently received.
- **Monitored** indicates the number of streams currently collecting statistics.

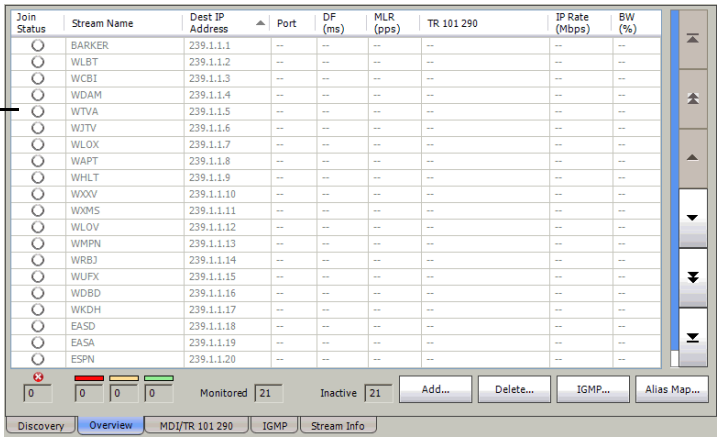
Overview

The **Overview** tab provides a summary of the key statistics that can be used as first alert information to evaluate the Quality of Experience (QoE) each monitored stream delivers to the end-user. This tab automatically organizes the Stream Name, its IP Address, MDI (Delay Factor, Medial Loss Rate), TR 101 290, IP rate, and Bandwidth Utilization using sorting criteria.

All information presented in the Overview page is updated in real-time. As new thresholds are crossed, alarmed streams are automatically sorted to the top of the page for easy viewing and highlighted in red along with the corresponding metric that caused the alarm.

To access the **Overview** tab, click **TEST**, **IPTV**, and **Overview**.

Stream monitoring list



The monitoring table allows to view the alarm status and metrics for up to 20 streams simultaneously. The number of streams that can be monitored simultaneously is based on the installed software options.

To organize the streams key statistics presentation, the Overview page supports several sorting criterion levels. The main sorting criterion is the Stream Alarm Status that automatically sorts the streams from the most important alarm group to the least (Red-Yellow-Green-White). The second sorting criterion is the Stream Activity Status that can either be Active (stream information is black) or Inactive (stream information is gray). The Active streams are presented first and are followed by the Inactive streams within each Stream Alarm Status group (the Red Stream Alarm Status group never shows Inactive streams, these automatically fall into the Yellow group). Finally a third criterion is used to sort in ascending or descending order of Stream Name or Dest IP Address within each Stream Alarm Status group. Of these last two criteria, the Dest IP Address is the default selection as highlighted by a small triangle in the column header. The selection of the **Stream Name** or **Dest IP Address** criterion is user controlled.

Alternatively it is also possible to override the Stream Alarm Status as the first criteria by selecting the **Join Status** column header as the main sorting criterion. Doing so the following sorting Join Status ordering can be achieved creating Failed-Joined-Joining-Idle or Idle-Joining-Joined-Failed groups. Then the Stream Alarm Status is applied within each group with the Dest IP Address presenting the streams in ascending order. Details about the Stream Alarm Status, Stream Activity Status, and Join Status description are presented below.

Column Description

➤ **Join Status**: Indicates the join status for each multicast stream only. The join status icons become grayed out when the test is stopped.

Icon	Status	Description
	Joining	The joining state is reported following a join request until the desired stream is received or the join timeout expires.
	Joined	The joined state is reported when the desired stream is received before the join timeout expires.
	Failed	The failed state is reported when the stream remains undetected within the join timeout. See **Join Timeout** on page 283. Upon failure, a leave request is issued on that stream.
	Idle	The idle state is reported initially for all multicast streams that are not member of a group and doesn't have the failed status.

➤ **Stream Name**: Indicates the configured name associated to an IP address in the Alias Map. See for more details.

➤ **Dest IP Address**: Indicates the IP address associated to the monitored stream.

➤ **Port**: Indicates the UDP port number associated to the monitored stream.

- **DF (ms)**: The Delay Factor (DF) provides a measure of the maximum packet delay variation over a period of 1 second. In other words, the metric presents in milliseconds how much buffer would be required in the next downstream network element to compensate for the media packet jitter. Note that by definition (as detailed in RFC 4445) a DF value representing a minimum of one line packet (in ms) is reported when no jitter exists in the network. This represents the minimum buffer size (in ms) required to properly process a media packet and this value changes depending on the media rate of the stream. For example, if no jitter exists in the network, a typical Standard Television stream with a media rate of 3.75 Mbps would exhibit a Delay Factor of 2.81 ms while for a High Definition Television stream of 10 Mbps the Delay Factor would be 1.05 ms.
- **MLR (pps)**: Indicates the count of lost packets in the last second (packets per second) as per RFC 4445, out-of-order and duplicate are considered lost packets.
- **TR 101 290**: By default this column presents the **PCR Jitter** value. If any of the supported TR 101 290 alarm occurs then the alarm temporarily replaces the PCR Jitter. Supported TR 101 290 alarms are **PCR Jitter**, **TS Sync Loss**, **Sync Byte Error**, **PAT Error2**, **CC Error**, **PMT Error2**, **PID Error Video**, and **PID Error Audio**.

  PCR Jitter (ms): Indicates the maximum absolute difference between a known reference and the PCR value decoded from the MPEG-2 Transport Stream packets in the last second.
- **IP Rate (Mbps)**: Indicates the number of IP bits received in the last second (Mbps).
- **BW (%)** (Bandwidth): Indicates the Ethernet bandwidth utilization of the stream.

Stream Status

The status of each stream, active or inactive, is visually presented as follow:

- Active: Streams on which MPEG-2 TS data is currently being received. Active streams are listed using black characters.
- Inactive: Streams that are no longer receiving MPEG-2 TS data. Inactive streams are listed using grey characters.

The alarm status of each stream is presented as follow:

Stream Name Background Color	Stream Alarm Status	Sorting order
Red	Streams in alarm/error	1
Yellow	Streams with historical alarm/error condition	2
Green	Streams without any alarm/error	3
White	Streams that have never been active	4

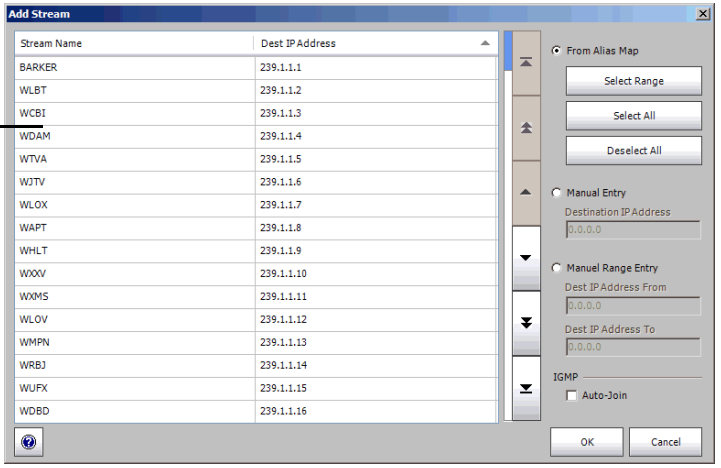
Statistics

- The  icon indicates the number of streams with a join status that is failed.
- *Red box* indicates the number of streams in alarm.
- *Yellow box* indicates the number of streams with fault history.
- Green box indicates the number of streams with no fault history.
- **Monitored** indicates the number of streams currently collecting statistics.
- **Inactive** indicates the number of inactive or pending streams.

Add Button

The **Add** button adds streams to the stream monitoring list. The **Add** button is disabled when the maximum number of monitored stream is reached.

Alias map list



Streams can be sorted using **IP address** or **Stream Name**.

Column Description

Stream Name: Indicates the configured name associated to an IP address in the Alias Map. See for more details.

Dest IP Address: Indicates the IP address associated to the stream presents in the Alias Map.

From Alias Map, when selected, allows the addition of stream(s) using the predefined streams available in the **Alias Map**.

- **Select Range** selects all streams located between two selected streams including the boundaries. To select a range, select a first stream from the list, select a second stream from the list, and click **Select Range** to complete the selection.
- **Select All** selects the entire streams in the list.

➤ **Deselect All** deselects all the streams in the list.

Manual Entry, when selected, adds one specific stream.

➤ **Destination IP Address**: Enter the IP address of the stream to be added.

Manual Range Entry, when selected, adds a range of streams.

➤ **Dest IP Address From**: Enter the first IP address of the range.

➤ **Dest IP Address To**: Enter the last IP address of the range.

The range only applies to the last portion of the IP addresses. The following example adds all streams IP addresses from 224.10.10.25 to 224.10.30 inclusively.

Dest IP Address From	224.10.10.**25**
Dest IP Address To	224.10.10.**30**

In this example, the streams that will be added are: 224.10.10.25, 224.10.10.26, 224.10.10.27, 224.10.10.28, 224.10.10.29, and 224.10.10.30.

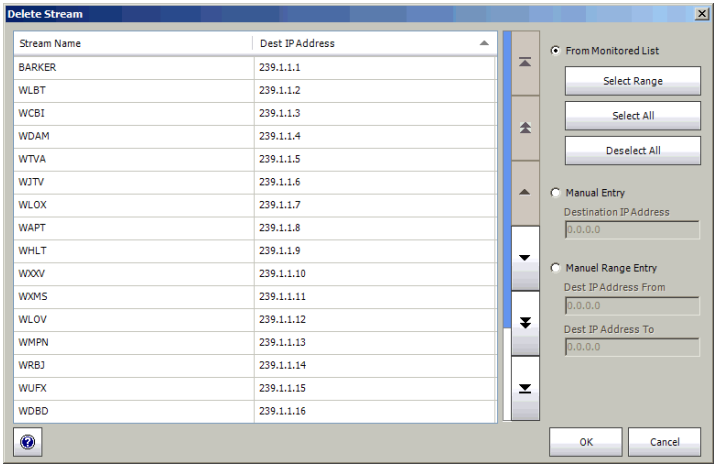
IGMP Auto-Join, when selected, enables the auto-join capability for all newly added streams.

Click **OK** to accept the selected streams to be added to the monitoring list.

Click **Cancel** to ignore all changes.

Delete Button

The **Delete** button removes streams from the stream monitoring list. Streams can be sorted using **IP address** or **Stream Name**.



Column Description

Stream Name: Indicates the configured name associated to an IP address in the Alias Map. See for more details.

Dest IP Address: Indicates the IP address associated to the monitored stream.

From Monitored List, when selected, allows the deletion of stream(s) from the current monitored list.

- **Select Range** selects all streams located between two selected streams including the boundaries. To select a range, select a first stream from the list, select a second stream from the list, and click **Select Range** to complete the selection.
- **Select All** selects the entire streams in the list.
- **Deselect All** deselects all the streams in the list.

Manual Entry, when selected, removes one specific stream.

➤ **Destination IP Address**: Enter the IP address of the stream to be deleted.

Manual Range Entry, when selected, removes a range of streams.

➤ **Dest IP Address From**: Enter the first IP address of the range.

➤ **Dest IP Address To**: Enter the last IP address of the range.

The range only applies to the last portion of the IP addresses. The following example removes all streams IP addresses from 224.10.10.25 to 224.10.30 inclusively.

Dest IP Address From	224.10.10.**25**
Dest IP Address To	224.10.10.**30**

In this example, the streams that will be removed are: 224.10.10.25, 224.10.10.26, 224.10.10.27, 224.10.10.28, 224.10.10.29, and 224.10.10.30.

Click **OK** to accept the selected streams to be removed from the monitoring list.

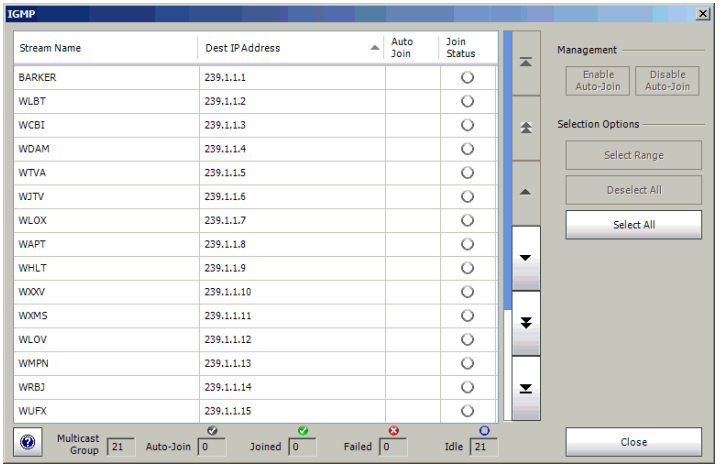
Click **Cancel** to ignore all changes.

Note: *In the event the **Delete** button is used while the **Auto-Add** (see page 254) is enabled, streams that where deleted may automatically be re-added. To prevent this from happening, disable the **Auto-Add** and use the **Manual Add** (see page 254) for new stream addition.*

IGMP Button

The **IGMP** button facilitates the management of the IGMP capabilities associated to the multicast streams presented in the Overview stream monitoring list. It provides specific controls (on a stream basis or for a range) that are adapted to the test case running status: stopped or started. When the test case is stopped the management controls are displayed as **Enable Auto-Join** and **Disable Auto-Join** that respectively enable and disable the ability to join or not a multicast group when a test case is started. When the test case is started, these controls are respectively modified to **Join** and **Leave** to immediately join or leave a multicast group upon selection. Note that while the test case is running, selecting the **Join** button also automatically configures the IGMP Auto-Join to an enabled state. The same holds true when the **Leave** button is selected i.e. following the leave request (if sent in accordance to RFC 2236 rules) the IGMP Auto-Join is disabled.

Note: *Stopping the test case will automatically issue a leave request to release all streams in joining or joined state.*



Streams can be sorted using **Stream Name**, **Dest IP address**, **Auto Join**, or **Join Status**. When sorting using **Auto Join**, the stream will be sorted in the following order: enabled-disabled or disabled-enabled. When sorting using **Join Status**, the streams will be sorted in the following order: **Failed-Joined-Joining-Idle** or **Idle-Joining-Joined-Failed** (see **Join-Status** on page 258 for more details).

Column Description

Stream Name: Indicates the configured name associated to an IP address in the Alias Map. See for more details.

Dest IP Address: Indicates the IP address associated to the stream.

Auto-Join: Indicates that the auto-join function is enabled or disabled (blank, no icon).

Join Status: Indicates the join status for a multicast stream only. See **Join-Status** on page 258 for more details.

Management

➤ **Enable Auto-Join** / **Join** button: This button toggles from **Enable Auto-Join** to **Join** when the test is started.

Enable Auto-Join, available when the test is stopped, enables the IGMP auto-join function. The **IGMP Auto-Join** function configures the system to issue join request to join multicast groups when the test ia started.

Join, available when the test is started, issues a join request for the selected multicast streams and enables the IGMP auto-join function for these steams.

➤ **Disable Auto-Join** / **Leave** Button: This button toggles from **Disable Auto-Join** to **Leave** when the test is started.

Disable Auto-Join, available when the test is stopped, disables the IGMP auto-join function.

Leave, available when the test is started, issues a leave request for the selected multicast streams and disables the IGMP auto-join function for these streams.

Selection Options

➤ **Select Range** selects all streams located between two selected streams including the boundaries. To select a range, select a first stream from the list, select a second stream from the list, and click **Select Range** to complete the selection.

➤ **Select All** selects the entire streams in the list.

➤ **Deselect All** deselects all the streams in the list.

Statistics

➤ **Multicast Group**: Indicates the number of multicast streams available.

➤ **Join Status**: The **Join-Status** is represented by the following icons. Icons become grayed out when the test is stopped.

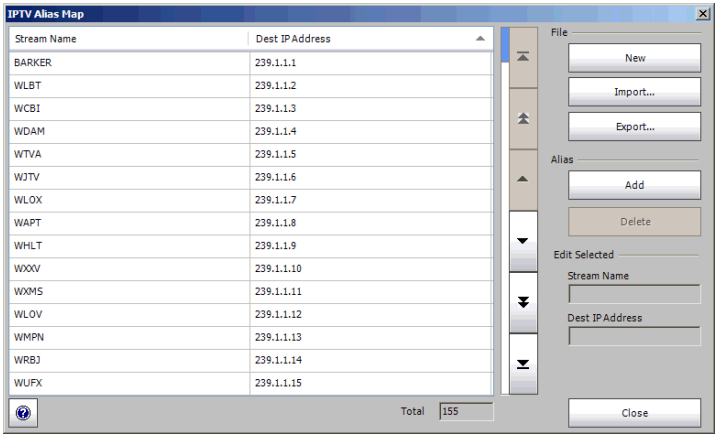
Icon	Status	Description
	Auto-Join	Indicates the number of monitored streams currently configured for auto-join.
	Joined	Indicates the number of monitored streams currently in joined state.
	Failed	Indicates the number of monitored streams currently in failed state.
	Idle	Indicates the number of monitored streams that have not the IGMP join request active.

Close button: Closes the IGMP window.

Alias Map

Allows the creation of a table establishing the relation between a destination IP address and a stream name.

From the **Overview** tab, click the **Alias Map** button.



➤ **File**

- ➤ **New** clears the current IPTV alias map list.
- ➤ **Import** allows to import a **csv** formatted file containing the list of stream name and associated IP address. Note that importing an alias map, will clear the currently used map.

  The **Alias Map** must be a **csv** file with a predefined format: Stream Name, Destination IP address. Each stream entry must be on a separated line. For example: EXFO,244.1.1.1. The **csv** predefined format uses the comma "**,**" delimiter in English and a semi-column "**;**" for other languages. Make sure to use the delimiter characters only to separate the stream name and IP address.
- ➤ **Export** allows to save/export the current IPTV alias map list. The exported file format is **csv**.

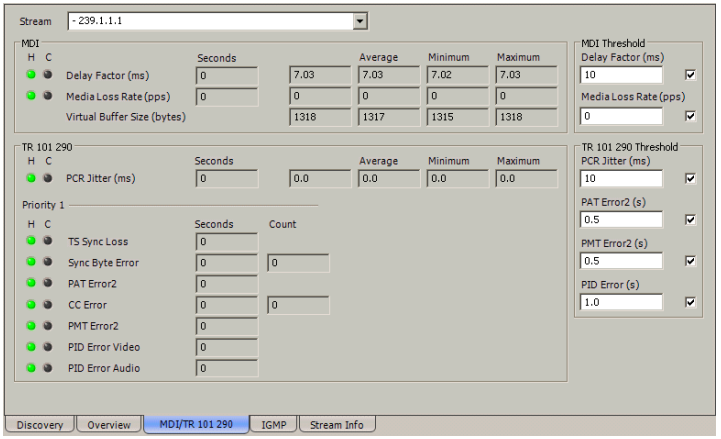
- **Alias**
  - **Add** allows a new alias map entry to the IPTV alias map list. Use the **Stream Name** and **Dest IP Address** fields from **Edit Selected** to enter the required information in order to complete the addition.
  - **Delete** removes the selected alias.
- **Edit Selected**
  - **Stream Name**: Enter or change the stream name of the selected alias stream. A maximum of 20 characters are allowed.
  - **Dest IP Address**: Enter or change the destination IP address of the selected alias stream.
- **Statistics**
  - **Total** indicates the number of streams in the **IPTV Alias Map** table.
- **Close** button: Closes the **IPTV Alias Map** window.

Note: *Since the alias map is managed locally by the application, make sure to use the same Alias Map when using Visual Guardian Lite. Refer to File* on page 269 *for more information on exporting and importing an Alias Map.*

MDI/TR 101 290

The MDI/TR 101 290 page contains the detailed statistics associated to first alert information provided in the Overview page for the Media Delivery Index and DVB Technical Report (TR) 101 290 (PCR Jitter and Priority 1) metrics. This page can be used to better understand the stream behavior over time. It also provides the global configuration associated to each of the supported threshold related to pre-defined metrics.

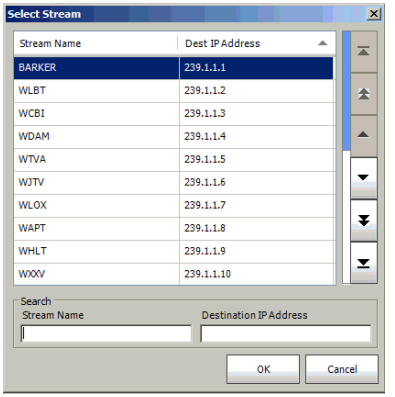
To access the **MDI/TR 101 290** tab, click **TEST**, **IPTV**, and **MDI/TR 101 290**.



Statistics are available for SPTS MPEG-2 TS streams only.

Stream

The Select Stream pop up allows the selection of a stream to see its statistics/thresholds.



Select a stream from the list by clicking on it, or perform a search in the stream list by entering either its **Stream Name** or **Destination IP Address**. When entering a **Stream Name** or the **Destination IP Address** the search is performed immediately when clicking **OK**. After a search, the stream is highlighted when found, otherwise the previous selection is kept.

MDI (Media Delivery Index)

The use of the Media Delivery Index as a testing metric provides the tools to measure and diagnose network induced impairments for IPTV streaming media. The Delay Factor (DF) and Media Loss Rate (MLR) together provide a measure of the quality (quality-of-service) of a delivered media stream which can be directly correlated the end users ultimate Quality of Experience (QoE).

- **Delay Factor (ms)**: The Delay Factor (DF) provides a measure of the maximum packet delay variation over a period of 1 second. In other words, the metric presents in milliseconds how much buffer would be required in the next downstream network element to compensate for the media packet jitter. Note that by definition (as detailed in RFC 4445) a DF value representing a minimum of one line packet (in ms) is reported when no jitter exists in the network. This represents the minimum buffer size (in ms) required to properly process a media packet and this value changes depending on the media rate of the stream. For example, if no jitter exists in the network, a typical Standard Television stream with a media rate of 3.75 Mbps would exhibit a Delay Factor of 2.81 ms while for a High Definition Television stream of 10 Mbps the Delay Factor would be 1.05 ms. **Average, Minimum**, and **Maximum** values are also displayed.
- **Media Loss Rate (pps)**: Indicates the count of lost packets in the last second (packets per second) as per RFC 4445, out-of-order and duplicate are considered lost packets. **Average, Minimum**, and **Maximum** values are also displayed.
- **Virtual Buffer Size (Bytes)**: Provides a measure of the required buffer size that would be required by a downstream network element to handle the delay variation, in the last second. **Average, Minimum**, and **Maximum** values are also displayed.

Note: *The Delay Factor (and associated Virtual Buffer Size) value behavior can change depending on the stream type: Constant Bit Rate (CBR) or Variable Bit Rate (VBR). For CBR, the streams should have relatively stable inter-arrival time values for each stream while VBR will have widely varying values depending on the media rate variability of the stream. In the case of VBR streams the DF may not be a direct indicator of the end-user experience. However the Maximum Delay Factor may be useful if sampled during IPTV service commissioning to create a baseline for network performance. Once the highest value is determined it can be used as an indicator of network problems if this value is crossed. DF threshold should be adjusted based on the type of streams used in the network being monitored. Higher DF threshold values than the one monitored in ideal conditions should be used in order to avoid unnecessary alarm reporting.*

MDI Threshold

MDI Thresholds apply to all streams.

- **Delay Factor (ms)**: Defines the value at which an alarm is declared when crossed. Choices are from **1** to **1000** ms. The default value is **10** ms. The **Delay Factor (ms)** check box is selected by default. Clearing the **Delay Factor (ms)** check box will disable alarm reporting for this metric.
- **Media Loss Rate (pps)**: Defines the value at which an alarm is declared when crossed. Choices are from **0** to **100** pps. The default setting is **0** pps. The **Medial Loss Rate (pps)** check box is selected by default. Clearing the **Media Loss Rate (pps)** check box will disable alarm reporting for this metric.

Note: *Higher DF threshold values than the one monitored in ideal conditions should be used in order to avoid unnecessary alarm reporting.*

TR 101 290

The TR 101 290 determines the integrity of the MPEG-2 Transport Stream across the network. Measurable impairments on the MPEG-2 transport stream can occur at the source or while in transit in the network.

- **PCR Jitter (ms)** (Program Clock Reference Jitter): Indicates the absolute difference between a known reference and the PCR value decoded from the MPEG-2 Transport Stream packets in the last second. **Average, Minimum**, and **Maximum** values are also displayed.
- **Priority 1**

  The Priority 1 Metrics are the Digital Video Broadcast (DVB) measurements defined to monitor the basic parameters accessible in the TS packet header. These parameters are necessary to validate the decoding capabilities of the transport stream. The following parameters can be monitored:

  TS Sync Loss: Indicates that at least 2 consecutive synchronization bytes received in the last second are corrupted in the MPEG-2 TS stream.

  Sync Byte Error: Indicates the number of synchronization bytes in error while the synchronization is maintained for a MPEG-2 TS composed of 188 bytes packets.

  PAT Error2: Indicates that any of the following conditions appear during a 1 second interval for a stream:

  - Section(s) with table_id other than 0x00 found on PID 0x0000.
  - Scrambling_control_field is not 00 for PID 0x0000.
  - Sections with table_id 0x00 do not occur for the user defined period (See *TR 101 290 Threshold* on page 277) on PID 0x0000

  CC Error (Continuity Counter Error): Indicates the number of continuity error experienced for all monitored PIDs when packets are received.

PMT Error2: Indicates that any of the following conditions appear during a 1 second interval for a stream:

- Scrambling_control_field is not 00 for all packets containing information of sections with table_id 0x02 on each program_map_PID which is referred to in the PAT.
- Sections with table_id 0x02 do not occur for the user defined period (See *TR 101 290 Threshold* on page 277) on each program_map_PID which is referred to in the PMT.

PID Error Video: Indicates that PID in a video stream is not received for a user defined period. Supported video stream types detected are **MPEG-2**, **MPEG-4 Part 2**, **H.264/MPEG-4 Part 10**, and **VC-1**

PID Error Audio: Indicates that PID in an audio stream is not received for a user defined period. Supported audio stream types detected are **MPEG-1**, **MPEG-2**, **MPEG-2 AAC**, **AC3**, and **MPEG-4 AAC**.

TR 101 290 Threshold

TR 101 290 Threshold parameters apply to all streams.

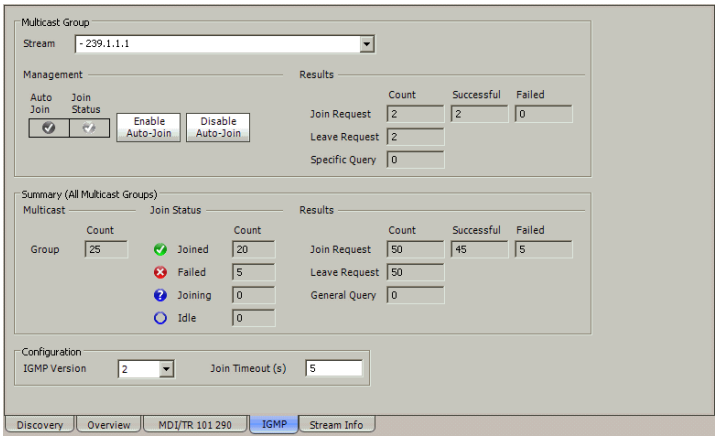
- **PCR Jitter (ms)**: Defines the value at which an alarm is declared when crossed. Choices are from **1** to **1000** ms. The default setting is **10** ms. The **PCR Jitter (ms)** check box is selected by default. Clearing the **PCR Jitter (ms)** check box will disable alarm reporting for this metric.
- **PAT Error2 (s)**: Defines the value at which an alarm is declared when crossed. Choices are from **0.1** to **5.0**s. The default setting is **0.5**s. The **PAT Error2 (s)** check box is selected by default. Clearing the **PAT Error2 (s)** check box will disable alarm reporting for this metric.
- **PMT Error2 (s)**: Defines the value at which an alarm is declared when crossed. Choices are from **0.1** to **5.0**s. The default setting is **0.5**s. The **PMT Error2 (s)** check box is selected by default. Clearing the **PMT Error2 (s)** check box will disable alarm reporting for this metric.
- **PID Error (s)**: Defines the value at which an alarm is declared when crossed. Choices are from **0.1** to **5.0** seconds. The default setting is **1.0** s. The **PID Erros (s)** check box is selected by default. Clearing the **PID Erros (s)** check box will disable alarm reporting for this metric.

IGMP

The IGMP functions associated to all streams currently support Version 2 of the IGMP standard (RFC 2236). The IGMP page provides the ability to control and configure the IGMP capabilities associated to one specific stream defined by a multicast IP address. It provides specific controls that are adapted to the test case running status: stopped or started. When the test case is stopped the management controls are displayed as **Enable Auto-Join** and **Disable Auto-Join** that respectively enables and disables the ability to join or not a multicast group when a test case is started. When the test case is started, these controls are respectively modified to **Join** and **Leave** to immediately join or leave a multicast group upon selection. Note that while the test case is running, selecting the join button also configures the IGMP Auto-Join to an enabled state. The same holds true when the **Leave** button is selected i.e. following the leave request (if sent in accordance to RFC 2236 rules) the IGMP Auto-Join is disabled. This page also presents an IGMP statistic summary of all the multicast groups being monitored by the RTU-310 and provides a selection allowing a view of the applicable statistics for a single stream. This page is further used to configure the **Join Timeout** value to determine the success or failure of a join request.

Note: *Stopping the test case will automatically issue a leave request to release all streams in joining or joined state.*

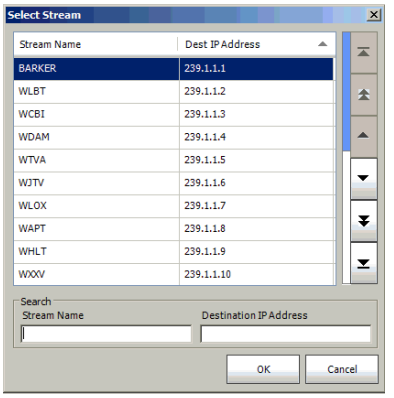
To access the **IGMP** tab, click **TEST**, **IPTV**, and **IGMP**.



Multicast Group

Stream

The Select Stream pop up allows the selection of a stream to see its statistics/thresholds.



Select a stream from the list by clicking on it, or perform a search in the stream list by entering either its **Stream Name** or **Destination IP Address**. When entering a **Stream Name** or the **Destination IP Address** the search is done immediately when clicking **OK**. After a search, the stream is highlighted when found, otherwise the previous selection is kept.

Note: *The **Stream** field displays the name of the stream followed by "**Unicast - IGMP Not Supported**" when the selected stream is a unicast IP address.*

Management

- **Auto-Join**: Indicates for a multicast stream only that the auto-join capability is enabled or disabled.
- **Join Status**: Indicates the join status for a multicast stream only. The join status icons become gray when the test is stopped.

Icon	Status	Description
	Joining	The joining state is reported following a join request until the desired stream is received or the join timeout expires.
	Joined	The joined state is reported when the desired stream is received before the join timeout expires.
	Failed	The failed state is reported when the stream remains undetected within the join timeout.
	Idle	The idle state is reported initially for all multicast streams that are not member of a group and doesn't have the failed status.

- **Enable Auto-Join** / **Join** button: This button toggles from **Enable Auto-Join** to **Join** when the test is started.

Enable Auto-Join, available when the test is stopped, enables the IGMP auto-join function. The **IGMP Auto-Join** function configures the system to issue join request to join multicast groups when the test is started.

Join, available when the test is started, issues a join request for the selected multicast streams and enables the IGMP auto-join function for these steams.

➤ **Disable Auto-Join** / **Leave** button: This button toggles from **Disable Auto-Join** to **Leave** when the test is started.

Disable Auto-Join, available when the test is stopped, disables the IGMP auto-join function.

Leave, available when the test is started, issues a leave request for the selected multicast streams and disables the IGMP auto-join function for these streams.

Results

The following results apply to the selected multicast stream.

➤ **Join Request**

Count: Indicates the number of join requests sent.

Successful: Indicates the number of streams received before the join timeout expires.

Failed: Indicates the number of streams undetected within the join timeout.

➤ **Leave Request**: Indicates the number of leave group requests for the selected multicast stream.

➤ **Specific Query**: Indicates the number of group specific query received.

Summary (All Multicast Groups)

The following gives statistics on all monitored multicast streams.

➤ **Multicast**

Group: Indicates the total number of multicast streams.

➤ **Join Status**

Icon	Status	Description
	Joined	Indicates the number of monitored streams currently in joined state.
	Failed	Indicates the number of monitored streams currently in failed state.
	Joining	Indicates the number of monitored streams currently in joining state.
	Idle	Indicates the number of monitored multicast streams for which no IGMP join request is issued.

Results

➤ **Join Request**

Count: Indicates the number of join requests sent for all monitored multicast streams.

Successful: Indicates the number of successful join requests for all monitored multicast streams.

Failed: Indicates the number of failed join requests for all monitored multicast stream.

➤ **Leave Request**: Indicates the number of leave request for all monitored multicast stream.

➤ **General Query**: Indicates the number of general queries received.

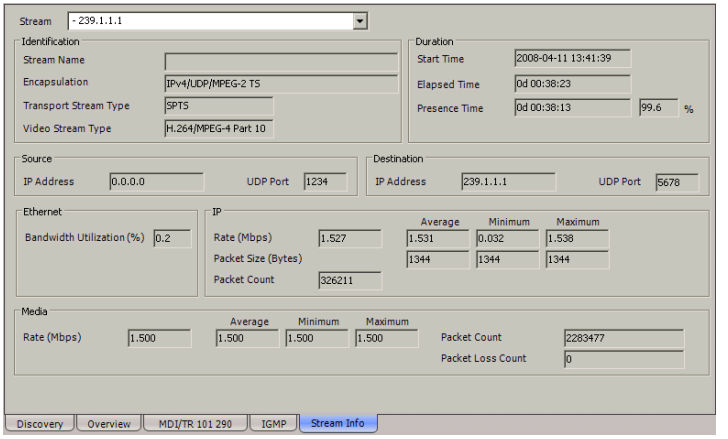
Configuration

- **IGMP Version**: Indicates the supported IGMP version which is IGMP version **2**. Note that version 2 is interoperable with version 3 as per RFC 3376.
- **Join Timeout (s)**: The join timeout is the maximum period for the requested stream to be received before it is declared failed. Choices are **1** to **1000** seconds. The default **Join Timeout** is **5** seconds.

Stream Information

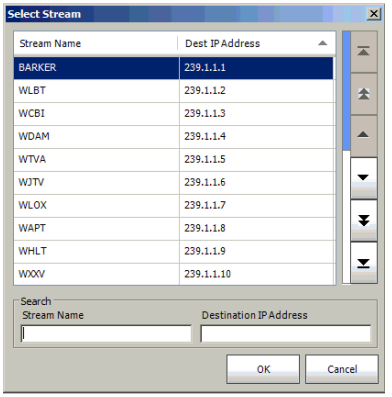
The **Stream Info** tab completes the information provided by the MDI/TR 101 290 tab by presenting the structure of the stream i.e. encapsulation used, transport stream type, etc. It also gives insights about the stream presence which may help understand the nature of certain metrics obtained from the MDI/TR 101 290 page.

To access the **Stream Info** tab, click **TEST**, **IPTV**, and **Stream Info**.



Stream

The Select Stream pop up allows the selection of a stream to see information about its structure.



Select a stream from the list by clicking on it, or perform a search in the stream list by entering either its **Stream Name** or **Destination IP Address**. When entering a **Stream Name** or the **Destination IP Address** the search is done immediately when clicking **OK**. After a search, the stream is highlighted when found, otherwise the previous selection is kept.

Identification

- **Stream Name**: Indicates the stream name.
- **Encapsulation**: Indicates how the stream is transported: **IPv4/UDP/MPEG-2 TS**, **IPv4/UDP/RTP/MPEG-2 TS**, or **Pending**.
- **Transport Stream Type**: Indicates the MPEG-2 transport stream type: **SPTS**, **MPTS**, or **Pending**.
- **Video Stream Type**: Indicates the detected video stream type: **MPEG-2**, **MPEG-4 Part 2**, **H.264/MPEG-4 Part 10**, **VC-1**, or **Pending**.

Duration

- **Start Time**: Indicates the time at which the stream monitoring has started. The stream monitoring start time corresponds either to the time the stream has been added while the test was running or the time the test has been started while the stream was already added to the monitoring list.
- **Elapsed Time**: Indicates the number of seconds elapsed since the beginning of the selected stream test.
- **Presence Time**: Indicates the number of seconds the stream was active during the monitoring period.

  %: Indicates the percentage of the stream activity over the stream monitoring period.

Source

- **IP Address**: Indicates the IP address of the device generating the stream.
- **UDP Port**: Indicates the UDP port number that will be used for stream generation.

Destination

- **IP Address**: Indicates the IP address of the monitored stream.
- **UDP Port**: Indicates the UDP port number of the monitored stream.

Ethernet

- **Bandwidth Utilization (%)**: Indicates the stream bandwidth usage over the link rate.

IP

- **Rate (Mbps)**: Indicates the number of megabits received in the last second (Mbps) for the selected stream ID address. **Average, Minimum**, and **Maximum** rate values are also displayed.
- **Packet Size (Bytes)**: Indicates the **Average**, **Minimum**, and **Maximum** IP packet size received during the monitoring period.
- **Packet Count**: Indicates the number of IP packets received during the monitoring period excluding packets containing FCS error.

Media

- **Rate (Mbps)**: Indicates the number of media bit rate received in the last second (Mbps) for the selected stream. **Average, Minimum**, and **Maximum** rate values are also displayed.
- **Packet Count**: Indicates the number of media packets received during the monitoring period.
- **Packet Loss Count**: Indicates the number of media packets lost during the monitoring period.

13 Pattern Tabs

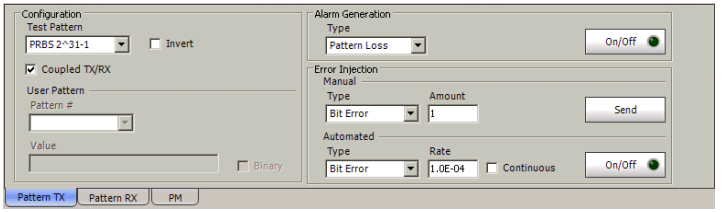
Note: *The Pattern tabs are only available with BERT test.*

Tab	Available with		Page
	Ethernet	Fibre Channel[a]	
Pattern TX	X	X	290
Pattern RX	X	X	293
Performance Monitoring (PM)[b]	X	X	359

a. Not available with RTU-310G.
b. Available with Ethernet/FC Framed Layer 1 and Framed Layer 2, and LAN transceiver mode.

Pattern TX

Click **TEST**, and **Pattern**.



Configuration

➤ **Test Pattern**: Select the test pattern from the list. The default setting is **PRBS 2^31-1**. Choices are:

- **Invert**: The generated test pattern will be inverted if the **Invert** check box is selected meaning that every 0 will be changed for 1 and every 1 for 0. For example, the pattern 1100 will be sent as 0011. The **Invert** check box is cleared by default.
- **Coupled**: Coupled allows coupling both the TX and RX signal with the same pattern configuration. This setting is enabled by default.
- **User Pattern**

  User Pattern is available when **User Pattern** is selected as the test pattern.

  Pattern #: Up to 10 patterns can be programmed. Select the pattern number to configure. The default setting is **1**.

  Value: Enter the pattern value (4 bytes). The default setting is **00 00 00 00**.

  Binary: Allows displaying the pattern value either in binary (when the **Binary** check box is selected) or hexadecimal (when the **Binary** check box is cleared). The **Binary** check box is cleared by default.

Note: *The User Pattern for TX and RX tabs share the same pattern list.*

Alarm Generation

Type: The only available type of pattern alarm is **Pattern Loss**.

On/Off button: Click the On/Off button to enable/disable the pattern alarm generation. This setting is disabled (Off) by default.

Error Injection

Allows selection and configuration of a manual or automated pattern error that will be generated.

Type: The only available type of pattern error is **Bit Error**.

Amount: Select the amount of error to be generated. Choices are **1** through **50**. The default setting is **1**.

Send button: Click **Send** to manually generate the pattern error according to the pattern error type and the amount.

Rate: Click the **Rate** field to select the rate for the selected pattern error. Choices are: **1.0E-02**, **1.0E-03**, **1.0E-04**, **1.0E-05**, **1.0E-06**, **1.0E-07**, **1.0E-08**, **1.0E-09**, or user definable from **1.0E-09** to **1.0E-02**. The default setting is **1.0E-04**.

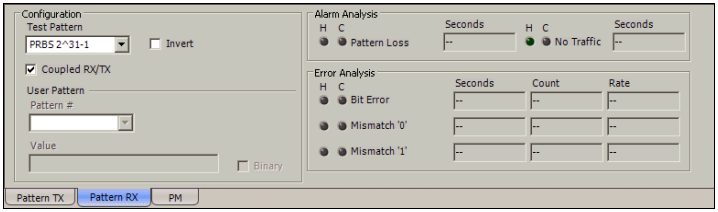
Continuous: Generates the Bit error for each bit generated when the **Continuous** check box is selected while the **On/Off** button is enabled (On). The **Continuous** check box is cleared by default.

On/Off button: The On/Off button is used to activate/deactivate the selected automated pattern error at the rate specified or for each bit generated when the **Continuous** check box is selected. This setting is disabled (Off) by default.

Note: *Manual and Automated error injection can run simultaneously.*

Pattern RX

Click **TEST**, and **Pattern**.



Configuration

Note: *See* Configuration *on page 290 for more information on* ***Test Pattern****,* ***Invert****, and* ***User Pattern****.*

Alarm Analysis

Pattern Loss

For Ethernet, a **Pattern Loss** is declared when the test sequence and the reference sequence can be unambiguously identified as out of phase.

For Fibre Channel, a **Pattern Loss** is declared when at least four consecutive words having at least one bit error are detected causing a loss of pattern synchronization. Not supported on RTU-310G.

No Traffic is declared when no pattern traffic has been received in the last second.

Error Analysis

Bit Error: A Bit Error indicates that there are logic errors in the bit stream (i.e., zeros that should be ones and vice versa).

Mismatch '0': A Mismatch '0' Error indicates a bit error on a binary "0" (for example ones that should be zeros) found in the test pattern only.

Mismatch '1': A Mismatch '1' Error indicates a bit error on a binary "1" (for example zeros that should be ones) found in the test pattern only.

14 RFC 2544 Tabs

Note: *The RFC 2544 tabs are only available with RFC 2544 test.*

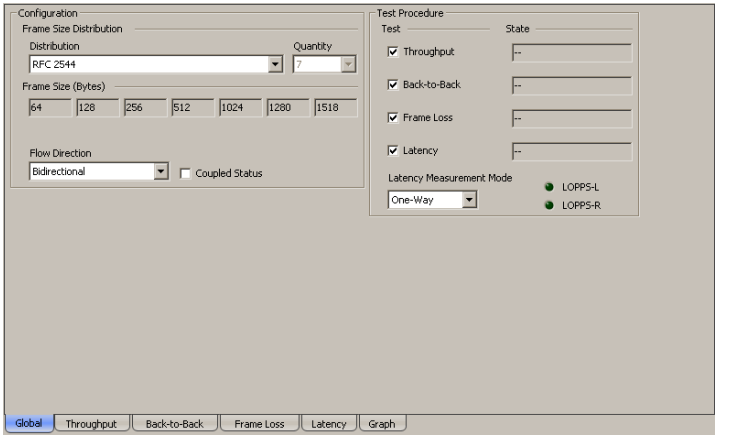
	Tab	Available with		Page
		Ethernet	Fibre Channel[a]	
Configuration and Results	*Global Configuration*	X		296
	Throughput	X		299
	Back-to-Back	X		304
	Frame Loss	X		308
	Latency	X		312
	Graph	X		317

a. Not available with RTU-310G.

Note: *The RFC 2544 measurements are based on all valid Ethernet FCS frames received regardless of their MAC and IP addresses.*

Global Configuration

Click **TEST**, **RFC 2544**, and **Global**.



Configuration

➤ **Frame Size Distribution**

➤ **Distribution**: Select the frame size distribution from the list. Choices are **RFC 2544** and **User Defined**. The default setting is **RFC 2544**.

➤ **Quantity**: Quantity is only available when User Defined has been selected for distribution. Select the quantity of frame size to be used for the test. Choices are **1** through **7**. The default setting is **7**.

➤ **Frame Size (Bytes): RFC 2544** gives predefined frame size distribution values. For **User Defined** distribution, enter up to seven frame size values.

Distribution	Frame Size
RFC 2544	**64**[a],**128**, **256**, **512**, **1024**, **1280**, and **1518**
User Defined	**64**[a] to **16000**[b]

a. The minimum frame size will be adjusted according to the frame structure and components selected.
b. The maximum frame size is limited to 10000 for 10Mbps interface.

The following table lists each component that may affect the minimum size value.

Component	Description
VLAN	4 bytes per VLAN (up to 3 VLAN)
Ethernet Header	14 bytes
LLC and SNAP Headers	8 bytes
IPv4	20 bytes
IPv6	40 bytes

➤ **Flow Direction**: Allows the selection of the test traffic direction. Choices are:

➤ **TX-to-RX** for single port topology.

➤ **P1-to-P2**, **P2-to-P1** and **Bidirectional** for dual ports topology. Available with RTU-310 only.

➤ **Local to Remote**, **Remote to Local**, and **Bidirectional** for **Dual Test Sets**.

Coupled Status: Couples the port direction algorithm for **Bidirectional** flow direction.

Test Procedure

- **Test**: Enables the **RFC 2544** sub-tests to be performed. Choices are **Throughput**, **Back-to-Back**, **Frame Loss**, and **Latency**. All tests are selected by default unless otherwise set during the test setup. For FTB-8120NGE and FTB-8130NGE in Dual Test Set round-trip latency measurement mode, the Latency sub-test is not available when the flow direction is set to either Local to Remote or Remote to Local.
- **State**: Indicates the status of the running **Throughput**, **Back-to-Back**, **Frame Loss**, and **Latency** tests. Possible status are:

  " -- ": Indicates that the test has not run yet.

  In Progress: Indicates that the **Throughput**, **Back-to-Back**, **Frame Loss**, or **Latency** test is running.

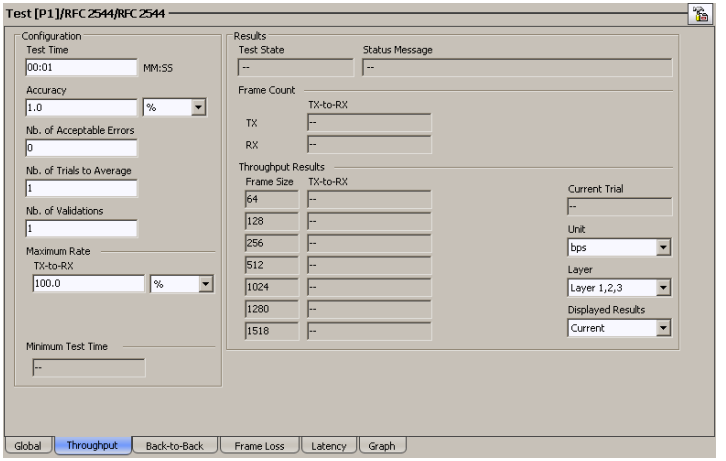
  Completed: Indicates that the test is completed.

  Aborted: Indicates that the test has been interrupted (stopped).

Throughput

The objective of this test is to find the throughput of the device under test for which there is no frame loss. Starting at full media speed, the rate converges towards the highest throughput without frame loss with the test having a predefined duration (**Test Time**). The search is done with a basic halving/doubling method until a final value is reached. The test performs the number of trials defined (**Number of trials to average**). The **Accuracy** and **Nb of acceptable errors** settings specify how precise that result must be. At the end, the results are validated the number of times specified (**Nb of validations**). The test is performed for each defined frame size.

Click **TEST**, **RFC 2544**, and **Throughput**.



Note: ***Throughput*** *must be enabled from* Test Procedure *on page 298.*

Configuration

- **Test Time (MM:SS)**: Enter the test time value. Possible values are **1** second to **30** minutes. The default setting is **1** second (00:01).
- **Accuracy**: Enter the accuracy value. The accuracy is not based on the the configured **Maximum Rate** but on the Ethernet line rate.
- The default setting is **1%**. Possible values are:

Interface	Accuracy		
	%	Gbps	MBps
10 Mbps	**0.1** to **10**	**0.00001** to **0.001**	**0.00125** to **0.125**
100 Mbps	**0.1** to **10**	**0.0001** to **0.01**	**0.0125** to **1.25**
1000 Mbps	**0.1** to **10**	**0.001** to **0.1**	**0.125** to **12.5**
10 Gbps	**0.1** to **10**	**0.01** to **1**	**1.25** to **125**

Select the Accuracy measurement unit. Choices are **%**, **Gbps**, and **Mbps**. The default setting is **%**.

- **Nb. of Acceptable Errors**: Select the number of acceptable errors for the test. Choices are **0** to **10** errors. The default setting is **0** error.
- **Nb. of Trials to Average**: Select the number of times the throughput test will be generated. Choices are **1** to **50** trials. The default setting is **1** trial.
- **Nb. of Validations**: Select the number of times the result should be validated. Choices are **1** to **50** times. The default setting is **1** time.

➤ **Maximum Rate:**

TX-to-RX/P1-to-P2/P2-to-P1/Local to Remote/Remote to Local: Select the maximum rate for the test. The default setting is **100%** for 10/100/1000 Mbps and 10 Gig-E LAN, and **92.8571428571429%** for 10 Gig-E WAN. **P1-to-P2/P2-to-P1** is only available with RTU-310. Choices are:

Interface	Unit	Rate	
		from	to
10 Mbps	**%**	**0.005**	**100.0**
	Mbps	**0.0005**	**10.0**
100 Mbps	**%**	**0.005**	**100.0**
	Mbps	**0.005**	**100.0**
1000 Mbps	**%**	**0.005**	**100.0**
	Mbps	**0.05**	**1000.0**
10 Gig-E LAN	**%**	**0.005**	**100.0**
	Gbps	**0.0005**	**10.0**
10 Gig-E WAN	**%**	**0.005**	**92.8571428571429**
	Gbps	**0.0005**	**9.2857142857142865**

Select the rate's unit. Choices are **%,** and **Mbps/Gbps**. The default unit is **%**.

➤ **Minimum Test Time**: Indicates the minimum time the test requires to run at best condition. The minimum test time is calculated and updated once the test is started.

Results

➤ **Test State**

--: Indicates that the test has not run yet.
In Progress: Indicates that the test is running.
Completed: Indicates that the test is completed.
Aborted: Indicates that the test has been interrupted (stopped).

➤ **Status Message**: Gives the test status. Following is the list of status messages.

Sending learning frames
Sending test frames
Test completed
Aborted by user
Aborted - Loss of remote connection
Link down
MAC address not resolved

➤ **Frames Count**

TX-to-RX/P1-to-P2/P2-to-P1/Local to Remote/Remote to Local: Gives the number of frames for the indicated direction. P1-to-P2/P2-to-P1 is only available with RTU-310.

- ➤ **TX Frame Count**: Indicates the number of transmitted frames.
- ➤ **RX Frame Count**: Indicates the number of received frames.

- **Throughput Results**
  - **Frame Size**: Indicates the frame sizes used for the test. Up to seven different frame sizes can be displayed.

Note: *The "--" indicates that the result is not available because the test has not run yet or the measured value is not valid.*

  - **TX-to-RX/P1-to-P2/P2-to-P1/Local to Remote/Remote to Local**: Gives the number of frames for the corresponding direction. **P1-to-P2/P2-to-P1** is only available with RTU-310.
  - **Current Trial**: Indicates the current trial number.
  - **Units**: Select the throughput result unit. Choices are **bps**, **Bps**, **Kbps**, **KBps**, **Mbps**, **MBps**, **Gbps**, **GBps**, **fps**, and **%**. The default unit is **bps**.
  - **Layer**: Select the layers used to calculate the throughput. Choices are **Layer 1,2,3**, **Layer 2,3**, and **Layer 3**. The default setting is **Layer 1,2,3**.

    Layer 1,2,3 contains the Idle, Preamble, Start of Frame Delimiter, MAC address, IP address, and data.

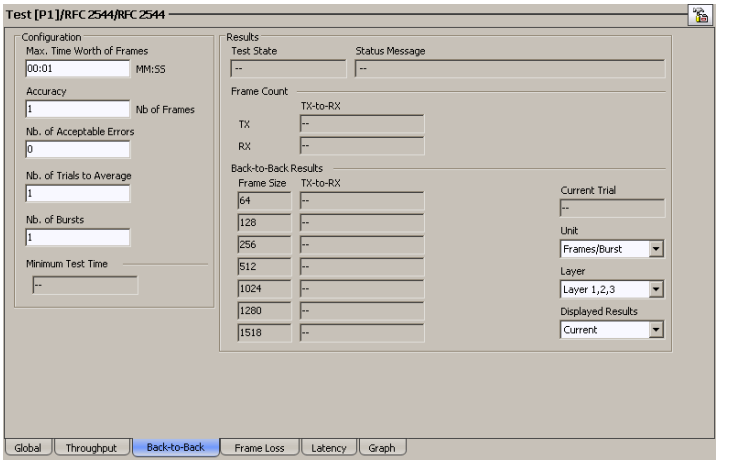
    Layer 2,3 contains the MAC layer, IP layer, and data.

    Layer 3 contains the IP layer, and data.
  - **Displayed Results**: Select the displayed result mode: **Current**, **Minimum**, **Maximum**, or **Average**. The default setting is **Current**.

Back-to-Back

The objective of this test is to find the maximum number of frames that can be sent at maximum throughput without frame loss. A burst of frames (**Max. time worth of frames**) is sent with minimum inter-frame gaps to the device under test and the number of forwarded frames is counted. If the count of transmitted frames is equal to the number of forwarded frames, the length of the burst is increased and the test is rerun. If the number of forwarded frames is less than the number of transmitted frames, the length of the burst is reduced and the test is rerun. The back-to-back value is the number of frames in the longest burst that the device under test (DUT) can handle without the loss of any frames. The test performs the number of defined trials (**Nb of trials to average**). The **Accuracy** and **Nb of acceptable errors** settings specify how precise that result must be. The test is performed for each defined frame size.

Click **TEST**, **RFC 2544**, and **Back-to-Back**.



Note: ***Back-to-Back*** *must be enabled from* Global Configuration *on page 296.*

Configuration

- **Max. time worth of frame (MM:SS)**: Choices are **1** to **5** seconds. The default setting is **1** second (00:01).
- **Accuracy (Frames)**: Enter the Accuracy measurement value in frames. Choices are **1** to **50** frames. The default setting is **1**.
- **Nb of Acceptable Errors**: Select the number of acceptable errors for the test. Choices are **0** to **10** errors. The default setting is **0** error.
- **Nb of Trials to Average**: Select the number of times the throughput test will be generated. Choices are **1** to **100** trials. The default setting is **1** trial.
- **Nb of Burst**: Select the number of burst that will be generated. Choices are **1** to **10** Bursts. The default setting is **1** Burst.
- **Minimum Test Time (Seconds)**: Indicates the minimum time the test requires to run at best condition. The minimum test time is calculated and updated once the test is started.

Results

➤ **Test State**

--: Indicates that the test has not run yet.
In Progress: Indicates that the test is running.
Completed: Indicates that the test is completed.
Aborted: Indicates that the test has been interrupted (stopped).

➤ **Status Message**: Gives the test status. Following is the list of status messages.

S**ending learning frames**
Sending test frames
Test completed
Aborted by user
Aborted - Loss of remote connection
Link down
MAC address not resolved

➤ **Frames Count**

TX-to-RX/P1-to-P2/P2-to-P1/Local to Remote/Remote to Local: Gives the number of frames for the indicated direction. P1-to-P2/P2-to-P1 is only available with RTU-310.

➤ **TX Frame Count**: Indicates the number of transmitted frames.

➤ **RX Frame Count**: Indicates the number of received frames.

➤ **Back-to-Back Results**

➤ **Frame Size**: Indicates the frame sizes used for the test. Up to seven different frame sizes can be displayed.

Note: *The "--" indicates that the result is not available because the test has not run yet or the measured value is not valid.*

➤ **TX-to-RX/P1-to-P2/P2-to-P1/Local to Remote/Remote to Local**: Gives the number of frames for the corresponding direction. P1-to-P2/P2-to-P1 is only available with RTU-310.

- **Current Trial**: Indicates the current trial number.
- **Unit**: Select the throughput result unit. Choices are **bps**, **Bps**, **Kbps**, **KBps**, **Mbps**, **MBps**, **Gbps**, **GBps**, **fps**, **%**, **Bytes/Burst**, and **Frames/Burst**. Default unit is **Frames/Burst**.
- **Layer**: Select the layers used for the Back-to-Back test. Choices are **Layer 1,2,3**, **Layer 2,3**, and **Layer 3**. The default setting is **Layer 1,2,3**.

  Layer 1,2,3 contains the Idle, Preamble, Start of Frame Delimiter, MAC address, IP address, and data.

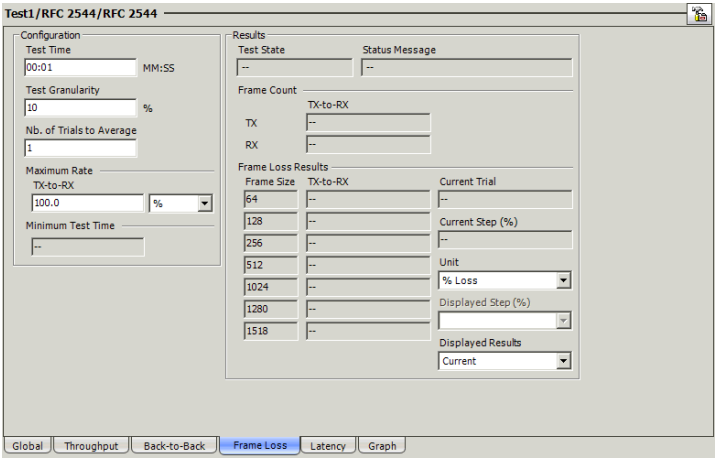
  Layer 2,3 contains the MAC layer, IP layer, and data.

  Layer 3 contains the IP layer, and data.
- **Displayed Results**: Select the displayed result mode: **Current**, **Minimum**, **Maximum**, or **Average**. The default setting is **Current**.

Frame Loss

The objective of this test is to find the percentage of frames that are lost due to lack of resources. Starting at full media speed, the test is performed for a specific frame size and for the specified duration (**Test Time**). The test is repeated by decreasing the throughput by the specified granularity (**Test granularity**), then the test is repeated again until there are two successive trials in which no frames are lost. The test performs the defined number of trials (**Nb of trials to average**). At the end, the results are validated the number of times specified (**Final result validation**). The test is performed for each defined frame size.

Click **TEST**, **RFC 2544**, and **Frame Loss**.



Note: ***Frame Loss*** *must be enabled from* Global Configuration *on page 296.*

Configuration

➤ **Test Time (MM:SS)**: Select the test time value. Possible values are **1** second to **30** minutes. The default setting is **1** second (00:01).

- **Test Granularity (%)**: Select the test granularity. The test granularity is the percentage interval between each throughput value used for the test. For example, 10% granularity means that the test will be performed for 100%, 90%, 80%... of the throughput value. Choices are **1** to **10%** (RFC). The default setting is **10%**.
- **Nb of trials to average**: Select the number of times the test will be generated. Choices are **1** to **50** trials. The default setting is **1** trial.
- **Maximum Rate**

  TX-to-RX/P1-to-P2/P2-to-P1/Local to Remote/Remote to Local: Select the maximum rate for the test. The default setting is **100 %** for 10/100/1000Mbps and 10Gig-E LAN, and **92.8571428571429%** for 10Gig-E WAN. P1-to-P2/P2-to-P1 is only available with RTU-310.

Unit	Interface	Rate	
		from	to
%	10Base-T	**1**	**100**
	100Base-T	**1**	**100**
	1000Base-T/X	**1**	**100**
	10Gig-E LAN	**1**	**100**
	10Gig-E WAN	**1**	**92.8571428571429**
Mbps	10Base-T	**0.1**	**10**
	100Base-T	**1**	**100**
	1000Base-T/X	**10**	**1000**
Gbps	10Gig-E LAN	**0.1**	**10.0**
	10Gig-E WAN	**0.1**	**9.2857142857142865**

  Select the rate's unit. Choices are **%**, and **Mbps/Gbps**. The default setting is **%**.
- **Minimum Test Time (Seconds)**: Indicates the minimum time the test requires to run at best condition. The minimum test time is calculated and updated once the test is started.

Results

➤ **Test State**

--: Indicates that the test has not run yet.
In Progress: Indicates that the test is running.
Completed: Indicates that the test is completed.
Aborted: Indicates that the test has been interrupted (stopped).

➤ **Status Message**: Gives the test status. Following is the list of status messages.

Sending learning frames
Sending test frames
Test completed
Aborted by user
Aborted - Loss of remote connection
Link down
MAC address not resolved

➤ **Frames Count**

TX-to-RX/P1-to-P2/P2-to-P1/Local to Remote/Remote to Local: Gives the number of frames for the indicated direction. **P1-to-P2/P2-to-P1** is only available with RTU-310.

➤ **TX Frame Count**: Indicates the number of transmitted frames.

➤ **RX Frame Count**: Indicates the number of received frames.

- **Frame Loss Results**
  - **Frame Size**: Indicates the frame sizes used for the test. Up to seven different frame sizes can be displayed.

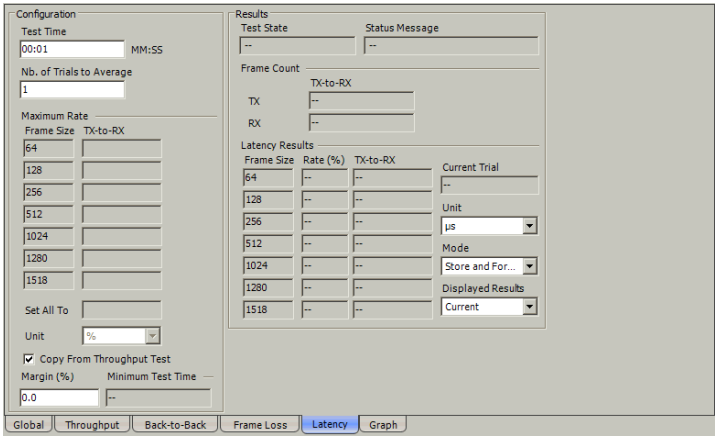
Note: *The "--" indicates that the result is not available because the test has not run yet or the measured value is not valid.*

  - **TX-to-RX/Local to Remote/Remote to Local**: Gives the number of frames for the corresponding direction.
  - **Current Trial**: Indicates the current trial number.
  - **Current Step**: Indicates the current percentage of the testing rate.
  - **Units**: Indicates the throughput result unit which is **% Loss**.
  - **Displayed Step**: Indicates what **TX-to-RX/Local to Remote/Remote to Local** rate result is displayed. This setting is only available when the test is running or completed.
  - **Displayed Results**: Select the displayed result mode: **Current**, **Minimum**, **Maximum**, or **Average**. The default setting is **Current**.

Latency

The objective of this test is to find the time required for the sent frame to go through the device under test and return to the RTU-310/310G. Starting by sending a stream of frames for the predefined duration (**Test Time**) and throughput (**% Util.**) at a particular frame size (**Frame Size**), an identifying dependent tag is included in one frame. The time at which this frame is transmitted is recorded (**timestamp A**). When the tagged frames come back, the time is recorded again (**timestamp B**) and the Latency result is: **timestamp B - timestamp A**. The test is repeated for the defined number of times (**Nb. of Trials to average**) and the average result is calculated. The test is performed for each defined frame size.

Click **TEST**, **RFC 2544**, and **Latency**.



Note: ***Latency*** *must be enabled from* Global Configuration *on page 296.*

Configuration

- **Test Time (MM:SS)**: Select the test time value. Choices are **1** second to **2** minutes (RFC). The default setting is **1** second (00:01).
- **Nb. of Trials to Average**: Select the number of trials to average. Choices are from **1** to **50** trials. The default setting is **1** trial.
- **Minimum Test Time (Seconds)**: Indicates the minimum time the test requires to run at best condition. The minimum test time is calculated and updated once the test is started.
- **Maximum Rate**: The maximum rate can be entered manually by typing the value for each frame size in the **TX-to-RX/P1-to-P2/P2-to-P1/Local to Remote/Remote to Local** column or using the **Set All to**, or by enabling the **Copy From Throughput Test**. **P1-to-P2/P2-to-P1** is only available with RTU-310.
  - **TX-to-RX/P1-to-P2/P2-to-P1/Local to Remote/Remote to Local**: Enter the value for each frame size. Choices are listed in the following table. The default setting is **100%**. **P1-to-P2/P2-to-P1** is only available with RTU-310.

Unit	Interface	Rate	
		from	to
%	10 Mbps 100 Mbps 1000 Mbps 10 Gig-E LAN 10 Gig-E WAN	**0.005** **0.005** **0.005** **0.005** **0.005**	**100** **100** **100** **100.0** **92.8571428571429**
Mbps	10 Mbps 100 Mbps 1000 Mbps	**0.0005** **0.005** **0.05**	**10** **100** **1000**
Gbps	10Gig-E LAN 10Gig-E WAN	**0.0005** **0.0005**	**10.0** **9.2857142857142865**

- **Set All To**: Enter a value in the **Set All To** and click **OK** to apply the value to all frame sizes. Choices are listed in the above table.
- **Unit**: Select the rate's unit. Choices are **%,** and **Mbps**/**Gbps**. The default setting is **%**.
- **Copy From Throughput Test**: Enable **Copy From Throughput** Test to get values from the Throughput test results. This check box is selected by default.

  Margin (%) allows to subtract a relative value to the maximum throughput test values. The delta equal to the interface rate multiplied by the Margin divided by 100. Thus, the maximum rate equals to the maximum Throughput test value minus the delta value. Choices are **0%** to **10%**. The default margin value is **0%**.

Note: *Set **All To**, **Unit**, and **TX-to-RX**/**P1-to-P2**/**P2-to-P1**/**Local to Remote**/**Remote to Local** fields are not available when **Copy From Throughput Test** is selected. **P1-to-P2**/**P2-to-P1** is only available with RTU-310.*

Results

➤ **Test State**

--: Indicates that the test has not run yet.
In Progress: Indicates that the test is running.
Completed: Indicates that the test is completed.
Aborted: Indicates that the test has been interrupted (stopped).

➤ **Status Message**: Gives the test status. Following is the list of status messages.

Sending learning frames
Sending test frames
Test completed
Aborting by user
Aborted - Loss of remote connection
Test not measurable
MAC address not resolved

➤ **Frames Count**

TX-to-RX/P1-to-P2/P2-to-P1/Local to Remote/Remote to Local: Gives the number of frames for the indicated direction. P1-to-P2/P2-to-P1 is only available with RTU-310.

- ➤ **TX Frame Count**: Indicates the number of transmitted frames.
- ➤ **RX Frame Count**: Indicates the number of received frames.

➤ **Latency Results**

Note: *The "--" indicates that the result is not available because the test has not run yet or the measured value is not valid.*

➤ **Frame Size**: Indicates the frame sizes used for the test. Up to seven different frame sizes can be displayed.

➤ **TX-to-RX/P1-to-P2/P2-to-P1/Local to Remote/Remote to Local**: Gives the latency for the corresponding direction.
P1-to-P2/P2-to-P1 is only available with RTU-310.

Note: *Latency measurement values below 15 µs will be shown as "<15 µs" for Dual Test Set. For all other test cases, values below 0.5 µs will be shown as "<500 ns".*

➤ **Current Trial**: Indicates the current trial number.

➤ **Unit**: Select the throughput result unit. Choices are **s**, **ms**, **µs**, and **ns**. The default setting is µs.

➤ **Mode**: Select the propagation time mode. The default setting is **Store and Forward**. Choices are:

Store and Forward (Frame Latency) allows the calculation of the propagation time of a frame.

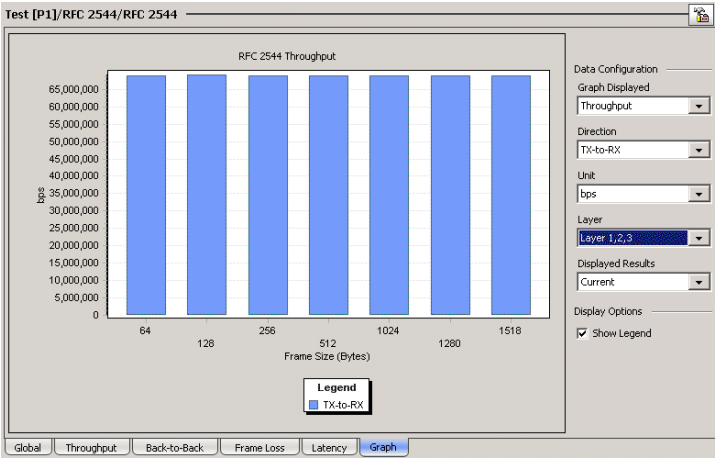
Cut Through (Bit Latency) allows the calculation of the propagation time of a bit.

➤ **Displayed Results**: Select the displayed result mode: **Current**, **Minimum**, **Maximum**, or **Average**. The default setting is **Current**.

Graph

Gives the graph showing the Throughput, Back-to-Back, Frame Loss, or Latency measurement.

Click **TEST**, **RFC 2544**, and **Graph**.



The X axis shows the frame sizes for **Throughput**, **Back-to-Back**, **Latency** or the **TX Rate** for **Frame Loss**. The Y axis shows the subtest results.

Data Configuration

- **Graph Displayed**: Select the test that has to be displayed. Choices are **Throughput**, **Back-to-Back**, **Frame Loss**, and **Latency**.
- **Direction**: Allows the selection of the test traffic direction. Choices are:
  TX-to-RX for single port topology (RTU-310)
  P1-to-P2, **P2-to-P1**, and **Bidirectional** for dual ports topology (RTU-310)
  Local to Remote, **Remote to Local**, and **Bidirectional** for dual test set.

➤ **Unit**: Select the result unit. Choices are:

Sub-test	Unit	Default unit
Throughput	**bps**, **Bps**, **Kbps**, **KBps**, **Mbps**, **MBps**, **Gbps**, **GBps**, **fps**, and **%**.	**bps**
Back-to-Back	**bps**, **Bps**, **Kbps**, **KBps**, **Mbps**, **MBps**, **Gbps**, **GBps**, **fps**, **%**, **Bytes/Burst**, and **Frames/Burst**.	**Frames/Burst**
Frame Loss	**% Loss** frames.	**% Loss**
Latency	**s**, **ms**, **µs**, and **ns**.	**µs**

➤ **Layer/Displayed Step/Mode**

Layer (Throughput and Back-to-Back): Select the Layer that will be used to compute the results. Choices are **Layer 1,2,3**, **Layer 2,3** and **Layer 3**. The default setting is **Layer 1,2,3**.

- ➤ **Layer 1,2,3** contains the Idle, Preamble, Start of Frame Delimiter, MAC address, IP address, and data.
- ➤ **Layer 2,3** contains the MAC layer, IP layer, and data.
- ➤ **Layer 3** contains the IP layer, and data.

Displayed Step (Frame Loss only): Select the percentage of the speed used for the test. Choices are **100%** (or % of the maximum speed) to **0%** with increment set by the **Test Granularity** from the RFC 2544 Frame Loss tab. The default setting is **100%** (or % of the maximum speed). This is only available once the Frame Loss test is started.

Mode (Latency test only): Select the propagation time mode. The default setting is **Store and Forward**. Choices are:

- ➤ **Cut Through (Bit Latency)**: Cut Through allows the calculation of the propagation time of a bit.
- ➤ **Store and Forward (Frame Latency)**: Store and Forward allows the calculation of the propagation time of a frame.

- **Displayed Results**: Select the displayed results mode: **Current**, **Minimum**, **Maximum**, or **Average**. The default setting is **Current**.
- **Legend**: Indicates the legend used for the graph according with the direction selected.

15 EtherSAM Tabs

Note: *The EtherSAM tabs are only available with* ***EtherSAM (Y.1564)*** *test. The EtherSAM tabs are not available on the module set as remote dual test set.*

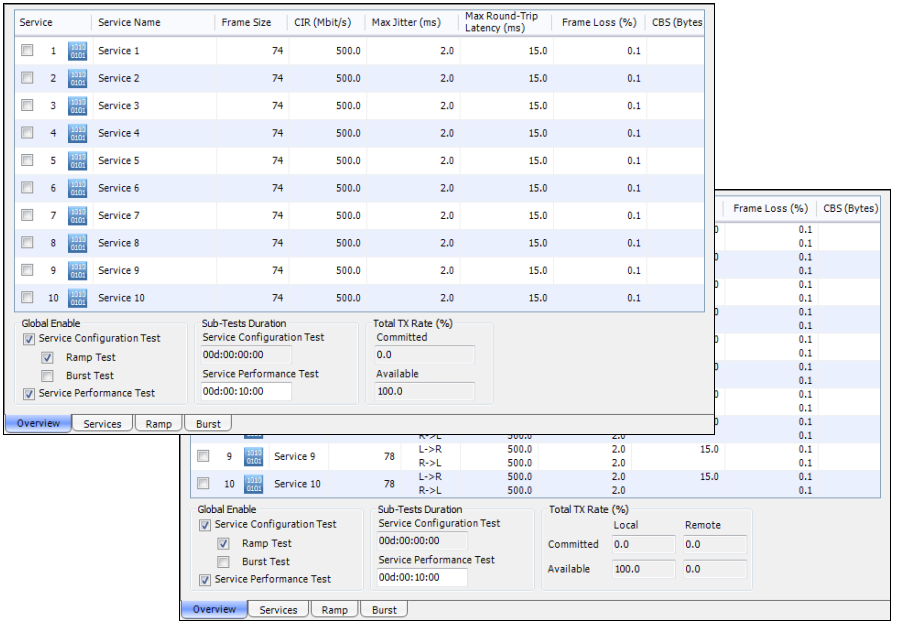
Tab	Available with		Page
	Ethernet	Fibre Channel[a]	
Overview (Configuration)	X		322
Services (Configuration)	X		327
Ramp (Configuration)	X		333
Burst (Configuration)	X		335
Overview (Results)	X		338
Service Configuration Test (Results)	X		343
Service Performance Test (Results)	X		346

a. Not available with RTU-310G.

Overview (Configuration)

The **Overview** tab allows the activation of up to 10 services and displays a summary of the service settings.

Click **TEST**, **EtherSAM Configuration**, and **Overview**.



Service Overview Table

The overview table allows the activation of up to 10 services and displays some service settings. See *Services (Configuration)* on page 327 for more information.

➤ The **Service** check boxes allow enabling the corresponding service to be part of the test. For Dual Test Set, services can only be enabled once the connection with the remote unit is established.

When the **Service Performance Test** is enabled, up to 10 services can be enabled one after the other, as long as the total TX Rate (bandwidth) is not reached (**Committed**). For example, if the first service is using the full bandwidth available, then no other service can be enabled. If the first enabled service uses half bandwidth, then at least another service can be enabled using up to half bandwidth. Thus, to enable a second service, first set the CIR value within the non-used bandwidth (**Available**), then enable it.

When the **Service Performance Test** is disabled, up to 10 services can be enabled one after the other; the total TX rate is not limited.

- **Dir.**: **Direction**: Direction is displayed for dual test set test case providing bidirectional data.
  L -> R indicates results from local to remote direction.
  R -> L indicates results from remote to local direction.
- Global Enable
- **Service Configuration Test**

  The objective of this test is to verify if the network configuration is correct for each service before starting a long term test (Service Configuration Test). In order to test the network configuration, a ramp and/or a burst test(s) will be generated for each configured service. The **Service Configuration Test** check box is selected by default.

  - **Ramp Test**

    In the first stage of the test, when CIR check box is enabled, the throughput will be increased incrementally in steps (see *Step List* on page 334) until the CIR level is reached. During the first stage, the maximum Jitter, Latency, Frame Loss, and throughput are measured and will be compared to the SLA thresholds to declare a pass/fail verdict.

    In the second stage of the test, when the **CIR+EIR** check box is enabled, the throughput will be increased to the CIR+EIR level to compare against expected maximum throughput threshold to declare a pass/fail verdict.

In the third stage of the test, when the **Ramp Traffic Policing Rate** check box is enabled, the throughput will be increased one step over the CIR+EIR if enabled otherwise over the CIR to compare against expected maximum throughput threshold to declare a pass/fail verdict.

The ramp test procedure is generated for each enabled service.

The **Ramp Test** check box is selected by default.

➤ **Burst Test**

The objective of the burst test is to verify that the expected burst size can be transmitted at maximum burst rate with minimal loss.

CBS (Committed Burst Size), when enabled, verifies the performance of a committed burst size at CIR's average TX rate.

EBS (Excess Burst Size), when enabled, verifies the performance of an excess burst size at CIR+EIR's average TX rate.

The maximum Jitter, Latency, Frame Loss, and throughput are measured. For CBS, the Jitter, Latency, and Frame Loss will be compared to the SLA thresholds to declare a pass/fail verdict. For EBS, the throughput will be compared to the SLA thresholds to declare a pass/fail verdict.

The burst test procedure is generated for each enabled service.

The **Burst Test** check box is cleared by default.

➤ **Service Performance Test**

The objective of this test is to verify that the SLA parameters are met over time by running multiple services simultaneously. The maximum Jitter, Latency, Frame Loss, sequence, and average throughput are measured and will be compared to the configured thresholds to declare a pass/fail verdict. The **Service Performance Test** is not performed for services that have their CIR check box cleared. The **Service Performance Test** check box is selected by default.

Sub-Tests Duration

- **Service Configuration Test** displays the **Service Configuration Test** duration in days:hours:minutes:seconds format based on Services, Ramp, and Burst settings (see *Services (Configuration)* on page 327, *Ramp (Configuration)* on page 333, and *Burst (Configuration)* on page 335).
- **Service Performance Test** sets the **Service Performance Test** duration in days:hours:minutes:seconds format. The default setting is 10 minutes.

Total TX Rate (%)

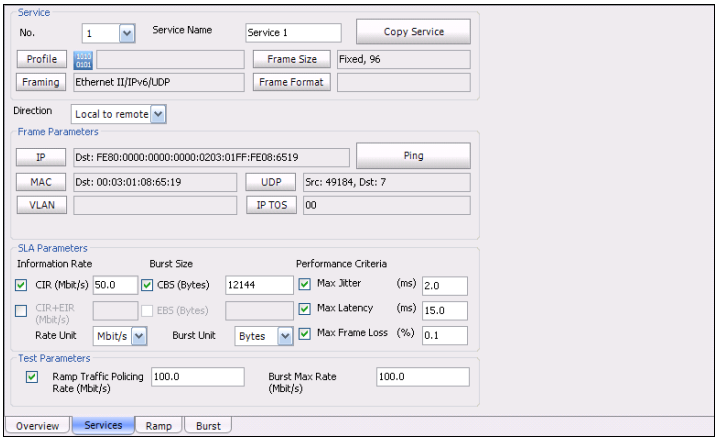
Note: *Only available when the* **Service Performance Test** *check box is selected.*

- **Committed** displays the total enabled TX rate (bandwidth) that will be generated by the selected service(s).
- **Available** displays the total TX rate (bandwidth) available for traffic generation.

Note: *For dual test sets, the committed and available TX rate are displayed for both* ***Local*** *and* ***Remote*** *directions.*

Services (Configuration)

Click **TEST**, **EtherSAM Configuration**, and **Services**.



Service

- **No**. select the service number from the list.
- **Service Name** displays and allows to modify the service name. Click the service name field to change the name of the service. Up to 16 characters are allowed. The default service names are **Service 1** to **Service 10**.
- **Copy Service** button allows to copy the configuration of a service to one or several services. Refer to *Copy Service Network Configuration* on page 496 for more information.
- **Profile** indicates and allows to change the selected emulation profile: **Voice** ( ), **Video** ( ), or **Data** ( ) service. The default setting is **Data**. Refer to *Service Profile Configuration* on page 497 for more information.

- **Framing** indicates and allows to change the selected framing. The framing is displayed as follow: **Data Link/Network/Transport**. Refer to *Framing Configuration* on page 498 for more information.
- **Frame Size** indicates and allows to change the selected frame size. Refer to *Frame Size Configuration* on page 499 for more information.
- **Frame Format** indicates and allows to change the selected frame format. Frame format is available when the **Data Link** is set to **802.3 SNAP** or when **Data Link** is set to **Ethernet II** while **Network** is set to **None**. Refer to *Frame Format Configuration* on page 501 for more information.

Direction

Direction is available with dual test set and allows to select the frame parameters for the local module when **Local to remote** is selected, and for the remote module when **Remote to local** is selected.

The following parameters are coupled for both directions: **CIR**, **CIR+EIR**, **CBS**, **EBS**, and **Traffic Policing** check boxes. However, their values are not coupled.

Frame Parameters

- **IP** indicates and allows to change the selected frame source and destination IP address. Refer to *IPv4 Configuration* on page 489 and *IPv6 Address Configuration* on page 491 for more information.
- **MAC** indicates and allows to change the selected frame destination MAC address. Refer to *MAC Configuration* on page 502 for more information.
- **VLAN** indicates and allows to change the selected VLAN level(s). Refer to *VLAN Configuration* on page 486 for more information.

- **PBB-TE** indicates and allows to change the selected frame PBB-TE destination address. PBB-TE is only displayed when PBB-TE has been enabled. Refer to *PBB-TE Interface configuration* on page 487 for more information.
- **MPLS** indicates and allows to change the selected frame label. MPLS is only displayed when MPLS has been enabled. Refer to *MPLS Configuration* on page 503 for more information.
- **UDP** indicates and allows to change the selected source and destination UDP ports. UDP is only available when the Framing's Transport is set to UDP. Refer to *UDP Configuration* on page 505 for more information.
- **TCP** indicates and allows to change the selected source and destination TCP ports. TCP is only available when the Framing's Transport is set to TCP. Refer to *TCP Configuration* on page 505 for more information.
- **IP TOS** indicates and allows to change the selected frame IP TOS settings. Refer to *Advanced TOS/DS* on page 506 for more information.

SLA Parameters

The SLA (Service-Level Agreement) parameters allows defining the pass/fail verdict thresholds for the service. Use the check boxes to enable the pass/fail verdict for these parameters and enter the threshold values.

Information Rate

Note: *At least one check box (**CIR** or **CIR+EIR**) has to be selected. Thus, clearing the CIR check box while CIR+EIR check box is cleared, will automatically select the CIR+EIR check box and vice versa.*

- **CIR** (Committed Information Rate) sets the service rate guaranteed by the SLA. The CIR check box is selected by default and its value sets to 50% of the line rate. CIR and preceding steps are not performed for services that have the CIR check box cleared.

- **CIR+EIR** sets the best effort allowed traffic for the service. The EIR (Excess Information Rate) value is equal to the "CIR+EIR" value minus "CIR". The **CIR+EIR** check box is cleared by default.
- **Rate Unit** allows the selection of **Mbit/s** (default) or **Gbit/s** as the rate unit for **CIR**, **CIR+EIR**, **Ramp Traffic Policing Rate**, and **Burst Max Rate**.

Note: *Changing a criteria value (CIR, CIR+EIR, Ramp Traffic Policing, or Burst Max Rate) may affect the other criteria values in order to comply to the following rules:*
CIR ≤ CIR+EIR ≤ Ramp Traffic Policing Rate ≤ Line Rate
CIR ≤ CIR+EIR ≤ Burst Max Rate ≤ Line Rate
However, make sure that the criteria values comply to the following rule with an adequate margin, as per ITU-T Y.1564 standard, for a burst test to be valid:
CIR < CIR+EIR < Burst Max Rate ≤ Line Rate

Note: *The minimum rate is 1Mbit/s when the **Frame Size** is **Random**.*

Burst Size

- **CBS** sets the maximum committed burst size to which services' frames will be sent and be CIR-compliant. The CBS minimum and maximum values are affected by the **CIR**, **Burst Max Rate**, and **Frame Size** values. **CBS** is only available when **Burst Test** (see page 324) and **CIR** are enabled.
- **EBS** sets the maximum excess burst size to which services' frames will be sent and be CIR+EIR compliant. The EBS minimum and maximum values are affected by the **CIR+EIR**, **Burst Max Rate**, and **Frame Size** values. **EBS** is only available when **Burst Test** (see page 324) and **CIR+EIR** are enabled.
- **Burst Unit** allows the selection of **Bytes** (default) or **ms** as the burst size unit for **CBS** and **EBS**.

Performance Criteria

- **Max Jitter** allows to set the maximum jitter value in millisecond (0.015 to 8000 ms), allowed for the service. The default setting is 2 ms.
- **Max Round-Trip Latency** allows to set the maximum round-trip latency value in millisecond (0.015 to 8000 ms), allowed for the service. The default setting is 15 ms. For Dual Test Set, the **Max Round-Trip Latency** is only configurable when the **Local to remote** direction is selected.
- **Max Frame Loss** allows to set the maximum percentage value (0 to 5%) of Frame Loss allowed for the service. The default setting is 0.1%.

Test Parameters

Ramp Traffic Policing Rate allows to stress the rate limiting of the network by sending traffic at higher rate than committed by the SLA. The **Ramp Traffic Policing Rate** check box is selected by default.

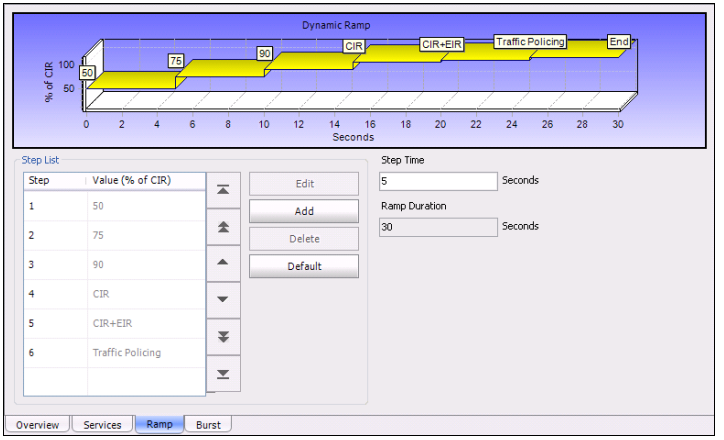
Burst Max Rate allows to set the rate that will be used for the CBS and EBS burst tests. **Burst Max Rate** is only available when the **Burst Test** is enabled; see *Burst Test* on page 324.

Note: *Changing a criteria value (CIR, CIR+EIR, Ramp Traffic Policing, or Burst Max Rate) may affect the other criteria values in order to comply to the following rules:*
CIR ≤ CIR+EIR ≤ Ramp Traffic Policing Rate ≤ Line Rate
CIR ≤ CIR+EIR ≤ Burst Max Rate ≤ Line Rate
However, make sure that the criteria values comply to the following rule with an adequate margin, as per ITU-T Y.1564 standard, for a burst test to be valid:
CIR < CIR+EIR < Burst Max Rate ≤ Line Rate

Ramp (Configuration)

Note: *The Ramp tab is only available when the ramp test is enabled (see Ramp Test* on page 323*).*

Click **TEST**, **EtherSAM Configuration**, and **Ramp**.



Note: *The ramp template is defined globally for all services but the presence of the CIR, CIR+EIR, and Traffic Policing steps are as per each Services configuration. For example a stream may be configured to use CIR, another one to use CIR+EIR, and another one to use both CIR and CIR+EIR with Traffic Policing.*

Dynamic Ramp

The graphic displays the percentage of each ramp step in time.

Step List

- **Step** indicates the step number. Up to 10 steps may be configured; up to 7 pre-CIR, **CIR**, **CIR+EIR**, and **Traffic Policing**. Steps are automatically sorted by the % of CIR value.
- **Value (% of CIR)** indicates a percentage of **CIR**, **CIR+EIR**, and/or **Traffic Policing** RX rate (throughput) level. **CIR+EIR** is part of the step list as soon as it is enabled for at least one service. However, the CIR+EIR step will only be part of the test for services that have the CIR+EIR check box selected.
- **Edit** button allows to edit a ramp step. To modify a ramp step, click the **Edit** button and enter the new CIR percentage.
- **Add** button allows to add a new ramp step. To add a new ramp step, click he **Add** button and enter the CIR percentage.
- **Delete** button allows to delete the selected ramp step. To delete a ramp step, select the ramp step from the list and click on the **Delete** button. **CIR**, **CIR+EIR** and **Traffic Policing** steps cannot be deleted. To remove **CIR+EIR**, **CIR**, and/or **Traffic Policing** from the list, clear the corresponding check box from the **Services** tab for all services.
- **Default** button allows to return to the default ramp steps.

Step Time

The step time represents the test duration for each ramp step (from 5 to 60 seconds).

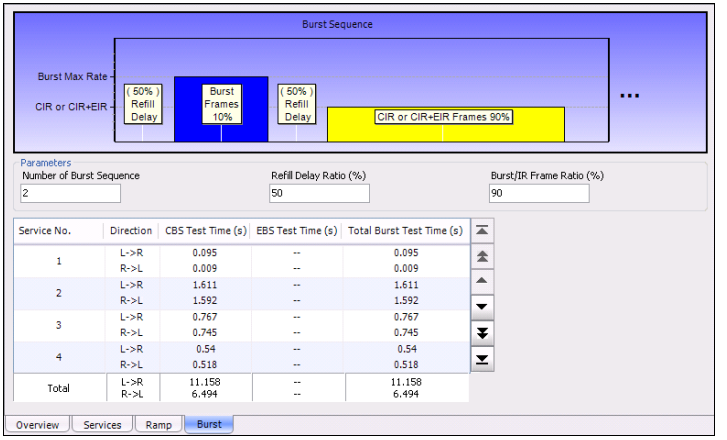
Ramp Duration

The ramp duration indicates the total time required to perform all the ramp steps for each service.

Burst (Configuration)

Note: *The Burst configuration is only available when the burst test is enabled (see Burst Test* on page 324*).*

Click **TEST**, **EtherSAM Configuration**, and **Burst**.



Note: *The burst template is defined globally for all services but CBS, EBS, and Burst Max Rate parameters are as per each Services configuration. For example, a stream may be configured to perform the CBS test, another one to perform the EBS test, and another one to perform both CBS and EBS tests.*

Burst Sequence

The graphic illustrates the configured burst sequence. The sequence contains in order, from left to right:

➤ **Refill Delay** represents the pre-burst recuperation time in percentage that is equal to the remaining percentage not used by the post-burt time (**Refill Delay Ratio**).

- **Burst Frame** represents the burst frame ratio in percentage that is equal to the substraction of **100% - Burst/IR Frame Ratio**.
- **Refill Delay** represents the post-burst recuperation time in percentage that is equal to the configured **Refill Delay Ratio**.
- **CIR or CIR+EIR Frames** represents the percentage of transmission at CIR or CIR+EIR rate. The **CIR or CIR+EIR Frames** percentage is equal to the configured **Burst/IR Frame Ratio**.
- The ". . ." next to the burst sequence indicates that the burst sequence is repeated the number of times specified in the **Number of Burst Sequence** field.

Parameters

- **Number of Burst Sequence** represents the number of times, **1** to **100** (default is **2**), the burst sequence will be repeated for the CBS and EBS tests.
- **Refill Delay Ratio** represents the percentage of time required to refill the CBS/EBS token buckets. The refill delay ratio is used for post-burst delay and the remaining percentage is applied to the pre-burst delay. The **Refill Delay Ratio** is configurable from **0** to **100%** (**50%** is the default as well as the standard's minimum recommended value).
- **Burst/IR Frame Ratio** represents the percentage of frames transmitted at CIR rate for the CBS test and the percentage of frames transmitted at CIR+EIR rate for the EBS test. The **Burst/IR Frame Ratio** is configurable from **0** to **90%** (**90%** is the default as well as the standard's recommended percentage value).

Table

Note: *Result values are only available for enabled services.*

- **Services No** indicates the service number.
- **Dir**.: Direction is displayed for dual test set test case providing bidirectional data.
  L -> R indicates results from local to remote direction.
  R -> L indicates results from remote to local direction.
- **CBS Test Time (s)** indicates the total time required to perform all burst sequence iterations of the CBS test for this service.

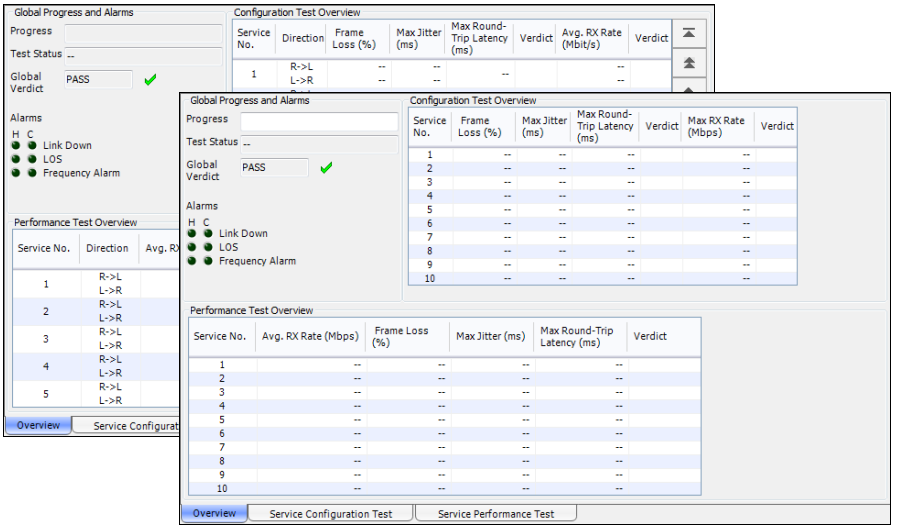
EBS Test Time (s) indicates the total time required to perform all burst sequence iterations of the EBS test for this service.

Total Burst Test Time (s) indicates the total time required to perform all burst sequence iterations of both CBS and EBS tests for this service.

Total indicates respectively the total time required to perform all burst sequence iterations for all services.

Overview (Results)

Click **TEST**, **EtherSAM Results**, and **Overview**.



Global Progress and Alarms

- **Progress** indicates the sub test progress message including the running sub test name and the step number.
- **Test Status** indicates the test status message.

Test Status	Description
Pending (--)	No sub test is started.
Running...	A sub test is currently running.
Data Transfer...	A sub test is running but no test traffic is being transmitted.
Completed, <Verdict>	A sub test has completed. <Verdict> represents the test global verdict upon completion of the sub test.

Test Status	Description
Aborted, <Reason>	A sub test has been aborted either manually (Stop) or by an alarm. <Reason> represents the reason why the test has been aborted. Possible reasons are: ➤ Link down alarm ➤ LOS alarm ➤ DTS connection failed ➤ Timeout during execution ➤ Invalid Configuration (DTS) ➤ Unresolved addresses ➤ No test enabled ➤ Stopped ➤ CIR disabled for all services ➤ Invalid Burst Configuration ➤ Excessive Refill Time[a]

a. An excessive refill occurs when the pre-burst and/or post-burst duration last for more than 2 seconds.

➤ **Global Verdict** indicates the actual test **PASS** or **FAIL** verdict. A **FAIL** verdict is declared when a **Link Down** or **LOS** is detected, or any SLA parameter fails during the test.

- **Alarms**
  - **Link Down**: Indicates that the Ethernet connection is down due to a local or a remote fault condition.
  - **LOS** (Loss Of Signal): A **LOS** indicates that there is no optical input signal.
  - **Frequency Alarm**: The frequency alarm indicates that the received signal rate meets the standard rate specifications (green) or not (red). For electrical port, refer to *Electrical RX* on page 136. For optical ports, refer to *Optical RX* on page 140. The frequency alarm will not be considered in the global verdict.

Service Configuration Test Overview

Displays an overview of the Service Configuration Test results. The following fields are presented in the same order as they appear in the table:

- **Services No** indicates the service number.
- **Dir**.: Direction is displayed for dual test set test case providing bidirectional data.
  L -> R indicates results from local to remote direction.
  R -> L indicates results from remote to local direction.
- **Frame Loss (%)** indicates the percentage of frames that are lost. Note that the reported value is the maximum percentage of Frame Loss from all the burst sequences and ramp steps excluding the **CIR+EIR**, **EBS**, and **Traffic Policing** steps.
- **Max Jitter (ms)** indicates the maximum measured delay variation.
- **Max Round-Trip Latency (ms)** indicates the maximum measured round trip latency (delay).

- **Verdict** indicates that the performance metrics (Jitter, Latency, and Frame Loss) comply (pass) or not (fail) to the SLA configuration. The verdict is based on the results from all the ramp steps excluding the **Traffic Policing** step.
- **Max RX Rate** indicates the measured maximum utilization RX rate (throughput).
- **Verdict** indicates the maximum throughput complies (pass) or not (fail) to the maximum allowed value based on either the configured CIR+EIR or CIR when CIR+EIR is not enabled.

Note: *Each metric with a fail verdict will be displayed with a red background.*

Service Performance Test Overview

Displays an overview of the service performance test results.

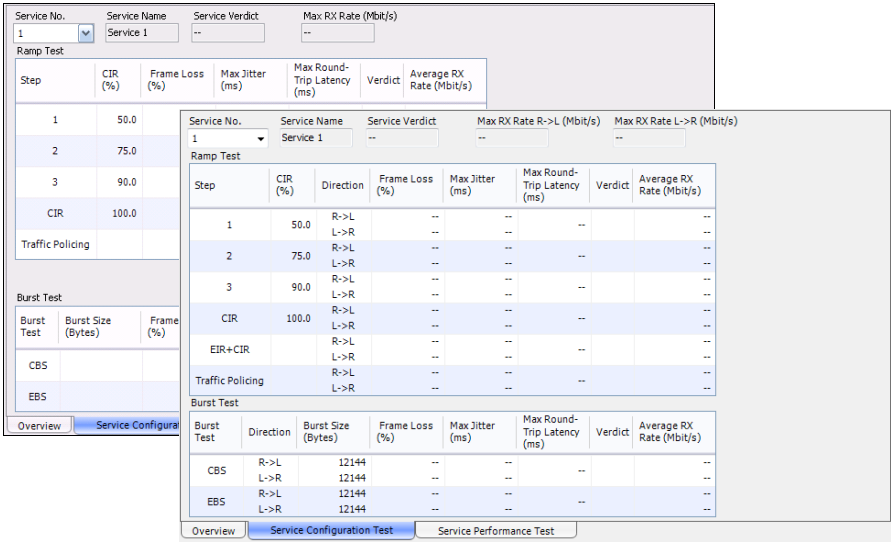
- **Service No** indicates the service number.
- **Dir**.: Direction is displayed for dual test set test case providing bidirectional data.
  L -> R indicates results from local to remote direction.
  R -> L indicates results from remote to local direction.
- **Avg. RX Rate** (**Mbit/s** or **Gbit/s**) indicates the measured average utilization throughput in either Mbit/s or Gbit/s.
- **Frame Loss (%)** indicates the percentage of frames that are lost. Note that the reported value is the maximum percentage of Frame Loss from all the burst sequences and ramp steps excluding the **CIR+EIR**, **EBS**, and **Traffic Policing** steps.
- **Max Jitter (ms)** indicates the maximum measured delay variation.
- **Max Round-Trip Latency (ms)** indicates the maximum measured round trip latency (delay).
- **Verdict** indicates if the service complies (pass) or not (fail) to the configured SLA parameters.

  For dual test set, both **Local Verdict** and **Remote Verdict** are available while the test is running. Once the test is completed only **Verdict** is displayed that combines both local and remote verdicts.

Note: *Each metric with a fail verdict will be displayed with a red background.*

Service Configuration Test (Results)

Click **TEST**, **EtherSAM Results**, and **Service Configuration Test**.



- **Service No** allows the selection of the service number.
- **Service name** indicates the name of the selected service number.
- **Service Verdict** indicates the pass or fail verdict for the selected service, including metrics and maximum throughput, once all the ramp steps and burst tests have been performed on this service.
- **Max RX Rate** indicates the measured maximum utilization throughput. The verdict is also displayed indicating if the maximum throughput complies (pass) or not (fail) to the maximum allowed value based on either the configured CIR+EIR or CIR when CIR+EIR is not enabled.
- **Max RX Rate R-> L** and **Max RX Rate L-> R**, for dual test set, indicates respectively the average of the measured maximum throughput for the entire configuration test from remote to local and local to remote unit.

Ramp and Burst Tests Table

- **Step**, for ramp test, indicates the ramp step number or name.
- **CIR %**, for ramp test, indicates the percentage of CIR used for each step (see *SLA Parameters* on page 329).
- **Burst Test**: indicates the two burst tests: CBS and EBS.
- **Burst Size** indicates the size of the burst used for the test (see *SLA Parameters* on page 329).
- **Direction**: Direction is displayed for dual test set test case providing bidirectional data.
  L -> R indicates results from local to remote direction.
  R -> L indicates results from remote to local direction.
- **Frame Loss (%)** indicates the percentage of frames that are lost. Note that the reported value is the maximum percentage of Frame Loss from all the burst sequences and ramp steps excluding the **CIR+EIR**, **EBS**, and **Traffic Policing** steps.
- **Max Jitter (ms)** indicates the maximum measured delay variation.
- **Max Round-Trip Latency (ms)** indicates the maximum measured round trip latency (delay).

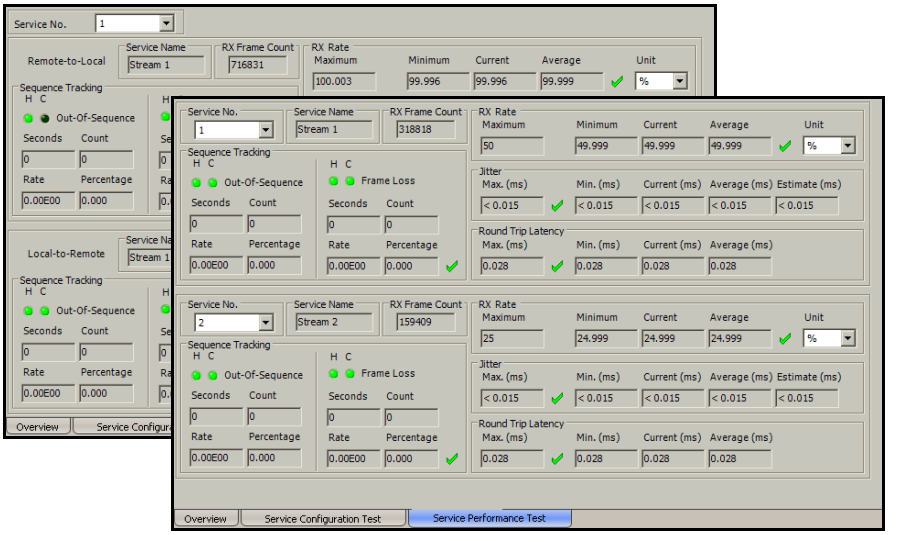
- **Verdict** indicates that the performance metrics (Jitter, Latency, and Frame Loss) comply (pass) or not (fail) to the SLA configuration for each ramp's step and for CBS burst test. Verdict is not available for EBS burst test.
- **Average RX Rate** (**Mbit/s**) indicates the measured average utilization rate (throughput).

Note: *Each metric with a fail verdict will be displayed with a red background.*

Service Performance Test (Results)

Click **TEST**, **EtherSAM Results**, and **Service Performance Test**.

This tab allows to see two EtherSAM result services simultaneously in loopback and to see the local and remote units simultaneously for dual test sets.



- **Service No** allows the selection of the service number.
- **Remote to Local** and **Local to Remove** indicates for dual test set, the service results respectively for remote to local and local to remote.
- **Service name** indicates the name of the selected service number.
- **RX Frame Count** indicates the number of frames received matching the selected service ID.

Sequence Tracking

- **Out-Of-Sequence** (OOS) is declared when a valid packet has its sequence number smaller than the previously received packet. Seconds, count, rate, and percentage values are reported. The Out-Of-Sequence will not be considered in the global verdict.
- **Frame Loss** is declared when a sequence number is missing. Note that the reported value is the maximum percentage of Frame Loss from all the burst sequences and ramp steps excluding the **CIR+EIR**, **EBS**, and **Traffic Policing** steps. Seconds, count, rate, and percentage values are reported. The pass or fail verdict is also displayed.

RX Rate

The RX Rate (throughput) is measured for each stream on all valid frames. The maximum, minimum, current, and average RX rate results are reported. The pass or fail verdict is also displayed for the average RX rate.

Unit choices are **%**, and **Mbps**. The default setting is **%**.

Note: *For the **Current** value, **0** is displayed when no RX rate has been measured in the last second.*

Jitter

The Jitter is measured for each stream on all valid frames. The estimated Jitter, maximum, minimum, current, and average delay values are reported. The pass or fail verdict is also displayed for the maximum jitter.

Note: *Delay variation measurements smaller than 15 µs will be discarded, not used for the sampling process, and "< 0.015" will be displayed as the minimum value. For the **Current** value, **Not measurable** is displayed when no delay has been measured in the last second.*

Round Trip Latency

The round trip latency (delay) is measured for each stream on all valid frames. The maximum, minimum, current, and average delay values are reported. The pass or fail verdict is also displayed for the maximum round trip latency. For Dual Test Set, the **Round Trip Latency** is only displayed on the **Remote to Local** page.

Note: *Delay measurements smaller than 15 µs will be discarded, not used for the sampling process, and "< 0.015" will be displayed. For the* ***Current*** *value,* ***Not measurable*** *is displayed when no delay has been measured in the last second.*

16 TCP Throughput Tabs

Note: *The TCP Throughput tabs are only available with TCP Throughput test. Available with RTU-310 only.*

Note: ***TCP Throughput*** *software option needs to be enabled to be available. Refer to* Available Options *on page 348.*

TCP Throughput Configuration

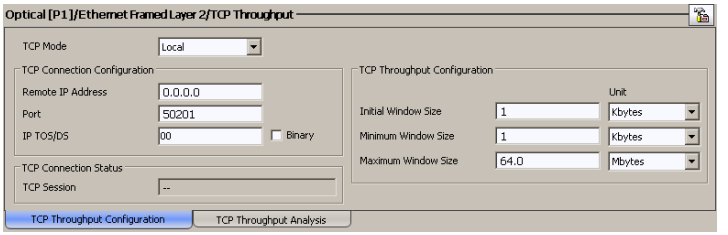
The objective of this test is to find the TCP throughput based on the successfully transported bytes over the test time.

Two units running a **TCP Throughput** test are required. One unit will act as the source (Local) and the other one as the destination (Remote).

The local unit starts sending TCP segments using the **Initial Window Size** defined. The window size is adjusted following the TCP algorithm. The window size is incremented until the **Maximum Window Size** or congestion is reached. However, the window size will be reduced when congestion occurs, then incremented again as described above when the congestion is cleared.

TCP Throughput and windows size statistics will be gathered throughout the test.

Click **TEST**, **TCP Throughput**, and **TCP Throughput Configuration**.



TCP Mode

Since two units are required to perform a TCP Throughput test, one unit must be the source (**Local**) unit and the other one the destination (**Remote**). Set the TCP Mode on both units. Choices are **Local** and **Remote**. The default setting is **Local**.

TCP Connection Configuration

- **Remote IP Address** (Available with **Local** TCP Mode): On the local unit, enter the IP Address of the remote unit.
- **Listening IP Address** (Available with **Remote** TCP Mode): On the remote unit, enter the IP Address of the local unit. The IP address **0.0.0.0** can be used to listen to any TCP stream. The default setting is **0.0.0.0**.

➤ **Port**: Enter the TCP port number. The default setting is **50201**.

For the local unit, the specified TCP port will be used for the TCP initialization algorithm with the remote unit. The following TCP segments sent by the local unit will use the TCP port number replied by the remote unit.

➤ **IP TOS/DS**: Enter the IP TOS/DS value. Choices are **00** to **FF**. The default setting is **00**.

Binary: Displays the IP TOS/DS value in binary when enabled.

TCP Connection Status

TCP Session: Indicates the TCP session status:

--: Indicates that the test has not run yet.

In Progress: Indicates on the local unit that the TCP initialization algorithm is in progress.

Waiting: Indicates on the remote unit that the test is started but the TCP initialization algorithm is not completed.

Established: Indicates that the TCP session has been successfully established between the local and remote units.

Closed: Indicates that either, no TCP initialization algorithm has been received after 12 seconds, the remote unit has received and completed the request to close the TCP session, or no data has been received at the remote unit for 30 seconds.

Closing: Indicates on the local unit that the test on the remote unit has just been stopped. The closing status lasts 3 seconds and switches to the **Closed** status.

Remote IP not found: Indicates that the local unit didn't received an answer to the ARP request sent to the IP address of the remote unit.

TCP Throughput Configuration

Note: ***TCP Throughput Configuration*** *is only available on the local unit.*

- **Initial Window Size**: Enter the window size that will be used when the test is started. Choices are from **1024 Bytes** to **65536 KBytes**. The entered value will be rounded to the closest multiple of 1024 Bytes. The default setting is **2048 Bytes**. The **Initial Window Size** value must be between the **Minimum Window Size** and the **Maximum Window Size** values.

  Unit: Select the window size unit. Choices are **Bytes**, **KBytes** and **MBytes**. The default setting is **KBytes**.

- **Minimum Window Size**: Enter the minimum window size for the application to be tested. Choices are from **1024 Bytes** to **65536 KBytes**. The entered value will be rounded to the closest multiple of 1024 Bytes. The default setting is **1024 Bytes**.

  Unit: Select the window size unit. Choices are **Bytes**, **KBytes** and **MBytes**. The default setting is **MBytes**.

- **Maximum Window Size**: Enter the maximum window size for the application to be tested. Choices are from **1024 Bytes** to **65536 KBytes**. The entered value will be rounded to the closest multiple of 1024 Bytes. The default setting is **65536 KBytes**.

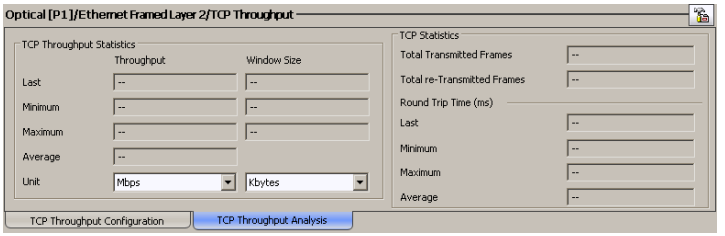
  Unit: Select the window size unit. Choices are **Bytes**, **KBytes** and **MBytes**. The default setting is **MBytes**.

Note: *A TCP Throughput frame has its payload value set to all zeros and its payload size set to 1024 Bytes.*

TCP Throughput Analysis

Note: *Only available on the local unit.*

Click **TEST**, **TCP Throughput**, and **TCP Throughput Analysis**.



TCP Throughput Statistics

➤ **Throughput**

Last: Indicates the last TCP Throughput measurement.

Minimum: Indicates the smallest TCP Throughput measurement.

Maximum: Indicates the highest TCP Throughput measurement.

Average: Indicates the average TCP Throughput measurement over the TCP Throughput test duration.

Unit: Select the TCP Throughput measurement unit. Choices are **%** and **Mbps**. The default setting is **Mbps**.

➤ **Window Size**

Last: Indicates the last TCP window size.

Minimum: Indicates the smallest TCP window size.

Maximum: Indicates the highest TCP window size.

Unit: Select the window size unit. Choices are **Bytes**, **KBytes**, and **MBytes**. The default setting is **KBytes**.

TCP Statistics

TCP Statistics are gathered from packets having good Ethernet FCS, IP header checksum, TCP header checksum, and socket.

➤ **Total Transmitted Frames**: Indicates the total of frames transmitted by the local unit excluding the re-transmitted frames.

➤ **Total re-Transmitted Frames**: Indicates the total of frames that have been re-transmitted by the local unit.

➤ **Round Trip Time (ms)**

Last: Indicates the last round trip time in ms gathered from the TCP Throughput test.

Minimum: Indicates the minimum round trip time in ms gathered from the TCP Throughput test.

Maximum: Indicates the maximum round trip time in ms gathered from the TCP Throughput test.

Average: Indicates the average round trip time in ms gathered from the TCP Throughput test.

17 Advanced Tab

Note: *The available Advanced tab depends on which test path is activated.*

Tab	Available with		Page
	Ethernet	Fibre Channel[a]	
Service Disruption Time (SDT)	X		355

a. Not available with RTU-310G.

Service Disruption Time (SDT)

Note: *Service Disruption Time is only available with BERT test.*

The Service Disruption Time (SDT) corresponds to the time during which there is a disruption of service due to the absence of traffic or the detection of defects.

Click **TEST** and **SDT**.

Configuration

Select the criteria that will be used for the SDT measurement.

Note: *The service disruption measurements are cleared when changing the criteria.*

➤ **Measurement Mode**: Select the SDT measurement mode. Choices are **Defect Mode** and **No Traffic Mode**. The default setting is **Defect Mode**.

Defect Mode is based on the detection of defects including **LOS**, **Link down**, **Invalid FCS**, **LSS**, and **Bit errors** in the payload. The SDT measurement is the time between the first defect and either the end of the last defect preceding the **No Defect Time** period, or the end of the test period.

No Traffic Mode is based on the absence of traffic. The SDT measurement is the time between the end of the last received frame and either the beginning of a new received frame, or the end of the test period.

➤ **No Traffic Time**: Available for **No Traffic Mode** only. **No Traffic Time** is a configured value which raises a defect if no Ethernet frame is received during the defined test period. Choices are:

Rate	No Traffic Time range
10/100/1000Mbps	**10** to **99990 µs** for RTU-310
10Gbps	**10** to **100000 µs** for RTU-310G

Unit choices are **µs**, **ms**, and **s**. The default setting is **10000 µs**.

➤ **No Defect Time**: Available for **Defect Mode** only. **No Defect Time** represents the period without any defects before stopping SDT measurement. Choices are from **20** to **99990 µs** for **10/100/1000Mbps** and **10** to **99000 µs** for **10Gbps** The maximum value is adjusted with respect to the test period (the max **No Defect Time** is obtained when

the **Test Period** value is set to its maximum value: 300000000 µs). The default setting is **20 µs** for **10/100/1000Mbps** and **10 µs** for **10Gbps**. Unit measurement selections are **µs**, **ms**, and **s**.

- **Test Period**: Represents the period of time used to calculate the SDT measurement. Choices are **20 µs** to **5 minutes** for **10/100/1000Mbps** and **10000 µs** to **5 minutes** for **10Gbps**. Unit choices are **µs**, **ms**, **s**, and **min**. The default setting is **100 ms**.
- **On/Off** button: Click On/Off to enable/disable the disruption time measurements. However, the measurement will only start if the test is already started, or when the test will be started.

Note: *Stopping the SDT test will stop the measurement without clearing the results. The SDT test is automatically stopped without clearing results when the test is stopped. However, starting the test again while the STD is still On (enabled) will reset the results before restarting.*

Statistics

- **Total Disruption Count**: Indicates the number of disruptions that happened since the beginning of the SDT test.
- **Shortest**: Indicates the shortest measured disruption time.
- **Longest**: Indicates the longest measured disruption time.
- **Last**: Indicates the length of the last measured disruption time.
- **Average**: Indicates the average length of all measured disruption times.
- **Total**: Indicates the total length of all measured disruption times.
- **Unit**: Select the unit for the statistics. Choices are **µs**, **ms**, **s**, and **min**. The default setting is **ms**.

Note: *When the measured SDT is equal or longer than the Test Period, then the SDT equals the **Test Period time**.*

➤ **Service Disruption**: Indicates the time (in seconds) during which there is a disruption of service due to the absence of traffic or to the detection of defects. The H and C LEDs indicate respectively the current (C) and history (H) SDT measurement states.

The **C** (Current) LED is red if there is an SDT, and lasts until the next **No Defect Time period** for **Defect Mode**, and until the next frame for the **No Traffic Mode**. For **No Traffic Mode**, the LED will only turn red when the **No Traffic Mode** period has been reached or exceeded. The C LED is green when there is no SDT. After an SDT with **Defect Mode**, the C LED will only turn green after the **No Defect Time** has been met.

The **H** (History) LED indicates if any SDT occurred in the past (LED is red) or not (LED is green).

18 Common Tab

Tab	Available with		Page
	Ethernet	Fibre Channel[a]	
Performance Monitoring (PM)	X	X	359

a. Not available with RTU-310G.

Performance Monitoring (PM)

The Performance Monitoring tab gives error performance events and parameters for the circuit under test.

Note: *Performance Monitoring (PM) is only available with BERT test. Not available with 10Gig-E WAN transceiver mode.*

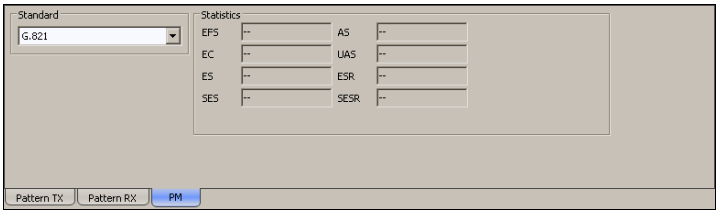
PM is available under the Traffic Analyzer and Pattern sections:

- For Traffic Analyzer section, PM is available Framed Layer 2 and for 1000Mbps interface with Frame Layer 1 (with xPAT pattern).

  Click **TEST, Traffic Analyzer,** and **PM** (**FC PM** for Fibre Channel).

- For Pattern section, PM is available with **Unframed**, **Framed Layer 1**, and **Framed Layer 2**.

  Click **TEST**, **Pattern**, and **PM**.



Standard

Select the desired standard from the list. Choices are:

	Standard	Framed Layer 2	Framed Layer 1	Unframed
Traffic Analyzer	**G.826 ISM**	X	X[a]	
	G.826 OOSM	X	X	
Pattern	**G.821**	X	X	X

a. Available with xPAT test pattern only. xPAT patterns are available with BERT 1000Mbps optical test using **Framed Layer 1**.

Statistics

- **EFS** (Error Free Second): Gives the number of seconds within which no bit error occurred.
- **EC** (Error Count) (**G.821** only): Gives the number of bit errors.
- **EB** (Errored Block) (**G.826** only): Gives the count of blocks (frame) in which one or more bits are in error.
- **ES** (Errored Second):

  For G.821: Gives the number of seconds within which one or more bit error occurred, or during which Loss Of Signal (LOS) or Link down is detected.

  For G.826: Gives the number of seconds within which one or more Errored Block (EB) occurred, or at least one NE defect occurred.

- **SES** (Severely Errored Second)

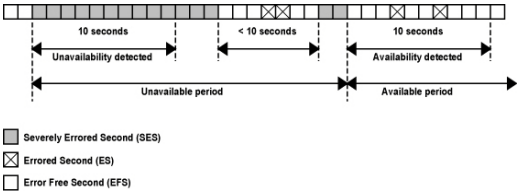
  For G.821: Gives the number of seconds within which a bit error ratio is $\geq 10^{-3}$, or during which Loss Of Signal (LOS), Link down, or Pattern Loss is detected.

  For G.826: Gives the number of seconds within which EB count is ≥ SES threshold (30%), or at least one NE defect occurred.

- **BBE** (Background Block Error) (**G.826** only): Gives the count of Errored Block not occurring as part of a SES. A Block corresponds to a complete Ethernet/Fibre Channel frame.

- **AS** (Available Second): Gives the count of the seconds corresponding to the periods of time within which no SES errors occurred for at least 10 consecutive seconds.

- **UAS** (Unavailable Second): Gives the count of the seconds corresponding to the periods of time within which SES errors occurred for at least 10 consecutive seconds. The unavailable period ends at the beginning of the next available period represented by ten consecutive seconds within which no SES errors are detected.



- **ESR** (Errored Second Ratio): Gives the ratio of the number of ES in available time (AS) during a fixed measurement interval.

  ESR = ES ÷ AS

- **SESR** (Severely Errored Second Ratio): Gives the ratio of the number of SES in available time (AS) during a fixed measurement interval.

  SESR = SES ÷ AS

- **BBER** (Background Block Error Ratio) (**G.826** only): Gives the ratio of BBE in available time (AS) to total frames (fps - Frames per second) in available time during a fixed measurement interval. The count of total frames excludes all frames during SESs.

  BBER = BBE ÷ ((AS - SES) * fps)

19 Expert Mode Tabs

Note: *The Expert Mode tabs are only available with BERT and RFC 2544 Ethernet tests (not available with Fibre Channel).*

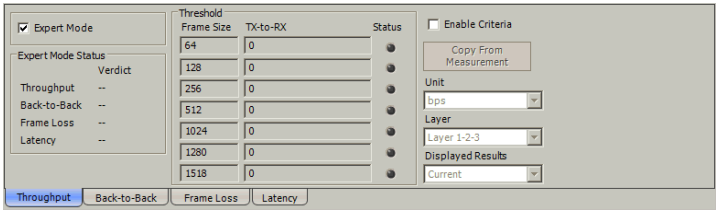
Tab	Available with		Page
	Ethernet	Fibre Channel[a]	
Expert Mode (RFC 2544)	X		364
Throughput (RFC 2544)	X		366
Back-to-Back (RFC 2544)	X		368
Frame Loss (RFC 2544)	X		370
Latency (RFC 2544)	X		372
Expert Mode (BERT)	X		374
Port (BERT)	X		375
Ethernet (BERT)	X		377
Pattern (BERT)	X		379

a. Not available with RTU-310G.

Expert Mode (RFC 2544)

Expert Mode allows the configuration of the thresholds for which each statistic will be compared to declare a PASS or FAIL verdict.

Click **TEST** and **Expert Mode**.



Expert Mode

Allows enabling/disabling the **Expert Mode**. This setting is disabled by default.

Expert Mode Status

Gives the verdict, **Pass** or **Fail**, of the **Throughput**, **Back-to-Back**, **Fame Loss**, and **Latency** tests according to the **Expert Mode** settings.

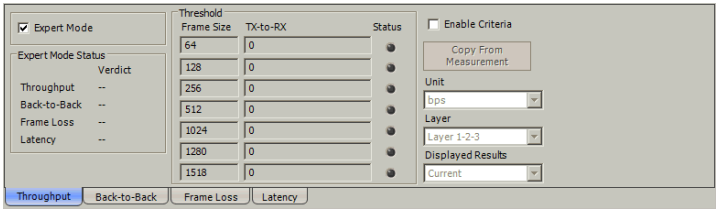
- **Pass** is declared if all result values meet the configured criteria.
- **Fail** is declared if any result value does not meet the configured criteria.
- **"--"** is displayed when at least one of the following conditions is met:

  - the **Expert Mode** is not enabled
  - if there is no defined criterion
  - when the specific test has not run yet.

Note: *The verdict results are only available when the Expert Mode has been enabled and when the specific test (**Throughput**, **Back-to- Back**, **Frame Loss**, or **Latency**) is completed.*

Throughput (RFC 2544)

Click **TEST**, **Expert Mode**, and **Throughput**.



➤ **Enable Criteria**: Allows to enable **Throughput Pass/Fail** criteria. This setting is disabled by default.

Note: *Both **Enable Criteria** and the test itself (see Global Configuration* on page 296*) have to be enabled for a specific test to be able to change its criteria values.*

➤ **Frame Size**: Indicates the frame sizes selected for the test.

➤ **TX-to-RXP1-to-P2/P2-to-P1/Local to Remote/Remote to Local**: For each frame size, enter the minimum throughput values allowed before declaring a **Fail** condition. The default values are the maximum throughput. **P1-to-P2/P2-to-P1** is only available with RTU-310.

➤ **Status**: Indicates the real-time pass/fail condition.

Grey LED: Indicates that **Expert Mode** is disabled or the test did not run yet.
Green LED: Indicates that the threshold is respected (**Pass**).
Red LED: Indicates that the threshold is not respected (**Fail**).

➤ **Copy From Measurement** button: Copy the performance results from the test that ran previously and use it as the **Pass/Fail** criteria. If no test ran before, default values used will be **0 bps**.

➤ **Unit**: Select the unit. Choices are: **bps**, **Kbps**, **Mbps**, **Bps**, **KBps**, **MBps**, **Gbps**, **GBps**, **% Util** and **fps** (Frame Per Second). The default setting is **bps**.

- **Layer**: Select the Layer. Choices are **Layer 1,2,3**, **Layer 2,3**, and **Layer 3**. The default setting is **Layer 1,2,3**.

  Layer 1,2,3 contains the Preamble, Start of Frame Delimiter, MAC address, IP address, and data.

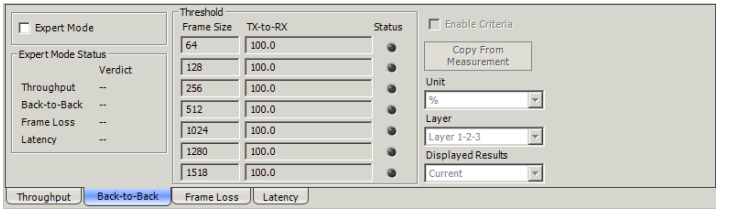
  Layer 2,3 contains the MAC address, IP address, and data.

  Layer 3 contains the IP address, and data.

- **Displayed Results**: Select the displayed results mode. Choices are **Current**, **Minimum**, **Maximum** and **Average**. The default setting is **Current**.

Back-to-Back (RFC 2544)

Click **TEST**, **Expert Mode**, and **Back-to-Back**.



➤ **Enable Criteria**: Allows to enable **Back-to-Back Pass/Fail** criteria. This setting is disabled by default.

Note: *Both **Enable Criteria** and the test itself (see Global Configuration* on page 296*) have to be enabled for a specific test to be able to change its criteria values.*

➤ **Frame Size**: Indicates the frame sizes selected for the test.

➤ **TX-to-RX/P1-to-P2/P2-to-P1/Local to Remote/Remote to Local**: For each frame size, enter the minimum number of frames values at maximum throughput allowed before declaring a Fail condition. **P1-to-P2/P2-to-P1** is only available with RTU-310.

➤ **Status**: Indicates the real-time pass/fail condition.

Grey LED: Indicates that **Expert Mode** is disabled or the test did not run yet.
Green LED: Indicates that the threshold is respected (**Pass**).
Red LED: Indicates that the threshold is not respected (**Fail**).

➤ **Copy From Measurement** button: Copy the performance results from the test that ran previously and use it as the **Pass/Fail** criteria. If no test ran before, default values used will be **0 Frames/Burst**.

➤ **Unit**: Select the unit. Choices are: **bps**, **Kbps**, **Mbps**, **Bps**, **KBps**, **MBps**, **Gbps**, **GBps**, **% Util**, **fps** (Frame Per Second), **Frames/Burst**, and **Bytes/Burst**. The default setting is **Frames/Burst**.

- **Layer**: Select the Layer. Choices are **Layer 1,2,3**, **Layer 2,3**, and **Layer 3**. The default setting is **Layer 1,2,3**.

  Layer 1,2,3 contains the Preamble, Start of Frame Delimiter, MAC address, IP address, and data.

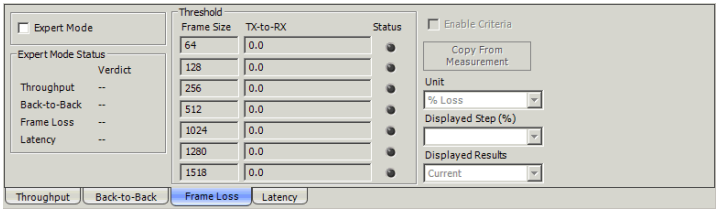
  Layer 2,3 contains the MAC address, IP address, and data.

  Layer 3 contains the IP address, and data.

- **Displayed Results**: Select the displayed results mode. Choices are **Current**, **Minimum**, **Maximum**, and **Average**. The default setting is **Current**.

Frame Loss (RFC 2544)

Click **TEST**, **Expert Mode**, and **Frame Loss**.



➤ **Enable Criteria**: Allows to enable **Frame Loss Pass/Fail** criteria. This setting is disabled by default.

Note: *Both **Enable Criteria** and the test itself (see Global Configuration* on page 296*) have to be enabled for a specific test to be able to change its criteria values.*

➤ **Frame Size**: Indicates the frame sizes selected for the test.

➤ **TX-to-RX/P1-to-P2/P2-to-P1/Local to Remote/Remote to Local**:

For each frame size, enter the maximum percentage of frames that can be lost before declaring a **Fail** condition.

➤ **Status**: Indicates the real-time pass/fail condition.

Grey LED: Indicates that **Expert Mode** is disabled or the test did not run yet.
Green LED: Indicates that the threshold is respected (**Pass**).
Red LED: Indicates that the threshold is not respected (**Fail**).

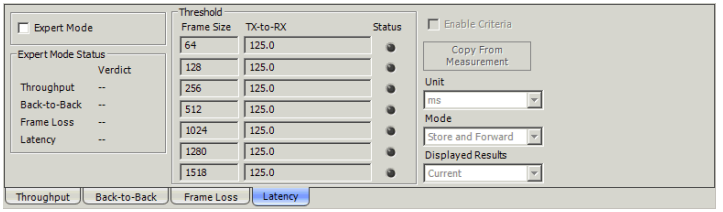
➤ **Copy From Measurement** button: Copy the performance results from the test that ran previously and use it as the Pass/Fail criteria. If no test ran before, default values used will be **0% Loss**.

➤ **Unit**: Unit is set to **% Loss** frames.

- **Displayed Step**: Indicates the last percentage of the speed used for the test. Possible values are **100%** (or % of the maximum speed) to **0%** with increment set by the Test granularity from the *Frame Loss* on page 308. The default setting is **100%** (or % of the maximum speed). Displayed Step is only available once the Frame Loss test is running or completed.
- **Displayed Results**: Select the displayed results mode. Choices are **Current**, **Minimum**, **Maximum**, and **Average**. The default setting is **Current**.

Latency (RFC 2544)

Click **TEST**, **Expert Mode**, and **Latency**.



➤ **Enable Criteria**: Allows to enable **Latency Pass/Fail** criteria. This setting is disabled by default.

Note: *Both **Enable Criteria** and the test itself (see Global Configuration* on page 296*) have to be enabled for a specific test to be able to change its criteria values.*

➤ **Frame Size**: Indicates the frame sizes selected for the test.

➤ **TX-to-RX/P1-to-P2/P2-to-P1/Local to Remote/Remote to Local**:

For each frame size, enter the maximum time required for the sent frame to come back before declaring a **Fail** condition.
P1-to-P2/P2-to-P1 is only available with RTU-310.

➤ **Status**: Indicates the real-time pass/fail condition.

Grey LED: Indicates that **Expert Mode** is disabled or the test did not run yet.
Green LED: Indicates that the threshold is respected (**Pass**).
Red LED: Indicates that the threshold is not respected (**Fail**).

➤ **Copy From Measurement** button: Copy the performance result minimum values from the test that ran previously and use it as the **Pass/Fail** criteria. If no test ran before, default values used will be **0.015 ms** with **Store and Forward** mode.

➤ **Unit**: Select the unit. Choices are **s**, **ms**, **µs**, and **ns**. The default setting is **ms**.

- **Mode**: Select the Mode. Choices are **Cut Through** and **Store and Forward**. The default setting is **Store and Forward**.

  Cut Through allows the calculation of the propagation time of a bit.

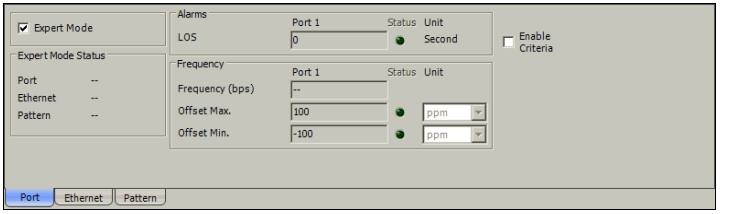
  Store and Forward allows the calculation of the propagation time of a frame.

- **Displayed Results**: Select the displayed results mode. Choices are **Current**, **Minimum**, **Maximum**, and **Average**. The default setting is **Current**.

Expert Mode (BERT)

Expert Mode allows the configuration of the thresholds for which each statistic will be compared to declare a PASS or FAIL verdict.

Click **TEST** and **Expert Mode**.



General Properties

Expert Mode: Allows enabling/disabling the **Expert Mode**. This setting is disabled by default.

Expert Mode Status

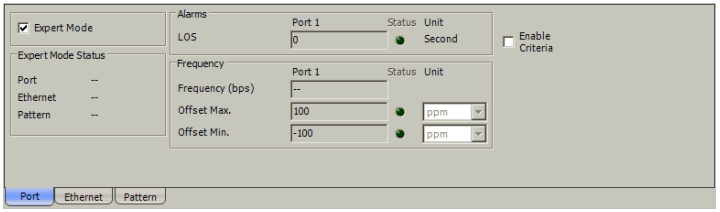
Verdict: Gives the verdict, **Pass** or **Fail**, of the **Port**, **Ethernet** and **Pattern** tests according to the **Expert Mode** settings.

Verdict	Description
Pass	If all result values meet the configured criteria.
Fail	If any result value does not meet the configured criteria.
"--"	Is displayed when at least one of the following conditions is met: the **Expert Mode** is not enabled, there is no defined criterion, or when the specific test has not run yet.

Note: *The verdict results are only available when the **Expert Mode** has been enabled and when the test is completed or stopped.*

Port (BERT)

Click **TEST**, **Expert Mode**, and **Port**.



Enable Criteria: **Enable Criteria** enables configuring the port (**Port 1** and **Port 2** for **Dual Ports** on RTU-310) **Pass/Fail** threshold values. This setting is disabled by default.

Alarms

LOS (Optical interface only): Enter the count of the seconds in which one or more LOS alarms can occur before declaring a Fail condition. Choices are **0** to **1800** seconds. The default setting is **0** second.

Frequency

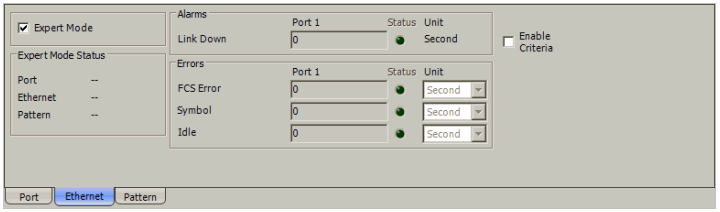
Enter the minimum and maximum frequency offsets either in ppm or bps according to the unit selection.

- **Frequency (bps)**: Indicates the frequency of the input signal.
- **Offset Max**: Enter the frequency maximum value allowed before declaring a Fail condition. Choices are from **0** to **120** ppm. The default setting is **100** ppm.
- **Offset Min**: Enter the frequency minimum value allowed before declaring a Fail condition. Choices are from **-120** ppm to **0** ppm. The default setting is **-100** ppm.
- **Status**: Indicates the real-time pass/fail condition.

  Grey LED: Indicates that Expert is disabled or the test did not run yet.
  Green LED: Indicates that the threshold is respected (Pass).
  Red LED: Indicates that the threshold is not respected (Fail).
- **Unit**: Select the unit. Choices are: **bps** and **ppm**. The default setting is **ppm**.

Ethernet (BERT)

Click **TEST**, **Expert Mode**, and **Ethernet**.



Enable Criteria: **Enable Criteria** enables configuring the Ethernet **Pass**/**Fail** threshold values (**Port 1** and **Port 2** for **Dual Ports** on RTU-310). This setting is disabled by default.

Alarms

Enter the threshold value for **Link Down**. Choices are **0** to **1800** seconds. The default setting is **0** second.

Errors

Enter the threshold value for each error.

Error	Second	Count	Rate	Default
Block (10Gbps)	**0** to **1800** seconds	**0** to **18000000000000**	**1.0E-20** to **1.0E-00**	**0** second
FCS Error (Framed Layer 2)	**0** to **1800** seconds	**0** to **27000000000**	**4.0E-11** to **1.0E-00**	**0** second
Symbol (10/100/1000Mps)	**0** to **1800** seconds	**0** to **2250000000000**	**1.0E-14** to **1.0E-00**	**0** second
Idle (10/100/1000Mps)	**0** to **1800** seconds	**0** to **2250000000000**	**1.0E-14** to **1.0E-00**	**0** second

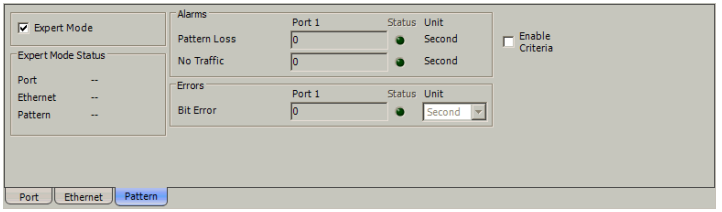
➤ **Status**: Indicates the real-time pass/fail condition.

Grey LED: Indicates that **Expert Mode** is disabled or the test did not run yet.
Green LED: Indicates that the threshold is respected (**Pass**).
Red LED: Indicates that the threshold is not respected (**Fail**).

➤ **Unit**: Select the unit. Choices are **Second**, **Count**, and **Rate**. The default setting is **Second**.

Pattern (BERT)

Click **TEST**, **Expert Mode**, and **Pattern**.



Enable Criteria: **Enable Criteria** enables configuring the Pattern pass/fail threshold values and parameters (**Port 1** and **Port 2** for **Dual Ports** on RTU-310). This setting is disabled by default.

Alarms

Enter the threshold value for each alarm: **Pattern Loss** and **No Traffic**.

➤ **Status**: Indicates the real-time pass/fail condition.

Grey LED: Indicates that **Expert Mode** is disabled or the test did not run yet.
Green LED: Indicates that the threshold is respected (**Pass**).
Red LED: Indicates that the threshold is not respected (**Fail**).

➤ **Unit**: The unit is **Second**.

Errors

Enter the threshold value for **Bit Error**.

Error	Second	Count	Rate	Default
Bit Error	**0** to **1800** seconds	**0** to **18000000000000**	**1.0E-14** to **1.0E-00**	**0** second

➤ **Status**: Indicates the real-time **Pass**/**Fail** condition.

Grey LED: Indicates that **Expert Mode** is disabled or the test did not run yet.
Green LED: Indicates that the threshold is respected (**Pass**).
Red LED: Indicates that the threshold is not respected (**Fail**).

➤ **Unit**: Select the unit. Choices are **Second**, **Count**, and **Rate**. The default setting is **Second**.

20 System Tabs

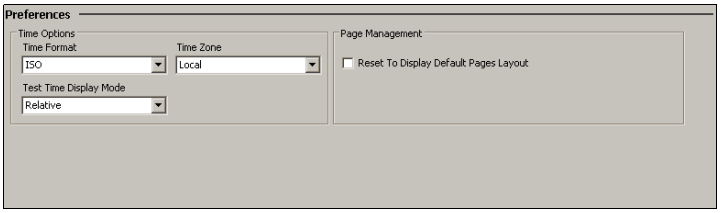
The **System** tab gives access to tabs containing general functions related to the RTU-310/310G operation.

Tab		Available with		Page
		Ethernet	Fibre Channel[a]	
Preferences	*Preferences*	X	X	382
	Default/Ethernet Test Preferences	X		384
	IPv6 Test Preferences	X		386
	FC Test Preferences[a]		X	389
RTU Information	*RTU Information*	X	X	391
	RTU Description	X	X	391
	Hardware Options	X	X	392
RTU Setup	*RTU Setup*	X	X	393
	LAN Interface	X	X	393
	Date and Time	X	X	394
Software Options	*Software Options*	X	X	396
	Configuration	X	X	396
	Available Options	X	X	397
Clock Synchronization	*Clock Synchronization*	X	X	400
Alarms & Log	*Alarms & Log*	X	X	404
	System Alarms	X	X	404
	System Alarm Logger	X	X	405

a. Not available with RTU-310G.

Preferences

Click **System**, and **Preferences/Default Perference**.



Time Options

➤ **Time Format**: Sets the absolute time format of the EX-Vu (current time and timers). The default setting is **ISO**. Choices are:

ISO displays the time and timers with the yyyy-mm-dd hh:mm:ss format.

USA displays the time and timers with the mm/dd/yy hh:mm:ss AM/PM format.

➤ **Time Zone Display Mode**: Allows the selection of the time zone source. The default setting is **Local**.

UTC/GMT displays the time base on the UTC time zone.

Local displays the time from the PC where **Visual Guardian Lite** is running.

Test Equipment displays the time from the RTU-310/310G unit.

➤ **Test Time Display Mode**: Allows the selection of the test time mode displayed in the Logger panel. The default setting is **Relative**.

Relative displays the time elapsed since the beginning of the test for a test event.

Absolute displays the date and time of a test event.

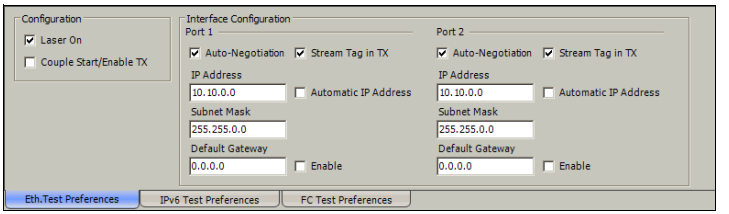
Page Management

➤ **Reset to Display Default Pages Layout** when enabled, resets the page layout to its default layout each time a test is modified.

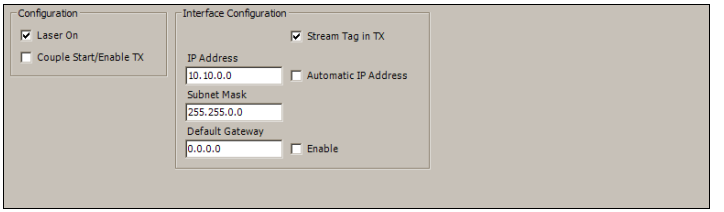
Default/Ethernet Test Preferences

Click **Default/System** and **Preferences/Default Test Preferences/Eth. Test Preferences**.

For RTU-310



For RTU-310G



Allows setting the Ethernet default test parameters that will be applied every time a test is created manually using **Test Setup**. Changes to the default test preferences will only apply when a new test case is created.

Configuration

- **Laser On**: Selects **Laser On** every time a test is created manually using the wizard. The **Laser On** check box is selected by default.
- **Couple Start/Enable TX**: Automatically selects the stream transmission when the test is started. This setting applies to Frame Analyzer test only. The stream transmission stops when the test is stopped. The **Couple Start/Enable TX** check box is cleared by default. Refer to **Enable TX - On/Off** button on page 164 for more information.

Interface Configuration

Note: *The following interface configuration parameters are available for both ports (RTU-310) and apply only to IPv4 at the exception of* ***Sequence Tag in TX*** *that also apply to IPv6.*

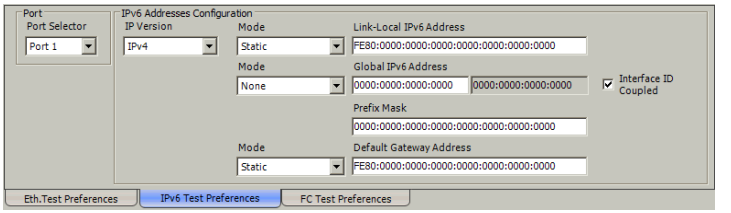
- **Auto-Negotiation**: The Auto-Negotiation check box should be selected if the connected switch is also set to Auto-Negotiation, otherwise the Auto-Negotiation check box should be cleared. When selected, the RTU-310/310G will indicate to the switch which parameters to use. The Auto-negotiation check box is selected by default. Available with 10/100/1000Mbps interfaces.
- **Sequence Tag in TX**, available with **Frame Analyzer** test on RTU-310 and RTU-310G only, automatically adds a sequence tag in all frames that will be generated. The **Sequence Tag in TX** check box is selected by default.
- **IP Address**: Enter the IP address for the Ethernet port. The factory IP address is **10.10.x.y**, where **x** and **y** are respectively the two least significant bytes of the port default MAC address.
- **Automatic IP Address**: Automatically selects DHCP when a test is created allowing to dynamically obtain an IP address from a DHCP server. The **Automatic IP Address** check box is cleared by default.
- **Subnet Mask**: Enter the subnet mask for the Ethernet port. The default setting is **255.255.0.0**.
- **Default Gateway**: Enter the default getaway address for the Ethernet port. Default Gateway must be enabled to enable the default gateway address field. The default setting is **0.0.0.0**.

  Enable: Enables the default gateway IP address. The **Enable** check box is not selected by default.

IPv6 Test Preferences

Click **System** and **Preferences/IPv6 Test Preferences**.

Note: *The following configuration parameters apply to both the stream and the interface.*



- Port Selector (RTU-310): Allows the selection of the port number to see or change its parameters. Choices are **Port 1** and **Port 2**. The default setting is **Port 1**.
- **IP Version**: Allows the selection of the IP version (**IPv4** or **IPv6**) that will be selected by default when creating a test case.

Note: *The following parameters apply only to IPv6 even when IPv4 is selected as the default **IP Version**. See Default/Ethernet Test Preferences* on page 336 *for more information on IPv4 parameters.*

- **Link-Local IPv6 Address**: The Link-Local IPv6 Address (LLA) is used for local communication between on-link neighbors and for Neighbor Discovery process.

  Mode

  - **Stateless Auto** allows automatic generation of the IPv6 address based on the MAC address. The mode **Stateless Auto** is selected by default.
  - **Static** allows to enter the IP address. The **Link-Local IPv6 Address** must starts with **FE80**. The default address is **FE80::[Interface ID]**, where **[Interface ID]** is generated from the source MAC address.

➤ **Global IPv6 Address**: The Global IPv6 Address (GUA) is used to communicate with on-link neighbors and for global communication with hosts outside the subnet.

Mode

➤ **None** disables the **Global IPv6 address** and the **Default Gateway address**.

➤ **Stateless Auto** allows automatic generation of the IPv6 address based on the Link-local address interface ID and the prefix obtained from router advertisements. If no Interface ID has been obtained for the Link-Local address, the Global address will not be generated. The mode **Stateless Auto** is selected by default.

➤ **Static** allows to enter the IP address. The default address is **2001::[Interface ID]**, where **[Interface ID]** is generated from the source MAC address.

Interface ID Coupled: Available when the **Static Mode** is selected, it allows to couple the interface ID of the Global address to the Link-local source address. The Global address interface ID will match the Link-local address interface ID. The **Interface ID Coupled** check box is selected by default.

Prefix Mask: Available when the **Static Mode** is selected, it allows to specify a prefix that defines the subnet. For example:

Global Address	`2001:0DB8:0001:0002:02AA:00FF:FE11:1111`
Prefix Mask	`FFFF:FFFF:FFFF:0000:0000:0000:0000:0000`
Corresponding Prefix	`2001:0DB8:0001`

Note: *When the Global address mode configuration is Stateless Auto, the prefixes are obtained from the Router Advertisement messages. When no prefix is obtained, the Global address is unspecified and the next-hop is assumed to be inside the subnet.*

- **Default Gateway Address**: The **Default Gateway Address** is used to forward packets outside the subnet. **Default Gateway Address** is not available when the Global IPv6 address **Mode** is set to **None**.

  Mode

  - **Automatic** allows automatic selection of the default gateway.
  - **Static** allows entering the default gateway IP address. The default address is **FE80::**.

FC Test Preferences

Note: *Not available with RTU-310G.*

Click **System** and **Preferences/FC Test Preferences**.

For RTU-310

Allows setting the default test parameters that will be applied every time a test is created manually using **Test Setup**. Changes to the default test preferences will only apply when a new test case is created. The default test preferences can be overwritten by the test setup configuration.

The default test preferences are saved per slot on the RTU-310/310G meaning that the configuration will not follow the module when changing the module from one slot to another. However, a configuration on a specific slot will remain when replacing a module by another module of the same model.

Configuration

Laser On: Allows to select **Laser On** every time a test is created manually using the wizard. This setting is selected by default.

Interface Configuration

Note: *The following interface configuration parameters are available for both ports (RTU-310).*

- **PSP (Link Protocol)**: Enabling the Primitive Sequence Protocol (PSP) allows link management. Disabling the **PSP** forces the port in **Active** mode.
- **Login**: Login is only available with Framed Layer 2 and allows changing the Advertised BB_Credit value.

- **Advertised BB_Credit**: Advertised BB_Credit is the number of frame buffers that a local port has available to receive frames from another port, and is advertised to the remote port through the login process.

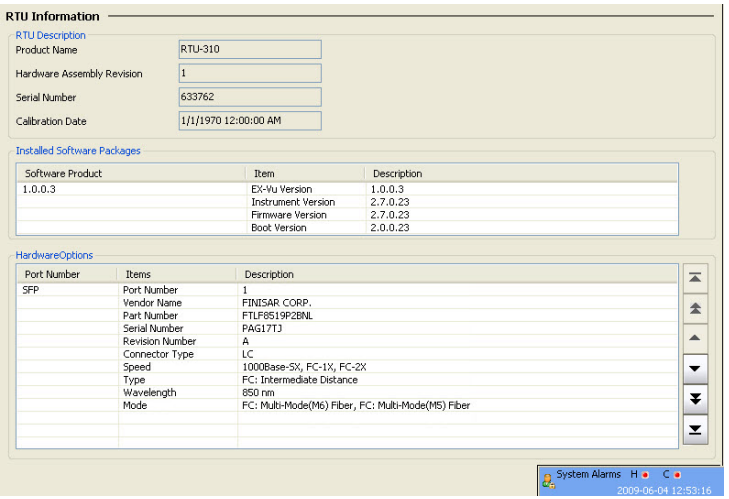
  Enter the **Advertised BB_Credit value**. Choices are from **1** to **65535**. The default setting is **10**.

- **WWN Source**: The Worldwide name is only available when Login is selected with **Fabric** network topology. Enter the Worldwide name source address.

RTU Information

The RTU Information provides details of the RTU-310/310G hardware and the software installed on the RTU platform.

Click **System** and **RTU Information**.



RTU Description

- **Product Name** indicates the name of the RTU platform.
- **Hardware Assembly Revision** indicates the product assembly hardware revision.
- **Serial Number** indicates the RTU serial number.
- **Calibration Date** indicates the RTU's last calibration date.

Installed Software Packages

This section indicates the software product, EX-Vu, Instrument, Firmware, and Boot versions.

Hardware Options

Provides hardware information related to the SFP. Available only with RTU-310.

➤ The following information is available for the inserted SFP:

Port Number

Vendor Name

Part Number

Serial Number

Revision Number

Connector Type: LC, MT-RJ, etc.

Speed: 1000Base-SX, FC-1X, FC-2X.

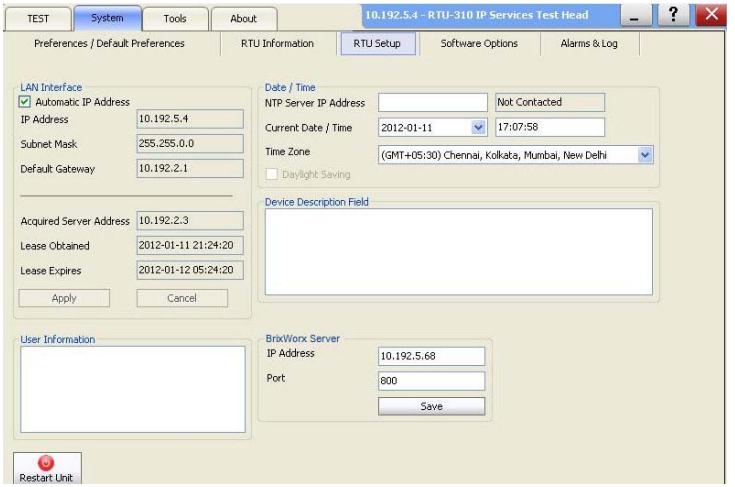
Type: FC: Intermediate Distance

Wavelength: 850 nm, 1310nm, and 1550nm.

Mode: FC: Multimode(M6) Fiber, FC: Multi-Mode(M5) Fiber.

RTU Setup

Click **System** and the **RTU Setup**.



LAN Interface

The following interface configuration parameters are available for the LAN Interface port. To apply the changes to the IP parameters, click **Apply**. To reset any changes to the IP parameters, click **Cancel**.

- **Automatic IP Address**: Allows the unit to obtain a LAN IP address automatically using the DHCP network application protocol. This setting is enabled by default.
- **IP Address**: Sets a static **IP address** for the LAN Interface port. If **Automatic IP Address** is selected, it displays the granted **IP Address** provided by the DHCP server. The default value is blank.
- **IP Subnet Mask**: Sets the subnet mask for the LAN Interface port. If **Automatic IP Address** is selected, it displays the granted subnet mask. The default value is blank.

- **Default Gateway**: Sets the **Default Gateway** for the LAN Interface port.If **Automatic IP Address** is selected, it displays the granted **Default Gateway**. The default value is blank.
- **Acquired Server Address**: Displays the current DHCP server address value.
- **Lease Obtained**: Displays the current DHCP lease obtained value.
- **Lease Expires**: Displays the current DHCP lease expiry value.

User Information

The **User Information** field allows a user to leave a message to other users when they connect to the same unit. When a new user logs in to the RTU-310/310G, a dialog box is displayed notifying any change in the **User Information** field. A maximum of 80 characters are allowed.

Device Description

The **Device Description** field allows to enter specific device information. Typical information can include device name, location, contact number, etc. A maximum of 256 characters are allowed.

Date and Time

- **NTP Server IP Address**: Sets the IP address of a Network Time Protocol (NTP) server, the RTU-310/310G will synchronize its clock according to the NTP protocol specification. If no **NTP Server IP Address** is provided, you must set the date and time manually.
  - **Contacted**: Indicates that the connection to the NTP server is established.
  - **Not Contacted**: Indicates that the NTP server is not reachable.
  - **Blank**: Indicates that no NTP server is defined.

- **Current Date and Time**: Allows the selection of the specific date (**YYYY-MM-DD**) and time (**HH:MM:SS**) when the IP address of a NTP server is not specified.
- **Time Zone**: Allows the selection of the time zone from the drop-down list.
- **Daylight Saving**: Allows automatic adjustment of clock for daylight saving changes.

BrixWorx Server

You can configure RTU-310 in BrixWorx. The following tests can run on RTU-310 for BrixWorx.

- EtherSAM Service Performance Active
- RFC 25445 Active

For configuration information, refer *BrixWorx User Guide* and for test information, refer *Test Suite Reference Guid*e.

The following configuration parameters are available for the BrixWorx server. To apply the changes to the IP parameters, click **Save**.

- **IP Address:** Sets the IP address of the BrixWorx server.
- **Port:** Sets the port number of the BrixWorx server.
- **Save:** Click to apply the changes.

Restart Unit

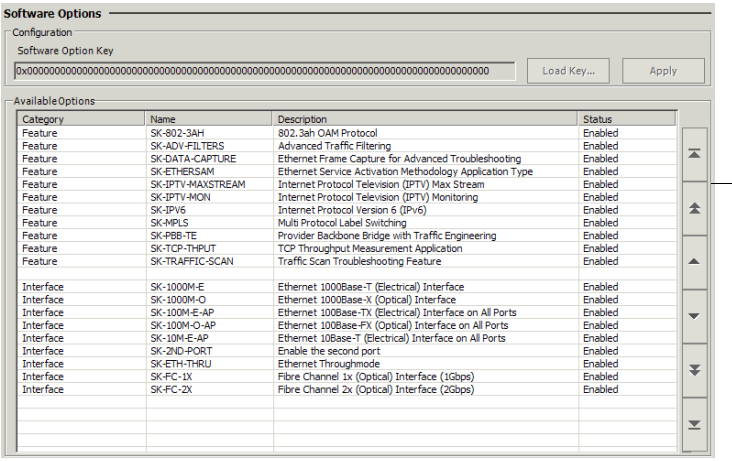
Restarts the RTU-310/310G unit.

Software Options

Allows the installation of software options. A software option key will be generated by EXFO for each option bought.

Click **System**, and **Software Option**.

Note: *Software option installation is only possible when no test case is created.*



Configuration

The software license key can be either entered (typed) or loaded (using the **Load Key** button).

- **Software Option key** allows typing the software option key.
- **Load Key** button allows selecting a file containing the option key.

  The default directory is C:\ProgramFiles\EXFO\Applications\RTU\310\UserFiles\Key or C:\ProgramFiles\EXFO\Applications\RTU\310G\UserFiles\Key.
- **Apply** button sends the option key to the RTU-310/310G. A confirmation message will be displayed.

Available Options

The available software options are listed with the **Status** indicating what software options are installed (enabled) or not (disabled) on the module.

For RTU-310

Category	Name	Description
Interface	**SK-10M-E-AP**	The 10Mbps Ethernet interface is enabled on both ports.
	SK-100M-E-AP	The 100Mbps Ethernet interface is enabled on both ports.
	SK-1000M-E	The electrical 1000Mbps Ethernet interface is enabled on port #1.
	SK-100M-O-AP	The optical 100Mbps Ethernet interface is enabled on both ports.
	SK-1000M-O	The optical 1000Mbps Ethernet interface is enabled on port #1.
	SK-2ND-PORT	All enabled interfaces on port #1 are also enabled on port #2.
	SK-ETH-THRU	Ethernet Through Mode.
	SK-FC-1X	Fibre Channel 1x (Optical) Interface (100MBps)
	SK-FC-2X	Fibre Channel 2x (Optical) Interface (200MBps)

Category	Name	Description
Feature	**SK-802-3AH**	The 802.3ah OAM Protocol is enabled.
	SK-TCP-THPUT	The TCP Throughput measurement application is enabled.
	SK-IPTV-MON	The IPTV testing is enabled with a testing capacity of 10 streams.
	SK-IPTV-MAXSTREAM	Increases the IPTV testing capacity to 100 streams.
	SK-ADV-FILTERS	Advanced Traffic Filtering
	SK-ETHERSAM	Ethernet Service Activation Methodology Application Type
	SK-PBB-TE	Provider Backbone Bridge with Traffic Engineering
	SK-MPLS	Multi-Protocol Label Switching
	SK-IPV6	Internet Protocol Version 6 (IPv6)

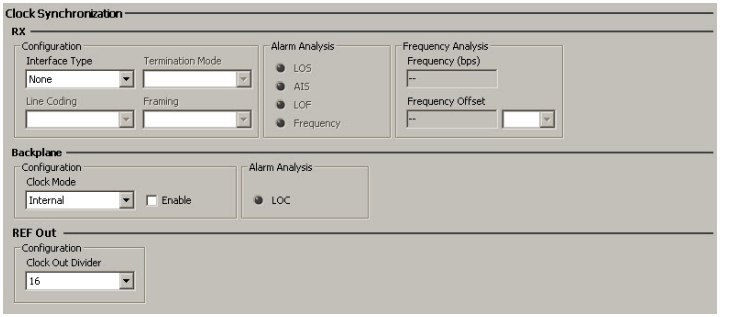
For RTU-310G

Category	Name	Description
Interface	**SK-ADV-FILTERS**	Advanced Traffic Filtering
	SK-ETHERSAM	Ethernet Service Activation Methodology Application Type
	SK-IPV6	Internet Protocol Version 6 (IPv6)
	SK-LAN	LAN testing capabilities
	SK-WAN	WAN testing capabilities
	SK-PBB-TE	Provider Backbone Bridge with Traffic Engineering
	SK-MPLS	Multi-Protocol Label Switching

Clock Synchronization

Note: *Clock Synchronization is only available for Ethernet 10G.*

Click **System** and **Clock Synchronization**.



RX

- **Configuration**: Allows the selection and configuration of the input clock. This clock will be used for test synchronization if External clock has been selected during test setup and/or for the backplane configuration when External clock mode is selected Interface **Type**: Allows the selection of the clock interface. Choices are **None**, **DS1**, and **E1**. The default setting is **None**.
- **Termination Mode**: The termination mode is set to **Term** for DS1 and E1.
- **Line Coding**: Allows the selection of the interface line coding. Choices are:

  For DS1: **AMI** and **B8ZS**. The default setting is **B8ZS**.

  For E1: **AMI** and **HDB3**. The default setting is **HDB3**.
- **Framing**: Allows the selection of the interface framing. Choices are:

  For DS1: **SF**, and **ESF**. The default setting is **SF**.

For E1: **PCM30**, **PCM30 CRC-4**, **PCM31**, and **PCM31 CRC-4**. The default setting is **PCM30**.

Alarm Analysis

- **LOS** (Loss Of Signal): The LOS alarm indicates absence of an input signal or an all-zeros signal is received.
- **AIS** (Alarm Indication Signal): The AIS alarm is declared when an unframed all-ones signal is received.
- **LOF** (Loss Of Frame):
  - **For DS1:** With SF Framing: The Loss-of-Frame condition will be assumed when 2 terminal frame and/or signaling frame errors in 5 consecutive frames have been received.
  - With ESF Framing: The Loss-of-Frame condition will be assumed when 2 FPS frame errors in 5 consecutive frames have been received.

  For E1: The Loss-Of-Frame condition will be assumed when three consecutive incorrect frame alignment signals have been received.

➤ **Frequency**: The Frequency alarm indicates if the received signal rate meets (green) or not (red) the following rate specifications.

Signal	Rate specification
DS1	1544000 ±15 bps (±9.2 ppm)
E1	2048000 ±19 bps (±9.2 ppm)
2MHz	2048000 ±19 Hz (±9.2 ppm)

Frequency Analysis

➤ **Frequency (bps)** displays the received DS1/2M/E1signal rate in bps.

➤ **Frequency Offset** displays the positive or negative frequency offset between the standard rate specification and the rate from the received signal. Frequency unit can be set to **bps**, or **ppm**. The default setting is **bps**.

Note: *The frequency value displays ">50" when the frequency offset is bigger than ±50 ppm.*

REF Out

Note: *Ref Output is only available with RTU-310G, the REF OUT signal is automatically enabled on the REF OUT port (SMA connector) when the laser is turned ON.*

Configuration

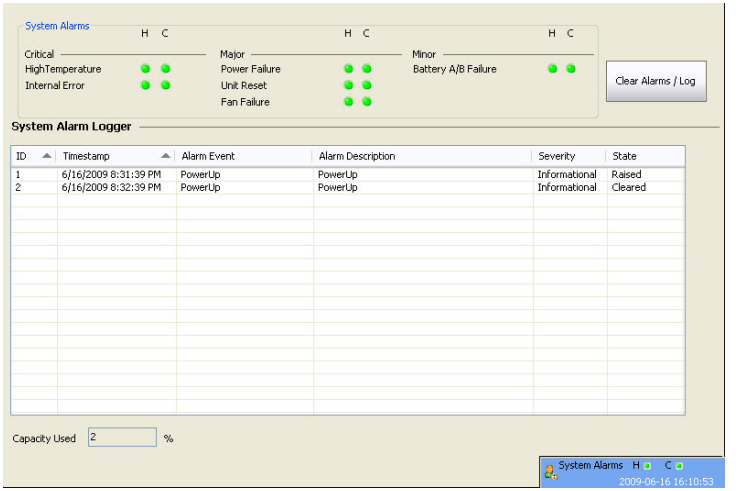
➤ **Divider Ratio**: Allows the selection of the transmit test clock divider. Choices are **16** and **32**. The following table shows the corresponding output frequency in MHz.

Divider Ration	LAN transceiver mode	WAN transceiver mode
16	644.53 MHz	622.08 MHz
32	322.266 MHz	311.04 MHz

Alarms & Log

Provides information on the system alarm status and system alarm logger.

Click **System** and **Alarms & Log**.



System Alarms

Maintains the history and current alarm status as per the critical, major or minor severity levels.

- **Critical**
  - **High Temperature**: Indicates high temperature fault conditions.
  - **Internal Error**: Indicates software related internal errors
- **Major**
  - **Power Failure**: Indicates power failure.
  - **Unit Reset**: Indicates a system restart.

- **Fan Failure**: Indicates that one of the internal fan's rotation speed has decreased below 50 percent of the normal operating speed. This alarm is cleared when the fans rotation speed goes above 60 percent of normal operating speed for at least 10 seconds.

- **Minor**
  - **Battery A/B Failure**: Indicates that the DC power input (Battery A or Battery B) is lost.

- **Clear Alarms/Log**: Provides a single control to delete the **System Alarm Logger** content and clear all **System Alarm** statuses.

System Alarm Logger

Stores information of the raised and cleared system alarms in the RTU-310/310G platform.

- **ID**: Provides a sequential number to the alarms raised or cleared.
- **Timestamp**: Indicates the date (**DD-MM-YYYY**) and time (**HH:MM:SS**) the alarm is detected.
- **Alarm Event**: Indicates the name of the system alarm.
- **Alarm Description**: Describes the critical, major or minor system alarm.
- **Severity**: Indicates the severity level of the alarm.
- **State**: Indicates the **Raised** or **Cleared** state of the alarm.

Capacity Used

This field displays the percentage of the alarm log table that is occupied.

Note: *When a system alarm event is recorded in the alarm log, a corresponding entry is written in the test logger if the system alarm impacts the running test. The entry in the test logger includes system alarm and event timestamp.*

21 Tools Tabs

Note: *The **Tools** tabs are only available when a test is created.*

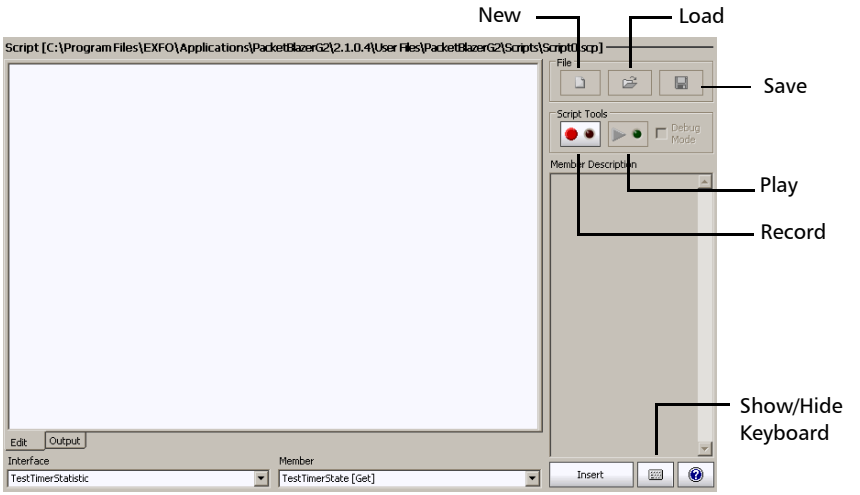
Tab		Available with		Page
		Ethernet	Fibre Channel[a]	
Script	*Script*	X		408
Ping & Trace Route[b]	*Ping Configuration*	X		412
	Trace Route Configuration	X		417
ENIU OAM[bc]	*ENIU Configuration*	X		421
	ADC Configuration	X		422
Traffic Scan	*Traffic Scan*	X		433

a. Not available with RTU-310G.
b. Not available when Through Mode is selected.
c. **ENIU OAM** is only available with **Framed Layer 2**. ENIU OAM is not available with 10Gig-E.

Script

The scripting tool allows a user to automate test process by creating scripts containing test setup configuration and actions. The scripting tool allows creating, saving, loading, modifying, and running script files. The script creation can be done manually or using the integrated recorder tool (**Script Tool**). Creating and editing a script is only recommended for users with writing knowledge of **Visual Basic .NET** (**Visual Basic**) programming language.

Click **Tools** and **Script**.



Edit

Lists the content of the current script and allows its edition. Users with writing knowledge of **Visual Basic .NET** (**Visual Basic**) programming language will be able to customize their scripts by inserting delays for example. Note that delays are not automatically inserted during recording.

Output

Gives status of the running script.

File

Allows loading, saving, and generating a new script file.

Note: *The default directory for the script files is: d:|ToolBox|User Files|PacketBlazerG2|Scripts*C:\ProgramFiles\EXFO\Applications\RTU\310\UserFiles\Scripts or C:\ProgramFiles\EXFO\Applications\RTU\310G\UserFiles\Scripts

Click **New** to create a new script and clear the one on the **Edit** tab if exist. Type a new file name in the **File name** field and click **Save**.

Click **Load** and select a script file and click **Load**.

Click **Save** and select a name for this script file followed by the **scp** extension and click **Save**. The **scp** extension is automatically added when omitted.

Script Tools

Allows automatic generation of scripts by setting step by step the parameters from the Test Setup tab and related test tabs.

Click **Record** to start the recording of the script. Click the **File Name** field, a pop-up keyboard is displayed, enter a file name for the new script followed by the **scp** extension, and click **Save**. The **scp** extension is automatically added when omitted. The record button LED is red while recording.

From the **Test Setup** create a test case and set its parameters.

Note: *A test can also be cleared before creating a new one. This is useful to automatically clear the test(s) before creating a new one without having to clear the test manually.*

Once the test is created, the following actions can also be performed and recorded as well.

- From the related test panels, set the parameters for the test.
- Start the test.
- Stop the test.
- Generate a report.
- Save the report.
- Etc.

From the **Script** tab, click **Record** again to end the script recording session and save the script file. The generated script is displayed once the recording ends.

Note: *Only the test case path and its configuration are saved. The SUI settings and results are not saved.*

Note: *However, for* **RFC 2544**, *all selected tests (**Throughput**, **Back-to-Back**, **Frame Loss**, and/or **Latency**) must complete before stopping the recording because tests that didn't run will not be part of the script.*

Click **Play** to run the script that generates the connection and sets the parameters as recorded.

The **Edit** tab automatically switches to the **Output** tab when playing a script allowing to see the script running status.

The script will automatically stop playing when an error occurs or when the script ends.

Clicking **Play** while the script is playing will interrupt (stop) it.

Note: *The **Play** button is not available when there is no script loaded or when a new script is generated and not saved yet.*

Script Line Editing

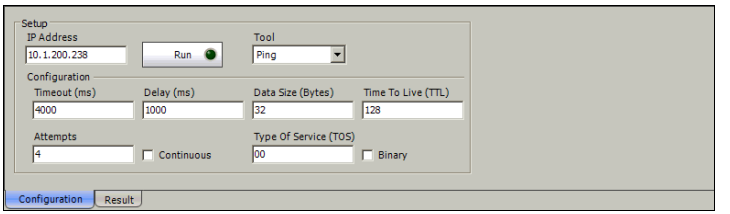
- **Interface**: Select the **Interface** form the list.
- **Member**: Select the **Member** from the list.
- **Member Description**: Displays the description of the member corresponding to the selected **Interface**/**Member**.
- **Insert** button: Allows inserting the selected script line. Make sure that the cursor is located where the new script line has to be inserted. Script line insertion is only available when a script is present in the **Edit** tab.
- **Show/Hide Keyboard** button: Allows showing/hiding the keyboard. Click the **show/hide keyboard** button while the keyboard is hidden to pop up the keyboard. Click **show/hide keyboard** button while the keyboard is shown to hide the keyboard.
- **Help** button: Gives help on instrument members and functions.

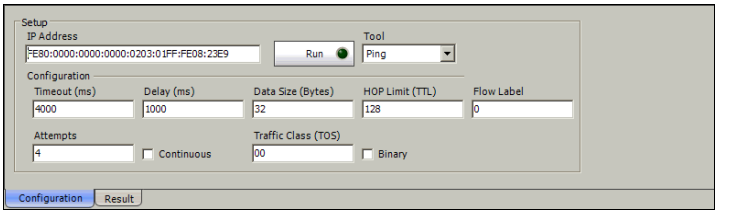
Ping Configuration

The Ping tool is used to determine if a network device is reachable. Ping is not available when no test is created

Click **Tools**, **Ping**, **Configuration**, and in the **Tool** list, click **Ping**.

Note: *For **Trace Route**, see* Trace Route Configuration *on page 417.*





Setup

- **IP Address/IPv6 Address**: Enter the IP address of the network device to be detected. The IP address version is as per the version selected during the test setup.
- **Run**: Click **Run** to start the **Ping** command.

Configuration

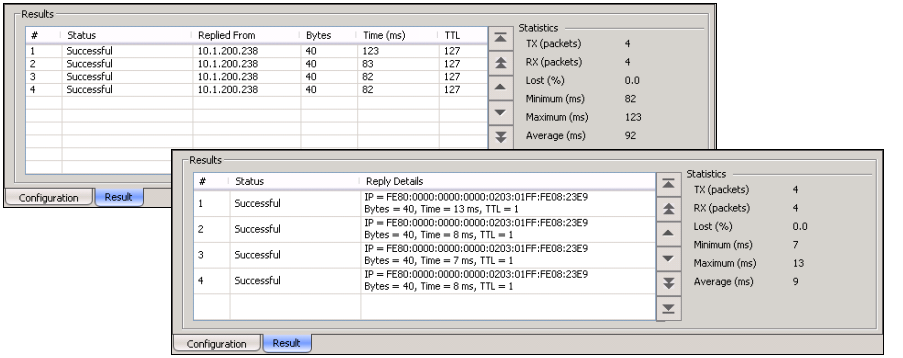
- **Timeout (ms)**: Enter the maximum time allowed between an ICMP echo and response. Choices are **200 ms** to **10000 ms**. The default setting is **4000 ms**.

- **Delay (ms)**: Available for ping only. Enter the delay between each attempt (PING). Choices are **100** to **10000 ms**. The default setting is **1000 ms**.
- **Data Size (Bytes)**: Available for ping only. Enter the buffer size that will be sent to the network device to be detected. Choices are **0** to **1472 bytes**. Default value is **32 bytes**.
- **Time To Live (TTL) for IPv4**
  Hop Limit (TTL) for IPv6
  Enter the maximum number of hops the packet can go through. Choices are **1** to **255**. The default setting is **128**.
- **Flow Label** (IPv6 only): Enter the **Flow Label** number that will be used to identify a series of related packets from a source to a destination. Choices are **0** to **1048575**. The default setting is **0**.
- **Attempts** and **Continuous**: Enter the number of attempt that will be performed to reach the network device or click **Continuous** to attempt indefinitely. Choices are **1** to **100**. The default setting is **4** and **Continuous** is disabled.
- **Type Of Service (TOS) for IPv4**
  Traffic Class (TOS) for IPv6
  Enter the type of service. Choices are **00** to **FF**. The default setting is **00**.
- **Binary**: Enable binary to set the TOS field in binary mode. Otherwise, the TOS field is in hexadecimal mode. This setting is disabled by default.

Ping Results

Click **Tools**, **Ping**, in the **Tool** list, click **Ping**, and click **Result**.

Note: *For **Trace Route**, see Trace Route Configuration* on page 417.



To succeed, a Ping command shall be acknowledged by the network device within a given delay. Typically a Ping command can fail for the following reasons:

- The IP address is unavailable or unknown.
- The time allowed to perform the Ping command is too short
- The remote device is not supporting ICMP messaging.

- **#**: Indicates the attempt number.
- **Status**: Indicates the status of the attempt.

Status	Description
Successful	Valid ICMPv4/ICMPv6 echo reply received.
User Aborted	When a user has manually stopped the Ping function before the end of attempts.

Status	Description
Time Out	When an ICMPv4/ICMPv6 echo reply was not received within the defined timeout.
Destination Specified is invalid	With reserved IP addresses: For IPv4: 0.0.0.0, 127.0.0.0, and all addresses above 240.0.0.0 (Class E and above). For IPv6: 0::/8 (reserved/unspecified), 0::1/128 (Loopback), FF00::/8 (Multicast).
TTL Expired	When the number of TTL was insufficient to reach the destination host.
Destination Unreachable	For IPv4: When the IP address is unreachable (no default gateway for an IP address, not in the same subnet, or an ICMP Unreachable message is received. For IPv6: When the IP address is unreachable (no default gateway for an IP address, not in the same subnet, or address resolution failed) or an ICMP Destination Unreachable message is received.
Data Corrupted	For IPv4 only, when the string of the received Ping reply is not valid.
Packet Too Big	For IPv6 only: The packet cannot be forwarded since it size is larger than the MTU of the outgoing link.
Undefined	For any other errors in Ping that do not fall into one of the above description.

For IPv4:

- **Replied From**: Indicates the IP address of the replier.
- **Bytes**: Indicates the buffer size of the ICMP echo response.
- **Time (ms)**: Indicates the time of response in milliseconds.
- **TTL**: Indicates the TTL of the ICMP echo response.

For IPv6:

- **Replied Details**: Indicates the IP address of the replier, the buffer size of the ICMP echo response (bytes), the time of response in milliseconds, and the TTL of the ICMP echo response (Hop Limit).

Statistics

- **Packets Transmitted** Indicates the number of sent packets.
- **Packets Received**: Indicates the number of received packets.
- **Percentage Lost (%)**: Indicates the percentage of packets lost.
- **Minimum Round Trip Time (ms)**: Indicates the minimum time recorded for a Ping request to be answered.
- **Maximum Round Trip Time (ms)**: Indicates the maximum time recorded for a Ping request to be answered.
- **Average Round Trip Time (ms)**: Indicates the average time required for a Ping request to be answered.

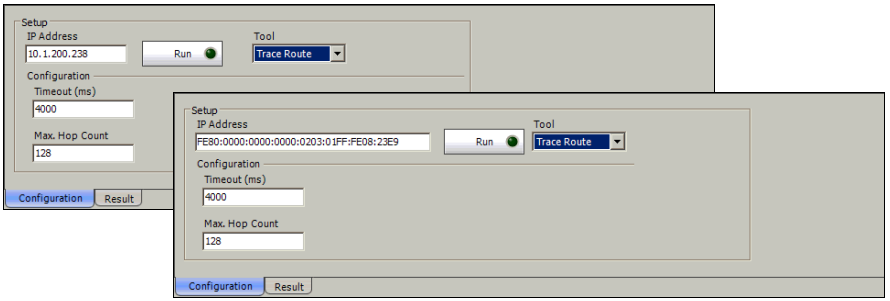
Note: *When MPLS is enabled, no statistics are available from the Label Switching Routers (LSRs).*

Trace Route Configuration

Trace Route is used to obtain the list of all routers identified between the local port (RTU-310/310G) and the destination IP port.

Click **Tools**, **Configuration**, and in the **Tool** List, click **Trace Route**.

For **Ping**, see *Ping Configuration* on page 412.



Setup

- **IP Address**: Enter the IP address of the network device to be detected. The IP address version is as per the version selected during the test setup.
- **Run**: Click **Run** to start the **Trace Route** command.

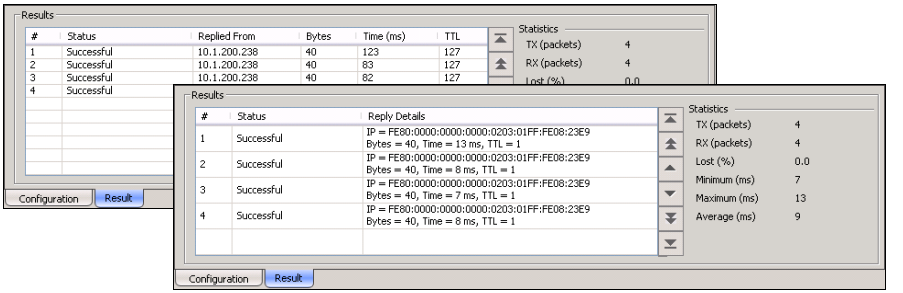
Configuration

- **Timeout (ms)**: Enter the maximum time allowed between an ICMP echo and response at each hop. Choices are **200 ms** to **10000 ms**. The default setting is **4000 ms**.
- **Max Hop Count**: Enter the maximum network device the packet is allowed to go through. Choices are **1** to **255**. The default setting is **128**.

Trace Route Results

Click **Tools**, **Ping**, **Configuration**, in the **Tool list**, click **Trace Route**, and click **Results**.

For **Ping**, see *Ping Results* on page 414.



To succeed, a **Trace Route** command shall be acknowledged by the network device within a given delay. Typically a **Trace Route** command can fail for the following reasons:

- The IP address is unavailable or unknown.
- The time allowed to perform the **Trace Route** command is too short.
- The remote device is not supporting ICMP messaging.

The Trace Route results are displayed with the following columns:

- **#**: Indicates the attempt number.

➤ **Status**: Indicates the status of the attempt.

Status	Description
Successful	Valid ICMPv4/ICMPv6 echo reply received.
User Aborted	When a user has manually stopped the Ping function before the end of attempts.
Time Out	When an ICMPv4/ICMPv6 echo reply was not received within the defined timeout.
Destination Specified is invalid	With reserved IP addresses: For IPv4: 0.0.0.0, 127.0.0.0, and all addresses above 240.0.0.0 (Class E and above). For IPv6: 0::/8 (reserved/unspecified), 0::1/128 (Loopback), FF00::/8 (Multicast).
Hop Reached	When a Time Exceeded message is received from a host while executing the Trace Route function.
Destination Unreachable	For IPv4: When the IP address is unreachable (no default gateway for an IP address, not in the same subnet, or an ICMP Unreachable message is received. For IPv6: When the IP address is unreachable (no default gateway for an IP address, not in the same subnet, or address resolution failed) or an ICMP Destination Unreachable message is received.
Data Corrupted	For IPv4 only, when the string of the received Ping reply is not valid.
Packet Too Big	For IPv6 only: The packet cannot be forwarded since it size is larger than the MTU of the outgoing link.
Undefined	For any other errors in Ping that do not fall into one of the above description.

- **Replied From**: Indicates the IP address of the replier.
- **Time (ms)**: Indicates the time of response in milliseconds.

Statistics

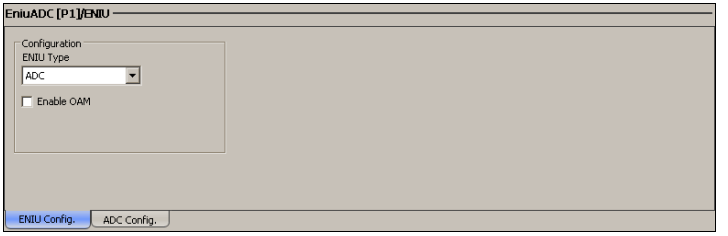
- **Packets Transmitted**: Indicates the number of sent packets.
- **Packets Received**: Indicates the number of received packets.

ENIU Configuration

Allows supporting the **Operation**, **Administration**, and **Maintenance** (OAM) layer between a RTU-310/310G and a third party ENIU (Ethernet Network Interface Unit). Not available with RTU-310.

Note: *Only one RTU-310 module can be connected at once on an ENIU.*

Click **Tools**, **ENIU**, and **ENIU Config**.



ENIU Type

Available with RTU-310: Allows the selection of the ENIU Type. Choices are **ADC**, and **802.3ah**. For 802.3ah, the software option needs to be installed to be available. Refer to *Available Options* on page 348.

Enable OAM

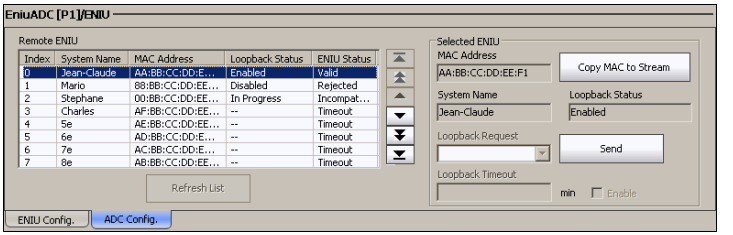
Enables the OAM interface when the **Enable OAM** check box is selected. This check box is cleared by default.

Note: *The ENIU discovery process will start automatically when **Enable OAM** check box is selected and the link is up.*

ADC Configuration

Note: *The **ADC Config** tab is only available when ADC is selected as the ENIU type. In order for the configuration to work, the ADC ENIU needs to be set to EXFO mode. Not available with 10Gig-E.*

Click **Tools**, **ENIU**, and **ADC Config**.



Remote ENIU List

Lists the detected ENIUs on the network or part of the RTU-310/310G VLAN domain when VLAN is enabled. Up to 20 ENIUs can be listed.

- **ID**: Indicates the ENIU number. The ENIUs are sequentially numbered as they are detected.
- **System Name**: Indicates the name of the detected ENIU.
- **MAC Address**: Indicates the MAC address of the detected ENIU.
- **Loopback Status**: Indicates the loopback status (Enabled/Disabled) of the ENIU.

- **ENIU Status**: Indicates the ENIU status. Possible statuses are:

  Valid: The remote ENIU satisfies the following conditions: support loopback, no events detected, ENIU stable, and OAM PDU version of both ENIU and EXFO are compatible.

  Rejected:
  The remote ENIU is rejected because it is sending critical event notification.
  The remote ENIU does not support loopback.
  The remote ENIU is not stable.

  Incompatible: The ENIU and OAM protocol versions are incompatible.

  Timeout: The RTU-310/310G has not received OAM PDU in the last 30 seconds.

- **Refresh List**: Allows refreshing the remote ENIU list by re-starting the discovery process.

Click any ENIU from the list to select it. The selected ENIU information is then displayed in the **Selected ENIU** section. Only ENIUs having a Valid status can be selected.

Selected ENIU

Indicates the information related to the selected ENIU.

- **MAC Address**: Indicates the MAC address of the selected ENIU.
- **Copy MAC to Stream**: Allows copying the MAC and VLAN destination parameters for the test/stream.

  For Performance Analyzer test: The MAC destination address, VLAN ID, and VLAN Priority from the Interface Setup panel will be replaced with the selected ENIU parameters.

  For Frame Analyzer test on RTU-310: The MAC destination address, VLAN ID, and VLAN Priority of each disabled stream from the Stream Configuration panel will be replaced with the selected ENIU parameters. Streams that are already enabled will not be affected with the copy.
- **System Name**: Indicates the name of the detected ENIU.

Loopback

Allows sending a loopback request to the selected ENIU.

Note: *If the selected ENIU becomes invalid, the loopback request cannot be sent.*

- **Request**: Allows the selection of the loopback request. Choices are **Enabled** and **Disabled**.
- **Send**: Sends an Enable or Disable Loopback request as selected in the Request field.
- **Loopback Status**: Indicates the loopback status of the selected ENIU.

  Enabled when the RTU-310/310G has received the confirmation that the ENIU is in loopback mode.

  Disabled when the RTU-310/310G has not received the confirmation that the ENIU is in loopback mode or when the ENIU is not in loopback mode.

  In progress when a loopback request has been sent to the ENIU but the RTU-310/310G has not received the confirmation yet.

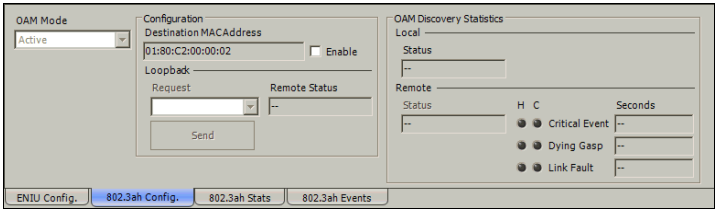
  "--" when no valid ENIU is selected.
- **Timeout**: Allows selection of the timeout when it is enabled. Choices are from **1** to **10080 minutes**. The default setting is **60 minutes**.

  Enable: Allows the activation of the timeout. When enabled the timeout value can be set. When disabled, the timeout is infinite.

802.3ah Configuration

Note: *The **802.3ah Config** tab is only available when 802.3ah is selected as the ENIU type.*

Click **Tools**, **ENIU**, and **802.3ah Config**.



OAM Mode

The OAM Mode is set to **Active** mode and is not configurable. In **Active** mode, the RTU-310/310G will initiate the discovery process and will not respond to variable request and loopback command received.

Configuration

➤ **Destination MAC Address**: A default Media Access Control (MAC) address is given to the Ethernet port. The default 802.3ah multicast destination MAC address is the standard **01:80:C2:00:00:02**. Click the **Destination MAC Address** field if the MAC address has to be changed for this port and enter the new MAC address.

Enable allows editing the **Destination MAC Address** when the Enable check box is selected. The destination MAC address returns to its default (**01:80:C2:00:00:02**) when the **Enable** check box is cleared.

➤ **Loopback**

Request allows the selection of the loopback request to be sent to the remote OAM link partner. Choices are **Enabled** and **Disabled**. The default setting is **Enabled**. The request will only be sent when clicking the **Send** button.

Send allows sending the selected request to the remote OAM link partner.

Remote Status: Indicates the status of the remote OAM link partner.

OAM Discovery Statistics

➤ **Local**

Status indicates the local OAM link discovery status. Possible status are **Evaluating**, **Stable**, and **Unsatisfied**.

➤ **Remote**

Status indicates the remote OAM link discovery status. Possible status are **Evaluating**, **Stable**, and **Unsatisfied**.

Critical Event: Indicates that the OAM link partner has sent a critical event notification.

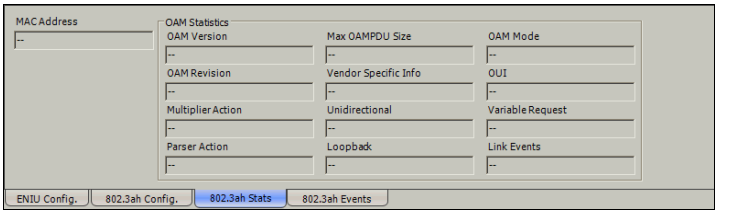
Dying Gasp: Indicates that the OAM link partner has sent an unrecoverable local failure notification.

Link Fault: Indicates that the OAM link partner has sent a link fault notification.

802.3ah Statistics

Note: *The **802.3ah Stats** tab is only available when 802.3ah is selected as the ENIU type.*

Click **Tools**, **ENIU**, and **802.3ah Stats**.



The 802.3ah Statistics window provides remote OAM link partner MAC address and OAM statistics.

MAC Address indicates the remote OAM link partner MAC address.

OAM Statistics provides the following remote OAM link partner statistics.

- **OAM Version**: Indicates the protocol version supported by the DTE.
- **OAM Revision**: Indicates the revision of the Information TLV.
- **Multiplier Action**: Bit 2 of the **State** byte reports the Multiplexer Action.

  Forward (bit 2 is set to “0”): Device is forwarding non-OAMPDUs to the lower sublayer.

  Discard (bit 2 is set to “1”): Device is discarding non-OAMPDUs.

- **Parser Action**: Bits 0 and 1 of the **State** byte report the Parser Action.

  Forward (bits 1 and 0 are set to “00”): Device is forwarding non-OAMPDUs to the higher sublayer.

  Loopback (bits 1 and 0 are set to “01”): Device is looping back non-OAMPDUs to the lower sublayer.

  Discard (bits 1 and 0 are set to “10”): Device is discarding non-OAMPDUs.

- **Max OAMPDU Size**: Bits 0 to 10 of the **OAMPDU Configuration** two-byte field report the maximum OAMPDU size. The **Max OAMPDU Size** is the largest OAMPDU, in bytes, supported by the DTE.

- **Vendor Specific Info**: The 32-bit **Vendor Specific Information** field identifies the vendor’s product model and version.

- **Unidirectional**: Bit 1 of the **OAM Configuration** byte reports unidirectional support capability.

  Supported (bit 1 is set to “1”): DTE is capable of sending OAMPDUs when the receive path is non-operational.

  Unsupported: (bit 1 is set to “0”): DTE is not capable of sending OAMPDUs when the receive path is non-operational.

- **Loopback**: Bit 2 of the **OAM Configuration** byte reports OAM remote loopback support capability.

  Supported (bit 2 is set to “1”): DTE is capable of OAM remote loopback mode.

  Unsupported (bit 2 is set to “0”): DTE is not capable of OAM remote loopback mode.

- **OAM Mode**: Bit 0 of the **OAM Configuration** byte reports OAM mode.

  Active (bit 0 is set to “1”): DTE is configured in **Active** mode.

  Passive (bit 0 is set to “0”): DTE is configured in **Passive** mode.

- **OUI**: The 24-bit IEEE Organizationally Unique Identifer field identifies the vendor.
- **Variable Request**: Bit 4 of the **OAM Configuration** byte reports variable retrieval capability.

  Supported (bit 4 is set to "1"): DTE supports sending Variable Response OAMPDUs.

  Unsupported (bit 4 is set to "0"): DTE does not support sending Variable Response OAMPDUs.
- **Link Events**: Bit 3 of the **OAM Configuration** byte reports link event capability.

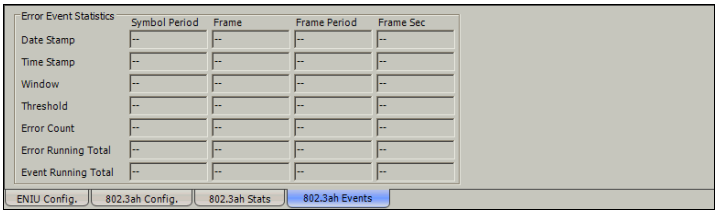
  Supported (bit 3 is set to "1"): DTE supports interpreting Link Events.

  Unsupported (bit 3 is set to "0"): DTE does not support interpreting Link Events.

802.3ah Events

Note: *The **802.3ah Events** tab is only available when 802.3ah is selected as the ENIU type.*

Click **Tools**, **ENIU**, and **802.3ah Events**.



- **Date Stamp**: The date the last event was received.
- **Time Stamp**: The time the last event was received.
- **Window**.

Symbol Period	Errored symbol Window in second
Frame	Errored frame event Window in second
Frame Period	Errored frame period Window - duration period in number of 64 bytes frames
Frame Seconds	Errored frame seconds summary Window

➤ **Threshold**.

Symbol Period	Errored symbol threshold in second
Frame	Errored frame event threshold in second
Frame Period	Errored frame period threshold in second
Frame Seconds	Errored frame seconds summary threshold in second

➤ **Error Count**.

Symbol Period	The number of symbol errors in Window
Frame	The number of frame event errors in Window
Frame Period	The number of frame period errors in Window
Frame Seconds	The number of frame seconds summary errors in Window

➤ **Error Running Total**.

Symbol Period	The number of symbol errors since the last reset
Frame	The number of frame event errors since the last reset
Frame Period	The number of frame period errors since the last reset
Frame Seconds	The number of frame seconds summary errors since the last reset

➤ **Event Running Total**

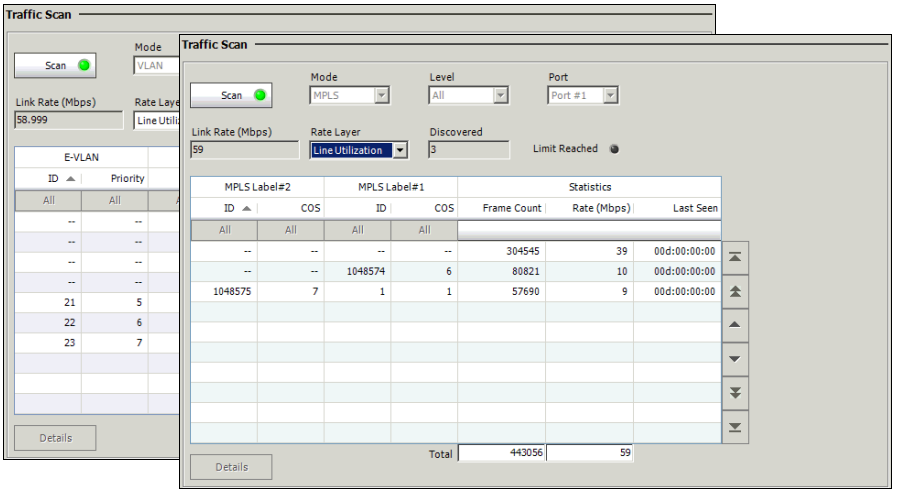
Symbol Period	The number of symbol events since the last reset
Frame	The number of frame events since the last reset
Frame Period	The number of frame period events since the last reset
Frame Seconds	The number of frame seconds events since the last reset

Traffic Scan

The traffic scan tool provides the capability to discover and monitor VLAN or MPLS traffic flows on the network.

Note: *In order to access traffic scan, a test must be created but not running. If the test is started while the traffic scan is running, the traffic scan will automatically stops.*

Click **Tools**, and **Traffic Scan**.



Scan

Starts/stops the traffic scan test.

Mode

Allows the selection of **VLAN** or **MPLS** traffic scan mode. The default setting is **VLAN**.

Level

Allows the selection of the criteria that will be used to filter the incoming VLAN or MPLS traffic flows. The default setting is **All**. Choices are:

Mode	Level	Description
VLAN	C-VLAN	Discovers/monitors only frames where the outer VLAN is a C-VLAN (TPID of 0x8100).
	S-VLAN	Discovers/monitors only frames where the outer VLAN is a S-VLAN (TPID of 0x8100, 0x88A8, 0x9100, 0x9200, or 0x9300)
	E-VLAN	Discovers/monitors only frames where the outer VLAN is a E-VLAN (TPID of 0x8100, 0x88A8, 0x9100, 0x9200, or 0x9300)
	Untagged	Monitors untagged frames only (no VLAN)
	All	Monitors untagged frames and up to 3 levels of stacked VLAN frames
MPLS	1 Label	Monitors MPLS frames with one label only (EtherType of 0x8847 or 0x8848)
	2 Labels	Monitors MPLS frames with two labels (EtherType of 0x8847 or 0x8848)
	Unlabeled	Monitors unlabeled frames only (no MPLS label)
	All	Monitors unlabeled frames and MPLS frames with up to two labels

Port

Allows the selection of the port when a dual ports test is created. For single port test, the port selected for the test is displayed.

Link Rate (Mbps)

Indicates the network link rate based on the received frames with a valid FCS regardless if the frame matches or not the traffic flows and filters, and regardless if the traffic flow was ignored due to the limit reached (see *Limit Reached* on page 435). The rate is expressed either in **Line Utilization** or **Ethernet Bandwidth** (see *Rate Layer*).

Rate Layer

Allows the selection of the rate unit used for **Link Rate** and **Rate** statistics.

- **Line Utilization** is used to express the real line rate including the Preamble, SFD, and IFG.
- **Ethernet BW** (Bandwidth) is used to express the Ethernet bandwidth rate excluding the Preamble, SFD, and IFG.

Discovered

Indicates the number of different traffic flows monitored based on the scan criteria and filters.

Limit Reached

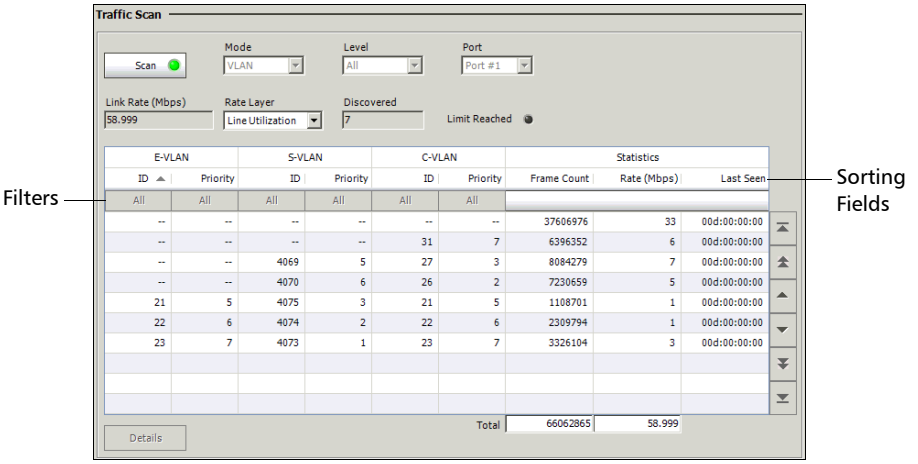
Up to 128 different traffic flows can be monitored, the **Limit Reached** LED turns on when the limit is reached.

Monitored Frames Table

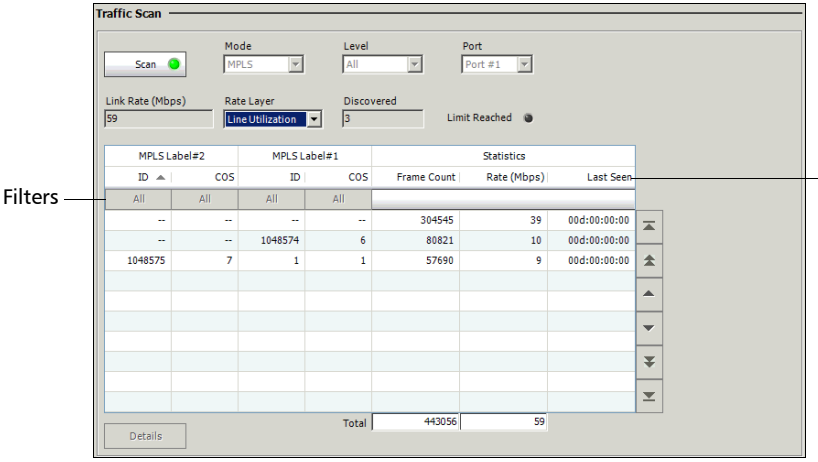
Statistics are gathered for each different traffic flow matching the scan criteria and filters. Each different traffic flow creates a separate entry in the scan table. When the limit is reached, new traffic flows are not considered but the existing traffic flows are still monitored.

Note: *Scan statistics are cleared when restarting the scan or when the test is cleared.*

For VLAN Mode, the level of VLAN (untagged, E-VLAN, S-VLAN, C-VLAN), and values of VLAN ID, Priority, and TPID are used to identify a traffic flow. Any difference in one of these values, except for those set to **Ignore** (see *Filters* on page 438), will create a separated entry in the table. PBB-TE frames are ignored.



For MPLS Mode, the level of MPLS (Unlabeled, 1 Label, 2 Labels), and the values of Label ID and COS are used to identify a traffic flow. Any difference in one of these values, except for those set to **Ignore** (see *Filters* below), will create a separated entry in the table.



➤ Filters

The column's **All**/**Ignore** toggle buttons are used to set the filtering criteria.

Only parameters set to **All** will be considered to identify each traffic flow. The availability of filters depends on the VLAN or MPLS Level selected.

Scan	Level	Filters
VLAN	**All** and **E-VLAN**	E-VLAN priority, S-VLAN ID and Priority, C-VLAN ID and Priority.
	S-VLAN	S-VLAN Priority, C-VLAN ID and Priority.
	C-VLAN	C-VLAN Priority.
	Untagged	Not applicable.
MPLS	**All** and **2 Labels**	MPLS Label#2 COS, MPLS Label#1 ID and COS.
	1 Label	MPLS Label#1 COS
	Unlabeled	Not applicable.

Filtering on a VLAN ID requires that all VLAN IDs from the current up to the outer VLAN are included in the filtering criteria. Filtering on a VLAN Priority requires that its VLAN ID is included in the filtering criteria.

Note: *Setting a VLAN ID to **Ignore** will automatically ignore its Priority and TPID values.*

Setting an MPLS ID to **Ignore** will automatically switch its COS's filter to **Ignore**.

➤ **Frame Count** indicates for each traffic flow, the number of frames matching the selected scan criteria and filters.

Total indicates the number of frames matching the selected scan criteria and filters.

➤ **Rate (Mbps)** indicates for each traffic flow, the rate of frames received matching the selected scan criteria and filters. The rate is expressed either in **Line Utilization** or **Ethernet Bandwidth** (see *Rate Layer* on page 435).

Total indicates the total rate of frames matching the selected scan criteria and filters.

➤ **Last Seen** indicates the time elapsed since the last frame, matching the selected scan criteria and filters, was received.

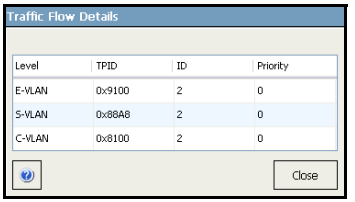
Note: *Traffic Flows may be sorted using any parameter appearing in the table by clicking on the corresponding column label (refer to Table Sorting* on page 56*).*

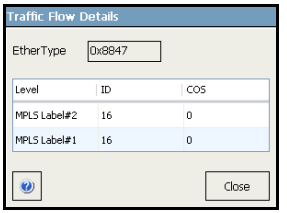
➤ **Details**

Allows to see detailed information for the selected traffic flow. Select a traffic flow from the list and click on the **Details** button. The detailed information includes:

For VLAN: The VLAN Label, and its TPID (Tag Protocol ID), ID, and Priority.

For MPLS: The EtherType, and its MPLS Level, ID, and COS.





22 Maintenance

To help ensure long, trouble-free operation:

- Always inspect fiber-optic connectors before using them and clean them if necessary.
- Keep the unit free of dust.
- Clean the unit casing and front panel with a cloth slightly dampened with water.
- Store unit at room temperature in a clean and dry area. Keep the unit out of direct sunlight.
- Avoid high humidity or significant temperature fluctuations.
- Avoid unnecessary shocks and vibrations.
- If any liquids are spilled on or into the unit, turn off the power immediately, disconnect from any external power source, remove the batteries and let the unit dry completely.

WARNING

Use of controls, adjustments, and procedures for operation and maintenance other than those specified herein may result in hazardous radiation exposure.

CAUTION

The RTU-310/310G contains a lithium battery and is not user replaceable. Contact the manufacturer regarding service of this equipment.

Recalibrating the Unit

Manufacturing and service center calibrations are based on the ISO/IEC 17025 Standard, which states that calibration documents must not contain a recommended calibration interval, unless this has been previously agreed upon with the customer.

Validity of specifications depends on operating conditions. For example, the calibration validity period can be longer or shorter depending on the intensity of use, environmental conditions and unit maintenance. You should determine the adequate calibration interval for your unit according to your accuracy requirements.

Under normal use, EXFO recommends calibrating your unit every two years.

Replacing Fuses

The RTU-310/310G contains two fuses (T4A, 5 mm x 20 mm (0.197 in x 0.787 in), slow-blow, low-breaking capacity, 250 V). The fuse holder is located at the front of the RTU-310/310G, just below the power inlet.

CAUTION

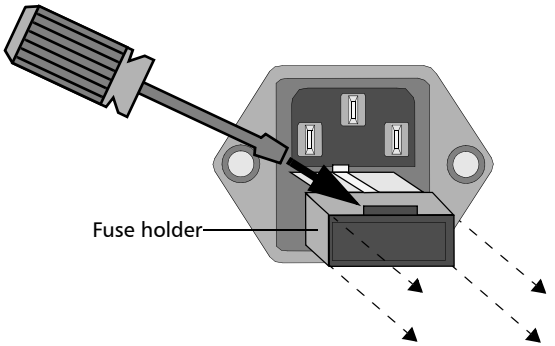
For continued protection against risk of fire, replace only with same type and rating of fuse.

CAUTION

DOUBLE POLE/NEUTRAL FUSING.

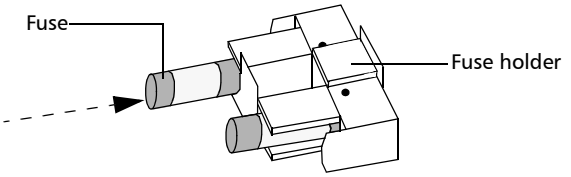
To replace a fuse:

1. Unplug the power cord.
2. Using a flat-head screwdriver as a lever, pull the fuse holder out of the RTU-310/310G.



3. Check and replace the fuses, if necessary.

4. Insert the new fuse into the fuse holder.



5. Make sure the fuses are placed firmly in the holder prior to reinsertion.

6. Firmly push the fuse holder into place.

23 Warranty

General Information

EXFO Inc. (EXFO) warrants this equipment against defects in material and workmanship for a period of one year from the date of original shipment. EXFO also warrants that this equipment will meet applicable specifications under normal use.

During the warranty period, EXFO will, at its discretion, repair, replace, or issue credit for any defective product, as well as verify and adjust the product free of charge should the equipment need to be repaired or if the original calibration is erroneous. If the equipment is sent back for verification of calibration during the warranty period and found to meet all published specifications, EXFO will charge standard calibration fees.

IMPORTANT

The warranty can become null and void if:

- **unit has been tampered with, repaired, or worked upon by unauthorized individuals or non-EXFO personnel.**
- **warranty sticker has been removed.**
- **case screws, other than those specified in this guide, have been removed.**
- **case has been opened, other than as explained in this guide.**
- **unit serial number has been altered, erased, or removed.**
- **unit has been misused, neglected, or damaged by accident.**

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES EXPRESSED, IMPLIED, OR STATUTORY, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. IN NO EVENT SHALL EXFO BE LIABLE FOR SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES.

Liability

EXFO shall not be liable for damages resulting from the use of the product, nor shall be responsible for any failure in the performance of other items to which the product is connected or the operation of any system of which the product may be a part.

EXFO shall not be liable for damages resulting from improper usage or unauthorized modification of the product, its accompanying accessories and software.

Exclusions

EXFO reserves the right to make changes in the design or construction of any of its products at any time without incurring obligation to make any changes whatsoever on units purchased. Accessories, including but not limited to fuses, pilot lamps, batteries and universal interfaces (EUI) used with EXFO products are not covered by this warranty.

This warranty excludes failure resulting from: improper use or installation, normal wear and tear, accident, abuse, neglect, fire, water, lightning or other acts of nature, causes external to the product or other factors beyond the control of EXFO.

IMPORTANT

EXFO will charge a fee for replacing optical connectors that were damaged due to misuse or bad cleaning.

Certification

EXFO certifies that this equipment met its published specifications at the time of shipment from the factory.

Service and Repairs

EXFO commits to providing product service and repair for five years following the date of purchase.

To send any equipment for service or repair:

1. Call one of EXFO's authorized service centers (see *EXFO Service Centers Worldwide* on page 448). Support personnel will determine if the equipment requires service, repair, or calibration.
2. If equipment must be returned to EXFO or an authorized service center, support personnel will issue a Return Merchandise Authorization (RMA) number and provide an address for return.
3. If possible, back up your data before sending the unit for repair.
4. Pack the equipment in its original shipping material. Be sure to include a statement or report fully detailing the defect and the conditions under which it was observed.
5. Return the equipment, prepaid, to the address given to you by support personnel. Be sure to write the RMA number on the shipping slip. *EXFO will refuse and return any package that does not bear an RMA number.*

Note: *A test setup fee will apply to any returned unit that, after test, is found to meet the applicable specifications.*

After repair, the equipment will be returned with a repair report. If the equipment is not under warranty, you will be invoiced for the cost appearing on this report. EXFO will pay return-to-customer shipping costs for equipment under warranty. Shipping insurance is at your expense.

Routine recalibration is not included in any of the warranty plans. Since calibrations/verifications are not covered by the basic or extended warranties, you may elect to purchase FlexCare Calibration/Verification Packages for a definite period of time. Contact an authorized service center (see *EXFO Service Centers Worldwide* on page 448).

EXFO Service Centers Worldwide

If your product requires servicing, contact your nearest authorized service center.

EXFO Headquarters Service Center
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
quebec.service@exfo.com

EXFO Europe Service Center
Omega Enterprise Park, Electron Way
Chandlers Ford, Hampshire S053 4SE
ENGLAND

Tel.: +44 2380 246810
Fax: +44 2380 246801
europe.service@exfo.com

EXFO Telecom Equipment (Shenzhen) Ltd.
3rd Floor, Building 10,
Yu Sheng Industrial Park (Gu Shu Crossing), No. 467,
National Highway 107,
Xixiang, Bao An District,
Shenzhen, China, 518126

Tel: +86 (755) 2955 3100
Fax: +86 (755) 2955 3101
beijing.service@exfo.com

24 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
Optical Laser LED is off and the SFP is not generating a signal.	➤ There is a configuration mismatch between the inserted SFP and the rate selected for the test case.	➤ Ensure that the SFP is supporting the rate used for the test case.
	➤ The SFP is not compatible with the RTU-310.	➤ Ensure to use a compatible SFP.

Contacting the Technical Support Group

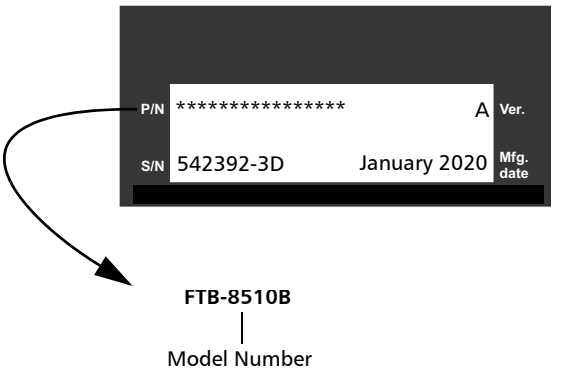
To obtain after-sales service or technical support for this product, contact EXFO at one of the following numbers. The Technical Support Group is available to take your calls from Monday to Friday, 8:00 a.m. to 7:00 p.m. (Eastern Time in North America).

For detailed information about technical support, visit the EXFO Web site at .

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

To accelerate the process, please have information such as the name and the serial number (see the product identification label—an example is shown below), 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.

A Specifications

Specifications for RTU-310

Optical Interfaces

	100Base-FX	100Base-LX	1000Base-SX	1000Base-LX	1000Base-ZX
Wavelength (nm)	1310	1310	850	1310	1550
TX level (dBm)	-20 to -15	-15 to -8	-9 to -3	-9.5 to -3	0 to +5
RX level sensitivity (dBm)	-31	-28 to -8	-20	-22	-22
Maximum reach	2 km	15 km	550 m	10 km	80 km
Transmission bit rate (Gbps)	0.125	0.125	1.25	1.25	1.25
Reception bit rate (Gbps)	0.125	0.125	1.25	1.25	1.25
Tx operational wavelength range (nm)	1280 to 1380	1261 to 1360	830 to 860	1270 to 1360	1540 to 1570
Measurement accuracy - Frequency (ppm) - Optical power (dB)	 ±4.6 ±2	 ±4.6 ±2	 ±4.6 ±2	 ±4.6 ±2	 ±4.6 ±2
Maximum RX before damage (dBm)	+3	+3	+6	+6	+6
Jitter compliance	ANSI X3.166	IEEE 802.3	IEEE 802.3	IEEE 802.3	
Ethernet classification	ANSI X3.166	IEEE 802.3	IEEE 802.3	IEEE 802.3	
Laser type	LED	FP	VCSEL	FP	DFB
Eye safety	CLASS 1	CLASS 1	CLASS 1	CLASS 1	CLASS 1
Connector	LC	LC	LC	LC	LC

	100Base-FX	100Base-LX	1000Base-SX	1000Base-LX	1000Base-ZX
Transceiver type	SFP	SFP	SFP	SFP	SFP

Electrical Interfaces

	10Base-T	100Base-T	1000Base-T
TX bit rate	10 Mbps	125 Mbps	1 Gbps
TX accuracy (ppm)	±100	±100	±100
RX bit rate	10 Mbps	125 Mbps	1 Gbps
RX measurement accuracy (ppm)	±4.6	±4.6	±4.6
Duplex mode	Half and full duplex	Half and full duplex	Full duplex only
Jitter compliance	IEEE 802.3	ANSI X3.263-1995	IEEE 802.3
Connector	RJ-45	RJ-45	RJ-45
Maximum reach (m)	100	100	100

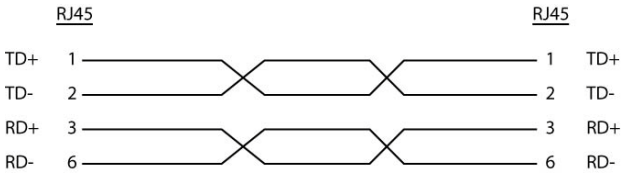
Ethernet Cables

Minimum Category 3 cable is required for 10Base-T connection while Category 5 cable is required for 100Base-T and 1000Base-T connections.

Maximum cable length (between two nodes) for 10Base-T, 100Base-T, or 1000Base-T connection is 328 feet (100 meters).

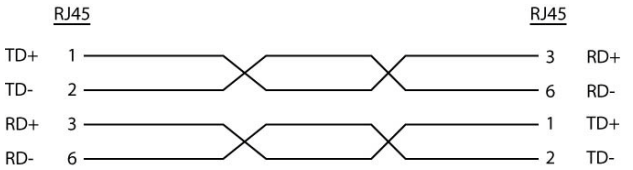
➤ Straight Through Cable (10/100 Mbps)

An Unshielded Twisted Pair (UTP) straight through cable is required to connect a 10/100Base-T RTU-310/310G port to a layer 1 or 2 device (ex: HUB, switch).

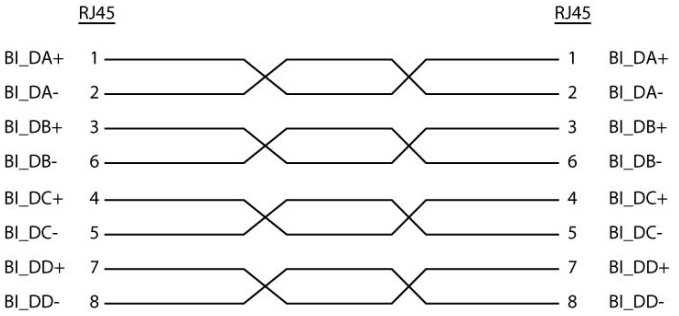


➤ Crossover Cable (10/100 Mbps)

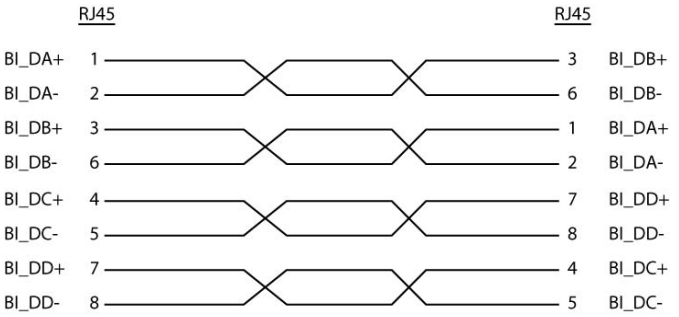
An Unshielded Twisted Pair (UTP) crossover cable is required to connect the 10/100Base-T RTU-310/310G port to a layer 3 device (ex: router).



➤ Straight Through Cable (1000 Mbps)



➤ Crossover Cable (1000 Mbps)



Functional Specifications

Communication Interfaces

- LAN

  Port RJ-45
  Rates: 10/100 Mbps

- CRAFT

  Port RJ-45
  Rates: 10/100 Mbps

Test Interfaces

- Electrical

  RJ-45 rates: 10/100/1000 Mbps

- Optical

  SFP Rates: 100/1000 Mbps

Other Interfaces

- 4 X USB ports
- Console port (RS-232 DB-9) and VGA port

Unit LEDs

- Power/status (green)
- Critical alarm (red)
- Major alarm (orange)
- Minor alarm (yellow)

Parallel Monitoring Capacity

- 250 streams

IPTV Statistics

RFC 4445 delivery index

- Delay factor (current, average, min, max)
- Media loss rate (current, average, min, max)
- Virtual buffer size (current, average, min, max)

ETSI TR 101 290 (Priority 1)

TS sync loss, Sync byte error, PAT error 2, Continuity counter error, PMT error 2, PID error, PCR jitter (current, average, min, max)

Stream Information

- Stream name
- Source and destination IP address
- Source and destination UDP port number
- Transport stream type (SPTS or MPTS)
- Encapsulation (IPv4/UDP or IPv4/UDP/RTP) MPEG-2, MPEG-4 part 2 or ITU H.264 over MPEG-2
- Video Stream Type
- Start time
- Elapsed time
- Presence time

Stream Statistics

- Ethernet
  - Bandwidth utilization
- IP
  - IP rate (current, average, min, max)
  - IP packet size
  - IP packet count
- Media
  - Media rate (current, average, min, max)
  - Packet count
  - Packet loss

Ethernet Statistics

Valid frame counts for multicast, broadcast.unicast, and n-unicast.

Frame size distribution, bandwidth, utilization, and frame rate.

Ethernet/IP/UDP Errors

Symbol, Idle, FCS, Jabber/giant, Oversize, Runt False carrier, Undersize, Alignment, IP header checksum, UDP checksum (including errored seconds, error count, and error rate).

Additional Features

- Stream auto discovery
- Stream alias map
- Configurable alarm thresholds
  - MDI DF
  - MDI MLR
  - PCR jitter
  - PID error
  - PAT
  - PMT error
- Data storage capabilities
  - Last 48 hours of sample measurements
  - Metrics include: delay factor, media loss rate, PCR jitter, CC error
- System event and alarm logs
- User management: unique user name password
- Remote configurations: thresholds, alias map, monitored streams
- Remote software upgrades
- Web-based user interface

General Specifications

Size (H x W x D)	1U rack-mount chassis (19 and 23 in. rack-mount supported)
Weight (without transceivers)	6 kg (13.23 lb.)
Temperature - operating - storing	 0 °C to 50 °C (32 °F to 122 °F) -40 °C to 70 °C (-40 °F to 158 °F)
AC Input Power	100 - 240 Vac (+6% / -10%); 50 - 60 Hz; 0.75 A
DC Input Power	40-72 Vdc; 2 A

Specifications for RTU-310G

Optical Interfaces

	10GBASE-SW	10GBASE-SR	10GBASE-LW	10GBASE-LR	10GBASE-EW	10GBASE-ER
Wavelength (nm)	850	850	1310	1310	1550	1550
TX level (dBm)	-7.3 to -1	-7.3 to -1	-8.2 to 0.5	-8.2 to 0.5	-4.7 to 4	-4.7 to 4
RX level sensitivity (dBm)	-9.9 to -1	-9.9 to -1	-14.4 to 0.5	14.4 to 0.5	-15.8 to -1	-15.8 to -1
Transmission bit rate (Gbps)	9.95328 Gbit/s ± 4.6 ppm*	10.3125 Gbit/s ± 4.6ppm*	9.95328 Gbit/s ± 4.6 ppm*	10.3125 Gbit/s ± 4.6 ppm*	9.95328 Gbit/s ± 4.6 ppm*	10.3125 Gbit/s ± 4.6 ppm*
Reception bit rate (Gbps)	9.95328 Gbit/s ± 150 ppm	10.3125 Gbit/s ± 150 ppm	9.95328 Gbit/s ± 150 ppm	10.3125 Gbit/s ± 150 ppm	9.95328 Gbit/s ± 150 ppm	10.3125 Gbit/s ± 150 ppm
Tx operational wavelength range (nm)	840 to 860	840 to 860	1260 to 1355	260 to 1355	1530 to 1565	1530 to 1565
Measurement accuracy						
- Frequency (ppm)	±4.6	±4.6	±4.6	±4.6	±4.6	±4.6
- Optical power (dB)	±2	±2	±2	±2	±2	±2
Maximum RX before damage (dBm)	0	0	1.5	1.5	+4	+4
Jitter compliance	IEEE 802.3	IEEE 802.3	IEEE 802.3	IEEE 802.3	IEEE 802.3	IEEE 802.3
Ethernet classification	IEEE 802.3	IEEE 802.3	IEEE 802.3	IEEE 802.3	IEEE 802.3	IEEE 802.3
Laser type	VCSEL	VCSEL	DFB	DFB	EML	EML

	10GBASE-SW	10GBASE-SR	10GBASE-LW	10GBASE-LR	10GBASE-EW	10GBASE-ER
Eye safety	CLASS 1	CLASS 1	CLASS 1	CLASS 1	CLASS 1	CLASS 1
Connector	Duplex LC	Duplex LC	Duplex LC	Duplex LC	Duplex LC	Duplex LC
Transceiver type	XFP	XFP	XFP	XFP	XFP	XFP

Synchronization Interfaces

DS1/E1 external input clock interface

Parameter	DS1	E1
Rx level sensitivity (short haul only)	For 772 kHz: TERM: 6 dB (cable loss only)	For 1024 kHz: TERM: 6 dB (cable loss only)
Reception bit rate	1.544 Mbit/s ± 50 ppm	2.048 Mbit/s ± 50 ppm
Input jitter tolerance	AT&T PUB 62411, GR-499 section 7.3	G.823 section 7.2
Line coding	AMI and B8ZS	HDB3 and AMI
Input impedance (resistive termination)	100 ohms ± 5%, balanced	120 ohms ± 5%, balanced
Connector type	BANTAM	BANTAM

Electrical Interfaces

Electrical Interfaces	External clock DS1/E1 and clock output	
External clock DS1/E1	Line coding	DS1: AMI and B8ZS
		E1: AMI and HDB3
	Termination mode	DS1/E1: Term
	Framing	DS1: SF and ESF
		E1: PCM30, PCM30CRC, PCM31 and PCM31CRC
	Clocking	Internal, external (BITS) and recovered
Clock output	REF out	Clock out divider: 16, 32 and 64

REF out interface

Parameter	Value	
Tx pulse amplitude	600 mVpp ± 130 mV	
Transmission frequency	LAN	WAN
Clock divider (MHz)	16 644.53	622.08
Clock divider (MHz)	32 322.266	311.04
Clock divider (MHz)	64 161.133	155.52
Output configuration	AC coupled	
Load impedance	50 ohms	
Maximum cable length (m)	3	
Connector type	SMA	

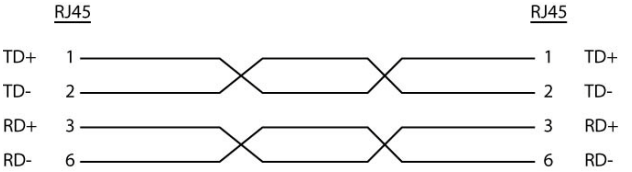
Ethernet Cables

Minimum Category 3 cable is required for 10Base-T connection while Category 5 cable is required for 100Base-T and 1000Base-T connections.

Maximum cable length (between two nodes) for 10Base-T, 100Base-T, or 1000Base-T connection is 328 feet (100 meters).

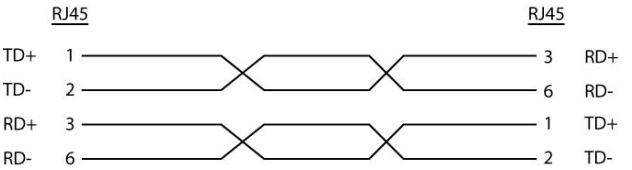
➤ Straight Through Cable (10/100 Mbps)

An Unshielded Twisted Pair (UTP) straight through cable is required to connect a 10/100Base-T RTU-310/310G port to a layer 1 or 2 device (ex: HUB, switch).

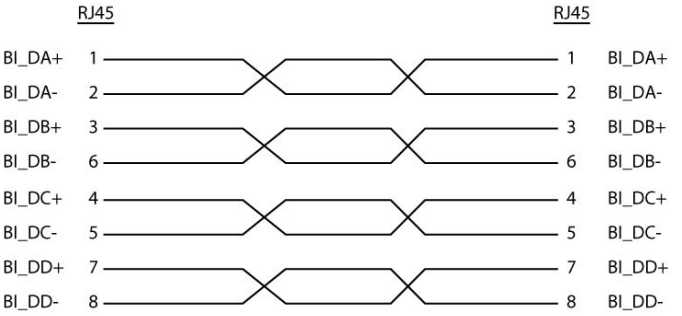


➤ Crossover Cable (10/100 Mbps)

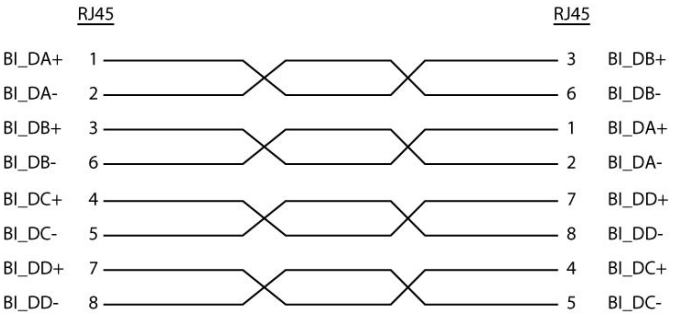
An Unshielded Twisted Pair (UTP) crossover cable is required to connect the 10/100Base-T RTU-310/310G port to a layer 3 device (ex: router).



➤ Straight Through Cable (1000 Mbps)



➤ Crossover Cable (1000 Mbps)



Functional Specifications

Communication Interfaces

- LAN

  Port RJ-45
  Rates: 10/100 Mbps

- CRAFT

  Port RJ-45
  Rates: 10/100 Mbps

Test Interfaces

- Optical

  XFP Rates: 10 GigE

Other Interfaces

- 4 X USB ports
- Console port (RS-232 DB-9) and VGA port

Unit LEDs

- Power/status (green)
- Critical alarm (red)
- Major alarm (orange)
- Minor alarm (yellow)

Stream Statistics

- Ethernet
  - Bandwidth utilization
- IP
  - IP rate (current, average, min, max)
  - IP packet size
  - IP packet count
- Media
  - Media rate (current, average, min, max)
  - Packet count
  - Packet loss

Ethernet Statistics

Valid frame counts for multicast, broadcast.unicast, and n-unicast.

Frame size distribution, bandwidth, utilization, and frame rate.

Ethernet/IP/UDP Errors

Local/Remote Fault and Block Error, Idle, FCS, Jabber/giant, Oversize, Runt False carrier, Undersize, Alignment, IP header checksum, UDP checksum (including errored seconds, error count, and error rate).

Additional Test and Measurement Functions

Power measurement	Supports optical power measurement, displayed in dBm.
Frequency measurement	Supports clock frequency offset generation and measurements (i.e., received frequency and deviation of the input signal clock from nominal frequency).
Frequency offset generation	
Range (ppm)	±120
Resolution (ppm)	±1
Accuracy (uncertainty) (ppm)	±4.6
Frequency offset measurement	
Range (ppm)	±150
Resolution (ppm)	±1
Accuracy (uncertainty) (ppm)	±4.6
Signal label control and monitoring	Ability to configure and monitor J0 trace, J1 trace and payload signal label C2 (WAN).
Dual test set	Performs end-to-end, bidirectional performance testing (as required by leading standards bodies)—remote Packet Blazer controlled via the LAN connection under test.
DHCP client	Capability to connect to a DHCP server to obtain its IP address and subnet mask to connect to the network.
Smart Loopback	Capability to return traffic to the local unit by swapping packet overhead up to layer 4 of the OSI stack.

Module Specifications

	RTU-310G-LAN	RTU-310G-WAN	RTU-310G-LAN/WAN
Port	One 10 Gigabit Ethernet port	One 10 Gigabit Ethernet port	One 10 Gigabit Ethernet port
Connector type	LC	LC	LC
Optical transceiver	850 nm optics (10GBASE-SR)	850 nm optics (10GBASE-SW)	850 nm optics (10GBASE-SR/-SW)
	1310 nm optics (10GBASE-LR)	1310 nm optics (10GBASE-LW)	1310 nm optics (10GBASE-LR/-LW)
	1550 nm optics (10GBASE-ER)	1550 nm optics (10GBASE-EW)	1550 nm optics (10GBASE-ER-/EW)
Port capacity	Full-line-rate traffic generation and analysis	Full-line-rate traffic generation and analysis	Full-line-rate traffic generation and analysis
Ethernet testing	RFC 1242, RFC 2544, RFC 3393, multistream	RFC 1242, RFC 2544, RFC 3393, multistream	RFC 1242, RFC 2544, RFC 3393, multistream
	traffic generation and analysis, EtherBERT	traffic generation and analysis, EtherBERT	traffic generation and analysis, EtherBERT

General Specifications

Communication Interface		
LAN port		RJ-45
		Rates: 10/100 Mbit/s
Craft port		RJ-45
		Rates: 10/100 Mbit/s
Test interfaces	Optical	XFP
		Rates: 10 Gbit/s
Other interfaces		4 X USB ports
		Console port (RS-232 DB-9) and VGA port
Size (H x W x D)		1U rack-mount chassis 44 mm x 445 mm x 292 mm (1 ¾ in x 17 ½ in x 11 ½ in) (19-inch and 23-inch rack-mount supported)
Weight		5.5 kg (12 lb)
Temperature	operating	0 °C to 50 °C (32 °F to 122 °F)
	storing	-40 °C to 60 °C (-40 °F to 140 °F)
Power		AC (110/220 V)
		DC (-48 V); dual DC power feed
Power consumption		70 W
Certifications		NEBS Level 1, CE, CSA, UL, WEEE and RoHS

B Using VNC to access the RTU-310/310G

VNC is a graphical desktop sharing software that allows a computer to remotely control another network device. VNC allows remote control of a computer from two different clients: the TightVNC client application or a web browser capable of running Java applets. The software load package contains the TightVNC client software, the TightVNC server is available on the RTU-310/310G.

Note: *The web capability of VNC is called http VNC. In http VNC the graphical display is shown inside the web browser. File transfer is not available with http VNC.*

Installing the TightVNC

To install the TightVNC client service on a remote computer:

1. Double-click the setup file.
2. Click **Next** to start the installation and follow the on-screen instructions.

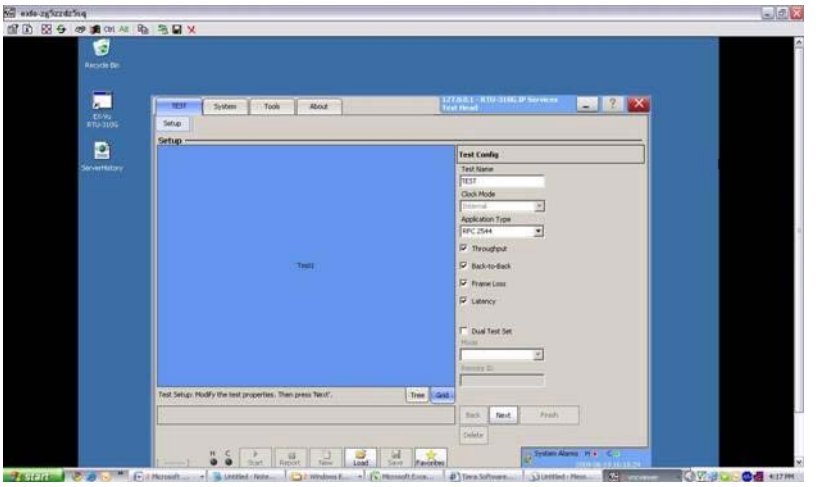
Remote Connection using TightVNC

Connect to the RTU-310/310G using TightVNC:

1. From the **Programs** menu, select **TightVNC** and click **TightVNC Viewer**.

2. Enter the IP address of the RTU-310/310G unit in the **VNC server** field and click **Connect**.

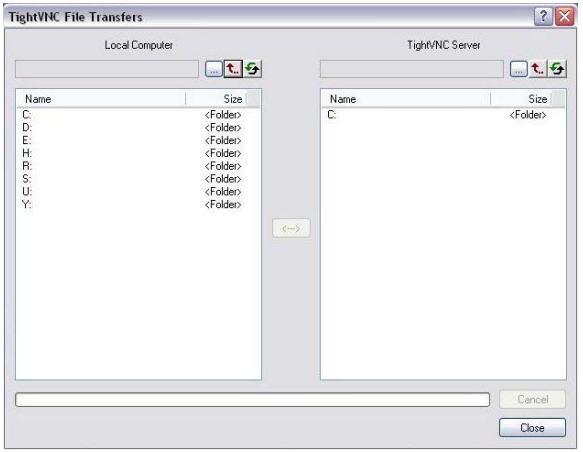
   The local RTU-310/310G screen is displayed. You can control the RTU-310/310G using this screen.



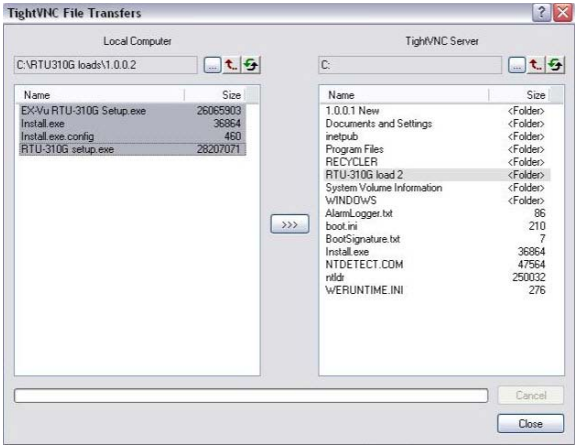
Transferring files using TightVNC

To transfer files from the local computer to the RTU-310/310G:

1. Create a folder on the local drive of the RTU-310/310G.
2. Right-click the task bar of the TightVNC Viewer screen and select **Transfer files**.
   - ➤ **Local Computer** displays the local drives available on your computer.
   - ➤ **TightVNC Server** displays the local drive of the RTU-310/310G.



3. Navigate to the new folder on the RTU-310/310G from the **TightVNC Server** field.



4. Locate the files that you need to transfer from the **Local Computer** field and click the >>> button.

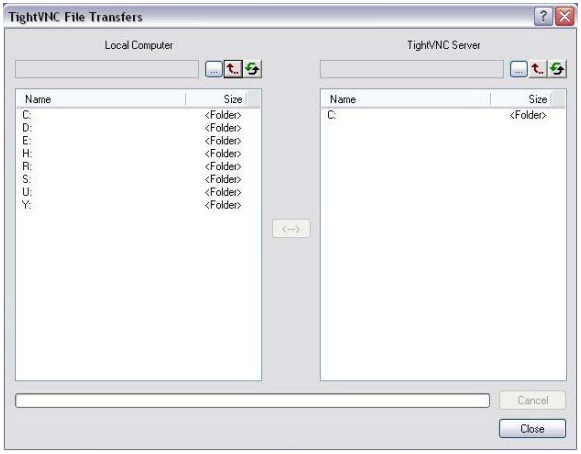
The files are transferred to the selected folder on the local drive of the RTU-310/310G.

To transfer files from the RTU-310/310G to the local computer:

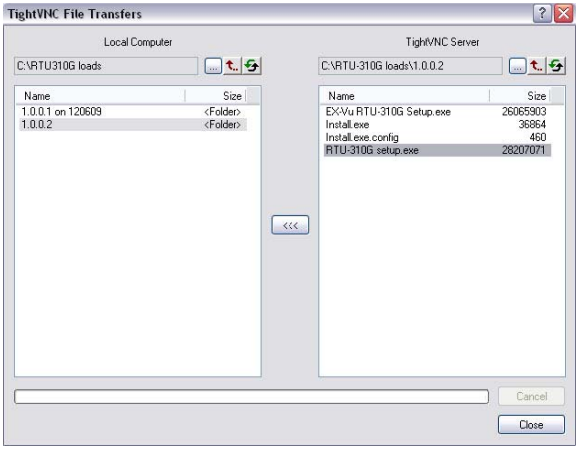
1. Create a folder on your computer.
2. Right-click the task bar of the TightVNC Viewer screen and select **Transfer files**.

   ➤ **Local Computer** displays the local drives available on your computer.

   ➤ **TightVNC Server** displays the local drive of the RTU-310/310G.



3. Navigate to the new folder on your machine from the **Local Computer** field.



4. Select the files on the RTU-310/310G local drive from the **TightVNC Server** field that you need to transfer and click the  button.

C Acronym List

?	Help

A

A	Ampere
AC	Alternating Current
AM a.m.	Ante Meridiem (period between midnight and noon)
ANSI	American National Standards Institute
AWG	American Wire Gauge

B

bps	Bit Per Second
BW	Bandwidth

C

CAGE	Commerce And Government Entities
CC Error	Continuity Counter Error
CE	European Conformity

D

dB	Decibel
dBm	Decibel - milliwatts
DC	Direct Current
DF	Delay Factor

DHCP	Dynamic Host Configuration Protocol

E

EMC	Electromagnetic Compatibility
EMS	Element Management System
ESD	Electrostatic Discharge
EULA	End User License Agreement

F

FAQ	Frequently Asked Questions
FCC	Federal Communications Commission
FCS	Frame Check Sequence
fps	frame per second

G

Gbps	GigaBit Per Second
GMT	Greenwich Mean Time

H

hr	hour
Hz	Hertz

I

IC	Industry Canada
ID	Identification
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical & Electronics Engineers
in	Inch
IN	Input
IP	Internet Protocol
IPTV	Internet Protocol Television
IPv4	Internet Protocol version 4
ISO	International Organization for Standardization
ITE	Information Technology Equipment

K

Kbps	KiloBit Per Second
Kg	Kilogram

L

LAN	Local Area Network
LED	Light-Emitting Diode
lb.	Pound
LOS	Loss Of Signal

M

m	Meter
MAC	Media Access Control
Mbps	Megabit Per Second
MDI	Media Delivery Index
min.	minute
MLR	Media Loss Rate
MMF	Multi-Mode Fiber
MPEG	Motion Picture Expert Group
MPTS	Multi-Program Transport Stream
ms	millisecond
MS	Microsoft Corporation

N

NATO	North Atlantic Treaty Organization
nm	Nanometer
NTP	Network Time Protocol

O

OUT	OUTput

P

PAT	Program Association Table
PC	Personal Computer

PCR	Program Clock Reference
PID	Packet Identifier
PM p.m.	Post Meridiem (period from noon to midnight)
PMT	Program Map Table
ppm	parts per million
pps	packet per second
PVID	Port VLAN Identifier

R

RFC	Request For Comments
RMA	Return Merchandise Authorization
RTP	Real-Time Protocol
RTU	Remote Testing Unit
RX	Receive

S

s	second
SFP	Small Form Factor Pluggable
SI	International System
SLA	Service-Level Agreement
SMF	Single-Mode Fiber
SPTS	Single Program Transport Stream

T

TX	Transmit

U

UDP	User Data Protocol
UI	User Interface
URL	Uniform Resource Locator
USA	United States of America
USB	Universal Serial Bus
UTC	Universal Time Coordinated
UTP	Unshielded Twisted Pair

V

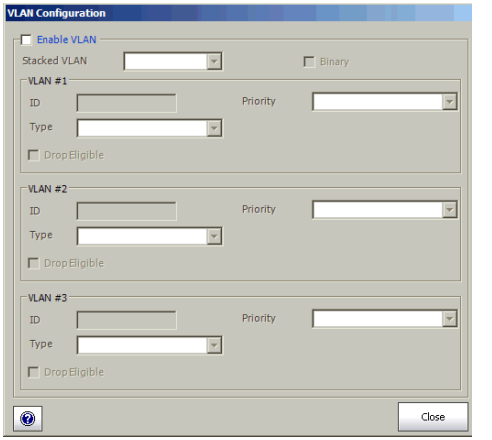
V	Volts
Vac	Volts Alternating Current
VBF	Virtual Buffer Size
Vdc	Volts Direct Current
VID	VLAN Identifier
VLAN	Virtual Local Area Network
VoD	Video on Demand

D Pop-Up Windows

Note: *The following Pop-Up windows are available throughout the user interface.*

VLAN Configuration

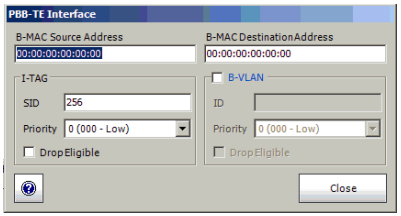
- **Enable VLAN** appears only for EtherSAM service configuration, for all other cases, VLAN is already enabled once the **VLAN Configuration** pop-up window is available. Enable VLAN, when selected, allows the configuration of VLAN. The **VLAN** check box is not selected by default.



- **Stacked VLAN**: Enables up to 3 stacked VLAN.
- **Binary**: When enabled, displays the VLAN ID in binary. This setting is disabled by default.
- **VLAN #1** (C-VLAN) / **#2** (S-VLAN) / **#3** (E-VLAN)
  - **ID**: Enter the VLAN ID. Choices are **0** through **4095**; refer to *VLAN/B-VLAN* on page 464 for more information.
  - **Priority**: Select the VLAN user priority. Choices are **0** to **7**; refer to *VLAN/B-VLAN* on page 464 for more information. The default setting is **0** (**000 - Low Priority**).
  - **Type**: Allows the selection of the VLAN Ethernet Type. Choices are **8100**, **88A8**, **9100**, **9200**, and **9300**. The default setting is **8100** for VLAN #1 (C-VLAN), **88A8** for VLAN #2 (S-VLAN), and **9100** for VLAN #3 (E-VLAN).
  - **Drop Eligible**: When the **Drop Eligible** check box is selected (DEI = 1), these transmitted frames will be dropped first on receipt when congestion occurs under test. Drop Eligible is not available when VLAN type is 8100. This setting is disabled by default.

PBB-TE Interface configuration

The PBB-TE Interface window allows to configure the source and destination parameters for PBB-TE network testing capability. This pop-up window is displayed when clicking on the **PBB-TE Config** button.



- **B-MAC Source Address**: Enter the source Backbone MAC address. The default address is the same as the source MAC address.
- **B-MAC Destination Address**: Enter the destination Backbone MAC address. The default setting is **00:00:00:00:00:00**.
- **I-TAG** (Backbone Service Instance Tag)

  SID (Service Instance Identifier): Enter the I-TAG SID which identifies the backbone service instance of the selected stream. Choices are **0** through **16777215**. The default setting is **256**.

  Priority: Select the B-VLAN user Priority Code Point (PCP). Choices are **0** to **7**. The default setting is **0** (**000** - Low).

  Drop Eligible: When the **Drop Eligible** check box is selected (DEI = 1), these transmitted frames will be dropped first on receipt when congestion occurs under test. This setting is disabled by default.

➤ **B-VLAN** (Backbone Virtual Local Area Network)

ID: Enter the B-VLAN identifier. Choices are **0** through **4095** (refer to *VLAN/B-VLAN* on page 464 for more information).

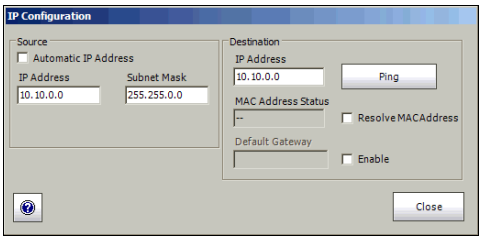
Priority: Select the B-VLAN user Priority Code Point (PCP). Choices are **0** to **7**; (refer to *VLAN/B-VLAN* on page 464 for more information). The default setting is **0** (**000** - Low).

Drop Eligible: When the **Drop Eligible** check box is selected (DEI = 1), these transmitted frames will be dropped first on receipt when congestion occurs under test. This setting is disabled by default.

IPv4 Configuration

Source

Note: *For EtherSAM Dual Test Set, the source IP address is only configurable through the Network* on page 150.



- **Automatic IP Address**: Allows to dynamically obtain an IP address from a DHCP (Dynamic Host Configuration Protocol) server.
- **IP Address**: Enter the IP address for the selected service. The default setting is **10.10.x.x**, where **x** and **y** are respectively the two least significant bytes of the port default MAC address.
- **Subnet Mask**: Enter the Subnet Mask for the selected service. The default setting is **255.255.0.0**.

Destination

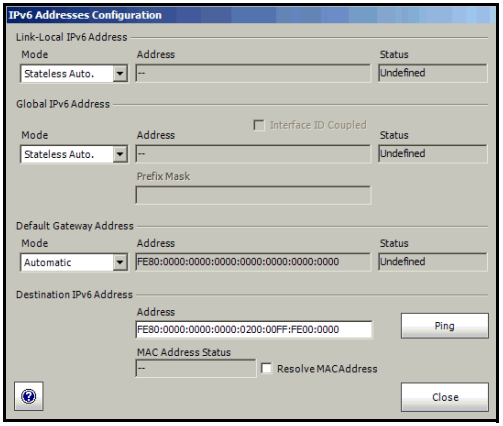
- **IP Address**: Enter the destination IP address for the selected service.
- **Ping** button: Click **Ping** to automatically start the quick Ping utility for the service destination IP address using the Ping parameters from the *Setup* on page 412. Refer to *Ping* on page 508 for more information.
- **Default Gateway**: Enter the default Gateway IP address. Enable Default Gateway must be activated to enable the Default Gateway IP address field. The default setting is **0.0.0.0**.
- **Enable**: Allows enabling the **Default Gateway**.

➤ **Resolve MAC Address**: When enabled, will send a request to the network to retrieve the MAC address corresponding to the selected destination IP address. This setting is disabled by default.

MAC Address Status: Indicates the Resolve MAC address status. Possible status are:

Status	Description
--	The **Resolve MAC address** is not enabled.
Resolving	The MAC address is being resolved.
Resolved	The MAC address is resolved.
Failed	The MAC address cannot be resolved.

IPv6 Address Configuration



Note: *The default IPv6 address parameters are set from the IPv6 Test Preferences* on page 339.

Link-Local IPv6 Address

The Link-Local IPv6 Address (LLA) is used for local communication between on-link neighbors.

Mode

- **Stateless Auto** allows automatic generation of the IPv6 address based on the MAC address. The mode **Stateless Auto** is selected by default.
- **Static** allows to enter the IP address. The **Link-Local IPv6 Address** must starts with **FE80**. The default address is **FE80:0000:0000:0000::[Interface ID]**, where **[Interface ID]** is generated from the source MAC address.

Global IPv6 Address

The Global IPv6 Address (GUA) is used for global communication with hosts outside the subnet and to communicate with on-link neighbors.

- **Mode**
  - **None** disables the **Global IPv6 address** and the **Default Gateway address**.
  - **Stateless Auto** allows automatic generation of the IPv6 address based on the MAC address and the prefix obtained from router advertisements. If no prefix has been obtained, the Global address will not be generated. The mode **Stateless Auto** is selected by default.
  - **Static** allows to enter the IP address. The default address is **2001::[Interface ID]**, where **[Interface ID]** is generated from the source MAC address.
- **Interface ID Coupled**: Available when the **Static Mode** is selected, it allows to couple the interface ID of the Global address to the Link-local source address. The Global address interface ID will match the Link-local address interface ID. The **Interface ID Coupled** check box is selected by default.
- **Prefix Mask**: Available when the **Static Mode** is selected, it allows to specify a prefix that defines the subnet. For example:

Global Address	`2001:0DB8:0001:0002:02AA:00FF:FE11:1111`
Prefix Mask	`FFFF:FFFF:FFFF:0000:0000:0000:0000:0000`
Corresponding Prefix	`2001:0DB8:0001`

Note: *The prefix mask must be a series, from left to right, of consecutive binary 1's followed by consecutive 0's.*

➤ **Link-Local/Global IPv6 Address Status**

Mode	Status	Description
Stateless Auto	--	Undefined
	Generating	Stateless address auto configuration in progress.
	Successful	IP address has been generated and no duplication has been detected.
	Duplication Detected	IP address has been generated but duplication has been detected.
	Failed	IP address has not been generated.
Static	--	Undefined
	DAD Checking	Duplication address detection in progress.
	No Duplication	No duplication has been detected.
	Duplication Detected	Duplication has been detected. Note that duplicated address is not assigned to the interface and consequently unspecified (::) is assumed.

Default Gateway Address

The **Default Gateway Address** is used to forward packets outside the subnet. **Default Gateway Address** is not available when the Global IPv6 address **Mode** is set to **None**.

- **Mode**
  - **Automatic** allows automatic selection of the default gateway.
  - **Static** allows entering the default gateway IP address. The default address is **FE80::**.
- **Default Gateway Address Status**

Status	Description
--	Undefined
Checking	Detection in progress to determine if the Default Gateway is reachable or not.
Unreachable	Default Gateway is unreachable.
Reachable	Default Gateway is reachable.

Destination IPv6 Address

Note: *Destination IPv6 address is only available for EtherSAM services configuration.*

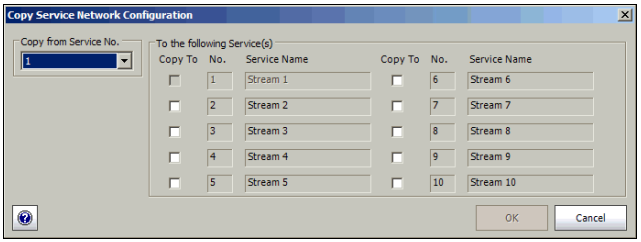
- **IP Address**: Enter the destination IP address for the selected service.
- **Ping** button: Click **Ping** to automatically start the quick Ping utility for the service destination IP address using the Ping parameters from the *Setup* on page 412. Refer to *Ping* on page 508 for more information.
- **Resolve MAC Address**: When enabled, will send a request to the network to retrieve the MAC address corresponding to the selected destination IP address. This setting is disabled by default.

  MAX Address Status: Indicates the Resolve MAC address status. Possible status are:

Status	Description
--	The **Resolve MAC address** is not enabled.
Resolving	The MAC address is being resolved.
Resolved	The MAC address is resolved and the next-hop reachability is confirmed.
Unreachable	The MAC address is resolved and the next-hop is unreachable.
Failed	The MAC address cannot be resolved.

Copy Service Network Configuration

This pop-up window is only available with **EtherSAM (Y.1564)** test case.



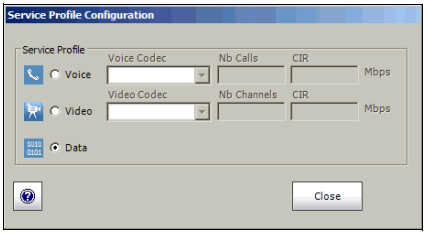
To copy the service configuration to one or several services.

1. In the **Copy from Service No** list, select the service number the configuration will be copied from.
2. Check all service check boxes that will inherit the configuration from the selected service.
3. Click on **OK** to confirm the service configuration copy for all selected services.

Service Profile Configuration

This pop-up window is only available with **EtherSAM (Y.1564)** test case.

Service profile allows the selection and configuration of the **Voice**, **Video**, or **Data** service profile. The default setting is **Data**. There is no parameter to set for **Data**.



For **Voice**:

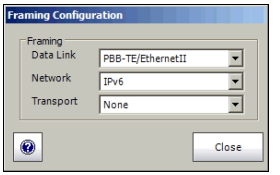
- **Voice Codec** choices are **VoIP G.711**, **VoIP G.723.1**, and **VoIP G.729**. The default setting is **VoIP G.711**.
- **Nb Calls** allows the selection of the equivalent number of calls that will be generated for the selected stream. The default setting is **1**.
- **CIR** indicates the committed information rate in Mbps according with the number of call selected.

For **Video**:

- **Video Codec** choices are **SDTV (MPEG-2)**, **HDTV (MPEG-2)**, and **HDTV (MPEG-4)**. Only **SDTV (MPEG-2)** is available with the 10 Mbps interface. The default setting is **SDTV (MPEG-2)**.
- **Nb Channels** allows the selection of the equivalent number of channels that will be generated for the selected stream. The default setting is **1**.
- **CIR** indicates the committed information rate in Mbps according with the number of channel selected.

Framing Configuration

This pop-up window is only available with **EtherSAM (Y.1564)** test case.



- **Data Link**: Select the data link type (layer 2). Choices are **Ethernet II**, and **802.3 SNAP**. **PBB-TE/Ethernet II** and **PBB-TE/802.3 SNAP** are also available when **PBB-TE** is enabled.
- **Network**: Select the network traffic type (layer 3). The default setting is either **IPv4** or **IPv6** when MPLS is not enabled and either **MPLS/IPv4** or **MPLS/IPv6** when MPLS is enabled.Choices are:

Interface IP version	Network
IPv4	**IPv4**, **MPLS/None**[a], **MPLS/IPv4**[a], and **None**.
IPv6	**IPv6, MPLS/None**[a], **MPLS/IPv6**[a], and **None**

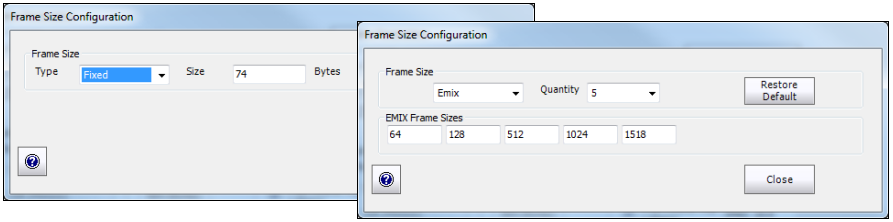
a. Only available when MPLS is enabled.

Note: *When the stream profile is set to either voice or video, Network is automatically set to **IPv4** or **IPv6**.*

- **Transport**: Select the transport traffic type (layer 4). Choices are **UDP**, **TCP**, and **None**. The default setting is **UDP**. Transport is automatically set to **None** when **Network** is set to **None**. Transport is automatically set to **UDP** when the stream profile is set to either voice or video.

Frame Size Configuration

This pop-up window is only available with **EtherSAM (Y.1564)** test case.



- **Type**: For **Data** profile, select **Fixed** (default), **Random**, or **EMIX** frame size. The **Type** is set to **Fixed** for **Video** and **Voice** profiles.
- **Size** and **EMIX Frame Sizes**:
  - For **Fixed** type with **Data** service profile, select the frame size. The size is not configurable and set to **1374** for **Video** and **138** for **Voice**.
  - For **EMIX** type, enter up to 8 frame size values depending on the quantity selected (see *Quantity* on page 500). The default frame sizes are 64, 128, 512, 1024, 1518, 1518, 1518, and 1518. However, the minimum frame size will be adjusted according to the frame structure and components selected. See tables below for components that may affect the minimum frame size value. The EMIX frame sequence will be repeated until the test ends.

For **Fixed** and **EMIX** types, the frame size range is as follow.

Test	10 Mbit/s	100/1000 Mbit/s and 10 Gbit/s
EtherSAM	64[a] to 10000	64[a] to 16000
EtherSAM DTS	68[a] to 10000	68[a] to 16000

a. The minimum frame size will be adjusted according to the frame structure and components selected.

The following table lists each component that may affect the minimum size value.

Component	Description
VLAN	4 bytes per VLAN (up to 3 VLAN)
PBB-TE	18 bytes
B-VLAN	4 bytes
MPLS	4 bytes per label (up to two labels)
UDP	8 bytes
TCP	20 bytes
Ethernet Header	14 bytes
LLC and SNAP Headers	8 bytes
IPv4	20 bytes
IPv6	40 bytes

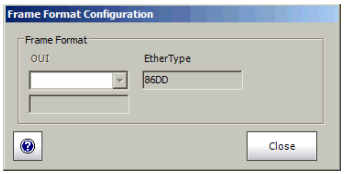
For **Random** type, the frame size range is from 64 to 1518 bytes. However, the minimum frame size will be adjusted according to the frame structure and components selected. See above table for components that may affect the minimum frame size value. The maximum frame size value is also adjusted for PBB-TE (+18 bytes), B-VLAN (+ 4 bytes), and VLAN (+4 bytes per VLAN).

Note: *Sending traffic with frame size >1518 in switched network may result in losing these frames.*

- **Quantity**: For **EMIX** type, select the quantity of frame sizes to be used for the test. Choices are **2** through **8**; default is **5**.
- **Restore Default**: For **EMIX** type, reverts the quantity and frame sizes to their default values.

Frame Format Configuration

This pop-up window is only available with **EtherSAM (Y.1564)** test case.



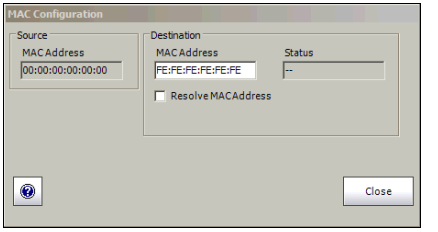
Frame Format

- **OUI** is available when the Data Link is set to 802.3 SNAP and allows the selection of the Organizationally Unique Identifier (OUI). Choices are **RFC1042**, **802.1H**, and **User Defined** (when **Network** is set to **None**).
- When **User Defined** is selected, enter the **OUI** hexadecimal value (**000000** to **FFFFFF**).
- **EtherType** is available when **Network** is set to **None** and allows to enter the EtherType hexadecimal value (**0000** to **FFFF**).

MAC Configuration

This pop-up window is only available with **EtherSAM (Y.1564)** test case.

Source



MAC Address: Indicates the MAC address of the selected service.

Note: *The source **MAC Address** is only configurable through the Network* on page 150.

Destination

MAC Address: Enter the destination MAC address for the selected service. The default setting is **FE:FE:FE:FE:FE:FE**.

Note: *The destination MAC Address field is not accessible when Resolve MAC Address is enabled.*

Resolve MAC Address: When enabled, will send a request to the network to retrieve the MAC address corresponding to the selected destination IP address. This setting is disabled by default.

Status: Indicates the Resolve MAC address status. Possible status are:

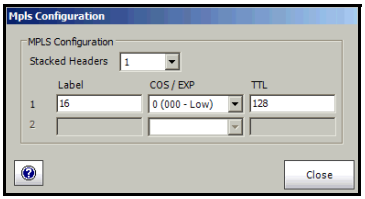
Status	Description
--	The **Resolve MAC address** is not enabled.
Resolving	The MAC address is being resolved.
Resolved	The MAC address is resolved and for IPv6, the next-hop reachability is confirmed.
Unreachable	For IPv6 only, the MAC address is resolved and the next-hop is unreachable.
Failed	The MAC address cannot be resolved.

MPLS Configuration

This pop-up window is only available with **EtherSAM (Y.1564)** test case.

Allows MPLS configuration of services with up to two layers of MPLS labels, COS/EXP and TTL parameters.

Note: ***MPLS*** *has to be enabled during the test setup (refer to* *MPLS on page 106**) and the* ***Network*** *framing configuration set to* ***MPLS/IPv4****,* ***MPLS/IPv6****, or* ***MPLS/None*** *to gives access to the MPLS configuration for the selected service.*



- **Stacked Headers**: Allows the activation of up to two MPLS headers. The default setting is **1**.
- **Label**: Allows the selection of the MPLS TX labels (**0** to **1048575**). The default label value is **16**.

- **COS/EXP** (Class Of Service / Experimental): Select the class of service. The default value is **0 (0000 - Low)**.

  0 (000 - Low)
  1 (001 - Low)
  2 (010 - Low)
  3 (011 - Low)
  4 (100 - High)
  5 (101 - High)
  6 (110 - High)
  7 (111 - High)

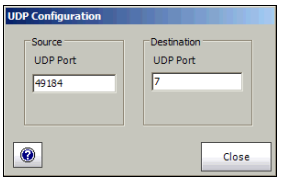
- **TTL** (Time To Live): Select the TTL value. Choices are **0** to **255**. The default setting is **128**.

-

UDP Configuration

This pop-up window is only available with **EtherSAM (Y.1564)** test case.

Allows the selection of the source and destination UDP port number.

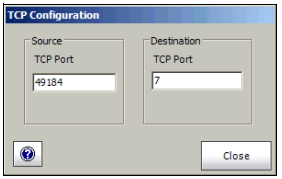


Choices are **0** to **65535**. The default setting is **49184** for the source port and **7 (echo)** for the destination port.

TCP Configuration

This pop-up window is only available with **EtherSAM (Y.1564)** test case.

Allows the selection of the source and destination UDP port number.

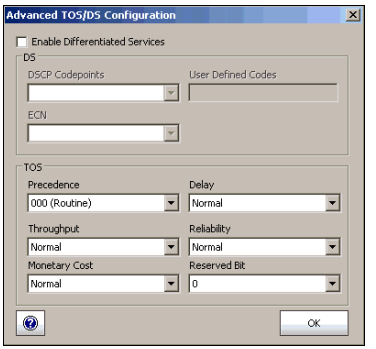


Choices are **0** to **65535**. The default setting is **49184** for the source port and **7 (echo)** for the destination port.

Advanced TOS/DS

Enable Differentiated Services

Allows enabling the Differentiated Services (DS). This setting is disabled by default.



DS

Note: *DS is available when* ***Enable Differentiated Services*** *is enabled.*

- **DSCP Codepoints**: Select the DSCP Codepoints. Choices are: **000000 (CS0)**, **001000 (CS1)**, **010000 (CS2)**, **011000 (CS3)**, **100000 (CS4)**, **101000 (CS5)**, **110000 (CS6)**, **111000 (CS7)**, **001010 (AF11)**, **001100 (AF12)**, **001110 (AF13)**, **010010 (AF21)**, **010100 (AF22)**, **010110 (AF23)**, **011010 (AF31)**, **011100 (AF32)**, **011110 (AF33)**, **100010 (AF41)**, **100100 (AF42)**, **100110 (AF43)**, **101110 (EF)**, and **User Defined**. The default setting is **000000 (CS0)**.
- **User Defined Codes**: Enter a user defined code. Choices are from hexadecimal **00** to **3F**. The default setting is **00**. **User Defined Codes** is available when **User Defined** has been selected from the **DSCP codepoints**.
- **ECN**: Select the ECN field. Choices are **00 (Not-ECT)**, **01 (ECT-1)**, **10 (ECT 0)**, and **11 (CE)**. The default setting is **00 (Not-ECT)**.

TOS

Note: *TOS is available when **Enable Differentiated Services** is not enabled.*

- **Precedence**: Select the **Precedence** value. Choices are:

  000 (Routine)
  001 (Priority)
  010 (Immediate)
  011 (Flash)
  100 (Flash Override)
  101 (CRITIC/ECP)
  110 (Internet Control)
  111 (Network Control)

  The default setting is **000 (Routine)**.

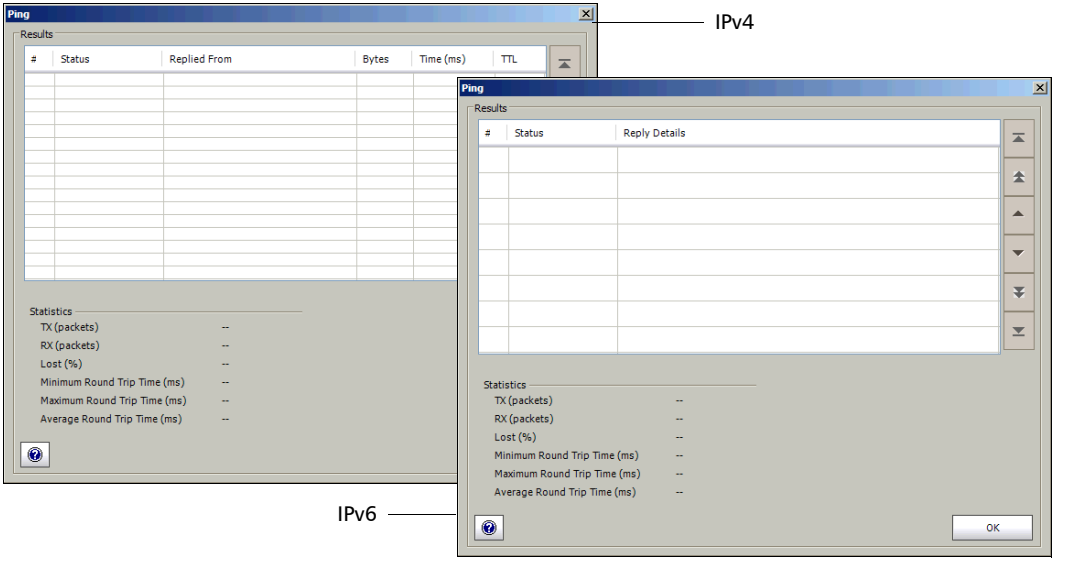
- **Throughput**: Allows the selection of the throughput level. Choices are **Normal** and **High**. The default setting is **Normal**.
- **Monetary Cost**: Allows the selection of the monetary cost level. Choices are **Normal** and **Low**. Default value is **Normal**.
- **Delay**: Allows the selection of the delay level. Choices are **Normal** and **Low**. The default setting is **Normal**.
- **Reliability**: Allows the selection of the reliability level. Choices are **Normal** and **High**. The default setting is **Normal**.
- **Reserved Bit**: Allows the selection of the reserved bit value. Choices are **0** and **1**. The default setting is **0**.

Ping

The Ping is used to determine if a network device is reachable.

Note: *The Ping button is not available when an **RFC 2544** test is running, or when a **Ping** or **Trace Route** command is running (refer to Ping Configuration* on page 412*).*

Click **TEST**, **Stream Gen**, **IP**, and **Ping**.



- **Results**: Refer to *Ping Results* on page 414 for more information.
- **Statistics**: Refer to *Statistics* on page 420 for more information.
- **OK**: Click **OK** to exit the **Ping/Trace Route** window.

Configuration

- **Timeout (ms)**: Enter the maximum time allowed between an ICMP echo and response. Choices are **200 ms** to **10000 ms**. The default setting is **4000 ms**.

- **Delay (ms)**: Available for ping only. Enter the delay between each attempt (PING). Choices are **100** to **10000 ms**. The default setting is **1000 ms**.
- **Data Size (Bytes)**: Available for ping only. Enter the buffer size that will be sent to the network device to be detected. Choices are **0** to **1472 bytes**. Default value is **32 bytes**.
- **Time To Live (TTL) for IPv4**
  Hop Limit (TTL) for IPv6
  Enter the maximum number of hops the packet can go through. Choices are **1** to **255**. The default setting is **128**.
- **Flow Label** (IPv6 only): Enter the **Flow Label** number that will be used to identify a series of related packets from a source to a destination. Choices are **0** to **1048575**. The default setting is **0**.
- **Attempts** and **Continuous**: Enter the number of attempt that will be performed to reach the network device or click **Continuous** to attempt indefinitely. Choices are **1** to **100**. The default setting is **4** and **Continuous** is disabled.
- **Type Of Service (TOS) for IPv4**
  Traffic Class (TOS) for IPv6
  Enter the type of service. Choices are **00** to **FF**. The default setting is **00**.
- **Binary**: Enable binary to set the TOS field in binary mode. Otherwise, the TOS field is in hexadecimal mode. This setting is disabled by default.

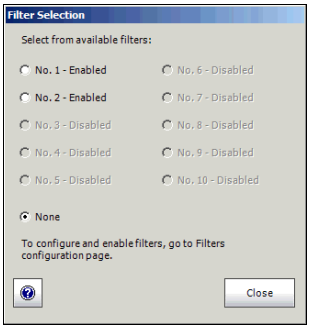
Configuration

- **Timeout (ms)**: Enter the maximum time allowed between an ICMP echo and response at each hop. Choices are **200 ms** to **10000 ms**. The default setting is **4000 ms**.
- **Max Hop Count**: Enter the maximum network device the packet is allowed to go through. Choices are **1** to **255**. The default setting is **128**.

Filter Selection

This pop-up window is only available from **Traffic Analyzer - Capture** tab.

Allows to select the filter number that will be used to select what frames are saved in the buffer.



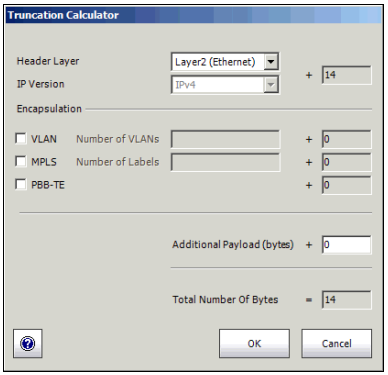
Only enabled filters are selectable. To configure and enable filters, see *Traffic Filters* on page 215 or *Traffic Filter Configuration* on page 220.

None indicates that there is no filter selected meaning that all received frames will be captured.

Truncation Calculator

This pop-up window is only available from **Traffic Analyzer - Capture** tab.

Allows to easily determine at what byte to truncate the frame that will be captured by selecting the desired frame header components.

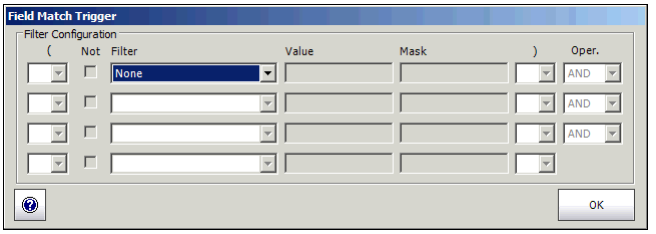


- **Header Layer**: Select the header layer level. Choices are **Layer 2 (Ethernet)**, **Layer 3 (IP)**, and **Layer 4 (TCP/UDP)**.
- **IP Version**: Select the IP version. Choices are **IPv4** and **IPv6**.
- **Encapsulation**:
  - **VLAN**: Optionally, select the **VLAN** check box and select the number of VLAN (1 to 3 VLAN).
  - **MPLS**: Optionally, select the **MPLS** check box and select the number of labels (1 or 2 labels).
  - **PBB-TE**: Optionally, select **PBB-TE** check box.
- **Additional Payload (bytes)**: Optionally, select the number of additional payload bytes (1 to 900 bytes).
- **Total Number of Bytes**: Indicates the number of bytes for the selected frame parameters. This value will be used as the truncated frame length; refer to *Frame Length* on page 225.

Field Match Configuration

This pop-up window is only available from **Traffic Analyzer - Capture** tab.

Allows to define the trigger criteria that will be used to automatically start the capture when a received frame matches the trigger's criteria.



Filter Configuration

"**(**" and "**)**": The open and close parenthesis may be useful to control the precedence of operands when more than two operands are used. Only one level of parenthesis is supported. When no parenthesis are used, a logical **AND** will have precedence over a logical **OR**.

Not: When selected, add the logical negation (not equal) operator for the operand filter defined at its right.

Filter: Allows the selection of the filter to be used. The default setting is **None**. See *Filter* on page 216 for the filter list.

Value: Allows entering the value associated to the selected filter. See *Overview* on page 162 for more information on possible values.

Mask: Allows masking the defined filter value. A bit mask of **1** indicates that the corresponding bit in the value is compared for the match. A bit mask of **0** indicates that the corresponding bit in the value is ignored.

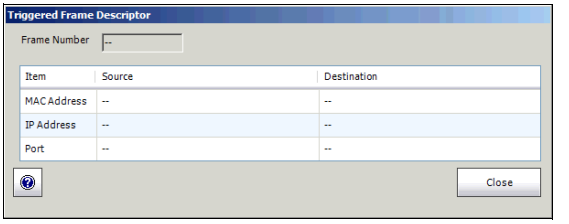
- For binary values, enter the mask value in binary format.
- For decimal values, enter the mask value in hexadecimal format.
- For IP address field, enter the mask in decimal format.
- For MAC address, enter the mask value in hexadecimal format.

Oper.: Allows the selection the logical operator (**AND** or **OR**) between two operands.

Triggered Frame Details

This pop-up window is only available from **Traffic Analyzer - Capture** tab.

This pop-up indicates the details on the captured trigger frame. The triggered frame corresponds to the first received frame that matches the filter and the trigger settings (see *Trigger* on page 226).

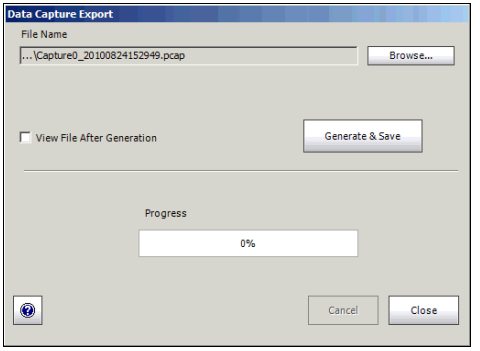


- **Frame Number** indicates the triggered frame position in the buffer.
- The framing MAC/IP/UDP/TCP source and destination addresses are displayed in a table.

Data Capture Export

This pop-up window is only available from **Traffic Analyzer - Capture** tab.

Allows to export the data capture into a .pcap file format and to view the file using **Wireshark**.



- **Save In**: Allows to select the folder to save the capture file.

  The capture file is saved in the following folder by default: C:\ProgramFiles\EXFO\Applications\RTU\<Product Name>\UserFiles\Capture Data..

- **View File After Generation**: Allows to display the report once it is generated using the Wireshark application. The **View File After Generation** check box is not selected by default.

- **Generate & Save**

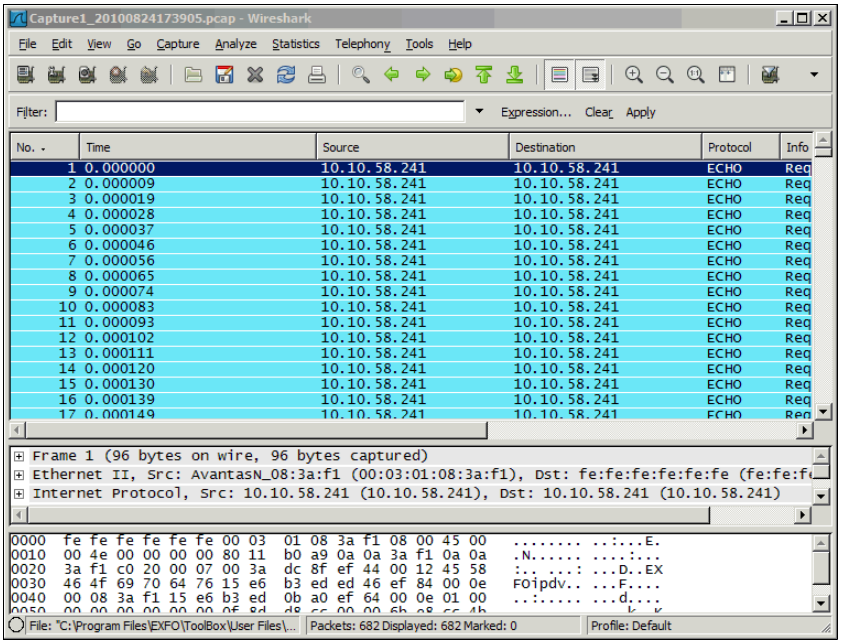
  Allows to generate and save the capture data. The name of the captured file is automatically selected and contains the date and time of the capture. Capture file bigger than 100Mbytes will be split into multiple files.

  Clicking on the **Cancel** button stops the capture generation. The captured data already processed will be saved.

Note: *The export process may take several minutes.*

Once generated, the capture file will be automatically opened in Wireshark when the **View File After Generation** check box is selected.

The capture file report may also be manually opened within Wireshark typically using Windows Explorer.



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NOTICE
通告

CHINESE REGULATION ON RESTRICTION OF HAZARDOUS SUBSTANCES
中国关于危害物质限制的规定

NAMES AND CONTENTS OF THE TOXIC OR HAZARDOUS SUBSTANCES OR ELEMENTS CONTAINED IN THIS EXFO PRODUCT
包含在本 **EXFO** 产品中的有毒有害物质或元素的名称和含量

O	Indicates that this toxic or hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement in SJ/T11363-2006 表示该有毒有害物质在该部件所有均质材料中的含量均在 SJ/T11363-2006 标准规定的限量要求以下。
X	Indicates that this toxic or hazardous substance contained in at least one of the homogeneous materials used for this part is above the limit requirement in SJ/T11363-2006 表示该有毒有害物质至少在该部件的某一均质材料中的含量超出 SJ/T11363-2006 标准规定的限量要求。

Part Name 部件名称	Toxic or hazardous Substances and Elements 有毒有害物质和元素					
	Lead 铅 (Pb)	Mercury 汞 (Hg)	Cadmium 隔 (Cd)	Hexavalent Chromium 六价铬 (Cr VI)	Polybrominated biphenyls 多溴联苯 (PBB)	Polybrominated diphenyl ethers 多溴二苯醚 (PBDE)
Enclosure 外壳	O	O	O	O	O	O
Electronic and electrical sub-assembly 电子和电子组件	X	O	X	O	X	X
Optical sub-assembly[a] 光学组件 [a]	X	O	O	O	O	O
Mechanical sub-assembly[a] 机械组件 [a]	O	O	O	O	O	O

a. If applicable.
如果适用。

MARKING REQUIREMENTS
标注要求

Product 产品	Environmental protection use period (years) 环境保护使用期限 (年)	Logo 标志
This Exfo product 本 EXFO 产品	10	
Battery[a] 电池 [a]	5	

a. If applicable.
如果适用。

P/N:1062500

www.EXFO.com · info@exfo.com

CORPORATE HEADQUARTERS	400 Godin Avenue	Quebec (Quebec) G1M 2K2 CANADA Tel.: 1 418 683-0211 · Fax: 1 418 683-2170
EXFO AMERICA	3701 Plano Parkway, Suite 160	Plano TX, 75075 USA Tel.: 1 972 907-1505 · Fax: 1 972 836-0164
EXFO EUROPE	Omega Enterprise Park, Electron Way	Chandlers Ford, Hampshire S053 4SE ENGLAND Tel.: +44 2380 246810 · Fax: +44 2380 246801
EXFO ASIA-PACIFIC	151 Chin Swee Road #03-29, Manhattan House	SINGAPORE 169876 Tel.: +65 6333 8241 · Fax: +65 6333 8242
EXFO CHINA	No. 88 Fuhua First Road, Central Tower, Room 801, Futian District Beijing New Century Hotel Office Tower, Room 1754-1755, No. 6 Southern Capital Gym Road	Shenzhen 518048 P. R. CHINA Tel.: +86 (755) 8203 2300 · Fax: +86 (755) 8203 2306 Beijing 100044 P. R. CHINA Tel.: +86 (10) 6849 2738 · Fax: +86 (10) 6849 2662
EXFO SERVICE ASSURANCE	285 Mill Road	Chelmsford MA, 01824 USA Tel.: 1 978 367-5600 · Fax: 1 978 367-5700
TOLL-FREE	(USA and Canada)	1 800 663-3936

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