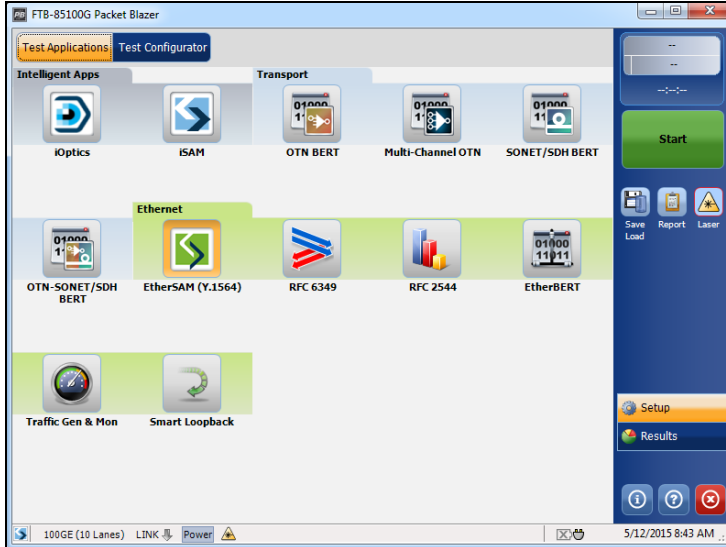


## 40G/100G MULTISERVICE TEST MODULE

# Packet Blazer

## FTB/IQS-85100G



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### ***Units of Measurement***

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

### ***Patents***

EXFO CFP-to-CFP2 adapter is protected by patent appl. US 2015/0092363 A1 and equivalents in other countries.

Dual Test Set/Bi-Directional testing is protected by US patent 9,432,206 and equivalents in other countries.

November 8, 2016

Document version: 14.0.0.2

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## **Certification Information**

### **North America Regulatory Statement**

This unit was certified by an agency approved in both Canada and the United States of America. It has been evaluated according to applicable North American approved standards for product safety for use in Canada and the United States.

Electronic test and measurement equipment is exempt from FCC part 15, subpart B compliance in the United States of America and from ICES-003 compliance in Canada. However, EXFO Inc. 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.

Modifications not expressly approved by the manufacturer could void the user's authority to operate the equipment.



## **European Community Declaration of Conformity**

Warning: This is a class A product. In a domestic environment, this product may cause radio interference in which case the user may be required to take adequate measures.

An electronic version of the declaration of conformity for your product is available on our website at [www.exfo.com/library](http://www.exfo.com/library).

## **Laser**



Your instrument is a Class 1 laser product in compliance with standards IEC 60825-1: 2007 and 21 CFR 1040.10, except for deviations pursuant to Laser Notice No. 50, dated June 24, 2007.



# 1 Introducing the 40G/100G Multiservice Test Module

Fully integrated layer 1/2/3/4 performance assessment of 40 Gbit/s and 100 Gbit/s Ethernet, SONET/SDH, and Optical Transport Network (OTN) equipment and network services.

## Features

Features	Test Applications
Intelligent Apps.	iOptics
	iSAM
Transport	OTN BERT
	Multi-Channel OTN
	SONET/SDH BERT
	OTN-SONET/SDH BERT
Ethernet	EtherSAM (Y.1564)
	RFC 6349
	RFC 2544
	EtherBERT
	Traffic Gen & Mon
	Smart Loopback

## Technical Specifications

To obtain this product's technical specifications, visit the EXFO Web site at [www.exfo.com](http://www.exfo.com).

### Conventions

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



#### **WARNING**

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



#### **CAUTION**

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



#### **CAUTION**

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



#### **IMPORTANT**

Refers to information about this product you should not overlook.

## 2 **Safety Information**



### **WARNING**

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




### **WARNING**

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



### **IMPORTANT**

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



### **IMPORTANT**

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

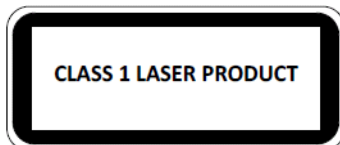
## Safety Information

### *Additional Laser Safety Information*

---

## Additional Laser Safety Information

This product employs Class 1 Laser transceivers.



### **WARNING**

When the LASER LED is on or flashing, the FTB/IQS-85100G is transmitting an optical signal on the CFP, or CFP2 transceiver ports.

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

## Installation Instruction Warnings



### **CAUTION**

For IQS platforms, keep all ventilation openings clear and unobstructed.



### **CAUTION**

When you use the unit outdoors, ensure that it is protected from liquids, dust, direct sunlight, precipitation, and full wind pressure.



### **CAUTION**

Unless otherwise specified, all electrical interfaces are SELV (Safety Extra Low Voltage) circuitry for intra-building use only.



### **CAUTION**

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



### **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.



### **WARNING**

Use only accessories designed for your unit and approved by EXFO.

## Safety Information

### Installation Instruction Warnings

---



## CAUTION

### Electrostatic Discharge (ESD) Sensitive Equipment:

Plug-in modules can be damaged by static electrical discharge. To minimize the risk of damage, dissipate static electricity by touching a grounded unpainted metal object

- before removing, inserting, or handling the module.
- before connecting or disconnecting cables to/from the Packet Blazer.
- before inserting or removing **CFP**, or **CFP2** transceiver to/from the Packet Blazer.



# 3 Getting Started

If the FTB/IQS-85100G has been purchased at the same time as the platform, the FTB/IQS-85100G module is pre-installed with the appropriate software version.

## Inserting and Removing Test Modules




### CAUTION

Never insert or remove a module while the platform and its expansion units (IQS-600) are turned on. This will result in immediate and irreparable damage to both the module and platform.



### WARNING

When the laser safety light () is flashing on the platform, at least one of your modules is emitting an optical signal. Please check all modules, as it might not be the one you are currently using.

**Note:** Refer to the platform user guide for more information on how to insert a module into the platform or to remove a module from the platform.

## Turning On the Unit

Turn on the platform. Refer to the platform user guide for more information.

## Starting the FTB/IQS-85100G Application

The module can be configured and controlled by starting the FTB/IQS-85100G application.

From **ToolBox** (FTB-500) or **IQS Manager** (IQS-600), tap the FTB/IQS-85100G button to start the application.



# 4 Physical Interfaces and LEDs

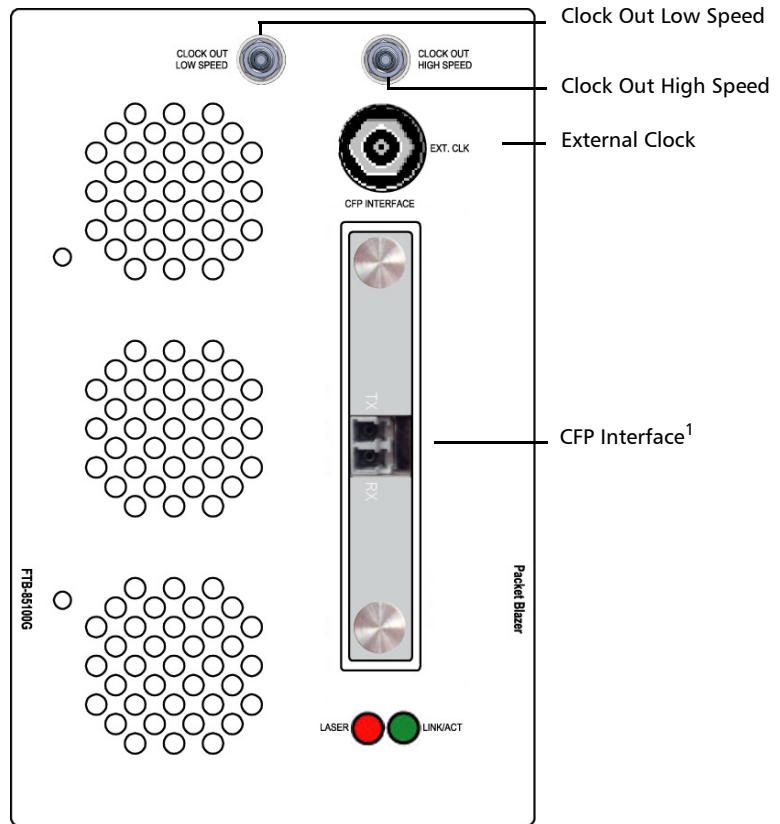
This section describes all connectors (ports) and LEDs available on the FTB/IQS-85100G.



## CAUTION

To prevent exceeding the maximum input/output power level, please refer to this product's technical specifications at [www.exfo.com](http://www.exfo.com).

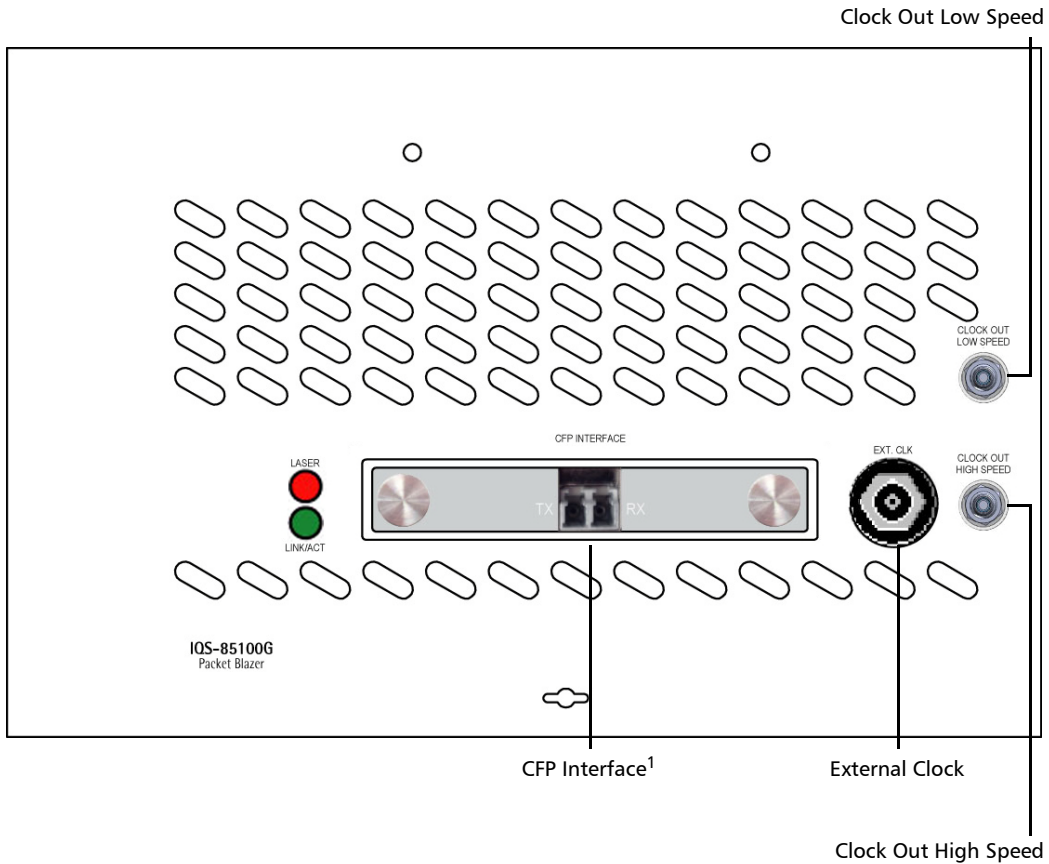
FTB-85100G



1. Laser radiation emitted from this port when LASER LED is on.

# Physical Interfaces and LEDs

IQS-85100G



1. Laser radiation emitted from this port when LASER LED is on.

## Supported Rates

The following table shows the list of available ports as well as a description and signals supported.

Port Labelled	Description	Supported Signal(s)
CFP	Optical IN/OUT port CFP transceiver.	Ethernet 40/100 Gbit/s OC-768/STM-256, OTU4, OTU3e2, OTU3e1, OTU3
CLOCK OUT LOW SPEED CLOCK OUT HIGH SPEED	Electrical port SMA for eye diagram clock signal generation.	Refer to <i>CFP/CFP2 Reference Clock (MHz)</i> on page 313 for more information.
EXT CLK	Electrical port SMB for external clock synchronization.	DS1/1.5M, E1/2M, 2MHz

## CFP Interface

The FTB/IQS-85100G provides a CFP interface slot that can be used with a CFP transceiver an EXFO's CFP to CFP2 adapter module or an EXFO's CFP to CXP adapter module.



### CAUTION

Before inserting an optical module into the CFP interface slot, inspect the slot to make sure nothing is inside.

**Note:** Do not replace the transceiver while the test is running to avoid distorting results. First stop the test, replace the transceiver, select the connector type (refer to Modify Structure Button on page 63), and then restart the test.

**Note:** To ensure proper optical module detection/validation, make sure that the CFP screws are fully secured.

## CFP Transceiver



### **WARNING**

Use only EXFO supported CFP transceivers. Refer to this product's technical specifications at [www.exfo.com](http://www.exfo.com) for the list of supported transceivers. Using non-supported transceivers can affect the performance and accuracy of the test.

## EXFO CFP-to-CFP2 Adapter

The EXFO CFP-to-CFP2 adapter (FTB-85970) offers 100G testing capabilities using CFP2 transceivers.



### **WARNING**

Use only EXFO supported CFP2 transceivers. Refer to this product's technical specifications at [www.exfo.com](http://www.exfo.com) for the list of supported transceivers. Using non-supported transceivers can affect the performance and accuracy of the test.

## Physical Interfaces and LEDs

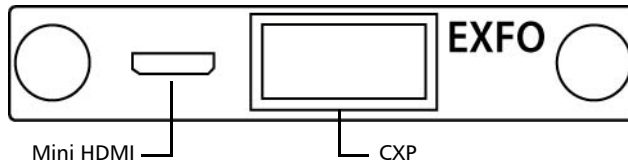
### Fibre Cables Connection

---

#### EXFO CFP-to-CXP Adapter

Carefully connect the supplied optical cable (32 feet) to the CXP port of the local module and the other end to the far end module. To ensure good signal quality, make sure that the optical cable connector is fully inserted into the CXP connector port.

EXFO's CFP-to-CXP Adapter



When using EXFO CFP-to-CXP Adapter on both ends, the EXFO proprietary mini HDMI port need be used to automatically configure the CXP of the far end module with the same parameters defined on the local module. Connect one end of the supplied mini HDMI cable (16 feet) to the local module and the other end to the far end module. The configuration of the far end module will be done once the test is started on the local module (refer to *Start/Stop | TX Button* on page 388).

## Fibre Cables Connection

Carefully connect optical fibre cables to the CFP/CFP2'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.



### CAUTION

To prevent exceeding the maximum input power level please use an attenuator when a loopback configuration is used.



## EXT CLK

The FTB/IQS-85100G provides one connector, labeled **EXT CLK** that can be used either for input/output external clock DS1 (1.5M), E1 (2M), or 2MHz synchronization signal. The connector type is BNC for coaxial 75-ohm cable connection. An adapter cable (BNC to Bantam) is required for Bantam connection (not supplied).

## Clock Out

**Low Speed:** The FTB/IQS-85100G provides a connector, labelled **CLOCK OUT LOW SPEED**, for eye diagram clock signal generation that can be used by another equipment. The clock connector type is SMA. Refer to *CFP/CFP2 Reference Clock (MHz)* on page 313 for more information.

**High Speed:** The FTB/IQS-85100G provides a connector, labelled **CLOCK OUT HIGH SPEED**, for eye diagram clock signal generation that can be used by another equipment. This clock is optional according to the CFP MSA (Multisource Agreement) and is only available when the CFP used provides this high speed clock signal. Refer to the CFP manufacturer and the relevant CFP part number for more information on the high speed clock. The clock connector type is SMA.

## LEDs

- **LASER** red LED is on when the FTB/IQS-85100G is emitting an optical laser signal.
- **LINK/ACT** green LED is on when the link is up, off when the link is down, and flashing when frames are transmitted and/or received.

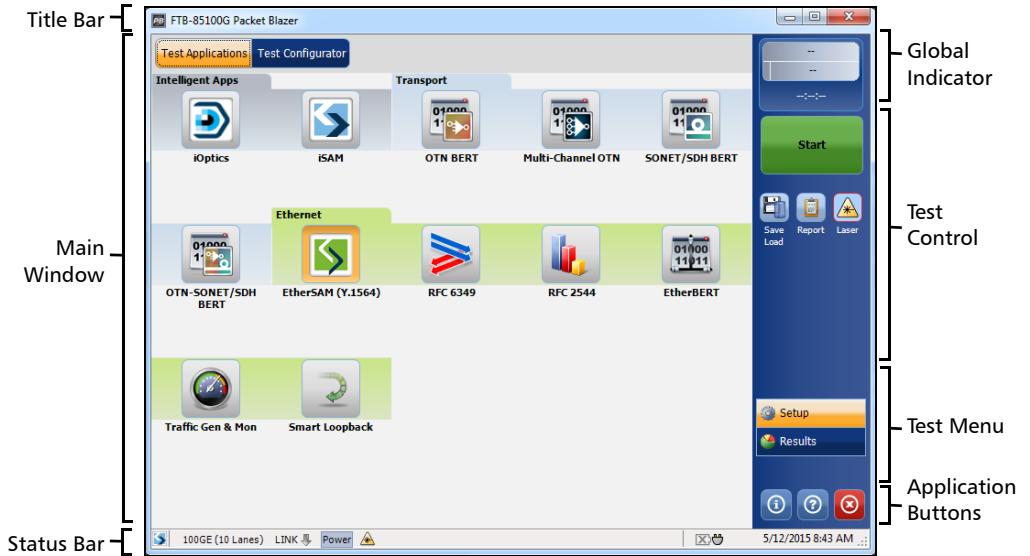


# 5 Graphical User Interface Overview

This chapter describes the FTB/IQS-85100G graphical user interface.

## Main Application Window

The following main application window is displayed when the Packet Blazer application is started.











## Main Window

The main window allows to setup a test and to view the test status and results.

### Status Bar

The status bar displays the following information.

Icon and/or text	Description	Test Application
Test icon	Icon representing the active test application.	All
Interface/Signal	The interface or signal rate: 40G, OTU3, etc.	All
LINK	Green arrow: Link up. Red arrow: Link down. Gray arrow: Awaiting incoming data to provide a status.	All
Power level	The received optical signal status: Green with "Power": Power level in range <sup>a</sup> . Yellow: Power level out-of-range <sup>b</sup> . Red with "LOS": Loss of signal <sup>b</sup> . Red with "Power": Power level is close to damage. Gray: The operational range value is either not available or not supplied by the transceiver.	All
	Laser ON <sup>b</sup> . The laser icon is not displayed when the laser is off <sup>a</sup> . The laser control is not affected when turning off the laser by generating a LOS for example. Refer to <i>Laser Button</i> on page 377.	All
	The status of the received signal pattern: Green: Pattern is synchronized. Red: Loss of pattern. Gray: Test is not running (EtherBERT test or EoOTN client) or the <b>No Pattern Analysis (Live)</b> check box is selected.	Transport EtherBERT
	Connection established between two testing units in <b>Dual Test Set</b> (DTS) or in <b>Loop Up</b> mode.	Ethernet
	Connection not established between two testing units in <b>Dual Test Set</b> (DTS) or in <b>Loop Up</b> mode.	Ethernet
	Clock synchronization signal clock. The clock icon is followed by the clock mode: <b>INT</b> for Internal, <b>EXT</b> for External, or <b>BKP</b> for Backplane. Green: Clock Synchronized. Red: Loss of clock.	All
	Indicates a manual change in the OH bytes transmitted. Not displayed when using the default OH values.	Transport

Icon and/or text	Description	Test Application
	Remote PC connection established with the Packet Blazer.	N/A
	Alarm/error is currently injected. Not displayed when there is no alarm/error injection.	Transport EtherBERT

- a. For all lanes for parallel interface.
- b. For at least one lane for parallel interface.

The following status are also displayed:

- Battery/AC icons, available on FTB platforms, indicate the battery level and if the platform is connected to an AC power source. Refer to the platform user guide for more information.
- Date and Time indicate the current date and time.

## Title Bar

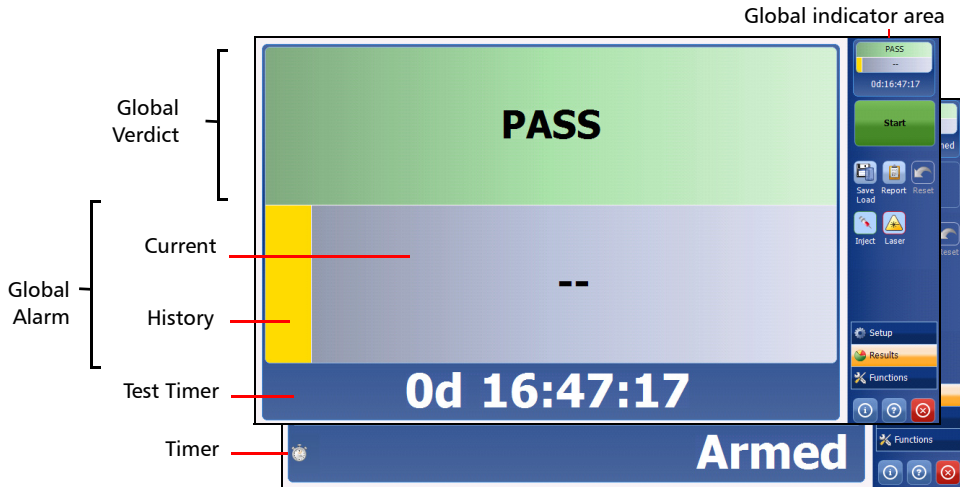
The Title Bar displays the module's slot number in brackets, the software application name and the minimize, maximize, and close buttons.

# Graphical User Interface Overview

## Global Indicator

### Global Indicator

The global indicator area displays the global pass/fail verdict, global alarm, and the test duration.



The global indicator area can be maximized for distant viewing. Tap anywhere within the global indicator area to display a maximized view. Tap again to exit the maximized view.

## Global Verdict

Reports the global test verdict status when supported by the test application and enabled (when applicable).

Verdict	Description
PASS	<b>PASS</b> is displayed with a green background when all result values meet the configured threshold criteria.
FAIL	<b>FAIL</b> is displayed with a red background when any result value does not meet the configured threshold criteria or when a specific alarm is detected (refer to each test application for additional information).
"--"	"--" is displayed with a gray background when at least one of the following conditions is met: <ul style="list-style-type: none"> <li>- Pass/Fail verdict is not enabled</li> <li>- there is no defined criterion</li> <li>- the test has not run yet.</li> </ul>

## Global Alarm

Indicates the current and history alarm/error status of the test.

Background color	Alarm/Error	Text displayed	Description
Gray	Current	--	No test result available.
	History		
Green	Current	<b>No Alarm</b>	No alarm/error has occurred in the last second.
	History		No alarm/error has occurred during the test.
Red	Current	<b>Alarms</b> or the name of the alarm.	An alarm/error occurred in the last second.
	History		
Amber	History		No current alarm/error but at least one alarm/error has occurred during the test.

### Test Timer

The test timer without the timer icon indicates the time elapsed since the beginning of the test. No timer action is active. The test timer format is “day hour:minute:second”.

### Timer

The timer icon with **Armed** indicates that a start time is active.

The timer icon with the Test Timer indicates that a duration and/or a stop time is active.

## Test Control

**Note:** Refer to Test Control on page 373 for more information.

## Test Menu

The test menu displays the following buttons:

- **Setup** allows to configure the selected test. Refer to *Test Setup - Test Configurator, Timer, and System* on page 55 for more information.
- **Results** allows to view test results. Refer to *Test Results* on page 211 for more information.
- **Functions** allows to configure additional test functions (refer to *Test Functions* on page 311).



## Application Buttons

- **Help (?)** displays the help information related to the content of the active main window. It is also possible to navigate through the remainder of the help information.
- **Exit (x)** closes the application.
- **About (i)** mainly displays the product version details and technical support information.

**Module Details** button displays the Packet Blazer details such as its ID, Serial Number, Software Product Version, etc.

**View Licence Agreement** button displays the details of the product licence agreement.

**Software Options** button displays the list of software options.

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

Software Option	Description
100GE	Ethernet 100G
40GE	Ethernet 40G
OTU4	Optical Transport Unit-4 (111.81 Gbit/s)
OTU3-e1-e2	Optical Transport Unit-3 Overclocked (44.571/44.583 Gbit/s)
OTU3	Optical Transport Unit-3 (43.018 Gbit/s)
40G	39.81312 Gbit/s (SONET/SDH)
ETH-CAPTURE	Ethernet Frame Capture
TRAFFIC-SCAN	Traffic Scan
RFC6349_40-100GE	RFC 6349 test application (40/100GE)
ADV-FILTERS	Advanced filtering
MPLS_40-100GE	MPLS Encapsulation (40/100GE)
IPv6_40-100GE	Internet Protocol Version 6 (IPv6) (40/100GE)
ODU0	OTN ODU0
ODUMUX	ODU Multiplexing Payload Type 20 and 21

## Graphical User Interface Overview

### *Application Buttons*

---

<b>Software Option</b>	<b>Description</b>
EoOTN	Ethernet over Optical Transport Network
ODUflex	OTN ODUflex
SONET	Synchronous Optical Network
SDH	Synchronous Digital Hierarchy
MULTI-CH-OTN	Multi-Channel OTN Test Application
TCM	Tandem Connection Monitoring STS/AU (embedded SONET/SDH up to 10G)
iOptics	Intelligent Pluggable Optic Test Application
iSAM	Intelligent Service Activation Methodology

### Zoomed-In/Zoomed-Out Views







Some configuration and result blocks give access to zoomed views allowing more detailed configurations/results.

The block title contains the magnifier (+) icon when a zoomed view is available.

To zoom-in, tap the magnifier (+) icon or anywhere on the block.

To zoom-out, tap on the magnifier (-) icon or anywhere on the block title.

### Arrow Buttons

	Moves to the top of the list.
	Moves one page up.
	Moves one line up.
	Moves one line down.
	Moves one page down.
	Moves to the end of the list.

## Keyboard Usage

The GUI 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.
- Up arrow increases the value by one.
- Down arrow decreases the value by one.
- **Del** deletes the value at the cursor position.
- **Back** deletes the value preceding the cursor position.
- **OK** completes data entry.
- **Cancel** closes the keyboard and discards the keyboard entry.
- **Previous...** allows the selection of previously configured values. This button is only available for certain fields like IP Address, MAC Address, etc.

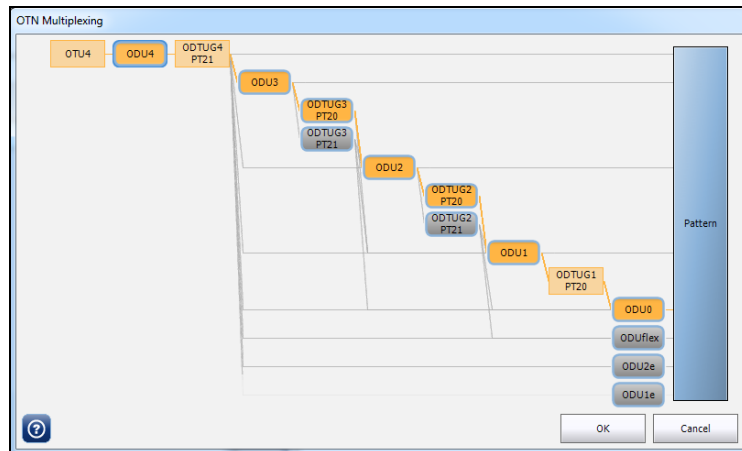
**Note:** *For certain text fields, the GUI pops up or uses the unit's on-screen keyboard. Refer to the platform user guide for more information on how to use it.*

For full keyboard, the **Back**, **Del**, **Shift**, and **Space** bar keys have the same functionality as a regular PC keyboard.

For multiplexing keyboard, tap on all mapped signals that have to be added/removed to/from the test path.

A mapped signal with an orange background color is part of the test path.

A mapped signal with a gray background color is not part of the test path.



## Graphical User Interface Overview

### Keyboard Usage

---

The Trace message keyboard allows entering alphanumerical characters (ITU T.50) required for TTI Trace fields. Tap the **Control Characters** 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

# 6 **Test Setup - Test Applications**

The Packet Blazer offers the following test applications.

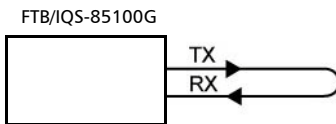
<b>Type</b>	<b>Application</b>	<b>Page</b>
Intelligent Apps	<i>iOptics</i>	30
	<i>iSAM</i>	31
Transport	<i>OTN BERT</i>	33
	<i>Multi-Channel OTN</i>	32
	<i>SONET/SDH BERT</i>	38
	<i>OTN-SONET/SDH BERT</i>	35
Ethernet	<i>EtherSAM (Y.1564)</i>	40
	<i>RFC 6349</i>	42
	<i>RFC 2544</i>	41
	<i>EtherBERT</i>	43
	<i>Traffic Gen &amp; Mon</i>	44
	<i>Smart Loopback</i>	45

### iOptics

iOptics test application provides a quick assessment of the proper operation of an optical transceiver before using it in a network or test environment. The validation is done by running sub-tests in addition to monitoring transceiver power consumption and temperature. Result and verdict are reported for each sub-test and monitoring task. Transceiver's manufacturing information is also automatically collected.

A fiber loopback patch cord is required to perform the test with applicable attenuation included to protect the optical device. Bidirectional (single fiber) transceivers are not supported since the iOptics test requires a loopback.

- Typical iOptics test application:



- Supported Interfaces/Rates: 40G/100G/OTU3/OTU3e1/OTU3e2/OTU4 parallel interfaces (refer to **Rate** on page 150 for more information).



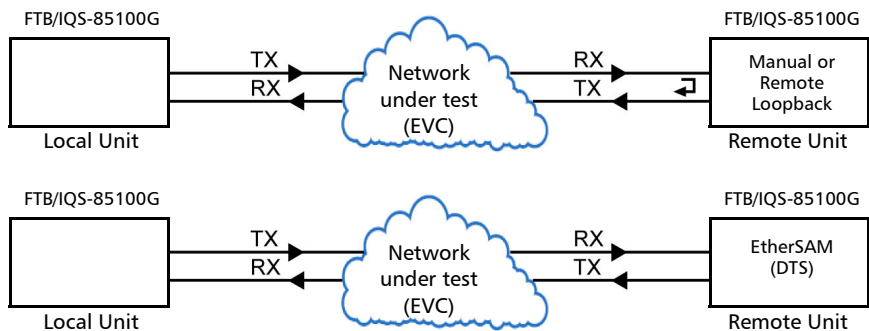
## iSAM

iSAM is a simplified version of EtherSAM that is centered around addressing turn-up of E-Line circuits (EVC). The objective of the test is to validate Carrier Ethernet-based services key performance indicators defined in MEF: Frame Delay (FD), Inter-Frame Delay Variation (IFDV), and Frame Loss Ratio (FLR). In addition the RFC 6349 subtest can be enabled to validate that the Ethernet service is able to properly carry TCP traffic.

The **iSAM** test has to be executed in conjunction with a remote module or in **Internal Loopback** mode. The remote module can be either in loopback configuration for unidirectional testing or in EtherSAM **Dual Test Set** mode for bidirectional testing.

The **Dual Test Set** test allows bi-directional test between two compatible modules providing independent results for each test direction. The results from local-to-remote and remote-to-local are available on the local testing unit.

➤ Typical iSAM test applications:

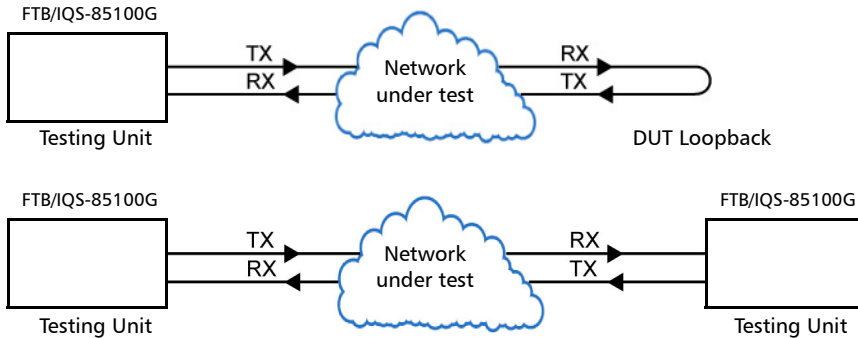


➤ Supported Interfaces/Rates: 40G and 100G.

## Multi-Channel OTN

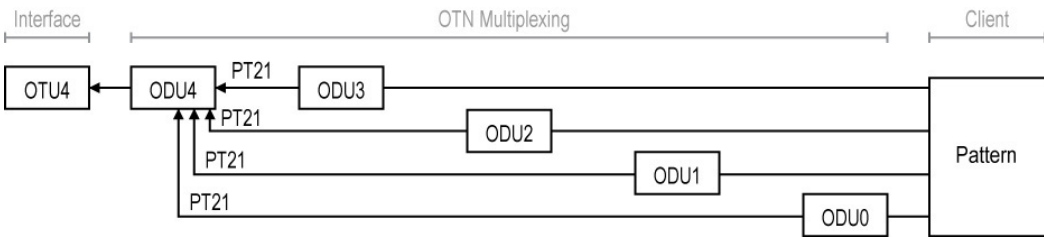
The Multi-Channel OTN test application validates individual channel connectivity with a device under test by allowing concurrent generation and monitoring of all channels of a single stage ODUmux test structure.

- Typical Multi-Channel OTN test applications:



- Path/Mapping

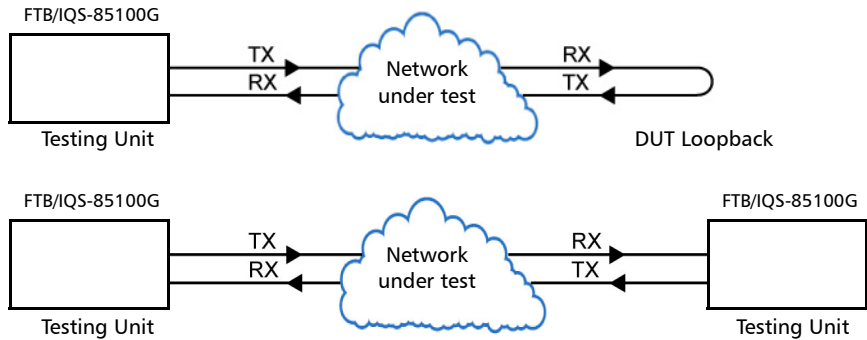
The **Multi-Channel OTN** test application offers the following path/mapping structures depending on the inserted CFP/CFP2 transceivers and enabled options.



## OTN BERT

Allows OTN (framed and unframed), OTN multiplexing, and EoOTN traffic generation with specific test pattern for Bit Error Rate analysis.

➤ Typical OTN BERT test applications:

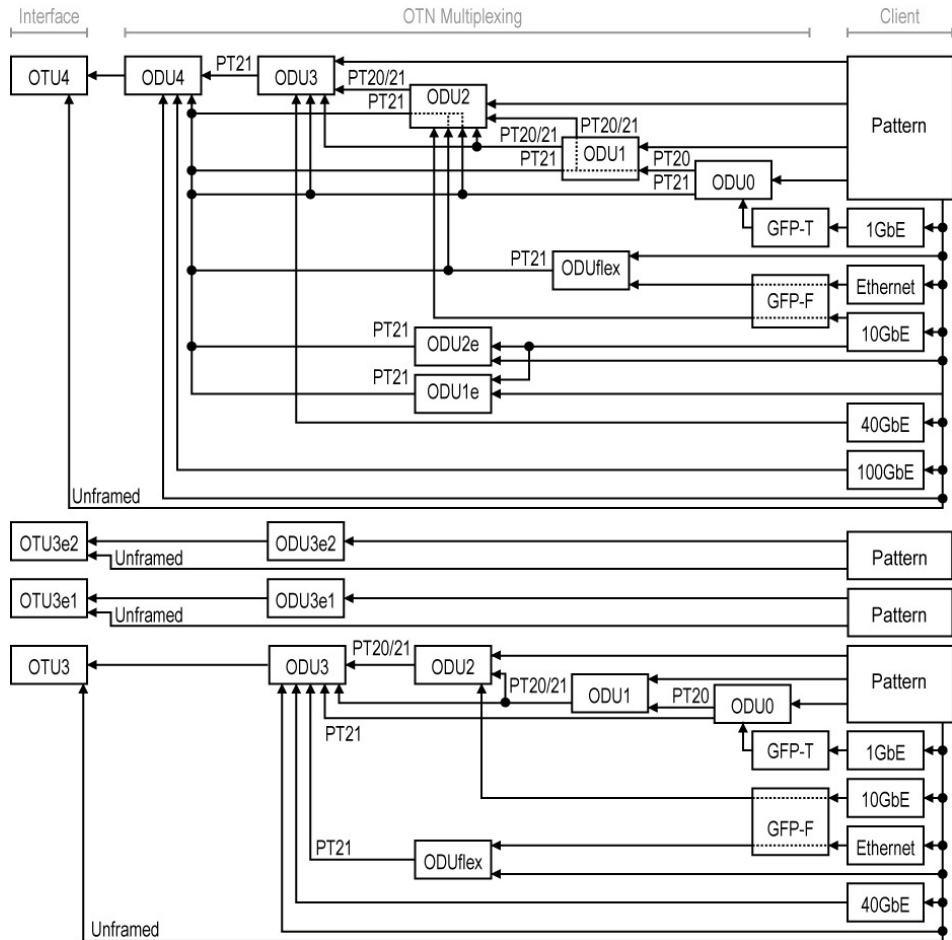


# Test Setup - Test Applications

## OTN BERT

### ➤ Path/Mapping

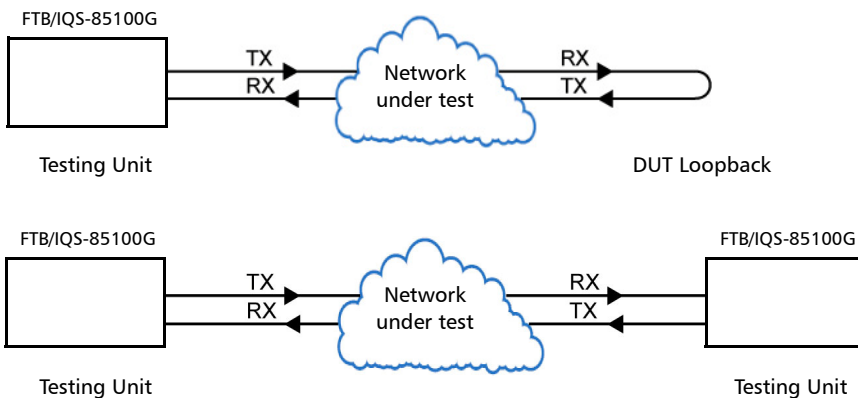
The **OTN BERT** test application offers the following path/mapping structures depending on the inserted transceiver and enabled options.



## OTN-SONET/SDH BERT

Allows the validation of the SONET/SDH embedded in OTN transport protocol by performing a BERT test to check the traffic or payload stability over a network facility.

- Typical OTN-SONET/SDH BERT test applications:



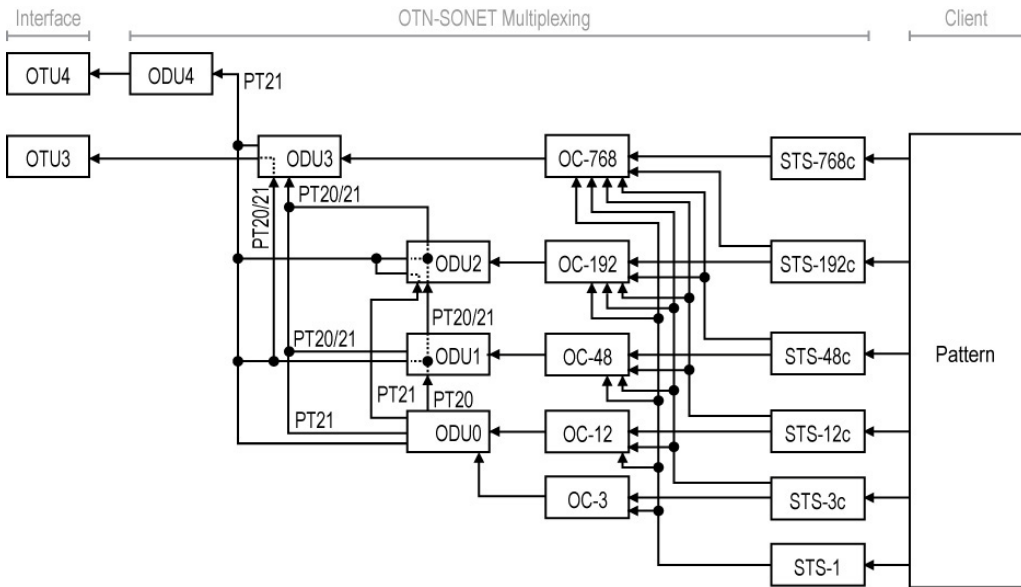
## Test Setup - Test Applications

### OTN-SONET/SDH BERT

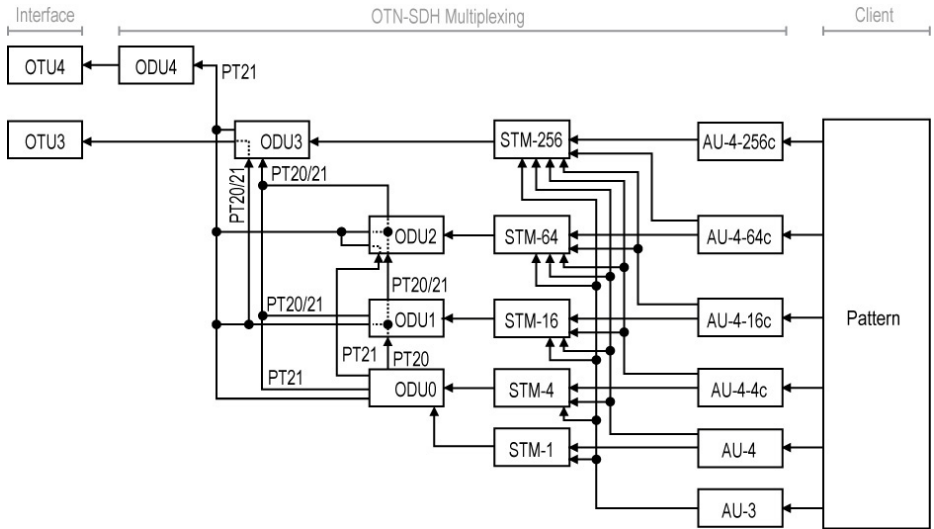
#### ► Path/Mapping

The **OTN-SONET/SDH BERT** test application offers the following path/mapping structures depending on the inserted transceiver and enabled options.

For OTN-SONET BERT



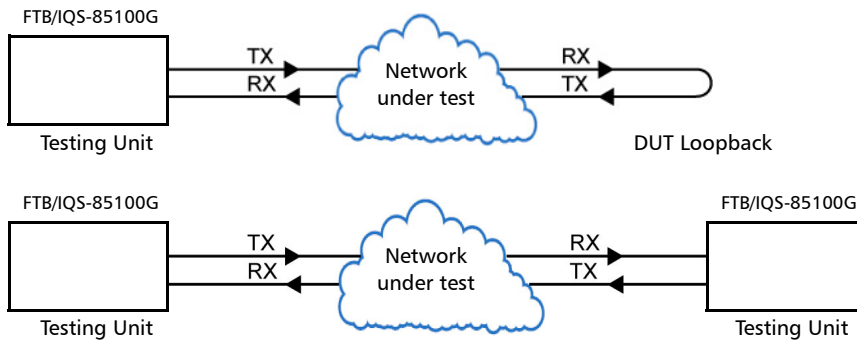
For OTN-SDH BERT



### SONET/SDH BERT

Allows the validation of the SONET or SDH transport protocol by performing a BERT test to check the traffic or payload stability over a network facility.

- Typical SONET/SDH BERT test applications:

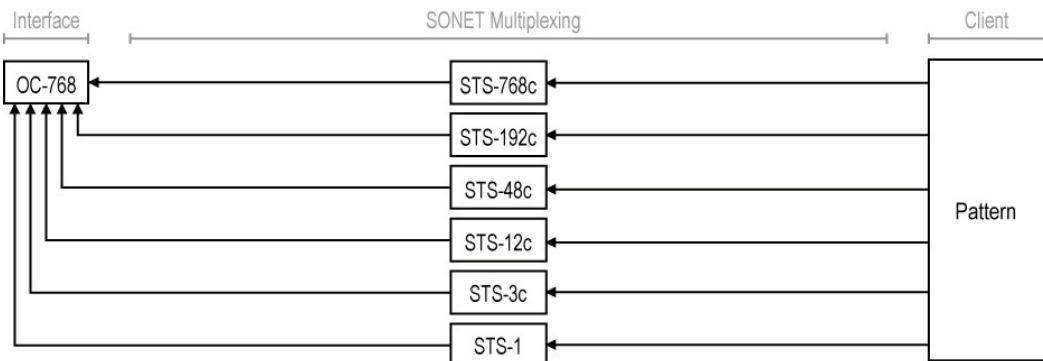




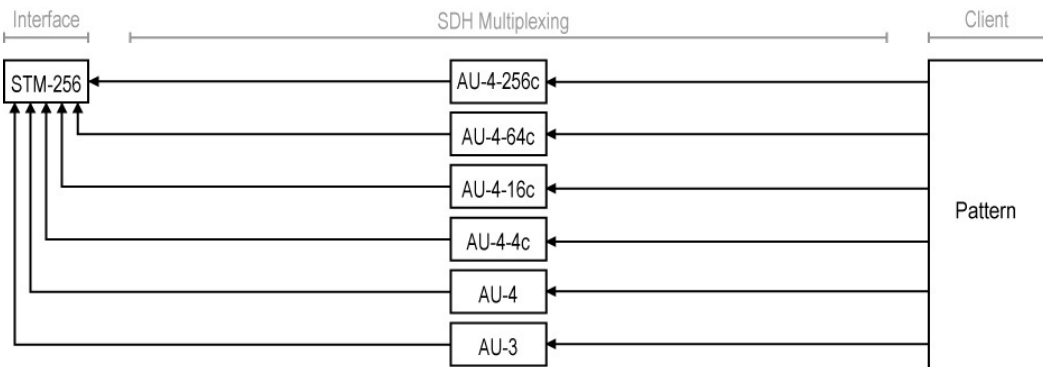
➤ Path/Mapping

The **SONET/SDH BERT** test application offers the following path/mapping structures depending on the inserted CFP module.

For SONET BERT



For SDH BERT



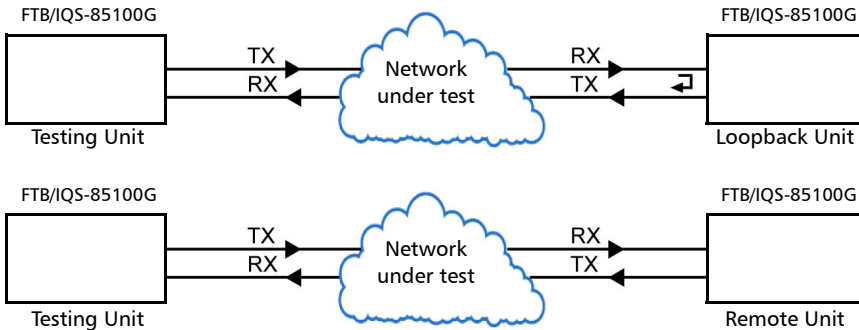
## **EtherSAM (Y.1564)**

EtherSAM 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.

The **EtherSAM (Y.1564)** test has to be executed in conjunction with a remote module or in Internal Loopback mode. The remote module can be either in loopback configuration for unidirectional testing or in **EtherSAM Dual Test Set** mode for bidirectional testing.

The **Dual Test Set** test allows bi-directional test between two compatible modules providing independent results for each test direction. The results from local-to-remote and remote-to-local are available on the local testing unit.

- Typical EtherSAM (Y.1564) test applications:



- Supported Interfaces/Rates: 40G and 100G.

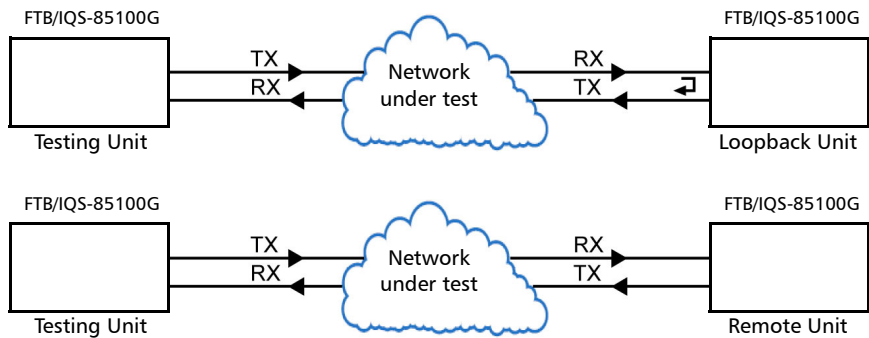
## RFC 2544

RFC 2544 allows Ethernet Throughput, Back-to-Back, Frame Loss, and Latency performance testing in accordance with RFC 2544 specifications.

The **RFC 2544** test has to be executed in conjunction with a remote module or in Internal Loopback mode. The remote module can be either in loopback configuration for unidirectional testing or in RFC 2544 **Dual Test Set** mode for bidirectional testing.

The **Dual Test Set** test allows bi-directional test between two compatible modules providing independent results for each test direction. The results from local-to-remote and remote-to-local are available on the local testing unit.

- Typical RFC 2544 test applications:



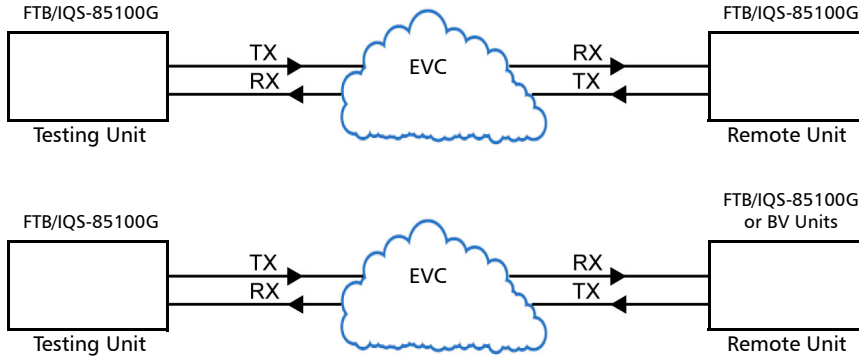
- Supported Interfaces/Rates: 40G and 100G.

### RFC 6349

RFC 6349 is used to confirm that the Ethernet service is able to properly carry TCP traffic.

The **RFC 6349** test has to be executed in conjunction with a remote compatible module in RFC 6349 **Dual Test Set** operation mode allowing bidirectional testing. The test provides independent results for each test direction. The results from local-to-remote and remote-to-local are available on the local testing unit.

- Typical RFC 6349 test application:

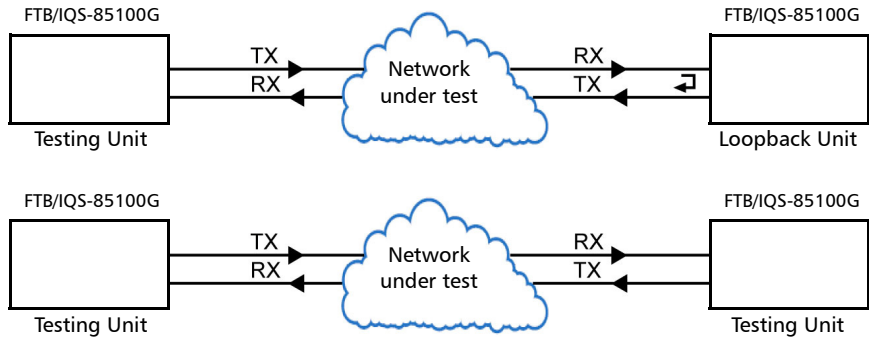


- Supported Interfaces/Rates: 40G and 100G.

## EtherBERT

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

- Typical EtherBERT test applications:

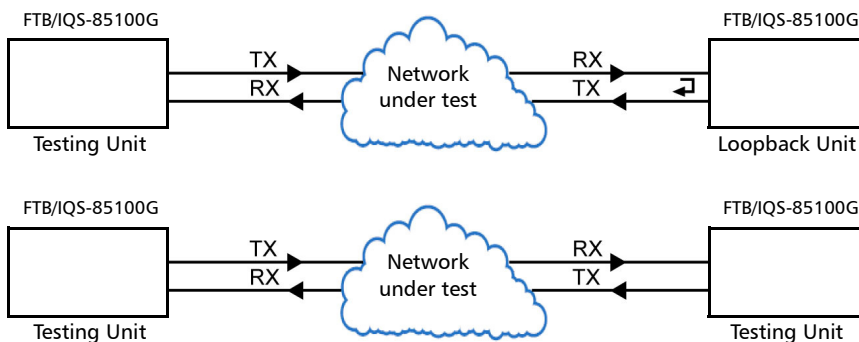


- Supported Interfaces/Rates: 40G and 100G.

### Traffic Gen & Mon

Allows Ethernet traffic generation and analysis of up to 16 streams.

- Typical Traffic Gen & Mon test applications:



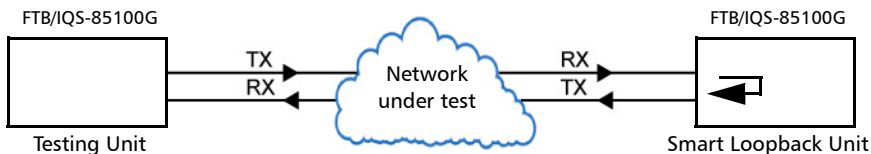
- Supported Interfaces/Rates: 40G and 100G.

## Smart Loopback

Allows transmitting back the received Ethernet stream of data while interchanging the source and destination MAC addresses, IP addresses, and/or UDP/TCP ports. However in **Transparent (Pseudo-Physical)** mode the Smart Loopback operates as a physical loopback by transmitting all received frames unaltered and without discrimination.

The Smart Loopback test can be created locally (refer to *Ethernet Test Applications* on page 53) or remotely using an EXFO unit (refer to *Discover Remote Button* on page 374).

- Typical Smart Loopback test application:



- Supported Interfaces/Rates: 40G and 100G.





# 7 Selecting and Starting a Test

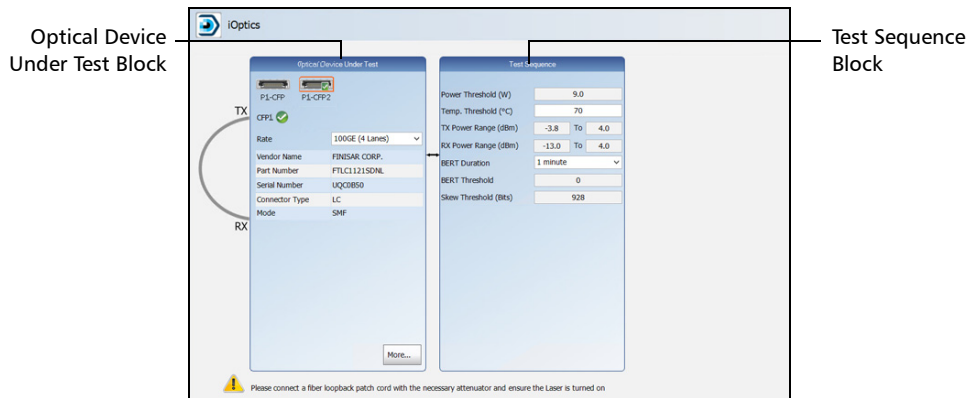
A test can be created either by selecting the test from the Test Applications tab or by loading a previously saved configuration (refer to *Save/Load Button* on page 384 for more information).

## Intelligent Apps

### iOptics

**To select, configure, and start iOptics:**

1. From the test menu, tap **Setup**.
2. From the **Test Applications** tab, under **Intelligent Apps**, tap the **iOptics** icon.
3. From the **Test Configurator** tab select the interface/port and its rate.



- 3a.** From the **Optical Device Under Test** block, tap the desired port icon.
- 3b.** Once the transceiver is correctly detected, select its rate.
- 3c.** From the **Test Sequence** block, select the test parameters and thresholds (refer to *Test Sequence (iOptics)* on page 202).

**Note:** The iOptics test application uses **Internal** timing for clock synchronization.

## Selecting and Starting a Test

### *Intelligent Apps*

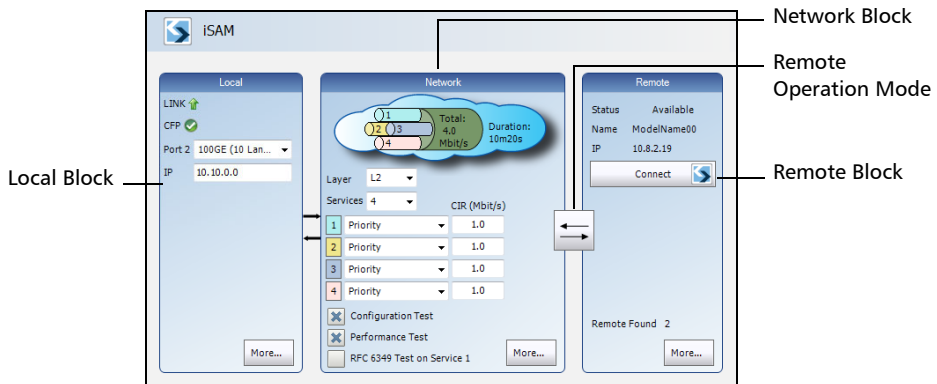
---

4. Ensure the laser is ON and tap the **Start** button from the right navigation bar to start the test (refer to *Start/Stop | TX Button* on page 388). The **Summary** result page will be automatically displayed when the test is started. For additional results refer to *Test Results* on page 211. The test automatically stops when the transceiver is invalid or missing.
5. When the test ends automatically or is manually stopped, the generate report pop-up is displayed by default. If required, tap **Yes** to generate a report of the test results and statistics (refer to *Report Button* on page 378 for more information).


## iSAM

**To select, configure, and start iSAM:**

1. From the test menu, tap **Setup**.
2. From the **Test Applications** tab, under **Intelligent Apps**, tap the **iSAM** icon.
3. From the **Test Configurator** tab configure the interface structure and its parameters.






- 3a. From the **Local** block, either select the basic port parameters or click on **More** for all settings (refer to *Local Details (iSAM)* on page 113). Ensure that the link is up and the power level for optical interface (when supported) is adequate in the status bar before proceeding to the next step (refer to *Status Bar* on page 18).

Check for the CFP optical validation check mark  indicating that the CFP matches the configured interface/rate (refer to *Physical Interface Port - Test Configurator Overview* on page 58).

- 3b. From the **Network** block, either select the basic test parameters or click on **More** for all settings (refer to *Network Details (iSAM)* on page 133). The total bandwidth and the estimated test duration are displayed.

## Selecting and Starting a Test

- 3c.** Select the remote operation mode; DTS is automatically selected when the **RFC 6349 Test** is enabled:

	<b>DTS (Dual Test Set)</b> The remote device is automatically set in EtherSAM when the connection/overtake is successfully established.
	<b>Remote Loopback</b> The remote device is automatically set in Smart Loopback when the connection/overtake is successfully established.
	<b>Manual Loopback</b> The remote device is a physical loopback or has to be manually set in loopback.

- 3d.** From the **Remote** block, either select the basic remote parameters or click on **More** for all settings (refer to *Remote Details (iSAM)* on page 152).

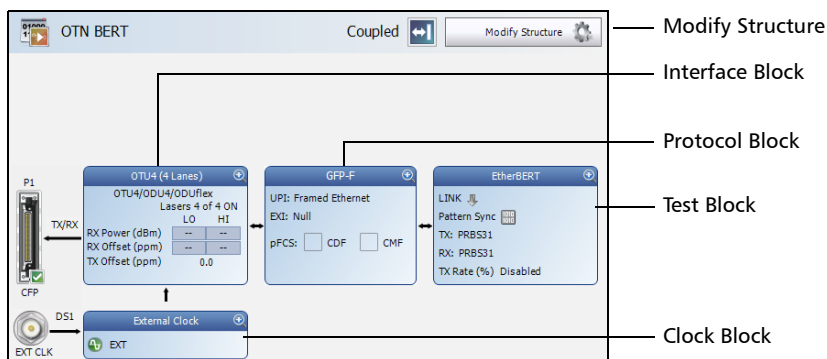
**Note:** The *iSAM* test application uses **Internal** timing for clock synchronization.

- 4.** Tap the **Start** button from the right navigation bar to start the test (refer to *Start/Stop | TX Button* on page 388). If the connection with the remote module is not established with either **DTS** or **Remote Loopback** mode, the automatic remote connection process is performed before starting the test. The **Summary** result page will be automatically displayed when the test is started from any **Setup** configuration page. For additional results refer to *Test Results* on page 211.
- 5.** When the test ends automatically or is manually stopped, the generate report pop-up is displayed by default. If required, tap **Yes** to generate a report of the test results and statistics (refer to *Report Button* on page 378 for more information).

## Transport Test Applications

**To select, configure, and start a Transport test:**

1. From the test menu, tap **Setup**.
2. From the **Test Applications** tab, under **Transport**, tap a test icon.
3. From the **Test Configurator** tab configure the signal structure and its parameters.



- 3a. Tap the **Modify Structure** button to set the basic structure of the test such as the interface/rate, connector, etc. (refer to *Modify Structure Button* on page 63).
- 3b. Check for the CFP optical validation check mark  indicating that the CFP matches the configured interface/rate (refer to *Physical Interface Port - Test Configurator Overview* on page 58).
- 3c. Tap the interface block to configure the signal parameters (refer to page 55).
- 3d. For an embedded signal, tap the protocol block to configure the signal (refer to page 55).

## Selecting and Starting a Test

### *Transport Test Applications*

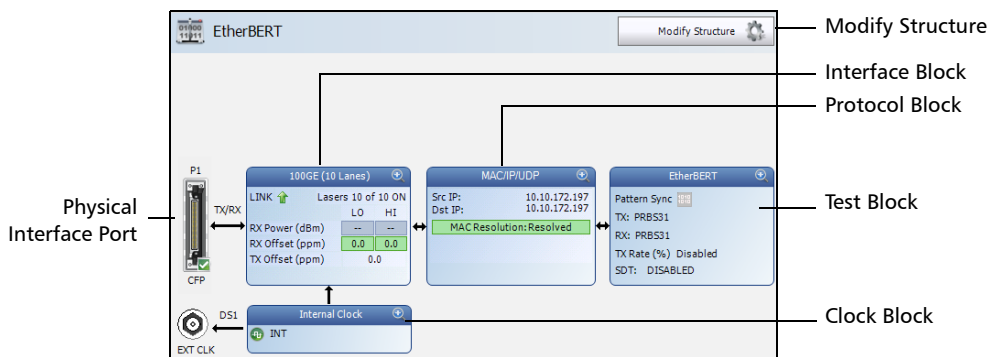
---

- 3e.** Tap the test block to configure the specific test settings (refer to page 55).
- 3f.** Tap the clock block to configure the clock synchronization (refer to *Clock* on page 80).
- 4.** Tap the **Timer** tab to automatically start and/or stop the test at a given time or for a specific duration (refer to *Timer* on page 203).
- 5.** For additional test configurations refer to *Test Functions* on page 311.
- 6.** Tap the **Start** button from the right navigation bar to start the test. (refer to *Start/Stop | TX Button* on page 388). The **Summary** result page will be automatically displayed when the test is started from any **Setup** configuration page. For additional results, refer to *Test Results* on page 211.
- 7.** Tap the **Stop** button to stop the test. By default the generate report pop-up is displayed. If required, tap **Yes** to generate a report of the test results and statistics (refer to *Report Button* on page 378).

## Ethernet Test Applications

**To select, configure, and start an Ethernet test:**

1. From the test menu, tap **Setup**.
2. From the **Test Applications** tab, under **Ethernet**, tap a test icon.
3. From the **Test Configurator** tab configure the interface structure and its parameters.



- 3a. Tap the **Modify Structure** button to set the basic structure of the test such as the interface/rate, connector, etc. (refer to *Modify Structure Button* on page 63).
- 3b. Check for the CFP optical validation check mark  indicating that the CFP matches the configured interface/rate (refer to *Physical Interface Port - Test Configurator Overview* on page 58).
- 3c. Tap the interface block to configure the interface parameters (refer to page 55). Ensure that the link is up and the power level (when supported) is present in the status bar before proceeding to the next step (refer to *Status Bar* on page 18).

## Selecting and Starting a Test

### *Ethernet Test Applications*

---

- 3d.** Tap the protocol block<sup>1</sup> to configure the frame structure and its parameters (refer to page 55).
- 3e.** Tap the test block<sup>2</sup> to configure the specific test settings (refer to page 55).
- 3f.** Tap the clock block to configure the clock synchronization (refer to *Clock* on page 80).
- 4.** Tap the **Timer** tab to automatically start and/or stop the test at a given time or for a specific duration (refer to *Timer* on page 203).
- 5.** For additional test configurations refer to *Test Functions* on page 311.
- 6.** Tap the **Start** button from the right navigation bar to start the test (refer to *Start/Stop | TX Button* on page 388). The **Summary** result page will be automatically displayed when the test is started from any **Setup** configuration page. For additional results refer to *Test Results* on page 211.
- 7.** Depending on the test, when the test ends automatically or is manually stopped, the generate report pop-up is displayed by default. If required, tap **Yes** to generate a report of the test results and statistics (refer to *Report Button* on page 378 for more information).

---

1. Not available with Smart Loopback.

2. Not available with Traffic Gen & Mon



# 8 **Test Setup - Test Configurator, Timer, and System**

The **Setup** menu offers the following structure:

- **Test Configurator for Intelligent Apps** test application.

<b>Test Application</b>	<b>Block</b>	<b>Subtab or Pop Up</b>	<b>Page</b>
iOptics	Optical Device Under Test	Optical Device Under Test Details	150
	Test Sequence	-	202
iSAM	Local	Local Details	113
		CFP/CFP2/SFP+	79
	Network	Network Details	133
	Remote	Remote Details	152

## Test Setup - Test Configurator, Timer, and System

➤ **Test Configurator** for **Transport** test applications.

Block	Subtab or Pop Up	Available with				Page
		OTN BERT	Multi-Channel OTN	OTN-SONET/SDH BERT	SONET/SDH BERT	
Button	Modify Structure	X	X	X	X	63
Interface	CFP/CFP2	X	X	X	X	79
	Frequency <sup>a</sup>	X	X	X	-	100
	FTFL/PT and PT	X	X	X	-	102
	Labels	-	-	-	X	112
	Signal	X	X	X	X	178
	Traces	205	205	205	209	<---
Protocol	GFP-F/GFP-T	X	-	-	-	116
	Labels	-	-	X	-	112
	Signal	-	-	X	-	178
	Traces	-	-	X	-	209
Test	BERT and Unframed BERT	X	-	X <sup>b</sup>	X <sup>b</sup>	74
	EtherBERT <sup>c</sup> and Unframed BERT	X	-	-	-	86
	Global	-	X	-	-	144
	PT	-	X	-	-	102
	Traces	-	X	-	-	205
Clock	Clock	X	X	X	X	80

- a. Available with parallel interface only.
- b. Only framed test is supported.
- c. Available with EoOTN client only.

➤ **Test Configurator** for Ethernet test applications.

Block	Subtab or Pop Up	Available With						Page
		EtherSAM	RFC 6349	RFC 2544	EtherBERT	Traffic Gen & Mon	Smart Loopback	
Button	Modify Structure	X	X	X	X	X	X	63
Interface	CFP/CFP2	X	X	X	X	X	X	63
	Frequency	X	-	X	X	X	X	100
	Interface	X	X	X	X	X	X	107
	Network	X	X	X	X	X	X	107
Protocol	MAC/IP/UDP	-	-	X	X	X	-	116
	Services - Global	X	-	-	-	-	-	168
	Services - Profile	X	-	-	-	-	-	171
	Streams - Global	-	-	-	-	X	-	191
	Streams - Profile	-	-	-	-	X	-	193
Test	EtherBERT and Unframed BERT	-	-	-	X	-	-	86
	EtherSAM - Burst	X	-	-	-	-	-	92
	EtherSAM - Global	X	-	-	-	-	-	94
	EtherSAM - Ramp	X	-	-	-	-	-	98
	RFC 2544 - Global	-	-	X	-	-	-	156
	RFC 2544 - Subtests	-	-	X	-	-	-	159
	RFC 6349	-	X	-	-	-	-	165
Smart Loopback	-	-	-	-	-	X	190	
Clock	Clock	X	-	X	X	X	X	80

➤ **Timer**, see page 203.

➤ **System**, see page 201.

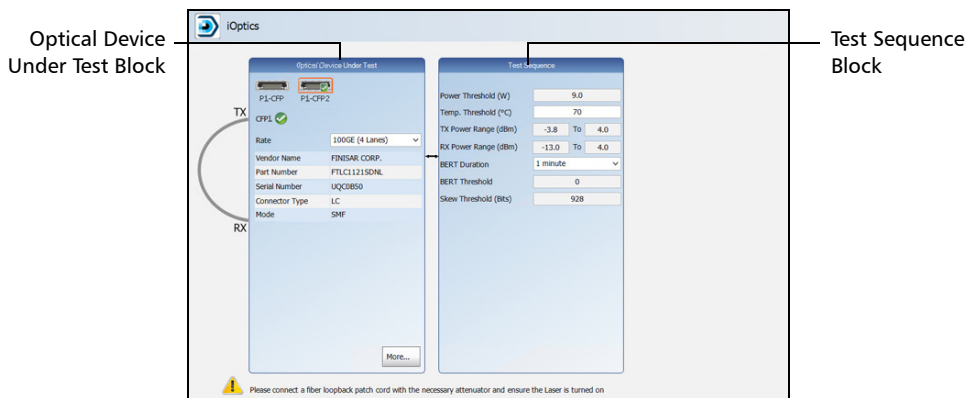
## Test Configurator Overview

The **Test Configurator** tab displays the interconnected blocks composing the test structure. Each block of the test structure gives an overview of its configuration/status. Availability of each block depends on the selected test application and its structure. Arrows are used to indicate the interconnection between blocks as well as the direction of the clock and data flow. Tap on a block to change the configuration parameters of this block.

From the **Test** menu, tap **Setup**, and the **Test Configurator** tab.

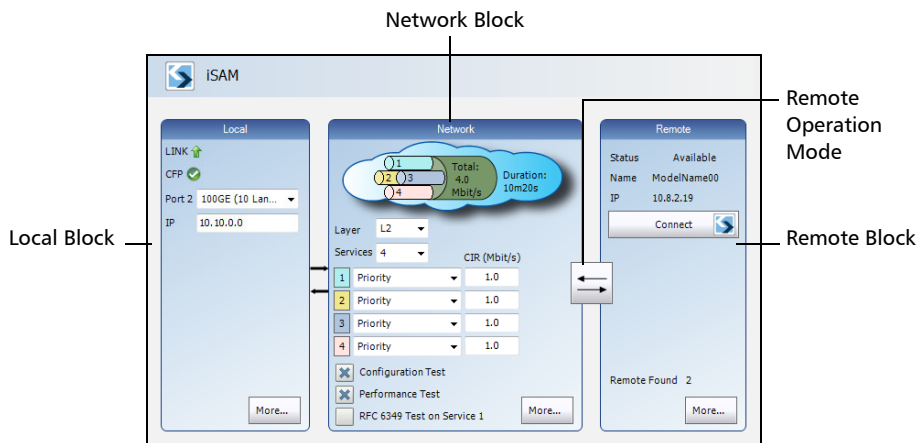
- Intelligent Apps:

iOptics:



- **Optical Device Under Test** block displays and allows to change basic interface/port settings. Tap on the **More** button to access more information and settings.
- **Test Sequence** block allows to change basic test settings.

iSAM:



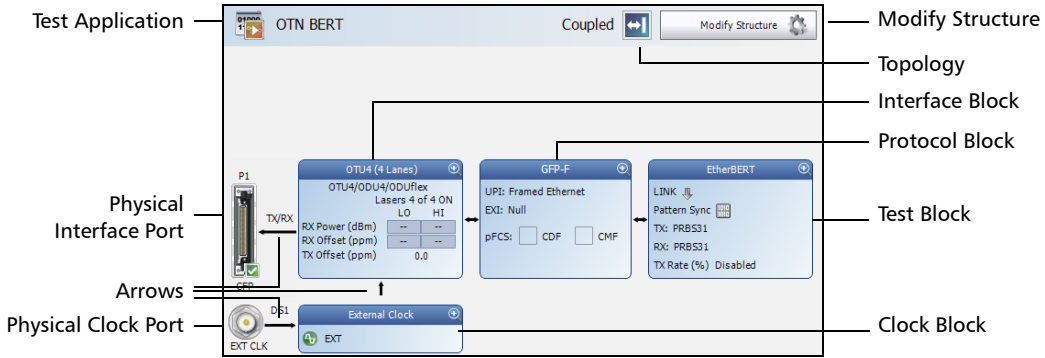
The block arrangement represents the network under test. From any block, either select the basic parameters or click on **More** for all settings.

- **Local** block displays and allows to change basic interface settings. Tap on the **More** button to access all settings.
- **Network** block displays and allows to change basic test settings. Tap on the **More** button to access all settings.
- Remote operation mode allows to select the remote operation mode. Tap on the button to change the remote operation mode.
- **Remote** block displays and allows to change basic remote settings. Tap on the **More** button to access all settings.

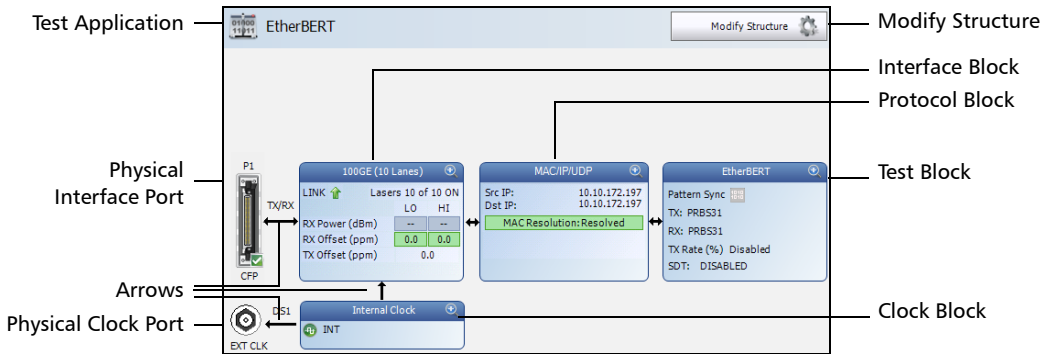
# Test Setup - Test Configurator, Timer, and System

## Test Configurator Overview

➤ Transport Test Applications:







➤ Ethernet Test Applications:




- Test Application indicates the selected test application.
- Topology, for Transport Test Applications, indicates the selected test topology.
- Modify Structure button, allows the configuration of the physical port and the signal interface structure.
- Physical Interface Port indicates the physical interface port.

To ensure proper optical module detection/validation, make sure that the CFP/CFP2 screws are fully secured.

The status for a physical CFP/CFP2 interface and the compatibility with the selected signal/interface is indicated as follows. The icon and its description are also displayed just below the test application name when validating or if there is a problem.

	Validating CFP/CFP2
	Missing CFP/CFP2
	Invalid CFP/CFP2 or mismatch with the selected signal/interface.
	Valid CFP/CFP2 matching the selected interface/rate.

For serial CFP interface, an interlink fault status indicates a problem at the interconnect between the serial CFP and the module. No icon is displayed when there is no interlink fault. The icon and its description is also displayed just below the test application name when there is a problem.

	Fault detected on either TX, RX, or TX/RX interlink. If an interlink fault is reported we recommend to try the following to fix the issue: Fully remove the CFP, wait 30 seconds then fully re-insert and secure the CFP with its screws.
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## Test Setup - Test Configurator, Timer, and System

### *Test Configurator Overview*

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- Arrows are used to indicate the interconnection between blocks as well as the direction of the clock and data flow.  
  
A line with an arrow on both ends indicates a bidirectional communication (TX/RX).  
  
A line with a single arrow indicates a unidirectional communication, either **TX** when going out of a block or **RX** when going into a block.  
  
A line going out of a block returning back to the same block, indicates a loopback communication.
- Physical Clock Port indicates the direction, TX or RX, of the selected clock. The arrow next to the physical clock image indicates if a clock is generated (TX, arrow pointing to the left) or received (RX, arrow pointing to the right) at/from the physical EXT CLK port.
- Interface Block displays an overview of the interface settings and status. Tap on the interface block to change the settings and to see detailed status.
- Protocol Block displays an overview of either the frame structure and its parameters for Ethernet test applications or the embedded signal for Transport test applications. This block is not present for all tests. Tap on the protocol block to change the settings and to see detailed status.
- Test Block displays an overview of the test settings and status. Tap on the test block to change the settings and to see detailed status.
- Clock Block displays an overview of the clock settings and status. Tap on the clock area to change the settings and to see detailed status.



## Modify Structure Button

From the **Test** menu, tap **Setup**, **Test Configurator**, and the **Modify Structure** button.

### For Transport Test Applications

- **Interface/Rate:** Select the desired interface rate. Choices depend on the selected test and the rates available on the Packet Blazer.

Test	Interface/Rate
OTN (Parallel)	OTU4 (10 Lanes) [111.81 Gbit/s] OTU4 (4 Lanes) [111.81 Gbit/s] OTU3e2 (4 Lanes) [44.583 Gbit/s] OTU3e1 (4 Lanes) [44.571 Gbit/s] OTU3 (4 Lanes) [43.018 Gbit/s]
OTN (Serial)	OTU3 [43.018 Gbit/s] OTU3e1 [44.571 Gbit/s] OTU3e2 [44.583 Gbit/s]
SONET (Serial)	OC-768 [39.813 Gbit/s]
SDH (Serial)	STM-256 [39.813 Gbit/s]

- **Connector** allows the selection of the Packet Blazer's CFP interface.

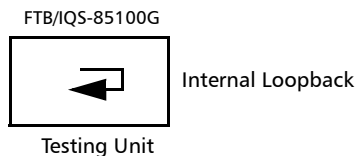
Interface/Rate	Connector
OTU4 (10 Lanes) [111.81 Gbit/s]	CFP
OTU4 (4 Lanes) [111.81 Gbit/s]	CFP2 (OTU4 only)
OTU3e2 (4 Lanes) [44.583 Gbit/s]	Internal Loopback
OTU3e1 (4 Lanes) [44.571 Gbit/s]	EXFO CXP Adaptor (Remote CXP: EXFO CXP Adaptor)
OTU3 (4 Lanes) [43.018 Gbit/s]	EXFO CXP Adaptor (Remote CXP: Standard CXP)
OTU3 [43.018 Gbit/s]	
OTU3e1 [44.571 Gbit/s]	
OTU3e2 [44.583 Gbit/s]	
OC-768 [39.813 Gbit/s]	
STM-256 [39.813 Gbit/s]	

## Test Setup - Test Configurator, Timer, and System

Modify Structure Button

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- **CFP:** Use this configuration when an optical CFP transceiver module is inserted in the CFP INTERFACE slot of the FTB/IQS-85100G module.
- **CFP2:** Use this configuration when an EXFO CFP to CFP2 adapter is inserted in the CFP INTERFACE slot of the FTB/IQS-85100G module.
- **EXFO CXP Adaptor (Remote CXP: Standard CXP):** Use this configuration when an EXFO CFP to CXP adapter is inserted in the CFP Interface slot of the FTB/IQS-85100G module and connects to a far end DUT that supports standard CXP interface.
- **EXFO CXP Adaptor (Remote CXP: EXFO CXP Adaptor):** Use this configuration when an EXFO CFP to CXP adapter is inserted in the CFP Interface slot of the FTB/IQS-85100G module and connects to a far end DUT that is also equipped with an EXFO CFP to CXP adaptor.
- **Internal Loopback:** Use this configuration to perform a loopback before the CFP connector without interfacing with the optical transceiver. The loopback is performed on each physical lane for parallel interface.

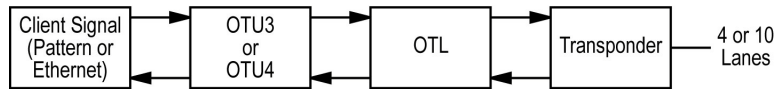


**Note:** *The Internal Loopback connector selection allows the isolation of the platform module CFP slot electrical interface from the CFP device. This can be useful in isolating a problem to a faulty CFP device.*

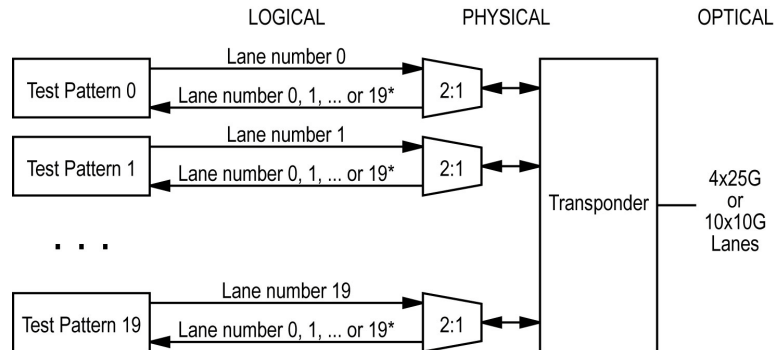
## ► Framing

For OTN BERT test application, parallel interfaces, allows the selection of the test framing type. For serial interfaces, Multi-Channel OTN, OTN BERT, and SONET/SDH BERT test applications, the **Framing** is set to **Framed**. For OTN - SONET/SDH BERT test application, the test is framed.

- **Framed (default):** Same Pattern or Ethernet client in each physical lane.



- **20 Unframed Logical Lanes:** Independent test pattern in each logical lane. Available with: OTU4 (4 and 10 Lanes [111.81 Gbit/s]).



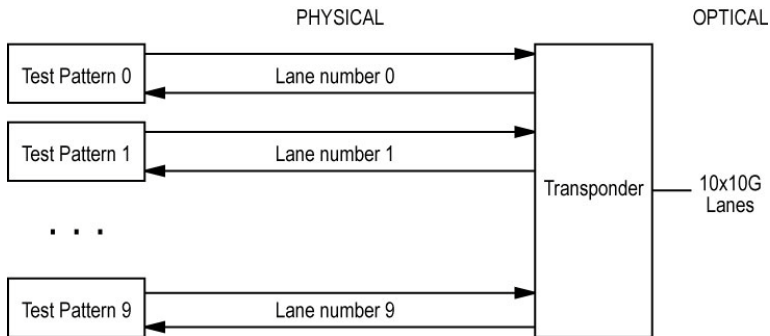
\* It is not possible to predict on which Lane a generated pattern will be detected on the receive side.

## Test Setup - Test Configurator, Timer, and System

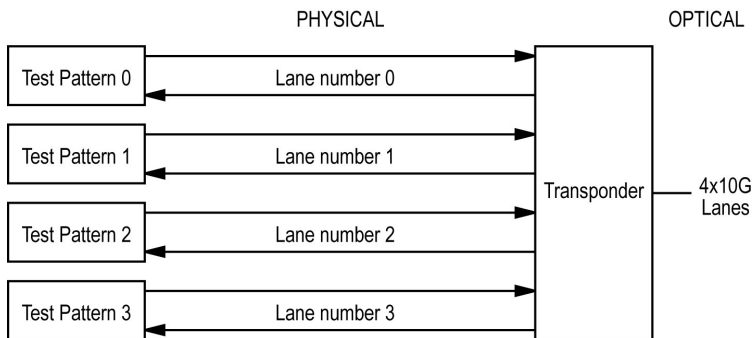
*Modify Structure Button*

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- **10 Unframed Physical Lanes:** Independent test pattern in each physical lane. Available with:  
OTU4 (10 Lanes [111.81 Gbit/s]).



- **4 Unframed Physical Lanes:** Independent test pattern in each physical lane. Available with:  
OTU3 (4 Lanes) [430.018 Gbit/s],  
OTU3e1 (4 Lanes) [44.571 Gbit/s], and  
OTU3e2 (4 Lanes) [44.583 Gbit/s].



- **OTN Multiplexing - Config Mux** button allows the selection of the OTN test mapping including the selection of the payload type (PT20 or PT21) when applicable. Refer to *Multi-Channel OTN* on page 32, *OTN BERT* on page 33 and *OTN-SONET/SDH BERT* on page 35 for supported path/mapping.

Interface/Rate	OTN Multiplexing
OTU3 (4 Lanes) [43.018 Gbit/s] <sup>a</sup> OTU3 [43.018 Gbit/s] <sup>b</sup>	ODU3 ODU3/ODU2 ODU3/ODU2/ODU1 ODU3/ODU2/ODU1/ODU0 ODU3/ODU1 ODU3/ODU1/ODU0 ODU3/ODU0 ODU3/ODUflex
OTU3e1 (4 Lanes) [44.571 Gbit/s] <sup>a</sup> OTU3e1 [44.571 Gbit/s] <sup>b</sup>	ODU3e1
OTU3e2 (4 Lanes) [44.583 Gbit/s] <sup>a</sup> OTU3e2 [44.583 Gbit/s] <sup>b</sup>	ODU3e2
OTU4 (4 Lanes) [111.81 Gbit/s] <sup>a</sup> OTU4 (10 Lanes) [111.81 Gbit/s] <sup>a</sup>	ODU4 (default) ODU4/ODU3 ODU4/ODU3/ODU2 ODU4/ODU3/ODU2/ODU1 ODU4/ODU3/ODU2/ODU1/ODU0 ODU4/ODU3/ODU1 ODU4/ODU3/ODU0 ODU4/ODU2 ODU4/ODU2/ODU1/ODU0 ODU4/ODU2/ODU1 ODU4/ODU2/ODU0 ODU4/ODU2/ODUflex ODU4/ODU1 ODU4/ODU1/ODU0 ODU4/ODU0 ODU4/ODU2e ODU4/ODU1e ODU4/ODUflex

- a. Parallel interface.
- b. Serial Interface.

## Test Setup - Test Configurator, Timer, and System

*Modify Structure Button*

- **Embedded SONET/SDH**, only available with **OTN-SONET/SDH BERT** test application, allows the selection of the embedded SONET/SDH signal.

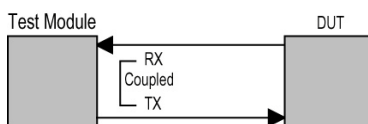
OTN Multiplexing	Embedded SONET/SDH
ODU4/ODU3 ODU3	OC-768, STM-256
ODU4/ODU3/ODU2 ODU4/ODU2 ODU3/ODU2	OC-192, STM-64
ODU4/ODU3/ODU2/ODU1 ODU4/ODU3/ODU1 ODU4/ODU2/ODU1 ODU4/ODU1 ODU3/ODU2/ODU1 ODU3/ODU1	OC-48, STM-16
ODU4/ODU3/ODU2/ODU1/ODU0 ODU4/ODU3/ODU0 ODU4/ODU2/ODU1/ODU0 ODU4/ODU2/ODU0 ODU4/ODU1/ODU0 ODU4/ODU0 ODU3/ODU2/ODU1/ODU0 ODU3/ODU1/ODU0 ODU3/ODU0	OC-3, OC-12, STM-1, STM-4

- **SONET/SDH Multiplexing - Config Mux** button allows the selection of SONET/SDH multiplexing. Available with OTN-SONET/SDH and SONET/SDH BERT test applications.

Interface/Rate or Embedded SONET/SDH	SONET/SDH Multiplexing
OC-768	STS-768c, STS-192c, STS-48c, STS-12c, STS-3c, STS-1
STM-256	AU-4-256c, AU-4-64c, AU-4-16c, AU-4-4c, AU-4, AU-3
OC-192	STS-192c, STS-48c, STS-12c, STS-3c, STS-1

Interface/Rate or Embedded SONET/SDH	SONET/SDH Multiplexing
STM-64	AU-4-64c, AU-4-16c, AU-4-4c, AU-4, AU-3
OC-48	STS-48c, STS-12c, STS-3c, STS-1
STM-16	AU-4-16c, AU-4-4c, AU-4, AU-3
OC-12	STS-12c, STS-3c, STS-1
STM-4	AU-4-4c, AU-4, AU-3
OC-3	STS-3c, STS-1
STM-1	AU-4, AU-3

- **Client** allows the selection of either **Pattern** (default) or an EoOTN (**1 GbE, 10 GbE, 40 GbE, 100 GbE, or Ethernet (flex/GFP-F)**) client. The client is set to **Pattern** for OTU3e1, and OTU3e2 parallel interfaces/rates, all serial interfaces, as well as for **Multi-Channel OTN**.
- **Topology** allows the selection of the network test topology. Only **Coupled (TX=RX)** is available with Multi-Channel OTN.  
**Coupled (TX=RX)** uses the same settings for both the TX and RX signals.



### For Ethernet Test Applications

- **Interface/Rate** choices depend on the selected test and the rates available on the Packet Blazer.

Test	Interface/Rate
EtherSAM	100GE (10 Lanes) [103.125 Gbit/s]
RFC 2544	100GE (4 Lanes) [103.125 Gbit/s]
RFC 6349	40GE (4 Lanes) [41.25 Gbit/s]
EtherBERT	
Traffic Gen & Mon	
Smart Loopback	

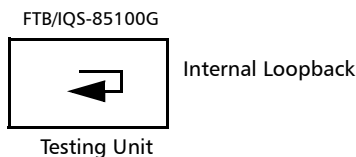
- **Connector** allows the selection of the Packet Blazer's CFP interface.

Interface/Rate	Connector
100GE (10 Lanes) [103.125 Gbit/s]	CFP
100GE (4 Lanes) [103.125 Gbit/s]	CFP2 (100GE only)
40GE (4 Lanes) [41.25 Gbit/s]	Internal Loopback
	EXFO CXP Adaptor (Remote CXP: EXFO CXP Adaptor)
	EXFO CXP Adaptor (Remote CXP: Standard CXP)

- **CFP:** Use this configuration when an optical CFP transceiver module is inserted in the CFP INTERFACE slot of the FTB/IQS-85100G module.
- **CFP2:** Use this configuration when an EXFO CFP to CFP2 adapter is inserted in the CFP INTERFACE slot of the FTB/IQS-85100G module.
- **EXFO CXP Adaptor (Remote CXP: EXFO CXP Adaptor):** Use this configuration when an EXFO CFP to CXP adapter is inserted in the CFP Interface slot of the FTB/IQS-85100G module and connects to a far end DUT that is also equipped with an EXFO CFP to CXP adaptor.



- **EXFO CXP Adaptor (Remote CXP: Standard CXP):** Use this configuration when an EXFO CFP to CXP adapter is inserted in the CFP Interface slot of the FTB/IQS-85100G module and connects to a far end DUT that supports standard CXP interface.
- **Internal Loopback:** Use this configuration to perform a loopback before the CFP connector of each physical lane without interfacing with the optical transceiver.



**Note:** *The Internal Loopback connector selection allows the isolation of the module CFP slot electrical interface from the CFP device. This can be useful in isolating a problem to a faulty CFP device.*

- **Framing**, available for EtherBERT test application, allows the selection of the test framing type; otherwise the framing is set to Framed Layer 2. See *Network* on page 128 for more information on frame format.
- **Framed Layer 2:** Frames of  $x^1$  bytes without network layer (**None**) that complies with IEEE 802a Ethernet II standard.

SOF	Destination Address	Source Address	Type	Test Pattern (Configurable length)	FCS	IFG
-----	---------------------	----------------	------	------------------------------------	-----	-----

- **Framed Layer 3/4 (default):** Frames of  $x^1$  bytes with UDP network layer that complies with IEEE 802a Ethernet II standard.

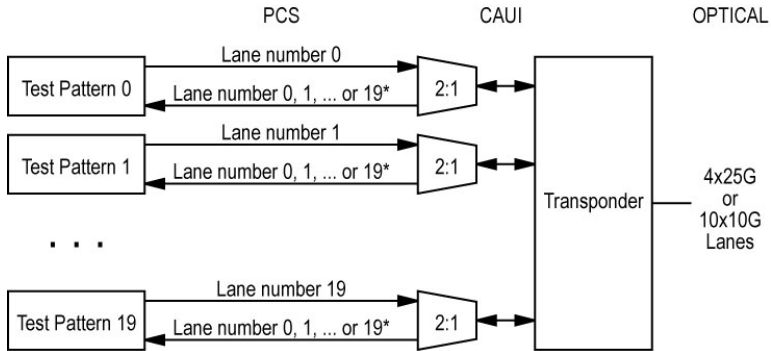
SOF	Destination Address	Source Address	Type	IP Header	UDP Header	BERT Tag	Test Pattern (Configurable length)	FCS	IFG
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1. To set the frame length, see Frame Size on page 90 for EtherBERT (Ethernet and EoOTN), and page 158 for RFC 2544.

## Test Setup - Test Configurator, Timer, and System

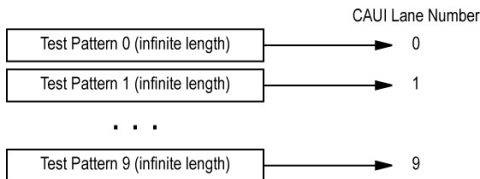
Modify Structure Button

- **20 Unframed PCS:** Independent infinite length test pattern in each PCS lane (no blocks and no lane markers). Available with 100GE (4 and 10 Lanes).

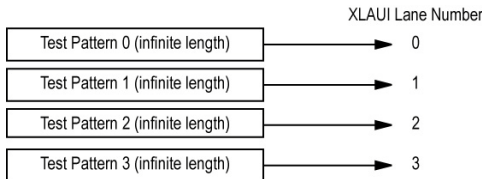


\* It is not possible to predict on which Lane a generated pattern will be detected on the receive side.

- **10 Unframed CAUI:** Independent infinite length test pattern in each CAUI lane (no blocks). Available with 100GE (10 Lanes).



- **4 Unframed XLAUI:** Independent infinite length test pattern in each XLAUI lane (no blocks). Available with 40GE (4 Lanes).



### ► Loopback Mode

**Note:** *Only available for Smart Loopback Ethernet test application.*

**Transparent (Pseudo-Physical)** check box when selected (cleared by default), determines that the Smart Loopback operates as a physical loopback by transmitting all received frames unaltered and without discrimination. When the check box is cleared, the Loopback mode is selectable from *Loopback* on page 190.

In transparent mode, the **Network** tab and the **Ping & Trace Route** functions are not available.

**Note:** *The **Transparent** mode is intended to be used for point-to-point topology, not for switched or routed networks. Use the **Transparent** mode with caution because all received frames are looped back without discrimination.*

# BERT and Unframed BERT

**Note:** *Available with Pattern client.*

From the **Test** menu, tap **Setup, Test Configurator**, and tap on the **BERT or Unframed BERT** block.

## Pattern

The icon next to the **Pattern** label indicates the status of the received pattern signal. Refer to *Status Bar* on page 18 for more information.

- **TX Rate**, available with ODUflex mapped to pattern, allows the selection of the transmission rate. Unit choices are **%**, **Kbit/s**, **Mbit/s**, and **Gbit/s** (default).
- **Coupled RX to TX** check box, when selected (default), allows coupling both the TX and RX signal with the same test pattern.

For a framed test, the **Coupled RX to TX** check box is selected and cannot be cleared.

For an unframed test, the **Coupled RX to TX** check box is selectable (selected by default) when **All Lanes** is selected.

- **No Pattern Analysis (Live)** check box when cleared (default), monitors the received traffic pattern. For live traffic, the **No Pattern Analysis (Live)** check box should be selected as the traffic is a live pattern thus there is no analysis of pattern loss, bit error, and no traffic indications. Only available with a framed test.

- **TX Pattern/RX Pattern** sets respectively the TX and RX test pattern.

Test	
OTN BERT - framed	PRBS9, PRBS15, PRBS20, PRBS23, PRBS31 (default), Null Client, and User Pattern.
OTN BERT - unframed	PRBS9, PRBS11, PRBS15, PRBS20, PRBS23, PRBS31 (default), Square Wave 1 zero/one, Square Wave 2 zeros/ones, Square Wave 4 zeros/ones, Square Wave 8 zeros/ones, and Square Wave 16 zeros/ones <sup>a</sup> .
OTN-SONET/SDH BERT, SONET/SDH BERT	PRBS9, PRBS11, PRBS15, PRBS20, PRBS23, PRBS31, 1111, 1100, 1010, 0000, 1in8, 1in16, 2in8, and User Pattern.

- a. Square Wave patterns are only available when the **All Lanes** check box is selected. Not available with **20 Unframed Physical Lanes**.

When **User Pattern** is selected, enter the payload pattern hexadecimal value.

- **Invert** check box, when selected (cleared by default), inverts the test pattern meaning that every 0 will be changed for 1 and every 1 for 0. For example, the pattern 1100 will be sent as 0011.
- **All Lanes** check box is available with an unframed test with parallel interface. When selected, it allows to set the same TX and/or RX test pattern for all lanes. When **All Lanes** check box is cleared (default), a different test pattern may be set for each lane.

When the **All Lanes** check box is cleared, for an unframed test, the following pattern settings are available for each lane.

- **TX Pattern/RX Pattern:** Select the test pattern from the list for each lane and direction (TX and RX). Choices are **PRBS9, PRBS11, PRBS15, PRBS20, PRBS23, and PRBS31** (default).
- **Invert** check box, when selected (cleared by default), inverts the test pattern meaning that every 0 will be changed for 1 and every 1 for 0. For example, the pattern 1100 will be sent as 0011.
- **Pattern Sync** icon indicates the status of the received signal pattern. Refer to *Status Bar* on page 18 for more information.

## Test Setup - Test Configurator, Timer, and System

### BERT and Unframed BERT

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#### Bit Error

- **Pass/Fail Verdict** allows to enable bit-error-rate pass/fail verdict by selecting either **Bit Error Count** or **Bit Error Rate**. The default value is **Disabled**.
- **BER Threshold** allows to enter the threshold **Count** or **Rate** value that will be used to declare the pass/fail verdict.

For **Count**, enter the maximum bit error count allowed before declaring a fail verdict: **0** (default) to **999999**.

For **Rate**, enter the maximum bit error rate allowed before declaring a fail verdict: **1.0E-14** to **1.9E-01**. The default value is **1.0E-12**.

#### Service Disruption

The Service Disruption Time (SDT) corresponds to the duration associated to a defect that occurred in the network. For example a disruption that occurs during a network switching from the active channels to the backup channels or vice versa.

**Note:** *The service disruption measurements are cleared when changing the criteria.*

- **Defect** allows to choose on which layer and defect the service disruption time test will be performed. Choices depend on the selected test path.

Layer	Defect
Interface	LOS
Section/RS	LOF-S/RS-LOF, B1
Line/MS	AIS-L/MS-AIS, RDI-L/MS-RDI, REI-L/MS-REI, B2
STS/AU Path	AIS-P/AU-AIS, LOP-P/AU-LOP, RDI-P/HP-RDI, REI-P/HP-REI, B3, UNEQ-P/HP-UNEQ, PDI-P (SONET)
OTL <sup>a</sup>	LOF, OOF, LOL, LOR, OOR, Inv. Marker, FAS

Layer	Defect
FEC	FEC CORR, FEC UNCORR
OTUk <sup>b</sup>	AIS, LOF, OOF, LOM, OOM, BDI, IAE, BIAE, BIP-8, BEI, FAS, MFAS
ODUk <sup>b</sup>	AIS, OCI, LCK, BDI, BIP-8, BEI, FSF, BSF, FSD, BSD
OPUk <sup>b</sup>	AIS, CSF, PLM <sup>c</sup> , MSIM <sup>d</sup> , LOOMFI <sup>de</sup> , OOMFI <sup>de</sup> , OMFI <sup>de</sup>
BER	Pattern Loss, Bit Error (default)

- The service disruption time measurement is available per lane for OTL defects at the exception of LOL which is global for all lanes. Refer to *OTL-SDT* on page 262 for results per lanes.
- Only available on the top layer.
- Available when the PLM check box is selected (refer to page 105 for more information).
- Available with multiplex test only.
- Available with OPU4 only.

**Note:** *The Service Disruption Time measurement supports a parent defect approach where the SDT measurement is triggered when the selected defect or a higher defect in the signal structure hierarchy is detected. For example, if Bit Error is selected, an OPU AIS error will trigger an SDT event.*

- **No Defect Time (ms)** represents the period without any defects before stopping SDT measurement: **0.005 ms** to **2000 ms** (default is **300 ms**).
- **Disruption Monitoring** check box when selected (disabled by default) enables the disruption time measurements. However, the measurement will only start if the test is already started, or when the test will be started.

**Note:** *Clearing the **Disruption Monitoring** check box will stop the measurement without clearing the results. The disruption monitoring is automatically stopped without clearing results when the test is stopped. However, starting the test again while the **Disruption Monitoring** check box is selected will reset the results before restarting.*

## Test Setup - Test Configurator, Timer, and System

*BERT and Unframed BERT*

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- **Pass/Fail Verdict** check box when selected (cleared by default) enables service disruption pass/fail verdict and allows to set the threshold value.
- **SDT Threshold (ms)** allows to enter the SDT threshold value that will be used to declare the pass/fail verdict: **0.001 to 299999.999 ms** (default is **50 ms**). For EtherBERT, the minimum value is adjusted with respect to the **No Traffic Time**.

### **Restore < Test Application > Defaults**

Reverts the current test application to its default factory settings.



### **CFP/CFP2**

This tab gives hardware information related to the inserted transceiver module.

From the **Test** menu, tap **Setup, Test Configurator**, tap on the interface block or on the **Local** block for iSAM, and on the CFP/CFP2 tab.

## Clock

Allows the configuration of the clock synchronization.

From the **Test** menu, tap **Setup**, **Test Configurator**, and tap on the clock block.

### Clock Synchronization

**Clock Mode** allows to select the source clock that will be used for transmission (TX). The clock mode is forced to **Internal** for Multi-Channel OTN.

- **Internal:** Internal clock of the unit (STRATUM 3).
- **External:** Clock signal from the EXT CLK port.
- **Backplane:** Clock from another module on the platform. The other module must support the backplane clock feature and must be enabled. Not available when the **Backplane Clock** check box is selected (see page 85).

## Ext Clock In

**Note:** Available when the *Clock Mode* is set to *External*.

Allows to set the external clock for test synchronization.

- **Interface Type** allows the selection of the clock interface: **DS1** (default), **E1**, or **2MHz**.

**Ext Clock In** on a green background indicates that a valid clock is received.

**LOS** on a red background indicates that the received clock is not valid.

- **Termination** mode specifies how the Packet Blazer is connected to the synchronization signal. The **Termination** mode is set to **TERM** for 2MHz and configurable for DS1 and E1.

For DS1:

- **TERM** provides an input that terminates the DS1 signal.
- **DSX-MON** provides high-input impedance and compensation for resistive loss. This setting is useful for monitoring DS1 signals at DSX monitor points, which are resistor-isolated.
- **BRIDGE** provides high-input impedance for bridging lines that are already terminated. This setting is useful for bridging directly across copper cable pairs.

## Test Setup - Test Configurator, Timer, and System

### Clock

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For E1:

- **TERM** provides an input that terminates the E1 signal.
- **MON** provides high-input impedance and compensation for resistive loss. This setting is useful for monitoring E1 signals at monitor points, which are resistor-isolated.
- **BRIDGE** provides high-input impedance for bridging lines that are already terminated. This setting is useful for bridging directly across copper cable pairs.
- **Line Coding** allows the selection of the interface line coding.

For DS1: **AMI** and **B8ZS** (default).

For E1: **AMI** and **HDB3** (default).

- **Framing:** Allows the selection of the interface framing.

For DS1: **SF**, **SLC-96**, and **ESF** (default).

For E1: **PCM30** (default), **PCM30 CRC-4**, **PCM31**, and **PCM31 CRC-4**.

- **Frequency (MHz)** displays the frequency of the received signal rate.
- **Offset (ppm)** displays the positive or negative frequency offset between the standard rate specification and the rate from the received signal. The background color is used to indicate if the received clock meets (green) or not (red) the standard rate specification.

Signal	Standard Rate specification
DS1	1544000 ± 8 bit/s (± 4.6 ppm)
E1	2048000 ± 10 bit/s (± 4.6 ppm)
2MHz	2048000 ± 10 bit/s (± 4.6 ppm)

## Ext Clock Out

**Note:** Available when the *Clock Mode* is set to *Internal*, or *Backplane*.

Allows to set the clock that will be generated.

- **Interface Type** allows the selection of the clock interface: **DS1** (default), **E1**, and **2MHz**.

**Ext Clock Out** on a green background indicates that a valid clock is generated on the clock port.

**LOC** on a red background indicates that no clock is generated on the clock port.

- **LBO** (Line Build Out), available with DS1 only, allows the selection of the interface Line Build Out that meets the interface requirements over the full range of cable lengths: **DSX-1 (0-133 ft)** (default), **DSX-1 (133-266 ft)**, **DSX-1 (266-399 ft)**, **DSX-1 (399-533 ft)**, and **DSX-1 (533-655 ft)**.
- **Line Coding**, available with DS1 and E1, allows the selection of the interface line coding.  
For DS1: **AMI** and **B8ZS** (default).  
For E1: **AMI** and **HDB3** (default).
- **Framing**, available with DS1 and E1, allows the selection of the interface framing.  
For DS1: **SF**, **SLC-96**, and **ESF** (default).  
For E1: **PCM30** (default), **PCM30 CRC-4**, **PCM31**, and **PCM31 CRC-4**.

## Clock Output (LS)

**Note:** Available with OTU3/OTU3e1/OTU3e2/40GE (4 Lanes) and OTU4/100GE (10 Lanes) interface/rate.

**Frequency (MHz)** displays the frequency of the generated clock signal on the **CLOCK OUT LOW SPEED** port.

**Clock Out** indicates that a clock is generated on the **CLOCK OUT LOW SPEED** port (green) or not (red).

**Note:** Refer to CFP/CFP2 Reference Clock (MHz) on page 313 for more information.

**Note:** The Ref Out clock port provides an eye diagram timing reference for optical devices. This clock is provided for basic assessment. Formal qualification may require specialized external circuitry.

## Clock Output (HS)

**Note:** Available with OTU4/100GE (4 Lanes) interface/rate.

**Frequency (MHz)** displays the frequency of the generated clock signal on the **CLOCK OUT HIGH SPEED** port.

**Clock Out** indicates that a clock is generated on the **CLOCK OUT HIGH SPEED** port (green) or not (red).

**Note:** Refer to CFP/CFP2 Reference Clock (MHz) on page 313 for more information.

## Backplane

**Note:** Available when the **Clock Mode** is set to **External** or **Internal**.

**Backplane Clock** check box when selected (cleared by default) makes available the source clock (**Clock Synchronization - Clock Mode**) to other modules on the platform. Other modules on the platform need to set the **Clock Mode** as **Backplane** to use this clock. The **Backplane Clock** should be only enabled on one module on the same platform.

**Backplane** indicates that the background clock is generated (green) or disabled (gray).

**LOC** on a red background indicates, when the backplane clock is enabled, that the synchronization is not possible with the selected reference clock.

# EtherBERT and Unframed BERT

From the **Test** menu, tap **Setup**, **Test Configurator**, and tap on the **EtherBERT** or **Unframed BERT** block.

## LINK

**Note:** Available with OTN BERT test application with Ethernet client (EoOTN).

A green/red arrow is used to indicate the status of the link at the PCS level:

- A green arrow indicates that the link is up.
- A red arrow indicates alarms at the PCS level, the link is down.

The **Local Fault Detected**, **Local Fault Received**, **Remote Fault**, **LOA** (OTU4), **Hi-BER** (OTU4), **LOBL1027B** (OTU3), **Hi-BER1027B** (OTU3), and **LOAML1027B** (OTU3) alarms are displayed. Refer to *Ethernet* on page 219, *Ethernet - PCS Lanes* on page 221, and *Transcoding* on page 248 for more information.

## Restore < Test Application > Defaults

**Note:** Available with OTN BERT test application with Ethernet client (EoOTN).

Reverts the current test application to its default factory settings.

## Pattern

- **Coupled RX to TX** check box, when selected (default), couples both the TX and RX signal with the same test pattern.
- **No Pattern Analysis (Live)** check box when cleared (default), monitors the incoming traffic pattern and Round-Trip Latency. For live traffic, the **No Pattern Analysis (Live)** check box should be selected as the traffic is a live pattern and in this case no monitoring is required. See *BER* on page 217 for more information.



- **TX Pattern/RX Pattern:** Select the test pattern from the list for each direction (TX and RX) if required. Choices are **PRBS9**, **PRBS11**, **PRBS15**, **PRBS20**, **PRBS23**, **PRBS31** (default), and **User Pattern**.

When **User Pattern** is selected, enter the payload pattern hexadecimal value.

- **Invert** check box, when selected (cleared by default), inverts the generated/expected test pattern meaning that every 0 will be changed for 1 and every 1 for 0. For example, the pattern 1100 will be sent as 0011.

### Bit Error

- **Pass/Fail Verdict** allows to enable and configure bit error rate/count threshold prior to run the test. This allows for a simple pass/fail verdict, leaving no room for misinterpretation of the test results. To enable the pass/fail verdict, select either **Bit Error Counter** or **Bit Error Rate** (default is **Disabled**).
- **BER Threshold** allows to enter the threshold **Count** or **Rate** value that will be used to declare the pass/fail verdict.

For **Count**, enter the maximum bit error count allowed before declaring a fail verdict: **0** (default) to **999999**.

For **Rate**, enter the maximum bit error rate allowed before declaring a fail verdict: **1.0E-14** to **1.9E-01**. The default value is **1.0E-12**.

### Service Disruption

- **No Traffic Time** (ms) represents the time between two Ethernet Frames that is acceptable without raising an alarm including a Service Disruption event: **0.005 ms to 1000 ms** in step of 0.005 ms (default is **50 ms**). Only available with EtherBERT.
- **Disruption Monitoring** check box when selected (disabled by default) enables the disruption time measurements. However, the measurement will only start if the test is already started, or when the test will be started.

**Note:** *Clearing the **Disruption Monitoring** check box will stop the measurement without clearing the results. The disruption monitoring is automatically stopped without clearing results when the test is stopped. However, starting the test again while the **Disruption Monitoring** check box is selected will reset the results before restarting.*

- **Pass/Fail Verdict** allows to enable and configure the SDT Threshold.
- **SDT Threshold** allows to configure the amount of time with no traffic that is accepted before failing the test: **0.005 to 299999.995** ms in step of 0.005 ms (default is **50** ms). The threshold value cannot be less than the **No Traffic Time** value.

### Shaping

- **TX Rate** allows the selection of the transmission rate in percentage of utilization (100 percent by default), Mbit/s, Gbit/s, Frame/s, or IFG. For Ethernet, the maximum percentage is 105 percent depending on the frame size selected.
- **Enable TX** check box is automatically selected when starting the test allowing stream generation; automatically cleared when the test stops. The **Enable TX** check box may also be selected or cleared while the test is running.

## Test Setup - Test Configurator, Timer, and System

*EtherBERT and Unframed BERT*

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### Ethernet Frame

**Frame Size (Bytes)** allows to enter the frame size for Ethernet test applications. The range is from **64**<sup>1</sup> to **16000**<sup>2</sup>.

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

Component	Description
VLAN	4 bytes per VLAN (up to 3 VLAN for EtherBERT test application and only 1 VLAN for EoOTN client)
UDP	8 bytes
Ethernet Header	14 bytes
IPv4	20 bytes
IPv6	40 bytes

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

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1. The minimum frame size will be adjusted according to the frame structure and components selected.
  2. The maximum frame size is limited to 10000 for 10/100/1000Mbps electrical interface.

**Note:** *The following frame parameters are only available for OTN BERT test application with Ethernet client (EoOTN).*

- **Source MAC Address** is the module default and unique Source Media Access Control (MAC) address that is automatically given to the stream. Tap the **Source MAC Address** field if the stream MAC address has to be changed and enter the new MAC address.
- **Destination MAC Address** is the destination MAC address for the stream. The default setting is the MAC address of the port. Tap the **Destination MAC Address** field if the stream MAC address has to be changed and enter the new MAC address.
- **VLAN ID** check box, when selected (cleared by default), allows the configuration of the following VLAN parameters. Selecting the VLAN check box affects the **Frame Size** value.
  - **VLAN ID** sets the VLAN ID. Choices are **0** through **4095** (default is **2**). Refer to *VLAN ID and Priority* on page 461 for more information.
  - **Priority** sets the VLAN user priority. Choices are **0** (default) to **7**. Refer to *VLAN ID and Priority* on page 461 for more information.
  - **Type** indicates the supported VLAN Ethernet type which is **0x8100**.

# EtherSAM - Burst

**Note:** The **Burst** settings are only available for configuration when the **Burst Test** check box is selected (see page 94).

From the **Test** menu, tap **Setup**, **Test Configurator**, tap on the test block, and on the **Burst** tab.

**Note:** The burst configuration parameters are defined globally for all services but **CBS**, **EBS**, and **Burst Max Rate** parameters are as per each service configuration.

## Burst Sequence

The graphic illustrates the configured burst sequence that 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-burst time (**Refill Delay Ratio**).
- **Burst Frames** represents the burst frame ratio in percentage that is equal to the subtraction 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** is 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 (%)** is 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** percent (**50** percent is the default as well as the standard's minimum recommended value).
- **Burst/IR Frame Ratio (%)** is 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 **10** to **90** percent (**90** percent is the default as well as the standard's recommended percentage value).

### Table

**Note:** *Test time values are only displayed for enabled services.*

- **Service No** indicates the service number.
- **Service Name** indicates the name of the service.
- **Direction**, available with **Dual Test Set**, indicates results from local to remote (L->R) and remote to local (R->L).
- **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.

### EtherSAM - Global

From the **Test** menu, tap **Setup, Test Configurator**, tap on the test block, and on the **Global** tab.

#### Dual Test Set

- **Dual Test Set (DTS)** check box when selected (cleared by default) enables EtherSAM **Dual Test Set**. Once **Dual Test Set** is enabled, use the **Discover Remote** button to select a remote unit.

**Note:** *Alternatively it is possible to use the Discover Remote button to connect to a remote module and automatically enable the Dual Test Set. For more details, refer to Discover Remote Button on page 374.*

- **Disconnected** indicates that there is no connection established with a remote module.
- **Connected** indicates that the connection is established with a remote module.
- **Discover Remote** button allows to discover remote modules supporting **Remote Loopback** and/or **Dual Test Set**. For more details, see *Discover Remote Button* on page 374.



### Subtests

- **Service Configuration Test** verifies if the network configuration is correct for each service before starting a long term test (Service Configuration Test). To test the network configuration, a ramp test and/or a burst tests is/are generated for each configured service.
- **Seconds per Service** indicates the **Service Configuration Test** duration in seconds based on the configured Services, Ramp, and Burst settings.

- **Ramp Test** check box when selected (default):

In the first stage of the test, when **CIR** check box is selected (see *SLA Parameters* on page 176), the throughput is increased incrementally in steps until the CIR level is reached. During the first stage, the maximum Jitter, Latency, Frame Loss, and throughput are measured and are 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 selected (see *SLA Parameters* on page 176), the throughput is 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 **Traffic Policing** check box is selected (see *Test Parameters* on page 175), the throughput is increased one step over the **CIR+EIR** if selected 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.

## Test Setup - Test Configurator, Timer, and System

*EtherSAM - Global*

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- **Burst Test** check box when selected (cleared by default) verifies that the expected burst size can be transmitted at maximum burst rate with minimal loss.

**CBS** (Committed Burst Size) check box when selected (see *SLA Parameters* on page 176), verifies the performance of a committed burst size at **CIR**'s average **TX** rate.

**EBS** (Excess Burst Size) check box when selected (see *SLA Parameters* on page 176), 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 are compared to the SLA thresholds to declare a pass/fail verdict. For **EBS**, the throughput is compared to the SLA thresholds to declare a pass/fail verdict.

The burst test procedure is generated for each enabled service.

- **Service Performance Test** check box when selected (default) verifies that the **SLA** parameters (see *SLA Parameters* on page 176) are met over time by running multiple services simultaneously. The maximum Jitter, Latency, Frame Loss, and average throughput are measured and compared to the configured thresholds to declare pass/fail verdicts. The **Service Performance Test** is only performed for services that have their **CIR** check box selected.

**Subtest Duration** allows to set the duration time, in HH:MM:SS format, for the **Service Performance Test** (default is 10 minutes).

- **Global Test Duration Estimate** indicates the total estimate duration of the test.

### Global Options

- **Per Direction Configuration** check box when selected (default) specifies that the values can be configured independently for each direction (local to remote and remote to local) for **Dual Test Set**. When the **Per Direction Configuration** check box is cleared the configuration will be coupled and the values apply to both directions.

**Note:** *For Dual Test Set the Per Direction Configuration is only available when the communication with the remote module is established.*

- **Pass/Fail Verdict** check box when selected (default) enables the pass/fail verdict. A global pass/fail verdict is given for the EtherSAM test, **Service Configuration**, and **Service performance** (for each service). The pass/fail verdict is based on the following criteria: **Frame Loss**, **Max Jitter**, **Round-Trip Latency**, and **Average RX Rate**.

### Restore EtherSAM Defaults

Reverts the current test application to its default factory settings.

# EtherSAM - Ramp

**Note:** The **Ramp** tab is only available for configuration when the **Ramp Test** check box is selected (see page 94).

From the **Test** menu, tap **Setup**, **Test Configurator**, tap on the test block, and on the **Ramp** tab.

**Note:** The ramp configuration parameters are defined globally for all services but the presence of CIR+EIR, and Traffic Policing steps are as per each service configuration. CIR, CIR+EIR, and Traffic Policing steps are part of the step list as soon as they are enabled for at least one service even if that service is not enabled.

## Dynamic Ramp

The graphic displays the percentage of each CIR level step in time.

## Step Time

The step time is the test duration for each ramp step: **5** (default) to **60** seconds.

## Ramp Duration

The ramp duration indicates the total time required to perform all the ramp steps for each service.

## Add Step

Allows to add a new ramp step. Enter the CIR percentage from **1** to **99**. A maximum of 7 pre CIR steps can be added in the ramp configuration.

### **Delete Step**

Allows to delete a step from the ramp. Select the step from the list and tap on **Delete**.

### **Defaults**

Reverts the ramp configuration to its default factory settings.

## Frequency

From the **Test** menu, tap **Setup**, **Test Configurator**, tap on the interface block, and on the **Frequency** tab.

### TX Frequency

- **TX Frequency (GHz)** indicates the frequency (actual frequency + Frequency offset) used for transmission.

**Note:** *Frequency offset is not available for Multi-Channel OTN test application.*

- **Offset (ppm)** check box, when selected (cleared by default), allows to set the frequency offset that will be generated. Use the “+” or “-” button to respectively increment or decrement the frequency offset value based on the defined **Increment/Decrement Size**, or directly type the frequency offset value in the field. The range is  $\pm 120$  ppm for Ethernet test applications, and  $\pm 50$  ppm for Transport Framed, and  $\pm 120$  ppm for Transport Unframed test applications.

Interface	Frequency Offset <sup>a</sup>	Nominal Frequency
OTU3	$\pm 50$ ppm (Framed)	43018413559 bit/s
OTU3e1	$\pm 120$ ppm (Unframed)	44571000000 bit/s
OTU3e2		44583000000 bit/s
OTU4		111810000000 bit/s

- 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.

**Step Size (ppm)** allows to set the increment/decrement value (from 0.1 to either 50 or 120 depending on the test configuration) that will be used when changing the frequency offset with the “+” or “-” button.

**Note:** The following frequency statistics are available for each lane.

### RX Frequency

- **Frequency (GHz)** indicates the frequency of the input signal.
- **Offset (ppm)** indicates the frequency offset between the standard rate specification and the rate at the input signal.

**Note:** For both **Frequency** and **Offset** the following background colors are used.

Background color	Description
Green	The frequency is in range.
Red	The frequency is out-of-range or LOC Lane. LOC is also displayed.
Gray	Pending state.

- **Max. Negative Offset (ppm)** indicates the maximum negative frequency offset between the standard rate specification and the rate from the received signal.
- **Max. Positive Offset (ppm)** indicates the maximum positive frequency offset between the standard rate specification and the rate from the received signal.

**Note:** Refer to Interface on page 229 for more information on standard rate specifications.

### FTFL/PT and PT

For OTN BERT and OTN-SONET/SDH BERT: From the **Test** menu tap **Setup**, **Test Configurator**, tap on the interface block, and on the **FTFL/PT** tab.

For Multi-Channel OTN: From the **Test** menu, tap **Setup**, **Test Configurator**, tap on either:

- the interface block, and on the **PT** tab to configure the higher ODU layer.
- the test block (**ODU Channels**), and on the **PT** tab to configure the lower ODU layer.

### ODUx Buttons

Tap on an **ODUx** button to select the multiplexed level. Not available with Multi-Channel OTN lower ODU level.



### FTFL

Allows the configuration of the Forward and Backward ODU Fault Type Fault Location (FTFL) to be generated. Not available with Multi-Channel OTN.

- **Fault Indication** and **Fault Indication Code** allow the selection of the FTFL fault indicator message/code (byte 0 for forward, byte 128 for backward) to be generated.

Fault Indication	Fault Indication Code (Hex)
No fault	00 (default)
Signal fail	01
Signal Degrade	02
Reserved	03 <sup>a</sup>

- a. Selecting **Reserved** will use the hexadecimal code 03 but, all codes from 03 to FF are reserved for future international standardization.

**Note:** *The **Fault Indication Code** field is automatically updated when the **Fault Indication** is changed and vice versa.*

- **Operator Identifier** allows editing the Operator Identifier to be generated (bytes 1 to 9 for forward, bytes 129 to 137 for backward; 9 characters allowed). By default no Operator Identifier is defined.
- **Operator Specific** allows editing the Operator Specific to be generated (bytes 10 to 127 for forward, bytes 138 to 255 for backward; 118 characters allowed). By default no Operator Specific is defined.

## Test Setup - Test Configurator, Timer, and System

FTFL/PT and PT

### PT / Global PT

**Note:** *Global PT, available with Multi-Channel OTN, indicates that the PT settings apply to all channels.*

**Note:** *Changing the payload type (PT) does not alter the signal structure; it only modifies the OH value that is generated.*

#### ► Payload Type and Code

**Generated:** Allows to select the payload signal type to be generated either by selecting the payload type from the list or by entering its code in hexadecimal (**00** to **FF**).

**Expected:** Allows to select the expected payload signal type.

**Note:** *Codes not listed in the table are reserved for future standardization (Reserved For International Standardization).*

Payload type	Hex Code	MSB 1234	LSB 5678
Reserved for International Standardization <sup>a</sup>	00	0000	0000
Experimental mapping	01	0000	0001
Asynchronous CBR mapping	02	0000	0010
Bit Synchronous CBR mapping	03	0000	0011
ATM mapping	04	0000	0100
GFP mapping	05	0000	0101
Virtual Concatenation Signal	06	0000	0110
PCS Codeword Transparent Ethernet	07	0000	0111
FC-1200 into ODU2e	08	0000	1000
GFP mapping into extended OPU2	09	0000	1001
OC-3/STM-1 into ODU0	0A	0000	1010
OC-12/STM-4 into ODU0	0B	0000	1011
FC-100 into ODU0	0C	0000	1100
FC-200 into ODU1	0D	0000	1101
FC-400 into ODUflex	0E	0000	1110

Payload type	Hex Code	MSB 1234	LSB 5678
FC-800 into ODUflex	0F	0000	1111
Bit Stream with Octet Timing mapping	10	0001	0000
Bit Stream Without Octet Timing mapping	11	0001	0001
IB SDR mapping into ODUflex	12	0001	0010
IB DDR mapping into ODUflex	13	0001	0011
IB QDR mapping into ODUflex	14	0001	0100
ODU Multiplex with ODTUjk	20	0010	0000
ODU Multiplex with ODTUk.ts/ODTUjk	21	0010	0001
Not Available <sup>b</sup>	55	0101	0101
Reserved Codes for Proprietary Use <sup>c</sup>	80	1000	0000
NULL Test Signal mapping	FD	1111	1101
PRBS Test Signal mapping	FE	1111	1110

- Selecting **Reserved for International Standardization** will use the hexadecimal code 00 but, all codes not listed in the previous table at the exception of those covered in notes b and c are reserved for future standardization.
- Selecting **Not Available** will use the hexadecimal code 55 but, 66 and FF are also Not Available payload types.
- Selecting **Reserved Proprietary** will use the hexadecimal code 80 but, all codes from 80 to 8F are reserved proprietary payload types.

**Note:** *The Code field is automatically updated when the Payload Type is changed and vice versa.*

- **OPU-PLM**, when selected, enables the OPU-PLM alarm analysis.

## GFP-F/GFP-T

**Note:** Only available with Ethernet **1GbE**, **10GbE**, or **Ethernet (flex/GFP-F)** client.

From the **Test** menu, tap **Setup**, **Test Configurator**, and tap on the **GFP-F/GFP-T** block.

**Note:** Refer to Generic Framing Procedure (GFP) on page 439 for more information on *Client Data* and *Client Management frames*.

- **CDF pFCS** (Client Data Frames payload Frame Check Sequence) enables the presence of the payload FCS for the client frames. This setting is only available with **Ethernet (flex/GFP-F)** client.
- **CMF pFCS** (Client Management Frames payload FCS) enables the presence of the payload FCS for the management frames. The **CMF pFCS** check box is automatically cleared when injecting FDI or RDI alarms.
- **EXI** (Extension Header Identifier) allows the selection of the type of GFP Extension Header. Choices are **Null** (0000) - (Default) and **Linear** (0001). EXI is only configurable with **Ethernet (flex/GFP-F)** client.
- **CID** (Channel Identifier) selects the communication channel used for the signal transmission for *both Client Data and Client Management frames*. Choices are from **0** (default) through **255**. CID is only available when EXI is set to **Linear**.

The status **Mismatch** is displayed next to the CID value when the TX and RX CID values differ.

- **Delta** indicates the GFP state machine synchronization parameter. Delta is set to 1.

## Interface (Ethernet)

From the **Test** menu, tap **Setup, Test Configurator**, the interface block, and the **Interface** tab.

### LINK

An arrow is used to indicate the status of the test link (at the PCS level for parallel interfaces).

- A green arrow indicates that the link is up.
- A red arrow indicates alarms, the link is down.
- A gray arrow indicates awaiting incoming data to provide a status.

The **Local Fault Detected**, **Local Fault Received**, **Remote Fault**, **LOA**, and **Hi-BER** alarm status are displayed. Refer to *Ethernet* on page 219 and *Ethernet - PCS Lanes* on page 221 for more information.

## Physical Interface

For parallel interface, the following information is displayed for each optical lane.

- **Optical Lane** indicates the optical lane number.

Optical Interface	Optical Lane Number
40GE (4 Lanes) [41.25 Gbit/s] 100GE (4 Lanes) [103.125 Gbit/s]	0 through 3
100GE (10 Lanes) [103.125 Gbit/s]	0 through 9

- **Laser** indicates the status of the laser: **ON** with the laser pictogram (emitting an optical laser signal) or **OFF**.
- **TX Power (dBm)** indicates, when supported, the transmit power level of the optical lane/laser in dBm.
- **Wavelength (nm)** indicates the detected wavelength when supported by the transceiver.
- **RX Power (dBm)** indicates, when supported, the current received power level of the optical laser/lane in dBm.

Green: Power level in range.

Yellow: Power level out-of-range.

Red: Loss of signal or power level is close to damage.

Gray: The operational range value is either not available or not supplied by the CFP.

- **Min RX Power (dBm)** indicates, when supported, the minimum received power level of the optical laser/lane in dBm.
- **Max RX Power (dBm)** indicates, when supported, the maximum received power level of the optical laser/lane in dBm.
- **Laser ON/OFF** button, available with parallel interface, is used to activate the laser control per optical lane or for all lanes.

Optical lane numbers are from **0** to **3** or from **0** to **9** depending on the selected interface/rate.

- **All Lanes** check box, when selected, applies the change(s) to all optical lanes at once.
- **Optical Lane** indicates the optical lane numbers and **All** which represents the setting for all optical lanes when the **All Lanes** check box is selected.
- **Laser** check box, when selected, indicates that the corresponding optical laser lane is activated and emitting an optical laser signal.
- **Lasers OFF at Start-Up** check box when selected automatically turns OFF the laser for serial interfaces or all lasers for parallel interfaces when starting the Packet Blazer or when switching from one test application to another. However the laser remains ON, on a remote module receiving a request for a DTS connection or a loopback command. This check box is cleared by default.
- **Power Range (dBm)** indicates the transceiver operational RX power range.

## TX Frequency

**Note:** *The following TX Frequency information applies to serial interface only, refer to TX Frequency on page 100 for parallel interface.*

- **TX Frequency (GHz)** indicates the frequency (actual frequency + Frequency offset) used for transmission.

**Note:** *Frequency offset is not available with RFC 6349 test application.*

- **Offset (ppm)** check box, when selected (cleared by default), allows to set the frequency offset that will be generated:  $\pm 120$  ppm. Use the “+” or “-” button to respectively increment or decrement the frequency offset value based on the defined **Increment/Decrement Size**, or directly type the frequency offset value in the field.
- **Step Size (ppm)** allows to set the increment/decrement value (from 0.1 to the maximum offset) that will be used when changing the frequency offset with the “+” or “-” button.



## RX Frequency

**Note:** The following RX Frequency information applies to serial interface only, refer to RX Frequency on page 101 for parallel interface. .

- **Frequency (GHz)** indicates the frequency of the input signal.
- **Offset (ppm)** indicates the frequency offset between the standard rate specification and the rate at the input signal.

**Note:** For both **Frequency** and **Offset** the following background colors are used.

Background color	Description
Green	The frequency is in range.
Red	The frequency is out-of-range or LOC Lane. LOC is also displayed.
Gray	Pending state.

➤ **Max Offset (ppm)**

**Negative** indicates the maximum negative frequency offset between the standard rate specification and the rate from the received signal.

**Positive** indicates the maximum positive frequency offset between the standard rate specification and the rate from the received signal.

## Labels

For SONET/SDH BERT, from the **Test** menu, tap **Setup, Test Configurator**, the interface block, and on the **Labels** tab.

For OTN-SONET/SDH BERT, from the **Test** menu, tap **Setup, Test Configurator**, the protocol block, and on the **Labels** tab.

**Note:** *Selecting a Label byte to be generated will automatically update the corresponding OH byte. Refer to OH - SONET/SDH on page 351 for more information.*

## Labels

- **STS/AU Path (C2):** The C2 byte is allocated to indicate the content of the STS SPE / VC, including the status of the mapped payloads.

**Generated:** Select the C2 byte from the list. Selecting a C2 byte value will automatically update the OH C2 selection and vice versa. Refer to C2 on page 357 for more information.

- **PLM-P/UNEQ-P / HP-PLM/HP-UNEQ:** Enables the Payload Mismatch and STS/AU UNEQ monitoring. This setting is coupled with the configuration of *Traces - SONET/SDH* on page 303.

**Expected:** Select the expected C2 byte from the list. Refer to C2 on page 357 for more information.

## Local Details (iSAM)

From the **Test** menu, tap **Setup**, **Test Configurator**, and the **More** button from the **Local** block.

### LINK

- An arrow is used to indicate the status of the test link (at the PCS level for parallel interfaces).
  - A green arrow indicates that the link is up.
  - A red arrow indicates that the link is down.
  - A gray arrow indicates awaiting incoming data to provide a status.
- **Interface/Rate** or **Port** choices depend on the rates available on the module.

Interface/Rate
100GE (10 Lanes) [103.125 Gbit/s]
100GE (4 Lanes) [103.125 Gbit/s]
40GE (4 Lanes) [41.25 Gbit/s]

- **Connector** allows the selection of the module's CFP interface.

Interface/Rate	Connector
100GE (10 Lanes) [103.125 Gbit/s]	CFP
100GE (4 Lanes) [103.125 Gbit/s]	CFP2 (100GE only)
40GE (4 Lanes) [41.25 Gbit/s]	Internal Loopback
	EXFO CXP Adaptor (Remote CXP: EXFO CXP Adaptor)
	EXFO CXP Adaptor (Remote CXP: Standard CXP)

## Test Setup - Test Configurator, Timer, and System

### *Local Details (iSAM)*

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- **Lasers OFF at Start-Up** allows to automatically turn off all lasers when starting the module or when switching from one test application of the same group (Ethernet or Transport) to another. This check box is cleared by default.

## MAC

- **Address** indicates the default and unique Media Access Control (MAC) address given to the Ethernet port.
- **VLAN ID/Priority** check box when selected, cleared by default, enables C-VLAN with VLAN Ethernet type of 8100 and allows to set both VLAN ID and priority.

**VLAN ID** choices are **0** through **4095**; default is **2**; refer to *VLAN ID and Priority* on page 461 for more information.

**Priority** choices are **0** (default) to **7**. Refer to *VLAN ID and Priority* on page 461 for more information.

### IP

- **IP Version** is set to **IPv4**.
- **Automatic IP (DHCP)** check box, when selected (cleared by default), allows to dynamically obtain an IP address from a DHCP (Dynamic Host Configuration Protocol) server.

**Note:** *IP Address, Subnet Mask, and Default Gateway are not available when the Automatic IP (DHCP) check box is selected.*

- **IP Address** allows to enter the source IP address for the stream. The default setting is 10.10.x.y, where x and y are respectively the two least significant bytes of the port default MAC address.
- **Subnet Mask** allows to enter the Subnet Mask for the stream. The default setting is **255.255.0.0**.
- **Default Gateway** check box, when selected (cleared by default), allows to enter a default Gateway IP address. When the **Default Gateway** check box is selected, its default address is **0.0.0.0**.

### Remote Discovery ID

**Remote Discovery ID** is used to easily identify this module in case another module is performing a discovery scan. Up to 16 alpha-numeric characters are allowed.

### MAC/IP/UDP

**Note:** Only available with Framed Layer 2 (see **Framing** from the Modify Frame Structure). For Traffic Gen & Mon all parameters are configurable per stream. For EtherSAM all parameters are configured per service.

From the **Test** menu, tap **Setup, Test Configurator**, and...

- For **RFC 2544** and **EtherBERT**, tap on the protocol block.
- For **EtherSAM**, and **Traffic Gen & Mon**, tap on the protocol block, and on the **MAC/IP/UDP** tab.

### Stream Selection (Traffic Gen & Mon)

The Traffic Gen & Mon test application supports the configuration of up to 16 different streams. Select the stream to be configured by either using the left/right arrow or by tapping over the stream numbers area then tapping on a specific stream number.

### Service Selection (EtherSAM)

The EtherSAM test application supports the configuration of up to 10 different services. Select the service to be configured by either using the left/right arrow or by tapping over the service numbers area then tapping on a specific service number.

### Couple with Interface

The **Frame Format**, **Network Layer**, and all **IP** and **VLAN** settings are coupled with the interface (see *Network* on page 128) when the **Couple with Interface** check box is selected (default). The **Source MAC Address** is always coupled.

## Modify Frame Structure

Allows to modify the structure of the frame.

### ► Global Option

**IP Version** allows to select **IPv4** (default) or **IPv6** that will be used for both the interface and all streams/services.

### ► Framing

► **Frame Format** (layer 2) allows to select **Ethernet II** (default) or **802.3 SNAP** as the frame format.

► **Network Layer** (layer 3) sets the network traffic type: **IPv4** (default)/**IPv6**, or **None**.

► **Transport Layer** is disabled when the **Network Layer** is **None**.

Test Application	Transport Layer
EtherSAM	None, UDP (default)
RFC 2544	UDP
EtherBERT	UDP
Traffic Gen & Mon	None, UDP (default)

► **MPLS**: The **MPLS Label** check box, when selected (cleared by default), enables 1 or 2 MPLS labels allowing management and test frames to be transmitted and received. Only available with EtherSAM and Traffic Gen & Mon test applications.

► **VLAN**: The **VLAN Tag** check box when selected (cleared by default), enables up to 3 stacked VLAN.

See *VLAN* on page 119 for additional VLAN settings.

## Preamble/SFD

Indicates that the frame structure contains the Preamble and SFD.

### MAC

- **Source MAC Address** indicates the default and unique Media Access Control (MAC) address given to the Ethernet port.
- **Destination MAC Address:** Enter the destination MAC address for the stream. The default setting is the source MAC address. The destination MAC Address field is not accessible when the **Resolve MAC Address** check box is selected.
- **Resolve MAC Address** check box, when selected (default), sends a request to the network to retrieve the MAC address corresponding to the selected destination IP address. This setting is coupled with the **Resolve MAC Address** check box from *IP* on page 121. This check box is not available when the **Network Layer** is set to **None** (refer to *Modify Frame Structure* on page 117).
- **EtherType** is set to the following values by default and is configurable from **0x0000** to **0xFFFF** when the **Network Layer** is set to **None**:
  - 0x0000** when **Network Layer** is set to **None**
  - 0x0800** for IPv4
  - 0x86DD** for IPv6
  - 0x8847** for MPLS
  - 0x88B7** when **Network Layer** is set to **None** with EtherBERT test.
- **OUI**, available when the frame format **802.3 SNAP** is selected, allows the selection of the Organizationally Unique Identifier (OUI):
  - RFC1042** (0x000000) - (default)
  - User Defined**, available when **Network Layer** is set to **None**, allows to enter the **OUI** value: **0x000000** (default) to **0xFFFFF**.



**Note:** *Source/Destination Flooding and Flood Range are only available with Traffic Gen & Mon when the Network Layer is set to None (see page 117).*

- **Source Flooding** and **Destination Flooding** check boxes when selected (cleared by default) allows generation of frames using source/destination MAC addresses flooding as follows: The first frame is transmitted starting with the least significant bits of the source/destination MAC address covered by the range set to 0; each subsequent frame is transmitted by incrementing the least significant bits by 1; when the upper limit of the range is reached, the source/destination MAC address restarts over with the least significant bits covered by the range set to 0.
- **Flood Range** is the range of the least significant bits used for the Source Flooding and/or Destination Flooding: **2 (1 bit)**, **4 (2 bits)**, **8 (3 bits)**, **16 (4 bits)**... up to **16777216 (24 bits)** (default).

### VLAN

**Note:** *VLAN is only available when the VLAN Tag is enabled; refer to Modify Frame Structure on page 117.*

For each VLAN tag enabled (C-VLAN/S-VLAN/E-VLAN) the following parameters are configurable.

- **VLAN ID** choices are **0** through **4095**; refer to *VLAN ID and Priority* on page 461 for more information.
- **Priority**, VLAN user priority, choices are **0** (default) to **7**. Refer to *VLAN ID and Priority* on page 461 for more information.
- **Type**, VLAN Ethernet Type, choices are **8100** (default for C-VLAN), **88A8** (default for S-VLAN), **9100** (default for E-VLAN), **9200**, and **9300**.
- **Drop Eligible**:, when set to **Yes** (DEI = 1), the transmitted frames will be dropped first on receipt when congestion occurs under test. Drop Eligible is not available when VLAN type is 8100. This parameter is set to **No** by default.

### MPLS

**Note:** *MPLS is only available when the MPLS Label is enabled; refer to Modify Frame Structure on page 117.*

- **Label** allows the selection of the MPLS TX labels: **0** to **1048575** (default is **16**). Refer to for the list of MPLS labels.
- **COS** allows the selection of the Class Of Service.
  - 0 (000 - Low)** (default)
  - 1 (001 - Low)**
  - 2 (010 - Low)**
  - 3 (011 - Low)**
  - 4 (100 - High)**
  - 5 (101 - High)**
  - 6 (110 - High)**
  - 7 (111 - High)**
- **TTL** allows the selection of the **Time to Live** value: **0** to **255** (default is **128**).

## IP

For **IPv4** the following configuration parameters are available.

- **Automatic IP (DHCP)** check box, when selected (cleared by default), allows to dynamically obtain an IP address from a DHCP (Dynamic Host Configuration Protocol) server.
- **Source IP Address** allows to enter the source IP address for the stream. The default setting is 10.10.x.y, where x and y are respectively the two least significant bytes of the port default MAC address. Not available when the **Automatic IP (DHCP)** check box is selected.
- **Destination IP Address** allows to enter the destination IP address for the stream. The default setting is the source IP address.

For **IPv6** the following configuration parameters are displayed: **Source Link-Local IPv6 Address**, and **Source Global IPv6 Address**. Tap on the **IPv6 Config** button to access all settings.

- **Link-Local IPv6 Address** (LLA) is used for local communication between on-link neighbors and for Neighbor Discovery process.
  - **Mode**
    - Stateless Auto** (default) allows automatic generation of the IPv6 address based on the MAC address.
    - Static** allows to enter the IP Address.
  - **Address**, available with **Static** mode, allows to select the Link-Local IPv6 Address. The accepted range is from **FE80:0000:0000:0000:0000:0000:0000** to **FE80:0000:0000:0000:FFFF:FFFF:FFFF:FFFF**. The default address is **FE80::[Interface ID]**, where **[Interface ID]** is generated from the source MAC address. When the **Address** field is selected for editing using virtual keyboard, the **Previous IPs** button appears allowing to select a previously configured IP address.

- **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** (default) allows automatic generation of the IPv6 address based on the Link-Local address interface ID and the prefix obtained from the router advertisements. If no Interface ID has been obtained for the **Link Local Address**, the global address will not be generated.
  - Static** allows to enter the IP address.
- **Address**, available with **Static** mode, allows to select the **Global IPv6 Address**. The accepted range is from **0000:0000:0000:0000::[Interface ID]** to **FFFF:FFFF:FFFF:FFFF::[Interface ID]**. The default address is **2001:0000:0000:0000::[Interface ID]**, where **[Interface ID]** is generated from the source MAC address. When the **Address** field is selected for editing using virtual keyboard, the **Previous IPs** button appears allowing to select a previously configured IP address.
- **Interface ID Coupled**, available when the **Source Global IPv6 Address** mode is **Static**, allows to couple the interface ID of the Global address to the Link-Local source address.
  - Enabled** (default): Only the 64 bit (MSB) prefix ID in the IPv6 address is configurable, and the 64 bit (LSB) Interface ID is not configurable (read-only).
  - Disabled**: The 64 bit (MSB) Prefix ID and 64 bit (LSB) Interface ID in the IPv6 address are configurable.

- **Prefix Mask**, available with **Static** mode, allows to specify a prefix that defines the subnet. The accepted range is **0000:0000:0000:0000:0000:0000:0000:0000** to **FFFF:FFFF:FFFF:FFFF:0000:0000:0000:0000**. 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.
- **Default Gateway** allows the configuration of the default gateway address to forward packets outside the subnet.
- **Mode**
  - Automatic** (default) allows automatic selection of the default gateway.
  - Static** allows entering the default gateway IP address.
- **Address**, available with **Static** mode, allows to enter the IP address of the Default Gateway. The accepted range is from **0000:0000:0000:0000:0000:0000:0000:0000** to **FE80:0000:0000:0000:FFFF:FFFF:FFFF:FFFF**. The default address is **FE80:0000:0000:0000:0000:0000:0000:0000**.
- **IPv6 Destination Address** allows to select the destination IP address for the stream that must start with **FE80**. The accepted range is from **0000:0000:0000:0000:0000:0000:0000:0001** to **FFFF:FFFF:FFFF:FFFF:FFFF:FFFF:FFFF:FFFF**. The default address is **2001::**. When the **Address** field is selected for editing using virtual keyboard, the **Previous IPs** button appears allowing to select a previously configured IP address.

## Test Setup - Test Configurator, Timer, and System

### MAC/IP/UDP

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The following configuration parameters are available for both **IPv4** and **IPv6** unless otherwise specified.

- **Quick Ping** button automatically starts the quick Ping utility for the stream destination IP address and provides either a successful or failed result. The quick Ping uses 3 attempts, a Delay of 1 second, a Timeout of 2 seconds, and a Data Size of 32 Bytes. Refer to *Ping & Trace Route* on page 360 for more options.
- **Resolve MAC Address** check box, when selected (default), sends a request to the network to retrieve the MAC address corresponding to the selected destination IP address. This setting is coupled with the Resolve MAC Address check box from *MAC* on page 118. The Resolve MAC address status is displayed. Possible status are:

Status	Description
--	The <b>Resolve MAC address</b> is not enabled.
Resolving	The MAC address is being resolved.
Resolved	The MAC address is resolved.
Failed	The MAC address cannot be resolved.

- **Source IP Multiplier** check box, when selected (cleared by default), allows changing the 7 LSB (Least Significant bit) of the source IP address as specified in the range: **1-128** (default) or **0-127**.
- **Subnet Mask** (IPv4) allows to enter the Subnet Mask for the stream. The default setting is **255.255.0.0**. Not available when the **Automatic IP (DHCP)** check box is selected.
- **Default Gateway** (IPv4) check box, when selected (cleared by default), allows to enter a default Gateway IP address. When the **Default Gateway** check box is selected, its default address is **0.0.0.0**. The **Default Gateway** address is not configurable when the **Automatic IP (DHCP)** check box is selected.

- **TTL (IPv4) or HOP Limit TTL (IPv6)** sets the Time To Live value: **1** to **255** (default is **128**).
- **Flow Label (IPv6)** is a number used to identify a series of related packets from a source to a destination: **0** (default) to **1048575**.
- **IP TOS/DS (IPv4) or Traffic Class (TOS/DS) - (IPv6)** allows to enter either an hexadecimal value, **00** (default) to **FF**, or tap on the **TOS/DS Config** button to set each TOS or DS parameter individually. Changing the **IP TOS/DS** value will affect the **TOS/DS Config** settings and vice versa.
- **TOS/DS Config** button allows to set the Type of Service or the Differentiated Service parameters.

### TOS/DS

- **TOS/DS** allows to select either Type Of Service (TOS) or Differentiated Services (DS).
- **Binary/Hex** allows to display, once this pop-up is closed, the IP TOS/DOS value either in binary or hexadecimal.

### Type Of Service (available when TOS is selected).

- **Precedence** value:
  - 000 (Routine)** (Default)
  - 001 (Priority)**
  - 010 (Immediate)**
  - 011 (Flash)**
  - 100 (Flash Override)**
  - 101 (CRITIC/ECP)**
  - 110 (Internet Control)**
  - 111 (Network Control)**
- **Delay** allows the selection of the delay level: **Normal** (default) or **Low**.
- **Throughput** allows the selection of the throughput level: **Normal** (default) or **High**.

## Test Setup - Test Configurator, Timer, and System

MAC/IP/UDP

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- **Reliability** allows the selection of the reliability level: **Normal** (default) or **High**.
- **Monetary Cost** allows the selection of the monetary cost level: **Normal** (default) or **Low**.
- **Reserved Bit** allows the selection of the reserved bit value: **0** (default) or **1**.

**Differentiated Services** (available when **DS** is selected).

- **DSCP Codepoints:**  
**000000 (CS0)** (default), **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)**, **110011 (51)**, **110110 (54)**, or  
**User Defined**.
- **User Defined Codes**, available when **User Defined** has been selected from the **DSCP codepoints**, allows to enter a user defined code from hexadecimal **00** (default) to **3F** once the **TOS/DS Config** pop-up is closed.
- **ECN** allows the selection of the Explicit Congestion Notification code: **00 (Not-ECT)** (default), **01 (ECT-1)**, **10 (ECT 0)**, or **11 (CE)**.



### UDP

Allows the selection of the source and destination UDP port number.

- **Source Port** is configurable from **0** to **65535**; the default is **49184**.
- **Destination Port** is configurable from **0** to **65535**; the default is **7 (echo)**.

### Payload

For RFC 2544 and EtherBERT, indicates that the frame structure contains a Payload.

For Traffic Gen & Mon, allows the selection of both user defined header and pattern. Payload is not configurable when the **QoS Metrics Tags Insertion** check box is selected (see the **Global** tab).

- **User Defined Header** check box when selected (cleared by default) allows to define a 16-byte header.
- **Pattern** allows the selection of a pattern: **00** to **FF** (default is **CC**).

### FCS

Indicates that the frame structure contains an Ethernet FCS.

# Network

From the test menu tap **Setup, Test Configurator**, the interface block, and the **Network** tab.

## MAC

- **MAC Address** indicates and allows to change, when the **Factory Default** check box is cleared, the default and unique Media Access Control (MAC) address given to the Ethernet port.
- **Factory Default** check box, when selected (default), indicates that the factory source MAC address is used.
- **Frame Format** (layer 2) allows to select **Ethernet II** (default) or **802.3 SNAP** as the frame format.

## IP

**IP Version** allows the selection of either **IPv4** (default) or **IPv6**. Only IPv4 is supported for RFC 6349 test application.

For **IPv4** the following configuration parameters are available.

- **Automatic IP (DHCP)** check box, when selected (cleared by default), allows to dynamically obtain an IP address from a DHCP (Dynamic Host Configuration Protocol) server.
- **IP Address**<sup>1</sup>: Enter the IP address of the port. The default setting is 10.10.x.y, where x and y are respectively the two least significant bytes of the port default MAC address.
- **Subnet Mask**<sup>1</sup>: Enter the Subnet Mask. The default setting is **255.255.000.000**.
- **Default Gateway**<sup>1</sup> check box, when selected (cleared by default), allows to enter a default Gateway IP address. When the **Default Gateway** check box is selected, its default address is **0.0.0.0**.

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1. Not configurable when the **Automatic IP (DHCP)** check box is selected.

For **IPv6** the following configuration parameters are displayed: **Link-Local IPv6 Address**, **Global IPv6 Address**, and **Default Gateway**. Tap on the **Config** button to access all settings.

- **Link-Local IPv6 Address** (LLA) is used for local communication between on-link neighbors and for Neighbor Discovery process.
  - **Mode**
    - Stateless Auto** (default) allows automatic generation of the IPv6 address based on the MAC address.
    - Static** allows to enter the IP Address.
  - **Address**, available with **Static** mode, allows to select the Link-Local IPv6 Address. The accepted range is from **FE80:0000:0000:0000:0000:0000:0000:0000** to **FE80:0000:0000:0000:FFFF:FFFF:FFFF:FFFF**. The default address is **FE80::[Interface ID]**, where **[Interface ID]** is generated from the source MAC address. When the **Address** field is selected for editing using virtual keyboard, the **Previous IPs** button appears allowing to select a previously configured IP address.

- **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** (default) allows automatic generation of the IPv6 address based on the Link-Local address interface ID and the prefix obtained from the router advertisements. If no Interface ID has been obtained for the **Link Local Address**, the global address will not be generated.
    - Static** allows to enter the IP address.
  - **Address**, available with **Static** mode, allows to select the **Global IPv6 Address**. The accepted range is from **0000:0000:0000:0000::[Interface ID]** to **FFFF:FFFF:FFFF:FFFF::[Interface ID]**. The default address is **2001:0000:0000:0000::[Interface ID]**, where **[Interface ID]** is generated from the source MAC address. When the **Address** field is selected for editing using virtual keyboard, the **Previous IPs** button appears allowing to select a previously configured IP address.
  - **Interface ID Coupled**, available when the **Source Global IPv6 Address** mode is **Static**, allows to couple the interface ID of the Global address to the Link-Local source address.
    - Enabled** (default): Only the 64 bit (MSB) prefix ID in the IPv6 address is configurable, and the 64 bit (LSB) Interface ID is not configurable (read-only).
    - Disabled**: The 64 bit (MSB) Prefix ID and 64 bit (LSB) Interface ID in the IPv6 address are configurable.

- **Prefix Mask**, available with **Static** mode, allows to specify a prefix that defines the subnet. The accepted range is **0000:0000:0000:0000:0000:0000:0000:0000** to **FFFF:FFFF:FFFF:FFFF:0000:0000:0000:0000**. 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.
- **Default Gateway** allows the configuration of the default gateway address to forward packets outside the subnet.
- **Mode**
  - Automatic** (default) allows automatic selection of the default gateway.
  - Static** allows entering the default gateway IP address.
- **Address**, available with **Static** mode, allows to enter the IP address of the Default Gateway. The accepted range is from **0000:0000:0000:0000:0000:0000:0000:0000** to **FE80:0000:0000:0000:FFFF:FFFF:FFFF:FFFF**. The default address is **FE80:0000:0000:0000:0000:0000:0000:0000**.

### VLAN

**VLAN Tag** check box, when selected (cleared by default), enables and allows to set up to 3 stacked VLANs.

For each VLAN tag enabled, C-VLAN / S-VLAN / E-VLAN, the following parameters are configurable.

- **VLAN ID** choices are **0** through **4095**; refer to *VLAN ID and Priority* on page 461 for more information.
- **Priority**, VLAN user priority, choices are **0** (default) to **7**. Refer to *VLAN ID and Priority* on page 461 for more information.
- **Type**, VLAN Ethernet Type, choices are **0x8100** (default for C-VLAN), **0x88A8** (default for S-VLAN), **0x9100** (default for E-VLAN), **0x9200**, and **0x9300**.
- **Drop Eligible**, when set to **Yes** (DEI = 1), the 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 set to **No** by default.

## Network Details (iSAM)

Either select the Layer parameter, the number of services, for each service the profile and CIR settings, or click on **More** for all settings. The total bandwidth (when the **Performance Test** is enabled) and the estimated test duration are also displayed.

From the **Test** menu, tap **Setup, Test Configurator**, and the **More** button from the **Network** block.

### iSAM

- **Layer** is the layer used for all services. The layer is fixed to **L3/L4** when the **RFC 6349 Test** is enabled.
  - **L2** (default) for Ethernet II.
  - **L3/L4** for Ethernet II, IP (IPv4), and respectively UDP for the Configuration and Performance subtests, and TCP for RFC-6349 subtest.
- **Classification** defines the traffic classification used in the provider network: **VLAN ID**, **VLAN Priority**, or **DSCP** (available with layer L3/L4).

**Note:** *At least one check box (**Configuration Test**, or **Performance Test**, or **RFC 6349 Test**) has to be selected.*

- **Configuration Test** check box when selected (default) verifies if the network configuration is correct for each service before starting a long term test (Performance Test).

Set the **Configuration Test** duration in seconds per step enabled (CIR and CIR+EIR): 5 seconds (default) to 60 seconds.

## Test Setup - Test Configurator, Timer, and System

*Network Details (iSAM)*

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- **Performance Test** check box when selected (default) verifies that the SLA parameters (FD, IFDV, and FLR) are met over time by running multiple services simultaneously. Results are measured and compared to the configured thresholds to declare the pass/fail verdicts. The **Performance Test** is only performed for services that have their **CIR** check box selected.

Set the **Performance Test** duration in hh:mm format: 1 minute to 24 hours (default is 10 minutes).

- **RFC 6349 Test on Service 1** check box when selected (cleared by default) verifies that the Ethernet service is able to properly carry TCP traffic; **Service 1** is used to performed the RFC 6349 test. Enabling the **RFC 6349 Test on Service 1** automatically set the operation mode to DTS and the layer to **L3/L4**; direction is bidirectional, max MTU is 1500 bytes, multiple connections as well as Path MTU Discovery are enabled.

Duration: The field next to the **RFC 6349 Test on Service 1** check box is used to set the duration of the TCP Throughput phase per direction in hh:mm format: 1 minute (default) to 24 hours.

**Threshold (% of ideal)** allows to enter the TCP Throughput as a percentage of the Ideal L4 Throughput that will be used to declare the pass/fail verdict for both directions: **0** to **100** %; default is **95** %.



### Services

Allows the selection of the number of services: **1** (default) to **4**.

The following parameters are configurable individually for each service:

➤ **Profile**

Two profiles are defined by default as well as **User Profile**. Profiles are user definable and up to 25 profiles can be predefined (see *Customizable Profiles* on page 140).

Profile	Parameter				
	Frame Type	Frame Sizes	VLAN Priority	DSCP	Performance Criteria
Priority	EMIX	64, 128, 512, 1024, and 1518 <sup>a</sup>	7	CS7 <sup>b</sup>	MEF Metro High
Best Effort			0	CS0 <sup>b</sup>	MEF Metro Low

- a. The minimum frame size value is adjusted according to the frame structure and components selected as shown in the table of *Frame Size* on page 137.
- b. ECN is not present and not configurable but is set to 00 (Not-ECT).

## Test Setup - Test Configurator, Timer, and System

### Network Details (iSAM)

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**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.*

**Note:** *For Dual Test Set, the **CIR** and **CIR+EIR** values are the same (Symmetric) for both **L->R** and **R->L** directions.*

- **CIR** (Mbit/s) (Committed Information Rate) check box when selected (default) sets the service rate guaranteed by the SLA (default is **1 Mbit/s**).
- **CIR+EIR** (Mbit/s) check box when selected (cleared by default) sets the best effort allowed traffic for the service. The EIR (Excess Information Rate) value is equal to the **CIR+EIR** value minus **CIR** (default is 1.5 Mbit/s). The threshold value is configurable from the defined **CIR** value for this service to the line rate minus the total **CIR** from all services.
- **Frame Type** allows the selection of the frame type and frame size(s).
  - **Frame types** choices are: **Fixed** and **EMIX**.

**Fixed** allows to set a single frame size.

**EMIX** allows to set up to 8 EMIX frame sizes. The EMIX frame sequence is repeated until the test ends. Default are **64**, **128**, **512**, **1024**, and **1518**.

**Quantity**, available with **EMIX**, allows to select the number of EMIX frame sizes: 2 to 8 frames (default is **5**).

➤ Frame Size

Type	Frame Size (bytes)
Fixed (default)	64 <sup>a</sup> (default) to 16000
EMIX	64 <sup>a</sup> to 16000

- a. The minimum value is adjusted according to the frame structure and components selected as shown in the following table.

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

Component	Description
C-VLAN	4 bytes
UDP	8 bytes
Ethernet Header	14 bytes
IPv4	20 bytes
Using DTS	4 bytes

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

## Test Setup - Test Configurator, Timer, and System

### Network Details (iSAM)

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#### ► Classification

Allows the selection of the value for the selected classification:

Classification	Value
VLAN ID	0 through 4095 (default is 2). Refer to <i>VLAN ID and Priority</i> on page 461.
VLAN Priority	0 (default) to 7. Refer to <i>VLAN ID and Priority</i> on page 461.
DSCP	000000 (CS0) (default), 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), 110011 (51), 110110 (54).

### ► Performance Criteria

The following performance criteria are available by default:

Name	≤ FD (ms)	≤ IFDV (ms)	≤ FLR (%)
MEF Metro High	10	3	0.01
MEF Metro Med	20	8	0.01
MEF Metro Low	37	Disabled	0.1
MEF Regional High	25	8	0.01
MEF Regional Med	75	40	0.01
MEF Regional Low	125	Disabled	0.1
MEF Continental High	77	10	0.025
MEF Continental Med	115	40	0.025
MEF Continental Low	230	Disabled	0.1
MEF Global High	230	32	0.05
MEF Global Med	250	40	0.05
MEF Global Low	390	Disabled	0.1

**User Performance** allows the configuration of the following values per service:

- **FD (Latency): 0.015 to 8000 ms** (default is **15 ms**).
- **IFDV (Jitter): 0.015 to 8000 ms** (default is **2 ms**).
- **FLR (Frame Loss): 0 to 5 %** (default is **0.1 %**).

**Note:** *The Performance Criteria list is user definable and up to 25 Performance criteria can be created (see Customizable Performance Criteria on page 142).*

### Customizable Profiles

As previously mentioned, 2 profiles are available by default and up to 25 profiles can be predefined by editing the profile's text file (iSAMProfilesTemplate.ini) using a word processor like **Notepad**. The file is located under ProgramData\EXFO\ProtocolProducts\  
Documents and Settings\All Users\Application Data\EXFO\ProtocolProducts\ depending on the operating system.

Example of profile's text file:

```
[Priority]
Frame Type = EMIX
Frame Size = 64, 128, 512, 1024, 1518
VLAN Priority = 7
DSCP = CS7
Performance Criteria = MEF Metro High

[Best Effort]
Frame Type = EMIX
Frame Size = 64, 128, 512, 1024, 1518
VLAN Priority = 0
DSCP = CS0
Performance Criteria = MEF Metro Low
```

Each profile entry has the following parameters.

- **Profile Name:** 1 to 16 characters. All ASCII characters from 32 to 126 decimal are supported.
- **Frame Type:** Enter **Fixed** or **EMIX**. When the frame type is missing from a profile, **EMIX** is used.
- **Frame Size** (see *Frame Size* on page 137 for possible values); when the frame size is missing from a profile, default value(s) is used:  
For **Fixed**: Enter a unique frame size.  
For **EMIX**: Enter 2 to 8 frame sizes with a comma between each entry.
- **VLAN Priority**<sup>1</sup> (optional): Enter the priority number.
- **DSCP**<sup>1</sup> (optional): Enter either the DSCP name or its binary value.
- **Performance Criteria**<sup>1</sup>: Enter the name of the performance criteria. When the **Performance Criteria** is missing from a profile or is not available from the user profile file, the **User Performance** criteria is used.

When a parameter is missing from a profile, the default value of the missing parameter is used.

The value of a parameter is validated to ensure it is within the supported range; otherwise the profile entry is unsupported.

If the profile file contain more than 25 profiles, only the first 25 valid profiles are retained.

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1. See *Classification* on page 138 for possible values.

### Customizable Performance Criteria

As previously mentioned, factory performance criteria are available and up to 25 performance criteria can be defined by editing the performance criteria text file (iSAMPerformanceCriteriaTemplate.ini) using a word processor application like **Notepad**. The file is located under

ProgramData\EXFO\ProtocolProducts\ or

Documents and Settings\All Users\Application Data\EXFO\ProtocolProducts\ depending on the operating system.

Example of performance criteria's text file:

```
[MEF Metro High]
FD = 10
IFDV = 3
FLR = 0.01

[MEF Metro Med]
FD = 20
IFDV = 8
FLR = 0.01

[MEF Metro Low]
FD = 37
IFDV =
FLR = 0.1
```

Each profile entry has the following parameters:

- Performance Criteria Name: 1 to 16 characters. All ASCII characters from 32 to 126 decimal are supported.
- Frame Delay (FD) Threshold: 0.015 ms to 8000 ms.
- Inter-Frame Delay (IFDV) Threshold: 0.015 ms to 8000 ms.
- Frame Loss Ratio (FLR) Threshold: 0 % to 5 %.



If the threshold value for a parameter is not defined, it is considered as disabled (as in the example above for IFDV =).

**RequiredForFormatting**The value of a parameter is validated to ensure it is within the supported range; otherwise the performance criteria entry is unsupported.

## ODU Channels - Global

From the **Test** menu, tap **Setup, Test Configurator**, tap on the test block (**ODU Channels**), and on the **Global** tab.

**Note:** *The ODU channels global configuration applies to all channels.*

### Pattern

The test pattern icon next to the **Pattern** label indicates the status of the received pattern signal. Refer to *Status Bar* on page 18 for more information.

- **No Pattern Analysis (Live)** check box when cleared (default), monitors the received traffic pattern. For live traffic, the **No Pattern Analysis (Live)** check box should be selected as the traffic is a live pattern thus there is no analysis of pattern loss and bit error.
- **Pattern** sets the test pattern that will be generated: **PRBS31** (default) or **NULL Client** (0000).
- **Invert** check box, when selected (cleared by default), inverts the test pattern meaning that every 0 will be changed for 1 and every 1 for 0. For example, the pattern 1100 will be sent as 0011.

### Bit Error

- **Pass/Fail Verdict** allows to enable bit-error-rate pass/fail verdict by selecting either **Bit Error Count** or **Bit Error Rate**. The default value is **Disabled**.
- **BER Threshold** allows to enter the threshold **Count** or **Rate** value that will be used to declare the pass/fail verdict.

For **Count**, enter the maximum bit error count allowed before declaring a fail verdict: **0** (default) to **999999**.

For **Rate**, enter the maximum bit error rate allowed before declaring a fail verdict: **1.0E-14** to **1.9E-01**. The default value is **1.0E-12**.

### Service Disruption

The Service Disruption Time (SDT) corresponds to the duration associated to a defect that occurred in the network. For example a disruption that occurs during a network switching from the active channels to the backup channels or vice versa.

- **Disruption Monitoring** check box when selected (disabled by default) enables the disruption time measurements. However, the measurement will only start if the test is already started, or when the test is started.

**Note:** *Clearing the **Disruption Monitoring** check box will stop the measurement without clearing the results. The disruption monitoring is automatically stopped without clearing results when the test is stopped. However, starting the test again while the **Disruption Monitoring** check box is selected will reset the results before restarting.*

**Note:** *The service disruption measurements are cleared when changing the criteria.*

## Test Setup - Test Configurator, Timer, and System

ODU Channels - Global

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- **Defect** allows to choose on which layer and defect the service disruption time test will be performed. Choices depend on the selected test path.

Layer	Defect
ODUk	LOFLOM, AIS, OCI, LCK, BDI, BIP-8, BEI
OPUk	AIS, CSF

**Note:** *The Service Disruption Time measurement supports a parent defect approach where the SDT measurement is triggered when the selected defect or a higher defect in the signal structure hierarchy is detected.*

- **No Defect Time (ms)** represents the period without any defects before stopping SDT measurement: **0.005 ms to 2000 ms** (default is **300 ms**).
- **Pass/Fail Verdict** check box when selected (cleared by default) enables service disruption pass/fail verdict and allows to set the threshold value.
- **SDT Threshold (ms)** allows to enter the SDT threshold value that will be used to declare the pass/fail verdict: **0.001 to 299999.999 ms** (default is **50 ms**).

## Modify Tributary Slots/Ports

- **ODU4 Channel Number** selects a channel number highlighting all tributary slots composing this channel. Alternatively, selecting a channel from the table on the right (**TX**, **RX**, or **TX = RX** tab) also selects a channel number.
- **RX**, **TX**, or **TX = RX** tab (table on the right) displays the tributary slot assignments per channel for either RX, TX, or both RX and TX (TX=RX) and allows to select tributary slots to be assigned/unassigned; see **Assign/Unassign** for more information.
- Each tributary slot displays its number (left top corner) and channel number (middle). The channel number is replaced by **U** for Unassigned, or **B** for Background traffic. Background traffic is only available with ODU3 and is displayed once both channels have all their tributary slots assigned meaning that the remaining tributary slots are used for background traffic.
- The following table indicates the number of tributary slots per channel:

For...	Mapped into...	Tributary slot per channel
ODU3	OPU4	31
ODU2	OPU4	8
ODU1	OPU4	2
ODU0	OPU4	1

- **TX = RX** check box, when selected, allows to used the same tributary slot configuration for both TX and RX.
- **Tributary Port** indicates the tributary port number associated to the channel number.
- **Payload Type** indicates the payload type for the mapped OPU level which is **21**.

## Test Setup - Test Configurator, Timer, and System

### ODU Channels - Global

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- **Channels Available** displays the status of the tributary slot assignment for each channel and allows to assign/unassign tributary slots to/from channels.

The table provides a status for each channel using a visual indication of missing tributary slots needed to complete the configuration as follows.

Background Color	Description
White	Tributary slot already assigned. All tributary slots must be assigned to complete the channel configuration.
Orange	Tributary slot(s) missing to complete the channel configuration. This channel is currently selected for assigning additional tributary slots by selecting each tributary slot in the table on the right.
Gray	Tributary slot(s) missing to complete the channel configuration. This channel is not currently selected for assigning additional tributary slots.

#### **To Unassign Tributary Slot:**

1. Tap the **Unassign** button.
2. Tap the tributary slot to be unassigned from the table on the right an the tributary slot displays U for unassigned and becomes available in the **Channels Available** table.

#### **To Assign Tributary Slot:**

1. Select a channel number.
2. Tap the tributary slot to be assigned to the selected channel from the table on the right. It is possible to select an unassigned tributary slot or a tributary slot from another channel number. Each channel must have all their tributary slots selected in order to complete the configuration.

- **Modify Tributary Slots** facilitates the tributary slot selection:
  - Copy RX MSI** allows automatic configuration of the Channel to Trib Slot that matches the system under test configuration
  - Default** returns to default tributary slot assignment.
  - Clear All** unassigns all tributary slots.





### **Restore Multi-Channel OTN Defaults**

Reverts the current test application to its default factory settings.

# Optical Device Under Test (iOptics)

From the **Test** menu, tap **Setup**, and **Test Configurator**.

- **Transceiver selection:** Tap on a transceiver icon to select the interface/port. The selected transceiver is highlighted with an amber contour. The selected transceiver type and its status are displayed.

Status	Description
	Validating the transceiver.
	Transceiver correctly detected.
	Incompatible transceiver detected.
	Missing transceiver/adapter.

- **Rate:** Once the transceiver is correctly detected, select the interface rate. Rates depend on the selected port and the inserted transceiver.

Transceiver	Rate	
	Transport	Ethernet
CFP	OTU4 (10 Lanes) OTU4 (4 Lanes) OTU3e2 (4 Lanes) OTU3e1 (4 Lanes) OTU3 (4 Lanes)	100GE (10 Lanes) 100GE (4 Lanes) 40GE (4 Lanes)
CFP2	OTU4 (10 Lanes) OTU4 (4 Lanes)	100GE (10 Lanes) 100GE (4 Lanes)

- **Vendor Name, Part Number, Serial Number, Connector Type, and Mode** are information retrieved from the transceiver (see page 151).



- **More** gives additional transceiver information and settings.
- **Parameters** are retrieved from the transceiver:

Parameter	CFP	CFP2
Module ID	X	X
Vendor Name	X	X
Part Number	X	X
Serial Number	X	X
Hardware Revision	X	X
Firmware Version	X	X
Adaptor Revision	-	X
Connector Type	X	X
Speed	X	X
Type/Compliance Code	X	X
Mode	X	X
Power Class	X	X
Lane Ratio Type	X	X
WDM Type	X	X
CLEI Code	X	X

- **Lasers OFF at Start-Up** allows to automatically turn off all lasers when starting the module or when switching from one test application to another. This check box is cleared by default.

### Remote Details (iSAM)

The remote block automatically scan the remote modules for **DTS** and **Remote Loopback** modes and allows the selection of the remote module that is used to loop back the traffic via **Smart Loopback** or EtherSAM in **Dual Test Set (DTS)** mode for simultaneous bidirectional results. The number module available for remote connection is displayed. If the connection with the remote module is not manually established, the remote connection process is automatically performed when starting the test.

From the **Test** menu, tap **Setup, Test Configurator**, and the **More** button from the **Remote** block.

**Note:** *Not available with **Manual Loopback** remote operation mode.*

### For both DTS and Remote Loopback Operation Modes

#### ➤ Discovered Remotes

The modules are discovered dynamically and listed with their **Name**, **IP** address, **Status**, **Connection**, and **Preferred** information. **Name** and **Status** are only available for remote 88000 Series, and 85100G modules. Only modules from the same subnet are automatically discovered. To access a module from a different subnet, use the **Add** button.

- **Preferred** check box when selected indicates that this module is part of the preferred module's list. Preferred remote modules will be considered first during the automatic connection process as follows:

Priority	Preferred or not	Status
1	Preferred	Available
2		Taken
3		Test in Progress
4	Non Preferred	Available
5		Taken
6		Test in Progress

- **Status**

Background Color	Status	Description
Green	Ready	Connected with the local unit
	Running	
Yellow	Taken	Connected with another unit
Red	Test in Progress	Test in progress with another unit
No color	Unreachable	Preferred remote does not reply
	Available	Not connected

- **Connection** indicates **Connected** when the local unit is connected to a remote module.
- **Add** button is used to add a preferred remote module to the preferred list. Enter the IP address of the remote module and tap **OK**. This is useful to access a module from a different subnet.

### For Remote Loopback Operation Mode

- **Loop-Up** button establishes the connection with the selected remote module and sets the remote module into **Smart Loopback** test application.

Following a successful loop-up, the IP address of the remote module will be used as the destination IP address for the test.

- **Overtake** button manually establishes the connection with the remote module and set the remote module into Smart Loopback test application. Available when the status is **Taken** or **Test in Progress** with another unit. A confirmation is required to overtake a module.
- **Loop-Down** button ends the connection between the local and the remote modules.

### For DTS Operation Mode

- **Connect** button manually establishes the connection with the selected remote module and sets the remote module into DTS EtherSAM test application.

Following a successful connection, the IP address of the remote module will be used as the destination IP address for the test.

- **Overtake** button manually establishes the connection with the remote module and set the remote module into DTS EtherSAM test application. Available when the status is **Taken** or **Test in Progress** with another unit. A confirmation is required to overtake a module.

Following a successful connection, the IP address of the remote module will be used as the destination IP address for the test.

- **Disconnect** button, available once the connection with the remote module is established, terminates the connection with the remote module. Available when the status is **Ready**.

### For Manual Loopback Operation Mode

- **MAC**, available with layer L2, allows to enter the destination MAC address of the remote.
- **IP**, available with L3/L4, allows to enter the destination IP address of the remote.
- Resolved MAC address status, available with L3/L4, indicates:
  - **Resolving** when the ARP process is resolving.
  - **Resolved** when the ARP process is resolved.
  - **Failed** when the ARP process failed.
- **Quick Ping**, available with layer L3/L4, tests if the destination IP address can be reached. A message displays if the ping attempt is **Successful** or **Failed**.

### RFC 2544 - Global

From the **Test** menu, tap **Setup, Test Configurator**, tap on the RFC 2544 block, and on the **Global** tab.

#### Dual Test Set

- **Dual Test Set (DTS)** check box when selected (cleared by default) enables RFC 2544 **Dual Test Set**. Once **Dual Test Set** is enabled, use the **Discover Remote** button to select a remote unit.

**Note:** *Alternatively it is possible to use the Discover Remote button to connect to a remote module and automatically enable the **Dual Test Set**. For more details, refer to Discover Remote Button on page 374.*

- **Disconnected** indicates that there is no connection established with a remote module.
- **Connected** indicates that the connection is established with a remote module.
- **Discover Remote** button allows to discover remote modules supporting **Remote Loopback** and/or **Dual Test Set**. For more details, refer to *Discover Remote Button* on page 374.

### Global Options

- **Flow Direction** allows the selection of the traffic direction as follows:
  - **TX to RX** for **Single Port** topology.
  - **Local to Remote, Remote to Local, and Bidirectional** for **Dual Test Set**.
- **Rate Unit** determines the unit used to display the rate values: **%**, **Mbit/s**, or **Gbit/s**.
- **Pass/Fail Verdict** check box when selected (default) enables the use of the pass/fail verdict.

### Subtests and Estimated Time

- **Subtests** allows to individually enable the **Throughput, Back-to-Back, Frame Loss**, and **Latency** subtests.
- **Estimated Time (H:MM)** indicates the estimated time required to complete each subtest at best conditions. The total estimated time to complete all subtests is also displayed.

### Frame Distribution

- **Frame Distribution** allows to select either **RFC 2544** (default) or **User Defined** distribution.
- **Quantity** is only available when **User Defined** is selected and allows to select the number of frames, from **1** to **7** (default), in the distribution.
- **Frame Size (Bytes):** For **RFC 2544** distribution, gives predefined frame size distribution values. For **User Defined** distribution, enter up to seven frame size values.

Distribution	Frame Size
RFC 2544	64 <sup>a</sup> , 128, 256, 512, 1024, 1280, and 1518
User Defined	64 <sup>a</sup> to 16000

- 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 tag (up to 3 VLAN tags)
IPv4	20 bytes
IPv6	40 bytes
Using DTS	4 bytes

### Restore RFC 2544 Defaults

Reverts the configured parameters to their default values.



## RFC 2544 - Subtests

From the **Test** menu, tap **Setup**, **Test Configurator**, tap on the RFC 2544 block. and on the **Subtests** tab.

Allows the configuration of each enabled subtest.

### 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 the specified maximum rate (**Max. Rate**), the rate converges towards the highest throughput without frame loss. The search is done with a halving/doubling method until a final value is reached. The test performs the number of trials defined (**Trials**). The throughput measurement is validated the number of times specified (**Validations**) for the predefined duration (**Trial Duration**). The **Accuracy** and **Acceptable Errors** specify how precise the result must be. The test is performed for each defined frame size.

- **Max. Rate** is the maximum rate the test should begin with, in terms of a percentage of the line rate (%), **Mbit/s**, or **Gbit/s**. For **Dual Test Set** Max. Rate is configurable for both local to remote (**L->R**) and remote to local (**R->L**) directions.

Interface Speed	Max. Rate		
	%	Mbit/s	Gbit/s
40G	0.0050 to 100.0000 <sup>a</sup>	0.1 to 40000.0 <sup>a</sup>	0.0001 to 40.0000 <sup>a</sup>
100G	0.0050 to 100.0000 <sup>a</sup>	0.1 to 100000.0 <sup>a</sup>	0.0001 to 100.0000 <sup>a</sup>

a. Default value.

- **Trial Duration** is the time for each trial in minutes:seconds: **1** second (default) to **30** minutes.
- **Trials** is the number of times the throughput test will be generated: **1** (default) to **50** trials.

## Test Setup - Test Configurator, Timer, and System

### RFC 2544 - Subtests

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- **Accuracy** is the accuracy measurement in percentage of the line rate (%), **Mbit/s**, or in **Gbit/s**. The accuracy is not based on the configured **Maximum Rate** but on the Ethernet line rate. The accepted values are as follows:

Interface Speed	Max. Rate		
	%	Mbit/s	Gbit/s
40G	0.1 to 10.0 (default 1.0)	40.0 to 4000.0 (default 400.0)	0.04 to 4.00 (default 0.40)
100G	0.1 to 10.0 (default 1.0)	100.0 to 10000.0 (default 1000.0)	0.10 to 10.00 (default 1.0000)

- **Acceptable Errors** represents the number of acceptable errors for the test: **0** (default) to **10**.
- **Validations** represents the number of times the result should be validated: **1** (default) to **50** times.

### 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 (**Burst Time**) 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 (**Trials**). The **Accuracy** and **Acceptable Errors** settings specify how precise that result must be. The test is performed for each defined frame size.

- **Burst Time** is expressed in seconds: **1** (default) to **5** seconds.
- **Trials** represents the number of times the Back-to-Back test will be generated: **1** (default) to **100** trials.
- **Accuracy (Frames)** is the accuracy measurement value in frames: **1** (default) to **50** frames.
- **Acceptable Errors** represents the number of acceptable errors for the test: **0** (default) to **10**.
- **Bursts** represents the number of burst that will be generated: **1** (default) to **10**.

### Frame Loss Configuration

The objective of this test is to find the percentage of frames that are lost due to lack of resources. Starting at the specified maximum rate (**Max. Rate**), the test is performed for a specific frame size and for the specified duration (**Trial Duration**). The test is repeated by decreasing the rate by the specified granularity (**Granularity**), then the test is repeated again until there are two successive trials in which no frames are lost. The test is performed for the defined number of trials (**Trials**). The test is performed for each defined frame size.

- **Max. Rate** is the maximum rate the test should begin with, in terms of a percentage of the line rate (%), **Mbit/s**, or **Gbit/s**. The accepted values are as shown in the Max. Rate table on page 159. For **Dual Test Set**, **Max. Rate** is configurable for both local to remote (**L->R**) and remote to local (**R->L**) directions.
- **Trial Duration** represents the time value for each trial in minutes:seconds: **1** second to **30** minutes (default is **00:01**).
- **Trials** represents the number of times the test will be generated: **1** (default) to **50** trials.
- **Granularity** corresponds to the percentage interval between each throughput value used for the test: 1 % to 10 % (RFC) - (default). For example, 10 % granularity means that the test will be performed for 100 %, 90 %, 80 %... of the rate value.

## Latency Configuration

The objective of the test is to measure the time required for the frame to go through the device under test and return back to source. Starting by sending a stream of frames for the predefined duration (**Trial Duration**) and throughput (**Max. Rate**) at a particular 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 frame comes 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 (**Trials**) and the average result is calculated. The test is performed for each defined frame size.

- **Trial Duration** represents the time value for each trial in “minutes:seconds”: **1** second (default) to **2** minutes.
- **Trials** represents the number of times the test will be generated: **1** (default) to **50** trials.
- **Copy From Throughput** check box, when selected (default), uses the Throughput subtest results max rate value for each corresponding frame size. When the check box is cleared, it is possible to set the **Max. Rate** by tapping on the **Config. per Frame Size** button.
- **Margin %**, available when **Copy From Throughput** check box is selected, decreases the max rate value(s) from the Throughput subtest by a value corresponding to the percentage of the line rate specified: **0** (default) to **10** percent.
- **Config. per Frame Size** is available when the **Copy From Throughput** check box is cleared and allows to set the **Max. Rate** for each frame size. For **Dual Test Set** the **Max. Rate** is configurable for both local to remote (**L->R**) and remote to local (**R->L**) directions.

**All Frames** check box when selected (cleared by default) allows to enter the maximum rate that will be applied to all frame sizes.

## Thresholds Button

**Note:** For *Dual Test Set*, thresholds are configurable for **Local to Remote** and **Remote to Local** directions.

- **Throughput Threshold** sets the threshold<sup>1</sup> value used to declare a pass/fail verdict and it applies to all frame sizes when applicable. The range is as follows:

Interface Speed	%	Max. Rate	
		Mbit/s	Gbit/s
40G	0.000 to 100.000 <sup>a</sup>	0.000 - 40000.000 <sup>a</sup>	0.000 - 40.000 <sup>a</sup>
100G	0.000 to 100.000 <sup>a</sup>	0.000 - 100000.000 <sup>a</sup>	0.000 - 100.000 <sup>a</sup>

a. Default value.

- **Back-to-Back Threshold** sets the threshold<sup>1</sup> value in percentage of frames per burst to declare a pass/fail verdict. The range is from **0.0** to **100.0** (default) percent and it applies to all frames sizes when applicable.
- **Frame Loss Threshold (%)** sets the threshold<sup>2</sup> value of frame loss. The range is from **0.000** to **100.000** (default is **0.100**) and it applies to all frame sizes when applicable.
- **Latency Threshold / Round-Trip Latency Threshold** sets the threshold value as the maximum delay in **ms** or **μs**. The range is from **0.5** to **8000.0 ms** (default is **125.0 ms**) and it applies to all frame sizes when applicable.
- **Latency Unit** allows to either select **ms** or **μs** as the reference unit for the **Latency Threshold**.

1. The verdict is PASS when the received/measured value is greater or equal to the threshold value.

2. The verdict is PASS when the received/measured value is lower or equal to the threshold value.

## RFC 6349

From the **Test** menu, tap **Setup**, **Test Configurator**, and the RFC 6349 block.

### Connection

- **Operation Mode** indicates the test operation mode: **Dual Test Set (DTS)**.

The connection is graphically displayed with its status as follows:

Operation Mode	Status	Description
Dual Test Set	Disconnected	No connection established with a remote module.
	Connected	Connection established with a remote module.

- **Discover Remote** button allows to discover remote modules supporting **Dual Test Set**. For more details, refer to *Discover Remote Button* on page 374.
- **Direction** allows the selection of the traffic direction: **Local to Remote**, **Remote to Local**, and **Bidirectional** (default).

### Parameters

- **Multiple Connections** check box when selected (default) indicates that the applicable TCP Throughput phases are performed with multiple connections; otherwise TCP Throughput phases are performed within a single connection.
- **TCP Server Port**

**Local** TCP Server Port is the port used by the server located at the local side: **1** to **65535** (excluding **62819** that is used for DTS connection), default is **50201**.

**Remote TCP Server Port** is the port used by the server located at the remote side: **1** to **65535** (excluding **62819** that is used for DTS connection), default is **50201**.

### ➤ **CIR**

The Local-to-Remote CIR and Remote-to-Local CIR represent the Committed Information Rate of the Ethernet Service under test: **1.0 Mbit/s** to Line Rate. The CIR is not used to actually transmit frames at this rate but to calculate a Bandwidth Delay Product (BDP) which in turn is used to set the Max Window Size of the TCP connections.

**Rate Unit** determines the unit used to display the rate values: **Mbit/s** (default) or **Gbit/s**.

- **TOS/DS (IPv4)** allows to enter an hexadecimal value, **00** (default) to **FF**. Changing the **IP TOS/DS** value will affect the **TOS/DS Config** settings and vice versa.

## **MTU**

- **Max MTU (bytes)** determines the Maximum Transfer Unit (MTU) to use when the client is generating TCP traffic toward the server: from **1080** to **1500** bytes (default).
- **Path MTU Discovery** check box when selected (default) allows to perform a Packetization Layer Path MTU Discovery phase.

## **Window Sweep**

- **Window Sweep** check box when selected (default) allows to perform the Window Sweep phase.
- **Duration (per step)** is the duration of the Window Sweep phase per direction and per Window tested: 30 seconds (default) to 5 minutes.



### TCP Throughput

- **Duration** is the duration of the TCP Throughput phase per direction: 1 minute (default) to 30 days.
- **Pass/Fail Verdict** check box when selected (default) enables the use of the pass/fail verdict.
- **Threshold (% of ideal)** allows to enter the TCP Throughput as a percentage of the Ideal L4 Throughput that will be used to declare the pass/fail verdict for both directions: **0** to **100** %; default is **95** %.

### Restore RFC 6349 Defaults

Reverts the configured parameters to their default values.

# Services - Global

From the **Test** menu, tap **Setup**, **Test Configurator**, tap on the services block, the **Global** tab, and on the **General** button.

## General Button

The following parameters are displayed and configurable per service.

- Check boxes:
  - The first check box (top-left) allows to sequentially enable service(s) within the limit of the link capacity when the **Service Performance Test** is enabled or enable all services when the **Service Performance Test** is disabled.
  - The check boxes next to the service numbers allow to enable each service individually.

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.

- **Service Name** indicates the name of each service. Tap on the **Service Name** button to modify the name of each service. See *Services - Profile* on page 171 for more information.
- **Direction**, available with **Dual Test Set**, indicates results from local to remote (**L->R**) and remote to local (**R->L**).
- **Frame Size** indicates the frame size of each service. Tap on the **Frame Size** button to modify the frame size of each service.

- **Framing** indicates the framing of each service. Tap on the **Framing** button to modify the **Frame Format**, **Network Layer**, **Transport Layer**, **VLAN**, and **MPLS** when applicable (see **Modify Frame Structure** from the *MAC/IP/UDP* on page 116).
- **VLAN (ID/Priority)** indicates the ID and Priority of each VLAN level for each service. Tap on the **VLAN** button to modify the VLAN settings (see **VLAN** from the *MAC/IP/UDP* on page 116).
- **Addressing** indicates the source and destination IP addresses for each services. Tap on the **Addressing** button to modify the addressing (see **MAC** and **IP** from the *MAC/IP/UDP* on page 116).

**Batch** button allows bulk configuration for services addressing. Select the check box of each configuration parameter that needs to be copied and set its parameters. From **Apply To**, select all services the copy applies to and tap on the **Copy From** to proceed.

### SLA Button

The SLA parameters are displayed and configurable per service. Click on the desired column button to access the configuration settings.

See *General Button* on page 168 for more information on check boxes, **Direction**, and **Service Name**.

See *SLA Parameters* on page 176 for more information on **CIR**, **CIR+EIR**, **CBS**, **EBS**, **Max Jitter**, **Max Latency**, and **Frame Loss Rate**.

### Total TX Rate

**Note:** Only available when the **Service Performance Test** check box is selected (see EtherSAM - Global on page 94). For **Dual Test Set**, the total TX rates are displayed for both **Local** and **Remote** directions.

- **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.

### Global Options

**Rate Unit** choices are % (default), **Mbit/s**, and **Gbit/s**.

### Copy Service Button

**Copy Service** button allows to copy the services configuration to one or several services.

- **Copy Service** allow to select the services number from which the configuration will be copied from.
- **To the following Services** allows to select all services that will inherit the configuration from the selected service. An orange background represents a selected service. A service that is already enabled cannot be selected for copy.
- **Copy** allows to confirm the service configuration copy for all selected services.

### Services - Profile

The EtherSAM test application supports the configuration of up to 10 different services individually. All parameters are configurable per service.

From the **Test** menu, tap **Setup**, **Test Configurator**, tap on the services block, and on the **Profile** tab.

#### Service Selection and Activation

Select the service to be configured by either using the left/right arrow or by tapping over the service numbers area then tapping on a specific service number. An orange background indicates the selected service while a green background indicates the services that are enabled.

- **Service** associates a name to the selected service number. Up to 16 characters are allowed. Default service names are **Service 1** to **Service 10**.
- **Enable** check box when selected (cleared by default) enables the selected service. However, the service will be generated only when the test is started. 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.

### Total TX Rate

**Note:** Only available when the **Service Performance Test** check box is selected (see EtherSAM - Global on page 94).

Indicates the total transmit rate of all services enabled for transmission. Unit selection is available from the *SLA Parameters* on page 176.

### Profile

- **Profile** button allows to select the emulation profile. The selected service profile icon, name, and configuration (when applicable) is displayed next to the **Profile** button.

Select the emulation profile: **Voice**, **Video**, or **Data** (default).

#### Voice

- **Voice Codec** choices are **VoIP G.711** (default), **VoIP G.723.1**, and **VoIP G.729**.
- **Number of Calls** allows the selection of the equivalent number of calls that will be generated for the selected stream (default is **1**).
- **CIR** indicates the committed information rate in Mbps based on the number of calls selected.

#### Video

- **Video Codec** choices are **SDTV (MPEG-2)** - (default), **HDTV (MPEG-2)**, and **HDTV (MPEG-4)**. Only **SDTV (MPEG-2)** is available with the 10 Mbps interface.
- **Number of Channels** is the equivalent number of channels that will be generated for the selected service (default is **1**).
- **CIR** indicates the committed information rate in Mbps based on the number of channels selected.

**Note:** The **CIR** value will be calculated on the basis of the selected service profile and the value entered in the **Number of Calls** or **Number of Channels** field.

- **Frame Size (Bytes)** indicates the frame size for **Voice** and **Video** profiles and allows to change the frame size for **Data** profile:

**Fixed** (default)

Profile and Codec	Type	Frame Size (bytes)	
		IPv4	IPv6
Voice Codec: - VoIP G.711 - VoIP G.723.1 - VoIP G.729	Fixed	138 82 78	158 102 98
Video Codec: All	Fixed	1374	1394
Data	Fixed (default)	64 <sup>a</sup> (default) to 16000	
	Random	64 <sup>a</sup> to 1518 <sup>b</sup>	
	EMIX	64 <sup>a</sup> to 16000	

- The minimum value is adjusted according to the frame structure and components selected as shown in the following table.
- The maximum frame size value is adjusted for each enabled VLAN (+4 bytes per VLAN).

## Test Setup - Test Configurator, Timer, and System

### Services - Profile

---

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

Component	Description
VLAN	4 bytes per VLAN (up to 2 VLAN)
MPLS	4 bytes per label (up to two labels)
UDP	8 bytes
Ethernet Header	14 bytes
IPv4	20 bytes
IPv6	40 bytes
Using DTS	4 bytes

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

- **EMIX** button is available when EMIX type is selected. The EMIX frame sequence is repeated until the test ends.

**Quantity** allows to select from 2 to 8 frames size values (default is **5**).

**EMIX Frame Sizes** allows to set the EMIX frame sizes (default are **64, 128, 512, 1024, and 1518**). The minimum frame size value is adjusted according to the frame structure and components selected as shown in the above table.

**Restore Default** button reverts the quantity and EMIX frame sizes to their default values.



## Test Parameters

**Note:** *Unit selection is available from the SLA Parameters on page 176.*

For **Dual Test Set**, parameters are configurable for both local to remote (**L->R**) and remote to local (**R->L**) directions.

- **Traffic Policing** check box when selected (default) allows to stress the rate limiting of the network by sending traffic at higher rate than committed by the SLA.
- **Burst Max Rate** allows to set the rate that is used for the CBS and EBS burst tests. Only available when the **Burst Test** is enabled (see *EtherSAM - Global* on page 94).

**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:*

*$CIR \leq CIR+EIR \leq Ramp\ Traffic\ Policing\ Rate \leq Line\ Rate$*

*$CIR \leq CIR+EIR \leq Burst\ Max\ Rate \leq Line\ Rate$*

*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:*

*$CIR < CIR+EIR < Burst\ Max\ Rate \leq Line\ Rate$*

### SLA Parameters

The Service-Level Agreement (SLA) parameters allow enabling and defining the pass/fail verdict thresholds for the service.

For **Dual Test Set**, parameters are configurable for both local to remote (**L->R**) and remote to local (**R->L**) directions.

#### Information Rate

- Unit choices are % (default), **Mbit/s**, or **Gbit/s**. This unit is also used for **Total TX Rate** and for **Test Parameters (Traffic Policing and Burst Max 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) check box when selected (default) sets the service rate guaranteed by the SLA. The threshold value is configurable from **0.0001**<sup>1</sup> to **100** percent (default is **50** percent). **CIR** and preceding steps are not performed for services that have the **CIR** check box cleared.
- **CIR+EIR** check box when selected (cleared by default) 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 threshold value is configurable from **0.0001**<sup>1</sup> to **100** percent (default is **75** percent).

**Burst Size** settings are only available when the **Burst Test** is enabled (see *EtherSAM - Global* on page 94).

- **Burst Size** unit choices are **Bytes** (default) or **ms**.

---

1. The minimum rate is 1Mbit/s when the **Frame Size** is **Random**.

- **CBS** check box when selected (default) sets the maximum committed burst size to which services' frames will be sent and be CIR-compliant (default is **12144** bytes). The CBS minimum and maximum values are affected by the **CIR**, **Burst Max Rate**, and **Frame Size** values. CBS is only available when CIR check box is selected.
- **EBS** check box when selected (cleared by default) sets the maximum excess burst size to which services' frames will be sent and be CIR+EIR compliant (default is **12144** bytes). The EBS minimum and maximum values are affected by the **CIR+EIR**, **Burst Max Rate**, and **Frame Size values**. EBS is only available when **CIR+EIR** check box is selected.

### Performance Criteria

- **Max Jitter (ms)** allows to set the maximum jitter value in millisecond, allowed for the service: **0.015** to **8000 ms** (default is **2 ms**).
- **Max Round-Trip Latency (ms)** allows to set the maximum round-trip latency value in millisecond allowed for the service: **0.015** to **8000 ms** (default is **15 ms**).
- **Frame Loss Rate** allows to set the maximum rate of Frame Loss allowed for the service: **0.0E00** to **5.0E-02**, default is **1.0E-03**.

**Note:** *For Dual Test Set, the Frame Loss Rate is changed to percentage when the remote module does not support exponential notation. In this case a Frame Loss Rate Threshold lower than 1.0E-06 (0.0001 %) is considered as 0 %; the configurable range is 0 to 5 percent.*

# Signal (Transport)

From the **Test** menu, tap **Setup, Test Configurator**, the interface block, and the **Signal** tab.

## Physical Interface

- **Optical Lane** indicates the optical lane number for parallel interfaces.

Optical Interface	Optical Lane Number
OTU3 (4 Lanes) [43.018 Gbit/s] OTU3e1 (4 Lanes) [44.571 Gbit/s] OTU3e2 (4 Lanes) [44.583 Gbit/s] OTU4 (4 Lanes) [111.81 Gbit/s]	0 through 3
OTU4 (10 Lanes) [111.81 Gbit/s]	0 through 9

- **Laser<sup>1</sup>** indicates the status of the laser: **ON** with the laser pictogram (emitting an optical laser signal) or **OFF**.
- **TX Power (dBm)<sup>1</sup>** indicates, when supported, the transmit power level of the optical lane/laser in dBm.
- **Wavelength (nm)<sup>1</sup>** indicates, when supported, the detected lane/laser wavelength.
- **RX Power (dBm)<sup>1</sup>** indicates, when supported, the current received power level of the optical lane/laser in dBm.

Green: Power level in range.

Yellow: Power level out-of-range.

Red: Loss of signal or power level is close to damage.

Gray: The operational range value is either not available or not supplied by the CFP.

---

1. Displayed for each optical lane for parallel interfaces.

- **Min RX Power (dBm)**<sup>1</sup> indicates, when supported, the minimum received power level of the optical lane/laser in dBm.
- **Max RX Power (dBm)**<sup>1</sup> indicates, when supported, the maximum received power level of the optical lane/laser in dBm.
- **Laser ON/OFF** button is used for parallel interface to activate the laser control per optical lane or for all lanes.

Optical lane numbers are from **0** to **3** or from **0** to **9** depending on the selected interface/rate.

- **All Lanes** check box, when selected, applies the change(s) to all optical lanes at once.
- **Optical Lane** indicates the optical lane numbers and **All** which represents the setting for all optical lanes when the **All Lanes** check box is selected.
- **Laser** check box, when selected, indicates that the corresponding optical laser lane is activated and emitting an optical laser signal.
- **Lasers OFF at Start-Up** check box when selected automatically turns OFF the laser for serial interfaces or all lasers for parallel interfaces when starting the Power Blazer or when switching from one test application to another. However the laser remains ON, on a remote module receiving a request for a DTS connection or a loopback command. This check box is cleared by default.
- **Power Range (dBm)** indicates the transceiver operational RX power range.

---

1. Displayed for each optical lane for parallel interfaces.

### TX Frequency

**Note:** The following TX Frequency information applies to serial interface only, refer to TX Frequency on page 100 for parallel interfaces.

- **TX Frequency (GHz)** indicates the frequency (actual frequency + Frequency offset) used for transmission.
- **Offset (ppm)** check box, when selected (cleared by default), allows to set the frequency offset that will be generated. Use the “+” or “-” button to respectively increment or decrement the frequency offset value based on the defined **Increment/Decrement Size**, or directly type the frequency offset value in the field. Possible offsets are:

Interface	Frequency Offset <sup>a</sup>	Nominal Frequency
OTU3	± 50 ppm (Framed)	43018413559 bit/s
OTU3e1	± 120 ppm (Unframed)	44571000000 bit/s
OTU3e2		44583000000 bit/s

- 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.

**Step Size (ppm)** allows to set the increment/decrement value (from 0.1 to the maximum offset) that will be used when changing the frequency offset with the “+” or “-” button.

## RX Frequency

**Note:** The following RX Frequency information applies to serial interface only, refer to RX Frequency on page 101 for parallel interfaces.

- **Frequency (GHz)** indicates the frequency of the input signal.
- **Offset (ppm)** indicates the frequency offset between the standard rate specification and the rate at the input signal.

**Note:** For both **Frequency** and **Offset** the following background colors are used:

Background color	Description
Green	The frequency is in range.
Red	The frequency is out-of-range. LOC is also displayed.
Gray	Pending state.

- **Max. Negative Offset (ppm)** indicates the maximum negative frequency offset between the standard rate specification and the rate from the received signal.
- **Max. Positive Offset (ppm)** indicates the maximum positive frequency offset between the standard rate specification and the rate from the received signal.

**Note:** Refer to Interface on page 229 for more information on standard rate specifications.

## Signal Configuration

- For OTN, refer to *Signal - Signal Configuration (OTN)* on page 182 for more information.
- For SONET/SDH, refer to *Signal - Signal Configuration (SONET/SDH)* on page 187 for more information.

# Signal - Signal Configuration (OTN)

**Note:** *The following signal configuration parameters are available from the interface block.*

From the **Test** menu, tap **Setup, Test Configurator**, the interface block, and on the **Signal** tab.

➤ **OTU4, OTU3, OTU3e1, or OTU3e2**

**Note:** *At least one of the two check boxes, **FEC** or **Scrambler**, must be selected in order to prevent potential alarms caused by a lack of bit transition on the optical signal. For example to disable **FEC**, first select the **Scrambler** check box then clear the **FEC** check box.*

- **FEC** check box, when selected (default), enables the FEC in TX/RX and allows to detect, report, and correct up to 8 symbol errors (Correctable) per codeword. If there are over 8 symbol errors detected, they are reported as uncorrectable errors.
- **Scrambler** check box, when selected (default), provides enough “0” and “1” transitions on the optical signal for clock recovery.

**Note:** *When the **Scrambler** check box is cleared, the receiver circuitry is forced to operate in a condition which is outside of the specified OTN operating conditions which may cause alarms/errors. This configuration can be used for special analysis in a lab environment.*



- **ODU4, ODU3, ODU3e1, ODU3e2, ODU2, ODU1, ODU0, or ODUflex.**  
Only the higher ODU layer is available with Multi-Channel OTN.
- **OPU Tributary Port<sup>1</sup>**, available for each OPU level of a mapped signal, indicates the OPU tributary port used for the test. Tap the **Modify Trib Slots/Port** button to change the OPU tributary port.
- **OPU Tributary Slots<sup>1</sup>**, available for each OPU level of a mapped signal, indicates the OPU tributary slots used for the test. Tap the **Modify Trib Slots/Port** button to change the OPU tributary slots.
- **TCM** indicates each Tandem Connection enabled; **No TCM** indicates that no TCM is enabled. To enable TCM, tap the **Config TCM<sup>1</sup>** button.

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1. Not available with Multi-Channel OTN.

## Test Setup - Test Configurator, Timer, and System

### Signal - Signal Configuration (OTN)

- **Background Traffic**, available for a multiplex signal, is used to generate traffic on the timeslots that are not part of the foreground test traffic. Choices are **Unallocated** (available with PT21 only), **AIS**, **Null Client**, and **PRBS31** (default). The background traffic is configurable for each mux type when the multiplex signal contains both PT20 and PT21 mux types. For Multi-Channel OTN, only available with ODU3 is mapped into ODU4.

Higher Layer	Tributary	Background Traffic <sup>a</sup>
ODU4	ODU3, ODU2, ODU1, ODU0, ODU2e, ODU1e, ODUflex	1.25 Gbit/s <sup>b</sup> or Unallocated
ODU3	ODU2	Fixed structure: ODU2 Non fixed structure: ODU1
	ODU1	ODU1
	ODU0, ODUflex	1.25 Gbit/s <sup>b</sup> or Unallocated
ODU2	ODU1	ODU1
	ODU0, ODUflex	1.25 Gbit/s <sup>b</sup> or Unallocated
ODU1	ODU0	ODU0

- a. Uses the selected AIS, Null Client, or PRBS31 background traffic unless Unallocated is selected which corresponds to undefined traffic.
- b. Per tributary slot.

➤ **Modify Tributary Slots/Port<sup>1</sup>**

The payload type 20 or 21 is indicated for each mapped OPU level.

For...	Mapped into...	Tributary slot selection
ODU3	OPU4	31
ODU2e ODU1e	OPU4	8
ODU2	OPU4 OPU3	8 4 (PT20), 8 (PT21)
ODU1	OPU4 OPU3 OPU2	2 1 (PT20), 2 (PT21) 1 (PT20), 2 (PT21)
ODU0	OPU4 OPU3 OPU2 OPU1	1 1 1 1
ODUflex	OPU4 OPU3	up to 80 up to 32
ODUflex/GFP-F	OPU4 OPU3	up to 8 up to 8

- **Fixed Structure** check box when selected (default) for OPU3, the selection of a tributary slot will automatically select four tributary slots from the same column, which constitute the foreground traffic. When the **Fixed Structure** check box is cleared, select the four tributary slots individually.

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1. Not available with Multi-Channel OTN.

## Test Setup - Test Configurator, Timer, and System

### Signal - Signal Configuration (OTN)

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- **Tributary Port**, configurable when the **Fixed Structure** check box is cleared, allows to select the **Tributary Port** number that will be associated to the selected tributary slots. When the **Fixed Structure** check box is selected, the **Tributary Port** is automatically assigned to either the selected slot number or for OPU3 to the first slot number in the column.
- **Nominal Bit Rate (Gbit/s)** available with ODUflex and ODUflex/GFP-F indicates the TX frequency based on the number of tributary slots selected. Note that for ODUflex with pattern Client, the **Nominal Bit Rate** may be affected by the **TX Rate** when not set to 100 % (see **TX Rate** on page 74).
- **Number of Trib Slots** indicates the number of tributary slots selected.

**Note:** *Tributary slots must be selected starting with the higher layer down to the lower and all required tributary slots must be selected to access the next level. **Clear All**, **Select All**, and **Default** buttons may be used to facilitate the selection.*

#### ➤ **Config TCM**

Allows to enable each TCM level (1 to 6) individually. All ODUx of a mapped signal are also available. All TCM check boxes are cleared by default (disabled). Refer to *Traces (OTN)* on page 205 for more information. Not available with Multi-Channel OTN.

## Signal - Signal Configuration (SONET/SDH)

For OTN-SONET/SDH BERT, from the **Test** menu, tap **Setup, Test Configurator**, the protocol block, and the **Signal** tab.

For SONET/SDH BERT, from the **Test** menu, tap **Setup, Test Configurator**, the interface block, and the **Signal** tab.

### OC/STM Signal

- **Synchronization Status Message (S1)**: Bits 5 through 8 of the S1 byte are used to convey synchronization status of the NE.

Bits 5 to 8	Description	
	SONET	SDH
0000 <sup>a</sup>	Synchronized - Traceability Unknown (STU)	Quality Unknown
0001	Stratum 1 Traceable (ST1)	Reserved
0010	Reserved	ITU G.811 (PRC)
0011	Reserved	Reserved
0100	Transit Node Clock Traceable (TNC)	SSU-A
0101	Reserved	Reserved
0110	Reserved	Reserved
0111	Stratum 2 Traceable (ST2)	Reserved
1000	Reserved	SSU-B
1001	Reserved	Reserved
1010	Stratum 3 Traceable (ST3)	Reserved
1011	Reserved	ITU-T G.813 Option I (SEC)
1100	SONET Minimum Clock Traceable (SMC)	Reserved
1101	Stratum 3E Traceable (ST3E)	Reserved
1110	Provisionable by the Network Operator (PNO)	Reserved
1111	Don't Use for Synchronization (DUS)	Do not use for synchronization

- a. Default message.

### STS/AU Mappings

➤ **Timeslot/Number**

**Timeslot** (SONET) allows the selection of the STS timeslot number. Refer to *SONET Numbering Convention* on page 456 for more information.

**Number** (SDH) allows the selection of the AU channel number. Refer to *SDH Numbering Convention* on page 457 for more information.

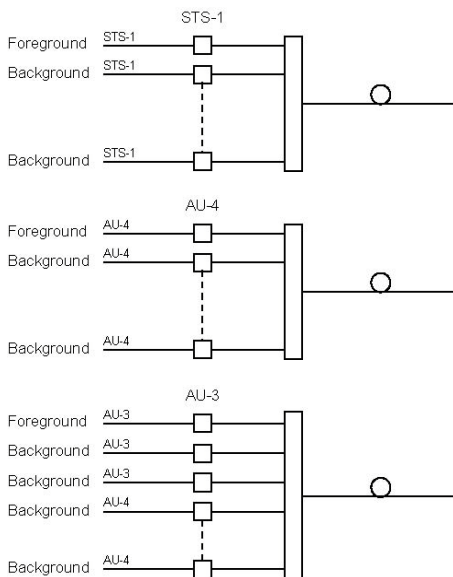
- **Overwrite Fixed Stuff** (STS-1 only) check box when selected (default) fills up the bytes of the STS-1 SPE's columns 30 and 59 with the selected pattern from the tab *BERT and Unframed BERT* on page 74.
- **Background Traffic** allows the selection of the high order path background traffic: **AIS**, **Equipped** (PRBS23) - (default), or **Unequipped**.

## Test Setup - Test Configurator, Timer, and System

*Signal - Signal Configuration (SONET/SDH)*

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The following diagrams show test case data paths that are terminated right after the SONET/SDH high order path using STS-1, AU-3, and AU-4.



## Smart Loopback

**Note:** *The Smart Loopback block is only displayed when the **Transparent (Pseudo-Physical)** check box is cleared (see Loopback Mode on page 73).*

From the **Test** menu, tap **Setup, Test Configurator**, and the Smart Loopback block.

### Loopback

- **Mode** determines at which layer the Smart Loopback address/port swapping operation will be.
  - **Ethernet** swaps the MAC addresses of received packets having their **Destination MAC** address matching the MAC address of the loopback port.
  - **Ethernet (All Unicast)** swaps the MAC addresses of received packets having Unicast **Destination MAC** address.
  - **IP**, for Ethernet Layer 3 and 4, swaps the MAC and IP addresses of received packets having their **Destination IP** address matching the IP address of the loopback port. For Ethernet Layer 2, swaps the **MAC addresses** for packets having their **Destination MAC** address matching the MAC address of the loopback port.
  - **UDP** (default), for Ethernet Layer 4, swaps the UDP ports and the MAC and IP addresses of received packets having their **Destination IP** address matching the IP address of the loopback port. For Ethernet Layer 3, swaps the MAC and IP addresses for packets having their **Destination IP** address matching the IP address of the loopback port. For Ethernet Layer 2, swaps the **MAC addresses** for packets having their **Destination MAC** address matching the MAC address of the loopback port.
- **Matching & Swapping** indicates the Loopback parameters that will be used based on the Loopback Mode selected.



## Streams - Global

From the **Test** menu, tap **Setup, Test Configurator**, the protocol block, and the **Global** tab.

The following parameters are displayed and configurable per stream.

➤ Check boxes:

The first check box (top-left) allows to sequentially enable stream(s) within the limit of the link capacity.

The check boxes next to the stream numbers allow to enable each stream individually within the limit of the link capacity.

- **Stream Name**<sup>1</sup> indicates the name of each stream. Tap on the **Stream Name** button to modify the name of each stream.
- **Frame Size**<sup>1</sup> indicates the frame size of each stream. Tap on the **Frame Size** button to modify the frame size of each stream.
- **TX Rate**<sup>1</sup> indicates the transmission rate for each stream. Tap on the **TX Rate** button to modify the transmission rate (see page 197).
- **Framing** indicates the framing of each service. Tap on the **Framing** button to modify the **Frame Format, Network Layer, Transport Layer, VLAN, and MPLS** when applicable (see **Modify Frame Structure** from the *MAC/IP/UDP* on page 116).
- **VLAN** indicates the ID and Priority of each VLAN level for each stream. Tap on the **VLAN** button to modify the VLAN settings (see **VLAN** from the *MAC/IP/UDP* tab).

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1. See the Profile tab for more information.

## Test Setup - Test Configurator, Timer, and System

### Streams - Global

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- **Addressing MAC/IP** indicates the source and destination MAC/IP addresses for each stream. Tap on the **Addressing MAC/IP** button to modify the customer addressing (see **MAC** and **IP** from the **MAC/IP/UDP** tab).

**Batch** button allows bulk configuration for stream addressing. Select the check box of each configuration parameter that needs to be copied and set its parameters. From **Apply To**, select all streams the copy applies to and tap on the **Copy From** to proceed.

The following parameters are global for all streams.

- **Total TX Rate** indicates the percentage of the total line utilization which is the TX rate sum of all enabled streams.
- **Link Capacity** indicates the total rate available for traffic generation.
- **Global Options:**
  - **Rate Unit** choices are % (default), **Mbit/s**, **Gbit/s**, **frame/s**, and **IFG**.
  - **QoS Metrics Tags Insertion** check box when selected (default) automatically adds a stream analysis tag containing Jitter, Latency, Throughput, and sequence tags in all frames that is generated.
- **Copy Stream** button allows to copy the stream configuration to one or several streams.

Select the stream number the configuration will be copied from.

From **To the following Streams**, select all streams that will inherit the configuration from the selected stream. An orange background represents a selected stream. A stream that is already enabled (Enable TX) cannot be selected for copy.

Tap **Copy** to confirm the stream configuration for all selected streams.

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

### Streams - Profile

The Traffic Gen & Mon test application supports the configuration of up to 16 different streams individually.

From the **Test** menu, tap **Setup**, **Test Configurator**, the protocol block, and the **Profile** tab.

**Note:** *All parameters are configurable per stream.*

### Stream Selection and Activation

Select the stream to be configured by either using the left/right arrow or by tapping over the stream numbers area then tapping on a specific stream number. An orange background indicates the selected stream while a green background indicates the streams that are enabled.

- **Stream** associates a name to the selected stream number. Default stream names are **Stream 1** to **Stream n**.
- **Enable** check box when selected (cleared by default) enables the selected stream. However, the stream will be generated only when the test is started while the global **Enable TX** check box is selected from the **Global** tab.

## Profile

- **Profile** button allows the selection and configuration of either **Voice**, **Video**, or **Data** (default) emulation profile. The selected profile icon and its Codec for Voice and Video are displayed next to the **Profile** button.

**Voice** when selected allows the configuration of the following parameters.

- **Voice Codec** allows the selection of the codec used by the voice profile: **VoIP G.711** (default), **VoIP G.723.1**, or **VoIP G.729**.
- **Number of Calls** allows the selection of the number of calls that will be generated for the selected stream. The minimum and default value is **10** for 40G and 100G interfaces.
- **Rate** indicates the rate corresponding to the selected codec and the number of calls.

**Video** when selected allows the configuration of the following parameters.

- **Video Codec** allows the selection of the codec used by the video profile: **SDTV (MPEG-2)** - (default), **HDTV (MPEG-2)**, or **HDTV (MPEG-4)**.
- **Number of Channels** allows the selection of the number of channels (**1** by default) that will be generated for the selected stream.
- **Rate** indicates the rate corresponding to the selected coded and the number of channels.

- **Frame Size (Bytes)** for Data profile is selectable: **Fixed** (default), **Random**, or **Sweep**. The Frame Size is forced to **Fixed** for Voice and Video profiles.
- For **Fixed** type, the frame size is as follow.

Profile	Codec	Frame Size	
		IPv4	IPv6
Voice	VoIP G.711	138	158
	VoIP G.723.1	82	102
	VoIP G.729	78	98
Video	All codec	1374	1394
Data	-	Programmable from 64 <sup>a</sup> 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 frame size value.
- 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. The following table lists each component that may affect the minimum frame size value. The maximum frame size value is also adjusted for VLAN (+4 bytes per VLAN).

## Test Setup - Test Configurator, Timer, and System

### Streams - Profile

---

- For **Sweep** type, the first frame is generated starting with the minimum number of bytes defined then each subsequent frame is incremented by 1 byte until the maximum number of bytes is reached and start over with minimum. The frame size range is from 64 to either 10000 bytes for electrical interfaces or 16000 bytes for optical interfaces; default is 1518 bytes. However, 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 frame size value.

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

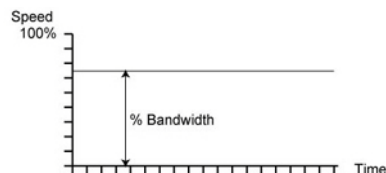
Component	Description
VLAN	4 bytes per VLAN (up to 2 VLAN)
UDP	8 bytes
Ethernet Header	14 bytes
IPv4	20 bytes
IPv6	40 bytes

## Shaping

- **TX Mode** allows the selection of the transmission mode for the selected stream when **Data** profile is selected. The TX Mode is forced to **Continuous** for Voice and Video profiles.

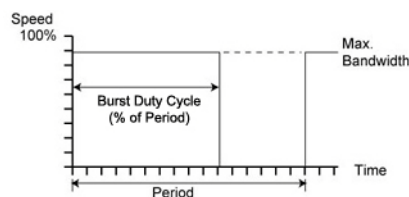
**Continuous** (default) transfers the selected frame continuously according to the selected percentage of bandwidth.

**n-Frame** transfers the selected number of frames.



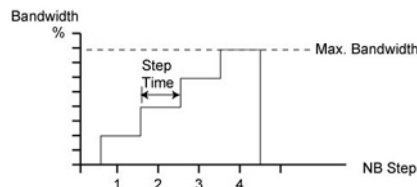
**Burst** transfers the selected frame at maximum bandwidth for the selected **Burst Duty Cycle** over the **Period**.

**n-Burst** transfers the selected number of Burst.



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

**n-Ramp** transfers the selected number of Ramp.



- **TX Rate / Max TX Rate** indicates the transmission rate for Voice and Video profiles, and allows to enter the transmission rate for Data profile.

Unit choices are: **%** (default), **Mbit/s**, **Gbit/s**, **frame/s**, **IFG**. However **frame/s** and **IFG** are not available for **Random** and **Sweep** frame sizes.

- **Frame Count** is only available with n-Frame Transmit Mode. Enter the frame count number: **1** (default) to **267857142857**.
- **Shaping** button

For **Burst** and **n-Burst** TX modes.

## Test Setup - Test Configurator, Timer, and System

### Streams - Profile

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- **Burst Duty Cycle (%)** represents the burst duration within the burst period: **1** to **100** percent (default is **50** percent).
- **Period** represents the burst pattern duration: **1** to **8000** milliseconds (default is **1000** ms).  
**Unit** choices are **ms** (default) and **s**.
- **Burst Count**, available with n-Burst TX Mode, represents the number of times the burst will be repeated: **1** (default) to **255**.

For **Ramp** and **n-Ramp** TX modes.

- **Ramp Nb. of Steps** represents the number of steps within the ramp: **2** to **100** (default is **10**).
- **Step Time** represents the duration of each step: **100** to **8000** milliseconds (default is **1000** ms).  
**Unit** choices are **ms** (default) and **s**.
- **Ramp Cycle Count**, available with n-Ramp TX mode only, represents the number of times the ramp will be repeated: **1** (default) to **255**.
- **Total TX Rate** indicates the percentage of the total line utilization which is the sum of all TX rate enabled streams.

**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 16, 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 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).*

- **Link Capacity** indicates the total rate available for traffic generation.



## QoS Metrics

**Note:** *QoS Metrics settings apply to all streams.*

- **Global Pass/Fail Verdict** check box when selected (default) enables the pass/fail verdict for all streams.
- **Global Thresholds Type** button
  - **Throughput** allows to select if the verdict is based on the **Current Throughput** (default) or **Average Throughput**.
  - **Frame Loss** allows to select if the verdict is based on a frame loss **Count** (default) or **Rate**.
  - **Out-of-Sequence** allows to select if the verdict is based on an Out-of-Sequence **Count** (default) or **Rate**.
- **Throughput (%)** check box when selected enables the throughput pass/fail verdict and allows to set the minimum and maximum threshold values.
- **Frame Loss Count/Rate** check box when selected enables the Frame Loss pass/fail verdict and allows to set threshold of frame that are lost.

For **Count**, enter the maximum count of frame that are lost before declaring a fail verdict: **0** (default) to **999999999**.

For **Rate**, enter the maximum rate of frame that are lost before declaring a fail verdict: **1.0E-14** (default) to **1.0E00**.
- **Out-of-Sequence Count/Rate** check box when selected enables the Out-of-Sequence pass/fail verdict and allows to set the threshold of frames that are Out-of-Sequence.

For **Count**, enter the maximum count of frames that are Out-of-Sequence before declaring a fail verdict: **0** (default) to **999999999**.

For **Rate**, enter the maximum rate of frames that are Out-of-Sequence before declaring a fail verdict: **1.0E-14** (default) to **1.0E00**.

## Test Setup - Test Configurator, Timer, and System

### *Streams - Profile*

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- **Jitter (ms)** check box when selected enables the Jitter verdict and allows to set the maximum Jitter in ms before declaring a fail verdict.
- **Latency (ms)** check box when selected enables the Latency verdict and allows to set the maximum Latency in ms before declaring a fail verdict.

# System

From the **Test** menu, tap **Setup**, and **System**.

## Factory Default

- **Restore Default** button restores the factory default settings for all test applications.
- **Restore Default at Start-Up** check box when cleared (default), reloads the last configuration settings when the application is launched; when selected, the factory settings are restored.

## Remote Control

**User Information** allows a user to leave a message to other users connected on the same module. Up to 80 characters are allowed.

**Time Zone** allows the selection of the time zone source.

- **Local** (default) uses and displays the time from the FTB/IQS-85100G module or from the PC for a Remote ToolBox session.
- **Test Equipment**, available for a Remote ToolBox session, uses and displays the time from the FTB/IQS-85100G module.

### Test Sequence (iOptics)

From the **Test** menu, tap **Setup**, and **Test Configurator**.

- **Temp. Threshold (°C)** allows to select the temperature threshold to declare the pass/fail verdict: **0** to **75 °C** (default is **70 °C**).
- **TX Power Range (dBm)** indicates the optical device TX operational range to declare the pass/fail verdict.
- **RX Power Range (dBm)** indicates the optical device RX operational range to declare the pass/fail verdict.
- **BERT Duration** is the time duration of the bit error test:  
**1 minute** (default), **2, 3, 4, 5,** or **30 minutes**.
- **BERT Threshold** indicates the bit error test threshold (set to **0**) to declare the pass/fail verdict.
- **Skew Threshold (Bits)** indicates the skew threshold to declare the pass/fail verdict: automatically set to either **928** or **1856** bits depending on the rate.

## Timer

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

From the **Test** menu, tap **Setup**, and **Timer**.

### Timer

**Note:** *For RFC 2544 and RFC 6349, only **Start Time** and the **ARM** button are available.*

- **Duration:** Selects the test duration based on the test start time. The test start time can be either the time the user starts the test or the time the test is automatically started when the start time is enabled. The **Duration** check box has to be selected to be included in the test timer. Choices are **15 minutes** (default), **1, 2, 4, 6, 12, 24, 72 hours, 7 days**, and **User Defined**.

When **User Defined** is selected, the field next to it becomes available to enter the test duration using the format: dd:hh:mm:ss.

**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.*

- **Start Time** selects the time the test will automatically start. The **Start Time** check box has to be selected to be included in the test timer.

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

## Test Setup - Test Configurator, Timer, and System

### Timer

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- **Stop Time** selects the time the test will automatically stop. The **Stop Time** check box has to be selected 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. The stop time cannot be enabled while **Duration** is enabled.*

- **ARM** button, available when the **Start Time** check box is selected (cleared by default), enables the start test timer. Not available while the test is running. It is not possible to start the test case when the start time is armed.

**Note:** *An icon is displayed in the global test status area indicating that the timer is enabled. **Armed** is displayed when the test start time is armed while the test is not started. Refer to Global Indicator on page 20 for more information.*

### Traces (OTN)

For OTN BERT and OTN-SONET/SDH BERT: From the **Test** menu tap **Setup, Test Configurator**, tap on the interface block, and on the **Traces** tab.

For Multi-Channel OTN: From the **Test** menu, tap **Setup, Test Configurator**, tap on either:

- the interface block, and on the **Traces** tab to configure the higher ODU layer.
- the test block (**ODU Channels**), and on the **Traces** tab to configure the lower ODU layer. Traces settings apply to all channels unless otherwise indicated.

### OTUx, ODUx, and TCM Buttons

Tap on either OTUx or an ODUx button. For ODUx when TCM is enabled (see **Modify TCM** on page 186), tap on a TCMx button to select a TCM level. TCM is not available with Multi-Channel OTN.

### SM/PM/TCM TTI Traces

**Note:** *The TTI Traces are configurable for SM (OTUx), PM (ODUx), and TCM (ODUx when TCM is enabled; see **Modify TCM** on page 186).*

- **Generated Message**


Allows editing the SAPI, DAPI and Operator Specific messages to be generated.

## Test Setup - Test Configurator, Timer, and System

### Traces (OTN)

---

#### ► Expected Message

Allows editing the expected SAPI, and DAPI messages. The expected message settings are coupled with the **Expected Message** from *Traces - OTN* on page 301. For Multi-Channel OTN lower ODU layer, expected traces apply to all channels but may be overwritten individually per channel from *Traces - OTN* on page 301; In this case the  icon appears next to the expected message indicating that at least one channel uses a different message.

- **SAPI** (Source Access Point Identifier) corresponds to the TTI bytes 0 to 15. A maximum of 16<sup>1</sup> characters is allowed. NULL (all 0's) characters are automatically appended to the message for bytes that are not defined. The expected SAPI message is available when the **SAPI OTU/ODU-TIM** check box is selected.

TTI Traces	Default Message <sup>a</sup>	
	OTN BERT OTN-SONET/SDH BERT Multi-Channel OTN (higher ODU layer)	Multi-Channel OTN (lower ODU layer)
SM	EXFO OTU SAPI	EXFO OTU SAPI
PM	EXFO ODU SAPI	XFO ODU SAPI <sup>b</sup>
TCM	EXFO TCMi SAPI	

- The default message contains a NULL (all 0's) character preceding it. NULL (all 0's) characters are automatically appended to the message for bytes that are not defined.
- The channel number is automatically appended to the generated/expected message.

---

1. For Multi-Channel OTN lower ODU layer, a maximum of 13 characters are allowed since the channel number is automatically appended to the message.



- **DAPI** (Destination Access point Identifier) corresponds to the TTI bytes 16 to 31. A maximum of 16<sup>1</sup> characters is allowed. NULL (all 0's) characters are automatically appended to the message for bytes that are not defined. The expected DAPI message is available when the **DAPI OTU/ODU-TIM** check box is selected.

TTI Traces	Default Message <sup>a</sup>	
	OTN BERT OTN-SONET/SDH BERT	Multi-Channel OTN
SM	EXFO OTU DAPI	EXFO OTU DAPI
PM	EXFO ODU DAPI	XFO ODU DAPI <sup>b</sup>
TCM	EXFO TCMi DAPI	

- The default message contains a NULL (all 0's) character preceding it. NULL (all 0's) characters are automatically appended to the message for bytes that are not defined.
  - The channel number is automatically appended to the message.
- **Operator Specific** corresponds to the TTI bytes 32 to 63. A maximum of 32 characters are allowed. NULL (all 0's) characters are automatically appended to the message for bytes that are not defined.

TTI Traces	Default Message <sup>a</sup>	
	OTN BERT OTN-SONET/SDH BERT	Multi-Channel OTN
SM	EXFO OTU OPERATOR SPECIFIC	EXFO OTU OPERATOR SPECIFIC
PM	EXFO ODU OPERATOR SPECIFIC	XFO ODU OPERATOR SPECIFIC
TCM	EXFO TCMi OPERATOR SPECIFIC	

- NULL (all 0's) characters are automatically appended to the message for bytes that are not defined.

## Test Setup - Test Configurator, Timer, and System

*Traces (OTN)*

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- **SAPI OTU/ODU/TCM-TIM** check box, when selected (cleared by default), allows editing the expected Source Access Point Identifier (SAPI) and also enables OTU/ODU/TCM-TIM alarm monitoring.
- **DAPI OTU/ODU/TCM-TIM** check box, when selected (cleared by default), allows editing the expected Destination Access Point Identifier (SAPI) and also enables the OTU/ODU/TCM-TIM alarm monitoring.

## Traces (SONET/SDH)

For SONET/SDH BERT, from the **Test** menu, tap **Setup, Test Configurator**, the interface block, and on the **Traces** tab.

For OTN-SONET/SDH BERT, from the **Test** menu, tap **Setup, Test Configurator**, the protocol block, and on the **Traces** tab.

**Note:** *Selecting a Trace byte to be generated will automatically update the corresponding OH byte. Refer to OH - SONET/SDH on page 351 for more information.*

### Traces

➤ **Section/RS (J0), and STS/AU/TU-3 Path (J1)**

**Format:** Allows the selections of the J0/J1 format: **1 Byte** (default), **16 Bytes**, or **64 Bytes** format.

**Generated:** When the 16 bytes or 64 bytes format is selected, enter the J0/J1 trace value/message to be generated.

Default values/messages

Format (bytes)	Traces	J0/J1
1	01 <sup>a</sup>	J0/J1
16	EXFO SONET/SDH	J0/J1
64	EXFO SONET/SDH Analyzer Section/RS trace test message	J0
	EXFO SONET/SDH Analyzer high order path trace test message	J1 (STS/AU)
	EXFO SONET/SDH Analyzer low order path trace test message	J1 (TU-3)

a. Hexadecimal value. Refer to *OH - SONET/SDH* on page 351 to change this value.

## Test Setup - Test Configurator, Timer, and System

Traces (SONET/SDH)

---

**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). 64-bytes selection allows typing up to 62-bytes (<C<sub>R</sub>> and <L<sub>F</sub>> bytes will be added at the end for a total of 64-bytes). Traces values should be ASCII suitable characters including the ITU T.50 Characters on page 28.

- **TIM-S/RS-TIM, TIM-P/HP-TIM:** Enables the corresponding Trace Identifier Mismatch for the expected message defined. These settings are coupled with the *Result - Traces/Labels* configuration (refer to *Traces - SONET/SDH* on page 303).

**Format:** Allows the selection of the expected format:

**16 Bytes** (default), or **64 Bytes**.

**Expected:** Allows entering the expected J0 trace message for TIM-S/RS-TIM, and J1 for TIM-P/HP-TIM. See *Default values/messages* on page 209.

## TCM Access Point Identifier

**Note:** Available when TCM is enabled from the Signal - Signal Configuration (SONET/SDH) on page 187.

- **STS/AU/TU Path (N1)**  
Enter the N1 value/message to be generated.
- **TC-TIM-P/HPTC-TIM:** Enables the corresponding TCM Access Point Identifier for the expected message defined. These settings are coupled with the Traces configuration from *Traces - SONET/SDH* on page 303.

# 9 Test Results

The Test Results menu offers the following structure:

## Intelligent Apps test applications

Tab	Test Application		Page
	iOptics	iSAM	
Logger	X	X	259
Summary	285	287	<---

## Transport test applications

Tab - Sub Tab	Available with				Page
	OTN BERT	Multi-Channel OTN	OTN SONET/SDH BERT	SONET/SDH BERT	
Alarms/Errors	X	-	X	X	215
FTFL/PT or PT	X	X	X	-	252
GFP-F/GFP-T	X	-	-	-	254
Labels	-	-	X	X	258
Logger	X	X	X	X	259
OTL-SDT	X	-	X	-	262
Performance Monitoring	X	-	X	X	264
SDT	-	X	-	-	269
Summary	278	291	278	278	<---
Traces	301	301	301 / 303	303	<---
Traffic - Ethernet	X	-	-	-	304

## Test Results

### Ethernet test applications

Tab - Sub Tab	Available with						Page
	EtherSAM	RFC 6349	RFC 2544	EtherBERT	Traffic Gen & Mon	Smart Loopback	
Alarms/Errors	-	X	X	X	X	-	215
Graph	-	-	X	-	-	-	257
Logger	-	X	X	X	X	-	259
Service Configuration - Burst	X	-	-	-	-	-	271
Service Configuration - Ramp	X	-	-	-	-	-	272
Service Performance	X	-	-	-	-	-	273
Streams - Frame Loss / Out-of-Sequence	-	-	-	-	X	-	275
Streams - Jitter	-	-	-	-	X	-	275
Streams - Latency	-	-	-	-	X	-	276
Streams - MPLS	-	-	-	-	X	-	261
Streams - Throughput	-	-	-	-	X	-	277
Summary	282	296	293	278	299	278	<---
Traffic - Ethernet	-	X	X	X	X	X	304
Traffic - Flow Control	-	X	X	-	X	-	306
Traffic - Graph	-	-	-	-	X	-	308
Window Sweep	-	X	-	-	-	-	309

## Alarms/Errors Overview

Current and history alarms/errors are displayed using different background colors as defined in the following table.

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

- **Seconds** gives the total number of 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 (for example: 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).

**Note:** *Some Alarms/errors groups display a magnifying icon allowing to see more information on alarm/error like Second, Count, and Rate information.*

## Test Results



*Alarms/Errors Overview*

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### Pass/Fail Verdict

**Note:** *The verdict is not displayed when disabled or unavailable.*

The Pass/Fail verdict is represented by the following icons:

Icon	Verdict	Description
	PASS	Result value meet the configured threshold criterion.
	FAIL	Result value does not meet the configured threshold criterion.

### Statistic Values

- **Current** indicates the average measurements in the last second.
- **Last** indicates the result of the last measurement.
- **Minimum** indicates the minimum value recorded.
- **Maximum** indicates the maximum value recorded.
- **Average** indicates the average value.



## Alarms/Errors

From the **Test** menu, tap **Results**, and the **Alarms/Errors** tab. Depending on the test structure, the Alarms/Errors page may be split in different tabs such as OTN, GFP-T/GFP-F, and Ethernet; tap on the desired tab when required.

Alarms/errors blocks containing the magnifier (+) icon in its title, opens a zoomed view giving more details like alarms/errors for each lane (parallel interface), errors in seconds, count, and rate.

When there is not enough room on the page to display the error in seconds, count, and rate, the error is displayed in **Seconds** per default. To select another unit, tap on the unit's button and select either **Seconds** (default), **Count**, or **Rate**.

**Total**, available with certain errors (parallel interface), indicates the total of all lanes when **Count** or **Rate** unit is selected.

## Test Results

### Alarms/Errors

The following table lists the availability of alarms/errors per layer for TX and RX.

Layer	Alarms/Errors		Page
	TX/RX	RX only	
BER	Pattern Loss	No Traffic, Client Frequency	217
	Bit Error	Mismatch '0', Mismatch '1', Frame Loss, Out-of-Seq.	
CLOCK	-	LOC	218
Ethernet	Link Down, Remote Fault, Local Fault <sup>a</sup>	Hi-BER, Local Fault Det., Local Fault Rcd.	219
	FCS	Jabber, Oversize, Runt, Undersize	
Ethernet - PCS Lanes	-	LOA, Inv. Mapping, LOBL, LOAML, Exc. Skew	221
	Block, Inv. Marker, PCS BIP-8	-	
FEC	CORR-BIT, CORR-CW, CORR-SYM, STRESS, UNCORR-CW	CORR, UNCORR	239
GFP	LFD, DCI, FDI, RDI, LOCS, LOCCS, User-Defined CMF	EXM, UPM, Reserved CMF	223
	cHEC-CORR, cHEC-UNCORR, tHEC-CORR, tHEC-UNCORR, eHEC-CORR, eHEC-UNCORR, SB-CORR (Post), SB-CORR (Pre), SB-UNCORR, 10B_ERR, pFCS	-	
GMP	-	OOS	228
	-	Cm-CRC-8, CnD-CRC-5	
Interface	LOS	LOC Lane, Frequency	229
IP/UDP	-	IP Chksum, UDP Chksum	230
ODU <sub>x</sub>	LOFLOM, AIS, OCI, LCK, BDI, FSF, BSF, FSD, BSD	TIM	231
	BEI, BIP-8	-	
ODU <sub>x</sub> -TCM	BDI, BIAE, IAE, LTC	TIM	234
	BEI, BIP-8	-	
OPU <sub>x</sub>	AIS, CSF, LOOMFI, MSIM, OOMFI, OMFI	PLM	236
OTL	LOF, LOL, LOR, OOF, OOR	Exc. Skew	238
	FAS, Inv. Marker	-	
OTU <sub>x</sub>	AIS, BDI, BIAE, IAE, LOF, LOM, OOF, OOM	TIM	239
	FAS, MFAS, BIP-8, BEI	-	

Layer	Alarms/Errors		Page
	TX/RX	RX only	
QoS Metrics	-	Frame Loss, Out-of-Seq.	242
Section/Line / RS/MS	LOF-S/RS-LOF, SEF/RS-OOF, AIS-L/MS-AIS, RDI-L/MS-RDI	TIM-S/RS-TIM	243
	FAS-S/RS-FAS, B1, B2, REI-L/MS-REI	-	
STS-x / AU-x	AIS-P/AU-AIS, LOP-P/AU-LOP, UNEQ-P/HP-UNEQ, PDI-P, RDI-P/HP-RDI, ERDI-PCD/ERDI-CD, ERDI-PPD/ERDI-PD, ERDI-PSD/ERDI-SD	TIM-P/HP-TIM, PLM-P/HP-PLM	245
	B3, REI-P/HP-REI	-	
Transcoding	-	LOBL1027B, Hi-BER1027B, LOAML1027B	248
	Inv. Flag, MSEQV, OTN BIP-8, PCS BIP-8 Mask	POSV, SEQV	

- a. Available in TX only.

## BER

### Alarms

- **No Traffic** (Available with EtherBERT or OTN BERT with EoOTN client)
  - RX:** No pattern traffic has been received in the last second.
- **Pattern Loss**
  - RX:** More than 20 percent of bit errors are received or the reference sequence can be unambiguously identified as out of phase.
- **Client Frequency** (Available for ODUflex with Pattern client)
  - RX:** The received client signal rate doesn't meet the nominal bit rate configured  $\pm 100$  ppm (refer to *Nominal Bit Rate* on page 186).

## Test Results

### Alarms/Errors

---

#### Errors

➤ **Bit Error**

**RX:** There are logic errors in the bit stream (i.e., zeros that should be ones and vice versa).

➤ **Mismatch '0'** (Available with EtherBERT and OTN BERT with EoOTN client)

**RX:** There is a bit error on a binary '0' (for example ones that should be zeros) found in the test pattern only.

➤ **Mismatch '1'** (Available with EtherBERT and OTN BERT with EoOTN client)

**RX:** There is a bit error on a binary '1' (for example zeros that should be ones) found in the test pattern only.

#### Clock

##### LOC (Loss Of Clock)

**RX:** The Packet Blazer is unable to synchronize with the selected **Clock Mode**. No valid clock is generated/extracted to/from the EXT CLK port.

## Ethernet

**Note:** Available with EtherBERT and OTN BERT with EoOTN client.

### Alarms

➤ **Link Down**

**RX:** There are alarms at the PCS level.

➤ **Local Fault Det.**<sup>1</sup> (Local Fault Detected)

**RX:** At least one of the following events is detected: Loss of bit synchronization, Loss of Block synchronization, Link down, or High BER.

➤ **Local Fault Rcd.**<sup>1</sup> (Local Fault Received)

**RX:** The received data path contains the **Local Fault** signal.

➤ **Remote Fault**<sup>1</sup>

**RX:** The received data path contains the **Remote Fault** status.

➤ **Hi-BER** (High-Bit Error Ratio) - (Available with 40GE/100GE interface, and EoOTN 100GbE client)

**RX:** The bit error ratio is  $> 10^{-4}$  on a fixed time period; 1250  $\mu$ s for 40G, and 500  $\mu$ s for 100G.

➤ **Client Frequency** (available with EoOTN 1GbE client)

**RX:** The received client signal rate doesn't meet the standard rate specification of 1250000000  $\pm$  150000 bps ( $\pm$  120 ppm).

---

1. Available with Ethernet 40/100 Gbit/s interface, Ethernet (flex/GFP-F) client, and EoOTN 10/40/100 Gbit/s client.

## Test Results

### Alarms/Errors

---

#### Errors

➤ **Symbol**<sup>1</sup>

**RX/TX:** Invalid code-group is detected/generated in the code.

➤ **Idle**<sup>1</sup>

**RX:** An error is detected between the end of a frame and the beginning of the next frame.

➤ **False Carrier**<sup>1</sup>

**RX:** Data is being received with invalid start of frame.

➤ **FCS (Frame Check Sequence)**

**RX:** Frames with an invalid FCS are received.

➤ **Jabber**

**RX:** Frames larger than 1518 bytes<sup>2</sup> with an invalid FCS are received.

➤ **Oversize** (available when the **Oversize Monitoring** check box is selected.)

**RX:** Frames larger than 1518 bytes<sup>2</sup> with a valid FCS.

➤ **Runt**

**RX:** Frames smaller than 64 bytes with an invalid FCS.

➤ **Undersize**

**RX:** Frames smaller than 64 bytes with a valid FCS.

➤ **Oversize Monitoring** check box, when selected (cleared by default), allows monitoring the **Oversize** frame errors.

---

1. Available with EoOTN 1GbE client.

2. Add 4 bytes to this value for each VLAN layer enabled.

## Ethernet - PCS Lanes

**Note:** *Available with parallel interface only: 40/100 Gbit/s Ethernet and OTN with 40/100GbE Ethernet client.*

- **Skew Alarm Threshold (bits)**, available with Ethernet test application, allows to set the threshold value that will be used to declare a skew alarm. The default value is 928 for 100G and 1856 for 40 G.
- **Default** restore the default skew alarm threshold value.

### Alarms

**Note:** *Alarms are only available with Ethernet test applications.*

- **LOA (Loss Of Alignment)**  
**RX:** Two or more logical lanes have the same logical lane marker value, or one or more logical lane marker recovery processes are in the OOR state, or if the differential delay between two logical lanes exceeds the configured alarm threshold compensable delay.
- **Inv. Mapping (Invalid Mapping)**  
**RX:** Indicates errors in the mapping attributed to either a mapping value appearing more than once or a non valid mapping value (out of range).
- **LOBL (Loss of Block Lock)**  
**RX:** In lock mode, 65 invalid sync fields (00 or 11) within a 1024 sync window are received. A PCS Lane Lock alarm is cleared when receiving 64 consecutive valid 66b sync field (01 or 10) in a row.

## Test Results

### Alarms/Errors

---

➤ **LOAML** (Loss of Alignment Marker Lock)

**RX:** In lock mode, four consecutive marker values are received that do not match the alignment marker that the lane is currently locked to. The LOAML alarm is cleared when the PCS Lane is declared Lock and two valid alignment markers 16384 blocks (66b) apart are received.

➤ **Exc. Skew** (Excessive Skew)

**RX:** The skew exceeds the defined threshold (see *Skew Alarm Threshold (bits)* on page 145).

### Errors

➤ **Block** is available with Ethernet test applications and 100GbE over OTU4.

**RX:** Invalid 64b/66b block code are received. An invalid 64b/66b block is declared when the synchronization field has a value of 00 or 11.

➤ **Inv. Marker** (Invalid Marker)

**RX:** There are errors in the 66-bit block alignment marker.

➤ **PCS BIP-8**

**RX:** There are PCS lane bit-interleave parity error. A routine even-parity check is performed over all bits of a PCS lane, from and including the previous alignment marker, but not including the current alignment marker.

➤ **PCS BIP-8 Mask** is available with 40GbE over OTU3 test.

**RX:** At the OTN ingress, the calculated 8-bit error mask contains at least one bit set to “1”.

➤ **OTN BIP-8** is available with 40GbE over OTU3 test

**RX:** Indicates for each lane that at the OTN egress, the calculated 8-bit error contains at least one bit set to “1”.



## GFP (Generic Framing Procedure)

**Note:** Available from the GFP-F/GFP-T sub-tab.

### Alarms

- **GFP-LFD** (GFP - Loss of Frame Delineation)  
**RX:** Indicates that the GFP engine is out of synchronization.  
**TX:** Generates a sufficient number of cHEC uncorrectable errors to avoid synchronization.
- **GFP-EXM** (GFP - Extension Header Mismatch)  
**RX:** The EXM alarm is declared when the EXI received is different from the expected EXI (refer to EXI on page 106) without uncorrectable cHEC, tHEC, eHEC, and no pFCS errors.
- **GFP-UPM** (GFP - User Payload Mismatch)  
**RX:** The UPM alarm is declared when the UPI received is different from the expected Client Data UPI without uncorrectable cHEC, tHEC, eHEC, and no pFCS errors. The *GFP-F/GFP-T* on page 106 displays the expected UPI value based on the test structure. Refer to page 446 for more information on UPI values.
- **GFP-DCI** (GFP - Defect Clear Indication)  
**RX:** The DCI alarm is declared when CMF frame is received with an UPI set to “0000 0011”.  
**TX:** Generates a client DCI by setting the UPI field to “0000 0011”.

## Test Results

### Alarms/Errors

---

- **GFP-FDI** (GFP - Forward Defect Indication) is available with GFP-F.  
**RX:** The FDI alarm is declared when CMF frame is received with an UPI set to “0000 0100”.  
**TX:** Generates a client FDI by setting the UPI field to “0000 0100”. Note that the configuration of the CMF pFCS check box (see *GFP-F/GFP-T* on page 106) is temporarily cleared and the UPI value changed when the GFP-FDI alarm is selected. The CMF pFCS check box state and the UPI value returns to their previous state/value when another alarm (other than GFP-FDI or GFP-RDI) is selected.
- **GFP-RDI** (GFP - Reverse Defect Indication) is available with GFP-F.  
**RX:** The RDI alarm is declared when CMF frame is received with an UPI set to “0000 0101”.  
**TX:** Generates a client RDI by setting the UPI field to “0000 0101”. Note that the configuration of the CMF pFCS check box (see *GFP-F/GFP-T* on page 106) is temporarily cleared and the UPI value changed when the GFP-RDI alarm is selected. The CMF pFCS check box state and the UPI value returns to their previous state/value when another alarm (other than GFP-FDI or GFP-RDI) is selected.
- **GFP-LOCS** (GFP - CSF-Loss of Client Signal)  
**RX:** LOCS is declared when CMF frame is received while UPI is set to “0000 0001”.  
**TX:** Generates a LOCS by setting the UPI field to “0000 0001”.
- **GFP-LOCCS** (CSF-Loss of Client Character Synchronization)  
**RX:** LOCCS is declared when CMP frame is received with an UPI set to “0000 0010”.  
**TX:** Generates a LOCCS by setting the UPI field to “0000 0010”.

- **GFP-Reserved CMF** (Client Management Frame) is available when the **Reserved CMF Monitoring** check box is selected.

**RX:** CMF alarms other than the ones described above.

**Reserved CMF Monitoring** check box, when selected, allows monitoring the **GFP-Reserved CMF** alarms.

- **GFP-UserDefined CMF**

**TX:** Generates a CMF (Client Management Frame) with a user defined UPI.

### Errors

- **GFP-cHEC-CORR** (GFP - core Header Error Check - Correctable)

**RX:** Indicates that only one bit error has been detected on Core header (PLI and cHEC).

**TX:** Generates a “Walking 1” pattern to hit all applicable bits covered by the cHEC and PLI.

- **GFP-cHEC-UNCORR** (GFP - core Header Error Check - Uncorrectable)

**RX:** Indicates that two or more bit errors have been detected on Core header (cHEC and PLI).

**TX:** Generates a “Walking 11” pattern to hit all consecutive 2 bits applicable to the bits covered by the cHEC and PLI.

- **GFP-tHEC-CORR** (GFP - type Header Error Check - Correctable)

**RX:** Indicates that only one bit error has been detected in the Type header (tHEC, PTI, PFI, EXI, and UPI).

**TX** (requires client data frame generation): Generates a “Walking 1” pattern to hit all applicable bits covered by the tHEC, PTI, PFI, EXI, and UPI.

## Test Results

### Alarms/Errors

---

- **GFP-tHEC-UNCORR** (GFP - type Header Error Check - Uncorrectable)  
**RX:** Indicates that two or more bit errors have been detected in the Type header (tHEC, PTI, PFI, EXI, and UPI).  
**TX** (requires client data frame generation): Generates a “Walking 11” pattern to hit all consecutive 2 bits applicable to the bits covered by the tHEC, PTI, PFI, EXI and UPI.
- **GFP-eHEC-CORR** (GFP - extension Header Error Check - Correctable) is only available with GFP-F when EXI is set to **Linear**.  
**RX:** Indicates that only one bit error has been detected in the Extension header (eHEC, CID and Spare).  
**TX** (requires client data frame generation): Generates a “Walking 1” pattern to hit all applicable bits covered by the eHEC, CID and Spare.
- **GFP-eHEC-UNCORR** (GFP - extension Header Error Check - Uncorrectable) is only available with GFP-F when EXI is set to **Linear**.  
**RX:** Indicates that two or more bit errors have been detected in the Extension header (eHEC, CID and Spare).  
**TX** (requires client data frame generation): Generates a “Walking 11” pattern to hit all consecutive 2 bits applicable to the bits covered by the eHEC, CID and Spare.
- **GFP-SB-CORR** (GFP - Superblock Correctable) is available with GFP-T.  
**RX:** Indicates that bit error has been detected in the CRC-16 word of the superblock. A received SB Correctable (Pre) error counts as one error while SB Correctable (Post) counts as two errors.  
**TX:**  
**GFP-SB-CORR (Pre)** generates a “Walking 1” pattern to include a single bit error in the CRC-16 word of the superblock.  
**GFP-SB-CORR (Post)** generates in the payload of the superblock, a “Walking 1” pattern to include two separate errors in one superblock separated by 43 bits.

- **GFP-SB-UNCORR** (GFP - Superblock Uncorrectable) is available with GFP-T.

**RX:** Indicates that two or more bit errors have been detected in the CRC-16 word of the superblock. Note that if two errors are spaced by exactly 43 bits, they will not be reported as uncorrectable.

**TX:** Generates a “Walking 11” pattern to include two consecutive errors in the CRC-16 word of the superblock.

- **GFP-10B\_ERR** (GFP - 10B\_Error) is available with GFP-T.

**RX:** Indicates that a 10B\_ERR code has been detected in the payload of the superblock.

**TX:** Generates a 10B\_ERR code over the payload of the superblock as defined in ITU G.7041.

- **GFP-pFCS** (GFP - payload Frame Check Sequence)

**RX:** Indicates that at least one bit error has been detected in the payload.

**TX** (requires client data frame generation): Generates a “Walking 1” pattern to hit all 32 bits of the pFCS only. Only available with **Ethernet (flex/GFP-F)** client when the **CDF pFCS** check box is selected (refer to *GFP-F/GFP-T* on page 106).

### **GMP and ODTU4.1 - GMP (Generic Mapping Procedure)**

**Note:** *GMP is only available with EoOTN client (ODU0 with PT21). GMP is displayed under ODUx alarms/errors group. **GMP** is labelled as **ODTU4.1 - GMP** with Multi-Channel OTN.*

#### **Alarms**

- **OOS** (Generic Mapping Procedure - Out Of Synchronization).

**RX:** Indicates that the GMP RX cannot synchronize with the GMP TX.

#### **Errors**

- **Cm-CRC-8**

**RX:** There is a Cm-CRC-8 mismatch between the received value and the locally computed value.

- **CnD-CRC-5**

**RX:** There is a CnD-CRC-5 mismatch between the received value and the locally computed value.

## Interface

### Alarms

➤ **LOS** (Loss Of Signal)

**RX:** Absence of an input signal or an all-zeros pattern is received.  
Available for each Optical Lane for parallel interface.

➤ **LOC Lane** (Loss Of Clock Lane) is available for each Physical Lane for parallel interface

**RX:** The module is unable to lock on the Physical/CAUI/XLAUI link interface.

➤ **Int. RX Fault** (Interlink RX Fault) is available with serial CFP

**RX:** Fault detected at the interlink point between the FTB/IQS-85100G and the CFP, an unexpected signal is coming out from the CFP.

➤ **Frequency** (available for each Physical Lane for parallel interface)

**RX:** The received signal frequency meets the standard specifications (green) or not (red).

For parallel interfaces:

Rate	Optic Type	Frequency
40GE	4x10G	10.3125 Gbit/s ± 100 ppm
OTU3	4x10G	10.7546 Gbit/s ± 20 ppm
OTU3e1	4x10G	11.1427 Gbit/s ± 20 ppm
OTU3e2	4x10G	11.1458 Gbit/s ± 20 ppm
100GE	10x10G, 4 x 25G	10.3125 Gbit/s ± 100 ppm
OTU4	10x10G, 4 x 25G	11.181 Gbit/s ± 20 ppm

## Test Results

### Alarms/Errors

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For serial interfaces:

Interface	Standard Rate Specification
OC-768/STM-256	39.81312 Gbit/s $\pm$ 20 ppm
OTU3	10.7546 Gbit/s $\pm$ 20 ppm
OTU3e1	11.1427 Gbit/s $\pm$ 20 ppm
OTU3e2	11.1458 Gbit/s $\pm$ 20 ppm

## IP/UDP

### Errors

➤ **IP Chksum** (IP Checksum)

**RX:** The IP datagrams received have invalid IP header checksum. Only available for IPv4.

➤ **UDP Chksum** (UDP Checksum)

**RX:** The UDP segments received have invalid UDP checksum.



## ODUx

**Note:** For OPUx alarms see page 236. For GMP alarms/errors see page 228.

### Alarms

➤ **AIS** (Alarm Indication Signal)

**RX:** The STAT information in the PM byte 3, bits 6 to 8 is “111” for at least 3 consecutive frames.

**TX:** Generates an all "1"s pattern in the entire ODUk signal, excluding the frame alignment overhead (FA OH), OTUk overhead (OTUk OH) and ODUk FTFL.

➤ **BDI** (Backward Defect indication)

**RX:** The BDI bit in the PM overhead field (byte 3, bit 5) is “1” for at least 5 consecutive frames.

**TX:** Generates a “1” in the BDI (byte 3, bit 5) of the PM overhead field continuously.

➤ **BSD** (Backward Signal Degrade)

**RX:** The FTFL byte 128 is “00000010”.

**TX:** Generates a “00000010” pattern in the FTFL Byte 128 continuously.

➤ **BSF** (Backward Signal Fail)

**RX:** The FTFL byte 128 is “00000001”.

**TX:** Generates a “00000001” pattern in the FTFL Byte 128 continuously.

➤ **FSD** (Forward Signal Degrade)

**RX:** The FTFL byte 0 is “00000010”

**TX:** Generates a “00000010” pattern in the FTFL Byte 0 continuously.

## Test Results

### Alarms/Errors

---

- **FSF** (Forward Signal Fail)  
**RX:** The FTFL byte 0 is “00000001”.  
**TX:** Generates a “00000001” pattern in the FTFL Byte 0 continuously.
- **LCK** (Lock)  
**RX:** STAT information in the PM byte 3, bits 6 to 8 is “101” for at least 3 consecutive frames.  
**TX:** Generates a repeating "01010101" pattern in the entire ODUk signal, excluding the frame alignment overhead (FA OH) and OTUk overhead (OTUk OH).
- **LOFLOM** (Loss of Frame Loss Of Multiframe) is only available for mapped ODU client signal (designated as LO in the standard).  
**RX:** OOF is present for at least 3 ms.  
**TX:** Generates error continuously in FAS and MFAS of a multiplexed test case.
- **OCI** (Open Connection Indication)  
**RX:** STAT information in the PM byte 3, bits 6 to 8 is “110” for at least 3 consecutive frames.  
**TX:** Generates a repeating "01100110" pattern in the entire ODUk signal, excluding the frame alignment overhead (FA OH) and OTUk overhead (OTUk OH).
- **TIM** (Trace Identification Mismatch)  
**RX:** The received SAPI and/or DAPI do not math the expected SAPI and/or DAPI. This alarm is only available when the SAPI ODU-TIM and/or DAPI ODU-TIM check boxes are selected from *PT / Global PT* on page 104.

**Errors**

➤ **BIP-8** (Bit Interleave Parity-8)

**RX:** There is a PM BIP-8 mismatch between the received value and locally computed value (0 to 8).

➤ **BEI** (Backward Error Indication)

**RX:** Interleaved block in error detected by the corresponding ODU path monitoring sink using the BIP-8 code.

<b>ODU BEI bits (1234)</b>	<b>BIP violations</b>	<b>ODU BEI bits (1234)</b>	<b>BIP violations</b>
0000	0	0101	5
0001	1	0110	6
0010	2	0111	7
0011	3	1000	8
0100	4	1001 to 1111	0

### ODUx-TCM

#### Alarms

- **BDI** (Backward Defect Indication)
  - RX:** The BDI bit in the TCM overhead field Byte 3, bit 5 is “1” for at least 5 consecutive frames.
  - TX:** Generates a "1" in the BDI bit of the TCM overhead field (byte 3, bit 5) continuously.
- **BIAE** (Backward Incoming Alignment Error)
  - RX:** The BEI/BIAE bits in the TCM overhead field Byte 3, bits 1 to 4 are “1011” for at least 3 consecutive frames.
  - TX:** Generates "1011" in the BEI/BIAE bits of the TCM overhead (byte 3, bits 1 to 4) continuously.
- **IAE** (Incoming Alignment Error)
  - RX:** The STAT information in the TCM is “010” for at least 3 consecutive frames.
  - TX:** Generates "1" in the IAE bit of the TCM overhead (byte 3, bit 6) continuously.
- **LTC** (Loss of Tandem Connection)
  - RX:** The STAT information in the TCM Byte 3, bits 6, 7, and 8 are “000” for at least 3 consecutive frames.
  - TX:** Generates "000" in the STAT field of TCM overhead (byte 3, bits 6 to 8) continuously.
- **TIM** (Trace Identification Mismatch)
  - RX:** The SAPI and/or DAPI do not math the expected SAPI and/or DAPI. This alarm is only available when the Enable TIM SAPI and/or DAPI check boxes are selected from *PT / Global PT* on page 104.

**Errors**

➤ **BIP-8** (Bit Interleave Parity-8)

**RX:** There is a TCM BIP-8 mismatch between the received value and locally computed value (0 to 8).

➤ **BEI** (Backward Error Indication)

**RX:** Interleaved block in error detected by the corresponding ODU tandem connection monitoring sink using the BIP-8 code.

<b>ODU TCM BEI bits (1234)</b>	<b>BIP violations</b>	<b>ODU BEI bits (1234)</b>	<b>BIP violations</b>
0000	0	0101	5
0001	1	0110	6
0010	2	0111	7
0011	3	1000	8
0100	4	1001 to 1111	0

## Test Results

### Alarms/Errors

---

## OPUx

**Note:** *OPUx is displayed under ODUx alarms/errors group.*

### Alarms

- **AIS** (Alarm Indication Signal) is only available on the OPU client signal (designated as LO in the standard).

**RX:** A PRBS11 pattern is received indicating a failure of the client signal.

**TX:** Generates a PRBS11 pattern.

- **CSF** (Client Signal Fail) is only available on the OPU client signal (designated as LO in the standard).

**RX:** Bit 1 of the OPUk PSI[2] byte is set to “1” indicating a failure of the client signal mapped into the OPUk of the OTN signal.

**TX:** Sets the bit 1 of the OPUk PSI[2] byte to “1”.

- **LOOMFI** (Loss of OPU Multi-Frame Identifier) is only available for OPU4 of a mapped signal.

**RX:** OOMFI is present for at least 3 ms.

- **MSIM** (Multiplex Structure Identifier Mismatch) is available for the high order path of a multiplexed test case only.

**RX:** The RX Payload Structure Identifier (PSI) information do not match the expected HO Multiplex Structure Identifier defined.

**TX:** Corrupts the content of the PSI

For PT20: Bytes 2 and 3 for ODU0 in ODU1, bytes 2 to 5 for ODU1 in ODU2, and bytes 2 to 17 for ODU2 in ODU3. Not applicable for ODU4.

For PT21: Bytes 2 to 9 for ODU1 in ODU2, bytes 2 to 33 for ODU2 in ODU3, and bytes 2 to 81 for ODU3 in ODU4. Not applicable for ODU0.

- **OOMFI** (Out of OPU Multi-Frame Identifier) is only available for OPU4 of a mapped signal.

**RX:** OPU Multi-frame Identifier number are in error for at least 5 consecutive OTU frames.

- **PLM** (Payload Mismatch) is available when OPU-PLM check box is selected.

**RX:** The Payload Structure Identifier (PSI) field does not match the expected PT for at least 3 consecutive frames.

### **Errors**

- **OMFI** (OPU Multi-Frame Identifier) is only available for OPU4 of a mapped signal.

**RX:** Invalid OMFI word sequence detected.

## Test Results

### Alarms/Errors

---

## OTL

### Alarms

- **LOL** (Loss of Lane Alignment)  
**RX:** Multilane alignment process is in the out-of-alignment (OLA) state for 3 ms.
- **LOF** (Loss of Frame)  
**RX:** OOF is present for at least 3 ms.
- **OOF** (Out-Of-Frame)  
**RX:** Any byte of the FAS (bytes 3, 4, and 5) is in error for at least 5 consecutive frames.
- **LOR** (Loss Of Recovery)  
**RX:** When OOR persists at least 3 ms.
- **OOO** (Out-Of-Recovery)  
**RX:** While in In-recovery (IR) state, in five consecutive 16320 byte periods each of the received logical lane marker (LLM) is different from the accepted LLM value.
- **Exc. Skew** (Excessive Skew)  
**RX:** The skew exceeds the defined threshold (see *Skew Alarm Threshold (bits)* on page 320).

### Errors

- **FAS** (Frame Alignment Signal)  
**RX:** The FAS bits are in error.
- **Inv. Marker** (Invalid Marker)  
**RX:** Errors are detected in the 66-bit block alignment marker.



## OTUx

**Note:** Available for OTU4, OTU3, OTU3e1, and OTU3e2.

### Alarms

- **AIS** (Alarm Indication Signal) available with serial interfaces only.
  - RX:** Polynomial number 11 (PN-11) is over all OTU frame bits including FAS and MFAS for at least 3 consecutive 8192 bit-interval.
  - TX:** Generates polynomial number 11 (PN-11) over all OTU frame bits including FAS and MFAS continuously.
- **BDI** (Backward Defect Indication)
  - RX:** The BDI bit in the SM overhead field (byte 3, bit 5) is “1” for at least 5 consecutive OTU frames.
  - TX:** Generates “1” for the BDI bit in the SM overhead field (byte 3, bit 5) continuously.
- **BIAE** (Backward Incoming Alignment Error)
  - RX:** The BEI/BIAE bits in the SM overhead field (byte 3, bits 1 to 4) are “1011” for at least 3 consecutive frames.
  - TX:** Generates “1011” for the BEI/BIAE bits in the SM overhead field (byte 3, bits 1 to 4) continuously.
- **IAE** (Incoming Alignment Error)
  - RX:** The IAE bit in the SM overhead field (byte 3, bit 6) is “1” for at least 5 consecutive OTU frames.
  - TX:** Generates “1” for the IAE bit in the SM overhead field (byte 3, bit 6) continuously.

## Test Results

### Alarms/Errors

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- **LOF** (Loss of Frame)
  - RX:** OOF is present for at least 3 ms.
  - TX:** Generates error in all FAS bits continuously.
- **LOM** (Loss Of Multiframe)
  - RX:** OOM is present for at least 3 ms
  - TX:** Generates error in MFAS bits continuously.
- **OOF** (Out-Of-Frame)
  - RX:** FAS (bytes 3, 4, and 5) are in error for at least 5 consecutive OTU frames.
  - TX:** Generates error in all FAS bits for 5 consecutive OTU frames.
- **OOM** (Out-Of-Multiframe)
  - RX:** MFAS are in error for at least 5 consecutive OTU frames.
  - TX:** Generates error in multiframe number for 5 consecutive OTU frames.
- **TIM** (Trace Identifier Mismatch)
  - RX:** Expected SM SAPI and/or SM DAPI do not match the received SM SAPI and/or DAPI for at least 3 consecutive TTI. This alarm is only available when the Enable TIM SAPI OTU-TIM and/or DAPI OTU-TIM check boxes are selected from page 210.

**Errors**

➤ **BEI** (Backward Error Indication)

**RX:** SM BEI errors are received from the DUT (value 0 to 8).

OTU BEI bits (1234)	BIP violations	ODUk BEI bits (1234)	BIP violations
0000	0	0101	5
0001	1	0110	6
0010	2	0111	7
0011	3	1000	8
0100	4	1001 to 1111	0

➤ **BIP-8** (Bit Interleave Parity-8)

**RX:** There is a SM BIP-8 mismatch between the received value and locally computed value (0 to 8).

➤ **FAS** (Frame Alignment Signal)

**RX:** The FAS bits are in error.

➤ **FEC-CORR** (Forward Error Correction - Correctable)

**RX:** Statistics on codewords (CW; default), symbols (SYMB), or bits (BIT) corrected by the FEC.

**TX:**

**FEC-CORR-CW** (Forward Error Correction - Correctable - Codeword): Generates 8 symbols (bytes) containing 8 bits in error each, in each codeword.

**FEC-CORR-SYM** (Forward Error Correction - Correctable - Symbol): Generates 1 symbol (byte) containing 8 bits in error.

**FEC-CORR-BIT** (Forward Error Correction - Correctable - Bit): Generates 1 symbol (byte) containing 1bit in error.

## Test Results

### Alarms/Errors

---

➤ **FEC-UNCORR** (FEC - Uncorrectable)

**RX:** Statistics on the detected codewords (CW) having uncorrectable errors.

**TX: FEC-UNCORR-CW** (Forward Error Correction - Uncorrectable - Codeword) generates 16 symbol (bytes) containing 8 bits in error each, in each codeword.

➤ **FEC-STRESS** (Forward Error Correction - Stress)

**TX:** Generates correctable errors composed of a random number of symbol errors (less or equal to 8) containing a random number of bits distributed all over the OTU frame.

➤ **MFAS** (Multiframe Alignment Signal)

**RX:** The MFAS bits are in error.

## QoS Metrics

**Note:** Only available with Traffic Gen & Mon test application.

### Errors

➤ **Frame Loss**

**RX:** A sequence number is missing in the received frames.

➤ **Out-of-Seq.** (Out-of-Sequence)

**RX:** The received frame sequence number is either smaller than the expected frame sequence number or is a duplicate number.

## Section/Line / RS/MS

### Alarms

- **LOF-S** (Loss Of Frame - Section) - SONET  
**RS-LOF** (Regeneration Section - Loss Of Frame) - SDH  
**RX:** A SEF (SONET)/RS-OOF (SDH) defect on the incoming optical signal persists for at least 3 milliseconds.  
**TX:** Generates non-valid framing bytes (A1 and A2).
- **SEF** (Severely Errored Framing) - SONET.  
**RS-OOF** (Regeneration Section - Out-Of-Frame) - SDH.  
**RX:** A minimum of four consecutive errored framing patterns are received.  
**TX:** Generates four consecutive errored framing patterns.
- **TIM-S** (Trace Identifier Mismatch - Section) - SONET  
**RS-TIM** (Regeneration Section - Trace Identifier Mismatch) - SDH  
**RX:** The received J0 Trace doesn't match the expected message value. Only available when Enable TIM-S/RS-TIM check box is selected (refer to *Traces (SONET/SDH)* on page 209).
- **AIS-L** (Alarm Indication Signal - Line) - SONET  
**MS-AIS** (Multiplex Section - Alarm Indication Signal) - SDH  
**RX:** Bits 6, 7 and 8 of the K2 byte contain the "111" pattern in five consecutive frames.  
**TX:** Generates a SONET/SDH signal that contains a valid Section Overhead (SOH) / Regenerator Section Overhead (RSOH) and an all-ones pattern on the SPE.

## Test Results

### Alarms/Errors

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- **RDI-L** (Remote Defect Indication - Line) - SONET  
**MS-RDI** (Multiplex Section - Remote Defect Indication) - SDH  
**RX:** Bits 6, 7, and 8 of the K2 byte contain the “110” pattern in five consecutive frames.  
**TX:** Generates a “110” pattern for the bits 6, 7 and 8 of the K2 byte.

### Errors

- **FAS-S** (Frame Alignment Signal - Section) - SONET  
**RS-FAS** (Regeneration Section - Frame Alignment Signal) - SDH  
**RX:** At least one A1 or A2 byte of the FAS word is in error.
- **B1** (BIP-8, Bit-Interleave Parity - 8 bits)  
**RX:** Indicates a Section (SONET) / Regeneration Section (SDH) parity error by performing a routine even-parity check over all frames of the previous STS-n/STM-n signal (located in the first STS-1/STM-1 of an STS-n/STM-n signal).
- **B2** (BIP-8, Bit-Interleave Parity - 8 bits)  
**RX:**
  - SONET: Indicates a Line parity error by performing an even-parity check over all bits of the LOH and SPE of the previous frame (located in every STS-1 of an STS-n signal).
  - SDH: Indicates a Multiplex Section parity error by performing an even-parity check over all bits (except those in the RSOH bytes) of the previous frame of a STM-N signal.
- **REI-L** (Remote Error Indicator - Line) - SONET  
**MS-REI** (Multiplex Section - Remote Error Indicator) - SDH  
**RX:** The M0, M1, or the combination of both M0 and M1 bytes indicate that one or more BIP violations have been detected. Refer to *M0* or *M1* (SONET) on page 355 for more information.

## STS-x/AU-x

### Alarms

- **AIS-P** (Alarm Indication Signal - Path) - SONET  
**AU-AIS** (Administrative Unit - Alarm Indication Signal) - SDH  
**RX:** The H1 and H2 bytes contain an all-ones pattern in three consecutive frames or more.  
**TX:** Generates an all-ones pattern over H1, H2, H3, and SPE.
- **LOP-P** (Loss Of Pointer - Path) - SONET  
**AU-LOP** (Administrative Unit - Loss Of Pointer) - SDH  
**RX:** A valid pointer is not found in N consecutive frames (where  $8 \leq N \leq 10$ ), or that N consecutive NDFs (“1001” pattern) are detected (non-concatenated payloads).  
**TX:** Generates a non-valid pointer.
- **UNEQ-P** (Unequipped - Path) - SONET  
**HP-UNEQ** (HP - Unequipped) - SDH  
**RX:** The C2 byte contains “00 H” in five consecutive frames. Only available when PLM-P/UNEQ-P / HP-PLM/HP-UNEQ is enabled (refer to *Labels* on page 112).  
**TX:** Generates an all-zeros pattern over POH and SPE.
- **H4-LOM** (H4 - Loss Of Multiframe)  
**RX:** For VT/TU structured optical frames, the system loss track of the H4 byte multiframe indicator sequence.  
**TX:** Generates a wrong H4 byte multiframe indicator sequence.
- **TIM-P** (Trace Identifier Mismatch - Path) - SONET  
**HP-TIM** (HP - Trace Identifier Mismatch) - SDH  
**RX:** J1 Trace doesn't match the expected message value. Only available when TIM-P/HP-TIM is enabled (refer to *Traces (SONET/SDH)* on page 209).

## Test Results

### Alarms/Errors

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- **PLM-P** (Payload Label Mismatch - Path) - SONET  
**HP-PLM** (HP - Payload Label Mismatch) - SDH  
**RX:** Five consecutive frames have mismatched STS/VC signal labels (C2 byte). Only available when PLM-P/UNEQ-P / HP-PLM/HP-UNEQ is enabled (refer to *Labels* on page 112).
- **PDI-P** (Payload Defect Indication - Path) - SONET  
**RX:** The C2 byte contains the hexadecimal FC code.  
**TX:** Inserts the hexadecimal FC code in the C2 byte.
- **RDI-P** (Remote Defect Indication - Path) - SONET  
**HP-RDI** (High Order Path - Remote Defect Indication) - SDH  
**RX:** Bits 5, 6, and 7 of the G1 byte contain the “100” or “111” pattern in five consecutive frames.  
**TX:** Generates a “100” pattern for bits 5, 6 and 7 of the G1 byte.
- **ERDI-PCD** (Enhanced RDI - Path Connectivity Defect) - SONET  
**ERDI-CD** (Enhanced RDI - Path Connectivity Defect) - SDH  
**RX:** Bits 5, 6 and 7 of the G1 byte contain the “110” pattern in five consecutive frames.  
**TX:** Generates a “110” pattern for bits 5, 6 and 7 of the G1 byte.
- **ERDI-PPD** (Enhanced RDI - Path Payload Defect) - SONET  
**ERDI-PD** (Enhanced RDI - Payload Defect) - SDH  
**RX:** Bits 5, 6 and 7 of the G1 byte contain the “010” pattern in five consecutive frames.  
**TX:** Generates a “010” pattern for bits 5, 6 and 7 of the G1 byte.



- **ERDI-PSD** (Enhanced RDI - Path Server Defect) - SONET  
**ERDI-SD** (Enhanced RDI - Server Defect) - SDH

**RX:** Bits 5, 6 and 7 of the G1 byte contain the “101” pattern in five consecutive frames.

**TX:** Generates a “101” pattern for bits 5, 6 and 7 of the G1 byte.

### **Errors**

- **B3** (BIP-8, Bit-Interleave Parity - 8 bits)

**RX:** Indicates a high order path parity error by performing an even-parity check over all bits of the previous SPE (SONET) / VC-N (SDH).

- **REI-P** (Remote Error Indicator - Path) - SONET  
**HP-REI** (HP - Remote Error Indicator) - SDH

**RX:** 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/STM-1 of an STS-n/STM-n signal).

### Transcoding

**Note:** Only available with OTU3 BERT test application with 40 GbE client.

#### Alarms

- **LOBL1027B** (Loss of Block Lock 1027 Blocks)  
**RX:** Sixteen 1027-bit blocks with invalid 3-bit patterns are received before sixty-four valid blocks.
- **Hi-BER1027B** (High-Bit Error Ratio 1027 Blocks)  
**RX:** The bit error ratio is  $> 10^{-4}$  on a fixed 250  $\mu$ s time period.
- **LOAML1027B** (Loss of Alignment Marker Lock 1027 Blocks)  
**RX:** In lock mode, four consecutive marker values are received that do not match the alignment marker that the lane is currently locked to. The LOAML alarm is cleared when the PCS Lane is declared Lock and two valid alignment markers 16384 blocks (66b) apart are received.

#### Errors

- **Inv. Flag** (Invalid Flag)  
**RX:** A 1027-bit block with invalid 3-bit pattern is received.
- **POSV** (POS Violation)  
**RX:** Two or more POS (Position Field) have the same POS values or they are not in ascending order.
- **SEQV** (Sequence Violation)  
**RX:** Unexpected sequence is detected.
- **MSEQV** (Marker Sequence Violation)  
**RX:** Unexpected marker sequence is detected.

## Inject Button

The screenshot shows a configuration window for injecting alarms or errors. It includes a 'Layer' dropdown menu, a 'Lane' selection area with buttons from 'All' to '9', and input fields for 'Type' (set to 'Alarms') and 'Defect' (set to 'LOS'). There are also fields for 'Mode' and 'Rate'. At the bottom, there is an 'Inject' button, a status indicator showing 'LOS (Continuous)', and a blue button to open or close the pop-up.

Selected Alarm/Error and status      Open/Close pop-up button

- **Layer:** Allows to select on which layer is the alarm/error to be generated. Choices depend on the test application and its interface.
- **Lane,** available with parallel interface, allows to select the physical lane that will be used for injection. Available for Interface, OTL, and PCS layers only.
- **Channel,** available with Multi-Channel OTN, allows to select the channel number that will be used for injection. The **All** button selects all channels.
- **Type:** Allows to select the type of injection, either **Alarms** or **Errors**.
- **Defect:** Allows the selection of the alarm/error defect to be generated. Choices depend on the selected **Layer** and **Type**. Refer to *Alarms/Errors* on page 215 for more information.

## Test Results

### Alarms/Errors

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- **Mode and Rate/Amount**
  - **Manual** allows to enter the amount of manual error to be generated: **1** (default) through **50** or **100** (depends on the selected error).
  - **Rate** allows the selection of the injection rate for the selected error. The rate must be within the minimum and maximum values specified.
  - **Max Rate** generates the selected error to its theoretical maximum rate.
  - **Burst Single**<sup>1</sup> available with any SONET/SDH layer, generates a burst of consecutive alarmed frames and then automatically stops the transmission. Use the **Duration** field to set the burst duration.
  - **Burst Repeat**<sup>1</sup> available with any SONET/SDH layer, generates a burst of consecutive alarmed frames over the period continuously. Use the **Duration** field to set the burst duration and the **Period** field to set the period.

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1. Available with OC-768/STM-256 interface only.

- **Duration** available with **Burst Single** and **Burst Repeat** modes, allows the selection of the burst duration: **1** (default) to **1440000** frames or **1** to **1800** seconds. The burst duration value must be less of equal to the period value.
- **Period**  
 For GFP layer, allows to set the alarm period associated with the client management frames: **10 ms** to **1200 ms** (default is **100 ms**).  
 For **Burst Repeat** mode, allows the selection of the burst period: **1** (default) to **1440000** frames or **1** to **1800** seconds. The burst period value must be bigger or equal to the duration value.
- **User-Defined UPI** available with GFP layer, allows entering the Client Management Frame UPI value when **GFP-User-Defined CMF** alarm is selected.

UPI	Description for PTI = 100
0000 0000 and 1111 1111	Reserved
0000 0001	Client Signal Fail (Loss of Client Signal)
0000 0010	Client Signal Fail (Loss of Client Character Synchronization)
0000 0011 through 1111 1110	Reserved for future use

- **Inject button**  
 For **Manual** mode: Manually generates the selected errors according to the defect and the amount selected.  
 For **Rate** and **Max Rate**: Generates respectively the selected error at the rate specified or at its theoretical maximum rate.

**Note:** *The selected alarm/error as well as its injection mode and status are displayed next to the **Inject** button.*

- The open/close pop-up button allows to respectively expand (up arrow) or collapse (down arrow) a pop-up allowing to set the alarm/error injection parameters.

## Test Results

*FTFL/PT and PT*

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### FTFL/PT and PT

For OTN BERT and OTN-SONET/SDH BERT: From the **Test** menu tap **Results**, and the **FTFL/PT** tab.

For Multi-Channel OTN: From the **Test** menu, tap **Results**, and the **PT** tab.

### Channel

Available with Multi-Channel OTN lower ODU layer, allows the selection of the channel number.

### ODUx Buttons

Tap on an **ODUx** button to select the multiplexed level.

### FTFL

Indicates the Forward and Backward ODU Fault Type Fault Location. Not available with Multi-Channel OTN.

- **Fault Indication** and **Code** displays the FTFL fault indicator message and its code in hexadecimal format (byte 0 for forward, byte 128 for backward).

Fault Indication	Code
No fault	00 (default)
Signal fail	01
Signal Degrade	02
Reserved	03

- **Operator Identifier** displays the received operator identifier (bytes 1 to 9 for forward, byte 129 to 137 for backward).
- **Operator Specific** displays the received operator specific (bytes 10 to 127 for forward, byte 138 to 255 for backward).

## **PT (Payload Type)**

### ➤ **Payload Type and Code**

**Received** displays the received payload signal type and its code in hexadecimal format.

**Expected** allows to select the expected payload signal type either by selecting the payload from the list or by typing its hexadecimal code.

**Note:** *Refer to PT / Global PT on page 104 for the list.*

- **OPU-PLM<sup>1</sup>**, when selected, enables the OPU-PLM alarm analysis.
- **Copy RX/Global Copy RX<sup>2</sup>** uses the received payload type as the expected payload type. For Multi-Channel OTN lower ODU layer, use the arrow button next to the **Copy RX** or **Global Copy RX** to switch from one button to the other; **Global Copy RX** uses the current channel received payload type as the expected payload type for all channels while **Copy RX** only affects the selected channel.

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1. For Multi-Channel OTN lower ODU layer, the OPU-PLM check box is only configurable from the test setup.  
2. Only available for Multi-Channel OTN lower ODU layer.

## Test Results

GFP-F/GFP-T

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### GFP-F/GFP-T

**Note:** This tab is only available with OTN BERT test application with **1GbE**, **10GbE**, or **Ethernet (flex/GFP-F)** client.

From the **Test** menu, tap **Results**, and the **GFP-F/GFP-T** tab.

#### Transport Layer

- **Bandwidth Usage (%)** indicates the transmitted/received transport layer bandwidth in the last second, excluding the Idle bytes.
- **Mapping Efficiency (%)** indicates the transmitted/received transport layer mapping efficiency (Client Payload Bytes divided by Client Data Bytes multiplied by 100) in the last second.

#### Frame Type

**Note:** For **Ethernet (flex/GFP-F)** client with **EXI** set to **Linear**, the **RX** count/rate is configurable to either **RX** (default) or **RX CID Filtered** by tapping on the table **RX** label. **RX CID Filtered** only includes frames that match the expected **CID** (refer to **CID** on page 5).

- **Client Data** indicates the transmitted/received client data frames without uncorrectable cHEC, tHEC, and eHEC errors. Possible rate units are **Frames** (default), **Bytes**, or **Payload Bytes** per second.
- **Client Management** indicates the transmitted/received client management frames without uncorrectable cHEC, tHEC, and eHEC, and pFCS errors. Possible rate units are **Frames** (default), or **Bytes** per second.
- **Idle** indicates the transmitted/received idle frames. Possible rate units are **Frames** (default), or **Bytes** per second.



- **Reserved PTI** indicates the received client data and management frames with a payload type identifier different of 000 and 100 without uncorrectable cHEC, tHEC, and eHEC, and pFCS errors. Possible rate units are **Frames** (default), or **Bytes** per second.
- **Reserved PLI** indicates the number of reserved control frames (PLI=1, 2, or 3 while in Synchronization state) received.
- **Invalid** indicates the number of received frames corresponding to at least one of the following conditions:
  - EXI=0000 while PFI=1 and PLI <8
  - EXI=0001 while PFI=0 and PLI <8
  - EXI=0001 while PFI=1 and PLI<12
- **Discarded** indicates the number of received frames with uncorrectable tHEC, eHEC errors, or Invalid Frames.
- **Total** indicates the received frames including Idle, Client Data, Client Management, and frames with a reserved PTI. Possible rate units are **Frames** (default), or **Bytes** per second.

## RX Mismatch

- **PFI** (Payload Frame Check Sequence Identifier) indicates the number of frames with PFI field not matching the expected PFI.
- **EXI** (Extension Header Identifier) indicates the number of frames with EXI field not matching the expected EXI.
- **UPI** (User Payload Identifier) indicates the number of frames UPI field not matching the expected UPI.
- **CID** (Channel Identifier), only available when EXI is set to **Linear**, indicates the number of frames CID field not matching the expected CID.

**Note:** For expected values, refer to GFP-F/GFP-T on page 106 for more information.

### Superblock

**Note:** *Superblock is only available with GFP-T.*

- **Valid** indicates the transmitted/received superblocks without any uncorrectable error.
- **Invalid** indicates the transmitted/received superblocks with uncorrectable error.
- **Total** indicates the total transmitted/received valid and invalid superblocks.

## **Graph (RFC 2544)**

Displays the graph showing the **Throughput**, **Back-to-Back**, **Frame Loss**, and **Latency** measurements. For **Dual Test Set** the graph shows results from **Local to Remote** and **Remote to Local** using distinctive colors.

From the **Test** menu, tap **Results**, and the **Graphs** tab.

- **All** button allows to view the graphs of all subtests simultaneously.
- **Throughput**, **Back-to-Back**, **Frame Loss**, and **Latency** buttons allow to view an enlarged graph view of the selected subtest.
- **Displayed Results** allows to select the displayed results mode, either **Minimum**, **Maximum** (default), **Average**, or **Current**.
- **Step**, available with Frame Loss, allows to select the result step (100 percent by default) to be displayed.

The X axis shows the frame sizes while the Y axis shows the subtest results.

- **Frame Size (Bytes)** and **Step (%)**, available with Frame Loss, allows to select either **Frame Size** (default) or **Step** as the X axis criterion.

## Labels

From the **Test** menu, tap **Results**, and **Labels**.

**Note:** *Selecting a Label byte to be generated will automatically update the corresponding OH byte. Refer to OH - SONET/SDH on page 351 for more information.*

## Labels

- **STS/AU Path (C2):** The C2 byte is allocated to indicate the content of the STS SPE / VC, including the status of the mapped payloads.

**Received:** Displays the received C2 byte. Refer to C2 on page 357 for more information.

- **PLM-P/UNEQ-P / HP-PLM/HP-UNEQ:** Enables the Payload Mismatch and STS/AU UNEQ monitoring. This setting is coupled with the configuration of *Labels* on page 112.

**Expected:** Select the expected C2 byte from the list. Refer to C2 on page 357 for more information.

## Logger

The Logger page displays color-coded events and pass/fail verdict.

From the **Test** menu, tap **Results**, and the **Logger** tab.

### Sort By

Select the sorting order of the event logger entries:

- **ID/Time** (default) displays the event logger entries in numeric ascending order based on the **ID** column of the event logger table.
- **Event** displays the event Logger entries in alphanumeric ascending order based on the **Event** column of the event logger table.

### Time Mode

- **Relative** displays the time elapse since the beginning of the test or since the last test reset. The format of the time is Dd HH:MM:SS.
- **Absolute** (default) displays the date and time the event occurred. The time format depends on the platform time settings.

For 24 hours, the time format is MM/DD HH:MM:SS.

For 12 hours, the time format is MM/DD HH:MM:SS <AM or PM>.

### Table

The logger table provides the following event logger information.

- **ID**: Indicates the event identification number. The events are sequentially numbered.
- **Time**: Indicates when the event has been detected.
- **Event**: Provides the event type and threshold crossing information.
- **Duration**: Indicates the number of seconds within which the event occurred. Test events like **Test Started** and **Test Stopped** will have no duration.

## Test Results

### Logger

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- **Details:** Provides contextual information including the pass/fail verdict.

The following table displays the nature of information reported by type of event:

Type of Event	Nature of Information
Test Started	Start Date
Test Stopped	Pass/Fail Verdict
Alarm Events	Count value, Lane #, Ch#, etc.
Error Events	Current Count, Ch#, and Total Count
SDT Events	Service Disruption Time
Threshold Crossing Event	Value at the end of the test

**Note:** *The Logger table can display up to 5000 event entries. Once the Logger table reports 5000 event entries, a log full indicator appears and no further entries is possible. However, the events in the Pending state will be updated if the test is still running.*

The Event Logger information will be cleared when:

- the test is reset or started.
- stopping the current test and selecting another test.
- the unit is restarted.

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

**Note:** *The Threshold Crossing events are displayed in red text color.*

## MPLS

From the **Test** menu, tap **Results, Streams**, and the **MPLS** tab.

### Label 1 and Label 2

The number of MPLS frames transmitted (TX) and received (RX) are displayed for both **Label 1** and **Label 2** for each **Stream**.

### Total TX/RX MPLS

- **Line Utilization** indicates the percentage of MPLS line rate utilization in TX and RX.
- **Ethernet BW (%)** (Ethernet Bandwidth) indicates the MPLS data rate in TX and RX.
- **Frame Rate (frames/s)** indicates the number of transmitted (TX) and received (RX) MPLS frames.
- **Frame Count** indicates the count of transmitted (TX) and received (RX) MPLS EtherType (0x8847 or 0x8848) frames regardless if FCS is good or not.

### OTL-SDT

**Note:** Only available for parallel interfaces when an OTL defect, at the exception of LOL, is selected for Service Disruption Time (refer to Service Disruption on page 76).

From the **Test** menu, tap **Results**, and the **OTL-SDT** tab.

### Service Disruption

**Note:** Service Disruption results are only available when **Disruption Monitoring** is enabled (refer to BERT and Unframed BERT on page 74).

Service Disruption is the time during which there is a disruption of service due to the absence of traffic or to the detection of defects per lane.

#### Disruption Time

- **Defect** indicates on which layer and defect the service disruption time test is performed.
- **Lane** indicates the lane number.
- **Longest (ms)** indicates the longest measured disruption time per lane.
- **Shortest (ms)** indicates the shortest measured disruption time per lane.
- **Last (ms)** indicates the length of the last measured disruption time per lane.
- **Average (ms)** indicates the average duration of all measured disruption times per lane.
- **Total (ms)** indicates the total duration of all measured disruption times per lane.
- **Count** indicates the number of disruption events detected since the beginning of the SDT test per lane.



- **Longest Disruption** indicates the longest measured disruption time.
- **Lanes with Disruption** indicates the number of lanes with service disruption.

**Note:** *When a disruption event is equal or longer than the test period which is fixed to 5 minutes, then the measured disruption time is equal to the test period.*

## Test Results

### Performance Monitoring

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# Performance Monitoring

**Note:** This tab is only available with Transport test applications with Pattern client.

The Performance Monitoring tab gives error performance events and parameters for the circuit under test.

From the **Test** menu, tap **Results**, and the **Performance Monitoring** tab.

Each button on top of the window represents a level of the analyzed signal for which the Performance Monitoring (PM) is available. Each button also displays the PM standard(s) available for this level. Tap a signal level button to get its PM results.

Analyzed Signal	Standard's availability				
	G.821	G.828 ISM	G.829 ISM	M.2100 OOSM	M.2101 ISM
Section/RS			X		
Line/MS			X		X
STS-n/AU-n		X			X
BERT	X			X	

**Note:** G.821 and M.2100 OOSM are only available when **No Pattern Analysis (Live)** check box is cleared (refer to page 74).

## Near-End

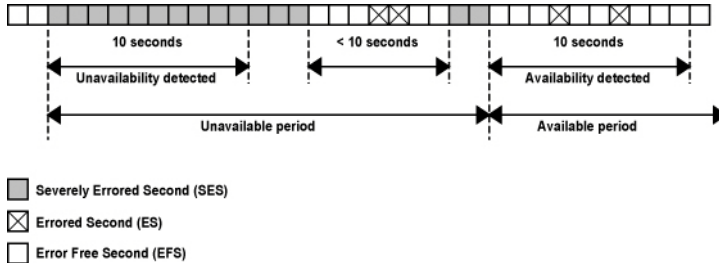
- **EFS** (Error Free Second) (**G.821**, **G.828**, and **G.829**): Gives the number of seconds within which no error occurred.
- **EC** (Error Count) (**G.821** only): Gives the number of bit errors.
- **EB** (Errored Block) (**G.828**, and **G.829**): Gives the count of blocks in which one or more bits are in error.
- **ES** (Errored Second)  
For **G.821**, and **M.2100 OOSM**: Gives the number of seconds within which one or more bit error occurred, or during which Loss Of Signal (LOS) or AIS is detected.  
For **G.828**, **G.829**, and **M.2101**: Gives the number of seconds within which one or more anomalies (EB, etc.) occurred, or at least one defect occurred.
- **SES** (Severely Errored Second)  
For **G.821**, and **M.2100 OOSM**: Gives the number of seconds within which a bit error ratio is  $\geq 10^{-3}$ , or during which one defect (LOS/AIS) is detected.  
For **G.828**, **G.829** and **M.2101**: Gives the number of seconds within which anomalies (EB, etc.) are  $\geq 30$  percent or at least one defect occurred.
- **BBE** (Background Block Error) (**G.826**, **G.828**, **G.829**, and **M.2101**): Gives the count of Errored Block not occurring as part of a SES.

## Test Results

### Performance Monitoring

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- **UAS (Unavailable Second):** Gives the count of the seconds corresponding to the periods of unavailable time that begins at the onset of 10 consecutive SES events, including these 10 seconds. A period of available time shall begin at the onset of 10 consecutive non-SES events, including these 10 seconds.



- **ESR (Errored Second Ratio) (G.821, G.828, and G.829):** Gives the ratio of the number of ES in available time (AS) during a fixed measurement interval.

$$ESR = ES \div AS$$

- **SESR (Severely Errored Second Ratio) (G.821, G.828, and G.829):** Gives the ratio of the number of SES in available time (AS) during a fixed measurement interval.

$$SESR = SES \div AS$$

- **BBER (Background Block Error Ratio) (G.828, G.829, and M.2101):** Gives the ratio of BBE in available time (AS) to total blocks in available time during a fixed measurement interval. The count of total blocks excludes all blocks during SESs.
- **DM (Degraded Minutes) (G.821 only):** A Degraded Minute is the number of minutes in which the estimated error rate exceeds  $10^{-6}$  but does not exceed  $10^{-3}$ . DM is determined by collecting all of the Available Seconds, removing any SES grouping the result in 60-second long groups and counting a 60-second long group as degraded if the cumulative errors during the seconds present in the group exceed  $10^{-6}$ .

- **SEP** (Severely Errored Period) (**G.828** only): A sequence between 3 to 9 consecutive SES. The sequence is terminated by a second which is not a SES.
- **SEPI** (Severely Errored Period Intensity) (**G.828** only): Gives the count of SEP events in available time, divided by the total available time in seconds.

## **Far-End**

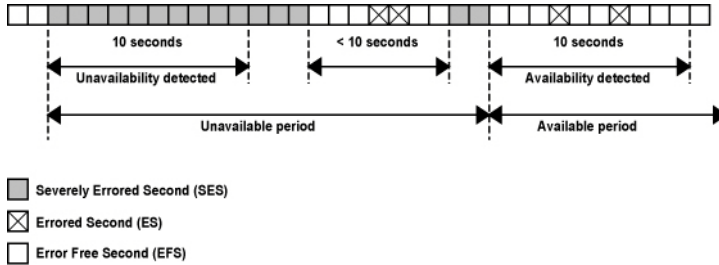
- **EFS** (Error Free Second): Gives the count of the seconds within which no error occurred or when a defect is detected on the near-end.
- **EC** (Error Count) (**G.821** only): Gives the number of bit errors.
- **EB** (Errored Block) (**G.828**, and **G.829**): Gives the count of blocks in which one or more bits are in error.
- **ES** (Errored Second): For **G.828**, **G.829**, and **M.2101**: Gives the count of the seconds within which one or more anomalies (EB, etc.) occurred or at least one defect occurred.
- **SES** (Severely Errored Second)  
**For G.828, G.829 and M.2101**: Gives the number of seconds within which anomalies (FAS (DSn/PDH), EB, etc.) are  $\geq 30$  percent or at least one defect occurred.
- **BBE** (Background Block Error) (G.828 and G.829 Line): Gives the count of Errored Blocks not occurring as part of an SES.

## Test Results

### Performance Monitoring

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- **UAS (Unavailable Second):** Gives the count of the seconds corresponding to the period of unavailable time that begins at the onset of 10 consecutive SES events, including these 10 seconds. A period of available time shall begin at the onset of 10 consecutive non-SES events, including these 10 seconds.



- **ESR (Errored Second Ratio):** Gives the ratio of the number of ES in available time to total seconds in available time during a fixed measurement interval.

$$ESR = ES \div AS$$

- **SESR (Severely Errored Second Ratio):** Gives the ratio of the number of SES in available time to total seconds in available time during a fixed measurement interval.

$$SESR = SES \div AS$$

- **BBER (Background Block Error Ratio):** Gives the ratio of BBE in available time to total blocks in available time during a fixed measurement interval. The count of total blocks excludes all blocks during SESs.

## SDT (Multi-Channel OTN)

From the **Test** menu, tap **Results** and the **SDT** tab.

**Note:** *The SDT tab is only available when **Disruption Monitoring** is enabled (refer to ODU Channels - Global on page 144).*

Service Disruption is the time during which there is a disruption of service due to the absence of traffic or to the detection of defects per channel.

- **Channels with Disruption** indicates the number of channels with service disruption.
- **Channels Monitored** indicates the number of channels monitored.
- **Channels Above Threshold**, available when pass/fail verdict is enabled, indicates the number of channels with a disruption time above the defined threshold.
- **Longest Disruption** indicates the duration of the longest measured disruption time and the channel number on which it occurred. The Pass/Fail verdict when enabled, is displayed next to duration value.
- **Last Disruption** indicates the duration of the last measured disruption time and the channel number on which it occurred.
- **SDT Threshold (ms)**, available when pass/fail verdict is enabled, allows to enter the SDT threshold value that will be used to declare the pass/fail verdict: **0.001** to **299999.999 ms** (default is **50 ms**).

The following statistics are presented per channel:

- **Channel** indicates the channel number.
- **Longest (ms)** indicates the longest measured disruption time.
- **Shortest (ms)** indicates the shortest measured disruption time.
- **Last (ms)** indicates the duration of the last measured disruption time.
- **Average (ms)** indicates the average duration of all measured disruption times.

## Test Results

### SDT (Multi-Channel OTN)

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- **Total (ms)** indicates the total duration of all measured disruption times.
- **Count** indicates the number of disruption events detected since the beginning of the test.
- **PASS FAIL**, available when pass/fail verdict is enabled, indicates the SDT pass/fail verdict.
  
- **Time Mode** selects the format used to display the disruption time.
  - Relative** displays SDT events based on the time elapsed since the beginning of the test.
  - Absolute** (default) displays SDT events based on date and time.
- **Units** selects the unit used to display SDT statistics:  $\mu$ s, ms (default), s, or min.
- **Time Stamp** displays the time or date/time for each SDT channel; this apply to **Longest** and **Last** disruption time statistics. Choices are **None** (default), **Time**, and **Date/Time**. An extra line is added for each channel to display the time, and two lines to display the time and date.

**Note:** *When a disruption event is equal or longer than the test period which is fixed to 5 minutes, then the measured disruption time is equal to the test period.*



## Service Configuration - Burst

From the **Test** menu, tap **Results**, **Service Configuration**, and the **Burst** tab.

### Service Name and Selection

**Service Name** indicates the name of the selected service.

Select the service to be displayed by either using the left/right arrow or by tapping over the service numbers area then tapping on a specific service number. An orange background indicates the selected service while a green background indicates the services that are enabled.

### Committed/Excess

- **Committed - Burst test** is the **CBS** subtest.
- **Excess - Burst test** is the **EBS** subtest.
- **Direction**, available with **Dual Test Set**, indicates results from local to remote (**L->R**) and remote to local (**R->L**).
- **Burst Size** indicates the size in bytes of the burst used for each subtest.
- **SLA Verified** indicates the committed SLA parameters that are used to declare the pass/fail verdict. See *Summary (EtherSAM)* on page 282 for more information on **Frame Loss**, **Max Jitter**, **Round-Trip Latency**, and **Max RX Rate**.
- **Informational** parameters are for information purpose only, they are not included in the test pass/fail verdict. See *Summary (EtherSAM)* on page 282 for more information on **Frame Loss Rate**, **Max Jitter**, and **Round-Trip Latency**.
- **Average RX Rate** indicates the measured average utilization throughput for the CBS subtest.

# Service Configuration - Ramp

From the **Test** menu, tap **Results**, **Service Configuration**, and the **Ramp** tab.

## Service Name and Selection

**Service Name** indicates the name of the selected service. Select the service to be displayed by either using the left/right arrow or by tapping over the service numbers area then tapping on a specific service number. An orange background indicates the selected service while a green background indicates the services that are enabled.

## Committed/Excess Steps

- **Committed Steps** indicate the pre CIR and CIR steps specified in the ramp configuration.
- **Excess Steps** indicate the **CIR+EIR** and **Traffic Policing** steps specified in the ramp configuration.
- **Direction**, available with **Dual Test Set**, indicates results from local to remote (**L->R**) and remote to local (**R->L**).
- **TX Rate** indicates the transmission rate for each step.
- **SLA Verified** indicates the committed SLA parameters that are used to declare the pass/fail verdict. See *Summary (EtherSAM)* on page 282 for more information on **Frame Loss Rate**, **Max Jitter**, **Round-Trip Latency**, and **Max RX Rate**.
- **Informational** parameters are for information purpose only, they are not included in the test pass/fail verdict. See *Summary (EtherSAM)* on page 282 for more information on **Frame Loss**, **Max Jitter**, and **Round-Trip Latency**.
- **Average RX Rate** indicates the measured average utilization throughput for each step.

## Service Performance

From the **Test** menu, tap **Results**, and the **Service Performance** tab.

### Service Name and Selection

**Service Name** indicates the name of the selected service.

Select the service to be displayed by either using the left/right arrow or by tapping over the service numbers area then tapping on a specific service number. An orange background indicates the selected service while a green background indicates the services that are enabled.

### SLA Parameters

The configured **CIR**, **Max Jitter**, **Frame Loss Rate** and **Max Latency** SLA parameters are displayed. Refer to *Services - Profile* on page 171 for more information. For **Dual Test Set**, parameters are displayed for both local to remote (**L->R**), remote to local (**R->L**) directions.

### Metrics

**Current**, **Average**, **Minimum**, **Maximum**, and **Estimate (Jitter)** measured values for each metric are reported. **Direction**, available with **Dual Test Set** indicates results from local to remote (**L->R**) and remote to local (**R->L**), and Round-Trip for Latency. For **Dual Test Set**, results for remote to local are obtained at the end of each step.

- **RX Rate** indicates the measured utilization throughput.
- **Jitter (ms)** indicates the measured delay variation.
- **Latency (ms)** indicates the measured round-trip latency (delay).

**Note:** For the **Current** value, 0 is displayed when no RX rate has been measured in the last second.

## Test Results

### Service Performance

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**Note:** *Delay variation measurements smaller than 15  $\mu$ s will be discarded, not used for the sampling process, and < 0.015 is displayed as the minimum value. For the **Current** value, **Not measurable** is displayed when no delay has been measured in the last second*

## Errors

For **Dual Test Set**, errors are reported for both local to remote (**L->R**) and remote to local (**R->L**).

- **Frame Loss** indicates that a sequence number is missing in the received frames. The pass/fail verdict when enabled reports only the verdict when it is fail. **Seconds, Count, and Rate values are reported.**
- **Out-of-Sequence** indicates that the received frame sequence number is either smaller than the expected frame sequence number or is a duplicate number. The Out-Of-Sequence will not be considered in the global verdict. **Seconds, Count, and Rate values are reported.**

## RX Frame Count

The **RX Frame Count** indicates the number of frames received matching the selected service ID. For **Dual Test Set**, the count is reported for both local to remote (**L->R**) and remote to local (**R->L**).

## Streams - Frame Loss / Out-of-Sequence

From the **Test** menu, tap **Results, Streams**, and the **Frame Loss / Out-Of-Sequence** tab.

- **Stream:** Indicates the stream identification number.
- **Thresholds** button allows to set the pass/fail thresholds (refer to *QoS Metrics* on page 199).
- **Frame Loss:** See *QoS Metrics* on page 242.
- **Out-Of-Sequence:** See *QoS Metrics* on page 242.

## Streams - Jitter

From the **Test** menu, tap **Results, Streams**, and the **Jitter** tab.

- **Stream:** Indicates the stream identification number.
- **Jitter (ms)** is measured for each stream on all valid frames (in-sequence frames, valid Jitter tag, and no FCS error) received. **Current, Average, Minimum, Maximum, and Estimate** delay values are reported.

**Note:** *Delay variation measurements smaller than 15  $\mu$ s 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.*

- **Thresholds** button allows to set the pass/fail thresholds (refer to *QoS Metrics* on page 199).

### Streams - Latency

From the **Test** menu, tap **Results**, **Streams**, and the **Latency** tab.

- **Stream**: Indicates the stream identification number.
- **Latency (ms)** is measured for each stream on all valid frames (valid Latency tag, expected originator identifier value, and no FCS error) received. **Current**, **Average**, **Minimum**, and **Maximum** round-trip latency (delay) are reported.

**Note:** *Latency statistics are only available in loopback test topology.*

**Note:** *Delay measurements smaller than 15  $\mu$ s 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.*

- **Thresholds** button allows to set the pass/fail thresholds (refer to *QoS Metrics* on page 199).

## Streams - Throughput

From the **Test** menu, tap **Results**, **Streams**, and the **Throughput** tab.

- **Stream** indicates the stream identification number.
- **TX Rate** indicates the transmitted throughput rate.
- **RX Rate** is measured for each stream on all valid frames (valid Throughput tag with no FCS error). **Current**, **Average**, **Minimum**, and **Maximum** throughput results are reported. Refer to *Unit* on page 192 for unit selection.

**Note:** A **Current** value of **0** indicates that no **RX** rate has been measured in the last second.

- **Total** indicates the total TX and current measured RX throughput of all valid frames (valid Throughput tag with no FCS error).
- **Thresholds** button allows to set the pass/fail thresholds (refer to *QoS Metrics* on page 199).

## Summary

**Note:** Available with Transport, and Ethernet (EtherBERT and Smart Loopback) test applications. For other test applications see the corresponding test summary page.

From the **Test** menu, tap **Results**, and the **Summary** tab.

- **Status** indicates the actual test status as follows.
  - “--”: The test is not running or results are not available.
  - **In Progress:** The test is running.
  - **Completed:** The test is completed, stopped at the planned time, or manually stopped when there is no set timer.
- **Start Time** indicates the date and time the test was started. The date and time is reset every time the test is restarted or reset.
- **Test/Power Recovery: Test Recovery** (Windows 8 or above) or **Power Recovery** (Windows XP), when displayed, indicates that the test has automatically recovered from a power failure. The number of occurrences is also displayed next to the **Test/Power Recovery** field. Refer to *Power Failure Recovery* on page 389.
- **Logger Full**, when displayed, indicates that the logger is full. Refer to *Logger* on page 259.

## BERT

**Note:** See BER on page 217 for a description of each alarm/error.

- **Receiving Live Traffic - RX Pattern Analysis Disabled** when displayed, indicates that the **No Pattern Analysis (Live)** check box is selected and in this case no other information/statistics are available.
- **BER Threshold** is available when **Pass/Fail Verdict** is enabled<sup>1</sup>.



- **Bit Error Rate/Count** graphically displays a meter representing either the bit error rate or the bit error count depending on the Pass/Fail Verdict selection<sup>1</sup>.

When the verdict is enabled<sup>1</sup>, the values under the threshold are presented in green while the values above are in red.

When the verdict is disabled, the bit error rate is displayed in blue.

The arrow pointer indicates the current received bit error rate/count.

The Pass/Fail verdict is displayed just on top of the meter when enabled<sup>1</sup>.

- **Bit Error, Amount/Rate, and Inject:** The bit error injection and settings are coupled with the *Inject Button* on page 249.

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1. Refer to *BERT and Unframed BERT* on page 74 or *EtherBERT and Unframed BERT* on page 86.

### Service Disruption

**Note:** *Service Disruption results are only available with Transport and EtherBERT test applications when **Disruption Monitoring** is enabled (refer to BERT and Unframed BERT on page 74 or EtherBERT and Unframed BERT on page 86). When Service Disruption is disabled, the message **Service disruption monitoring disabled** is displayed.*

Service Disruption is the time during which there is a disruption of service due to the detection of defects.

➤ **Disruption Time**

**Note:** *For OTL defects, at the exception of LOL, the disruption time is displayed for the lane having the longest disruption time. See OTL-SDT on page 262 for results per lanes.*

**Longest (ms):** Indicates the longest measured disruption time.

**Shortest (ms)** indicates the shortest measured disruption time.

**Last (ms)** indicates the length of the last measured disruption time.

**Average (ms)** indicates the average duration of all measured disruption times.

**Total (ms)** indicates the total duration of all measured disruption times.

- **Defect**, available with Transport test applications, indicates on which layer and defect the service disruption time test is performed. For OTL defect (parallel interface) also indicates within parenthesis the lane number having the longest disruption time.
- **Disruption Count:** Indicates the number of disruption events detected since the beginning of the SDT test.

**Note:** *When a disruption event is equal or longer than the test period which is fixed to 5 minutes, then the measured disruption time is equal to the test period.*

- **SDT Threshold (ms)** allows to enter the SDT threshold value that will be used to declare the pass/fail verdict: 0.005 to 299999.995 ms in step of 0.005 ms (default is **50** ms). This setting is only accessible when Pass/Fail Verdict is enabled and is coupled with the SDT Threshold set from the test setup (refer to page 78).

## **GFP Frames**

GFP Frames are available for OTN BERT with Ethernet 1 GbE, 10 GbE or Ethernet (flex/GFP-F) client (see *GFP-F/GFP-T* on page 254).

## **Traffic / Traffic Ethernet**

**Note:** *The **Traffic** statistics are available for Smart Loopback and OTN BERT (with EoOTN client) test applications. See Traffic - Ethernet on page 304 for more information.*

## Test Results

Summary (EtherSAM)

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### Summary (EtherSAM)

From the **Test** menu, tap **Results**, and the **Summary** tab.

**Note:** For *Dual Test Set*, only *Start Time* is displayed on the remote module.

- **Service Configuration/Performance Test Status** indicates the actual test status as follows:

Test Status	Description
"--"	Test has not started.
Disabled	Test/subtests is/are disabled.
Running	Test/subtest is currently running.
Data Transfer	Test/subtest is running but no test traffic is being transmitted.
Completed, <Verdict>	Test/subtest has completed with the test pass/fail verdict. A fail verdict is declared when a <b>Link Down</b> or <b>LOS</b> is detected, or when any SLA parameter fails.
Aborted, <reason>	Test/subtest has been aborted either manually (Stop) or automatically from an alarm and the reason why the test has been aborted is also displayed as follows: <b>Link down alarm, LOS alarm, Timeout during execution, DTS connection failed, Loss of remote connection (DTS), Unresolved addresses, No test enabled, Invalid Burst Configuration, CIR disabled for all services, Excessive Refill Time<sup>a</sup>, Stopped</b>

- An excessive refill occurs when the pre-burst and/or post-burst duration last for more than 2 seconds.

- **Start Time** indicates the date and time the test was started. The date and time is reset every time the test is restarted.
- **Remote unit in use and locked for Dual Test Set** indicates that this module is used for **Dual Test Set** as the remote module.
- **Remote unit in Dual Test Set Mode** indicates that this module is set as remote but the DTS Connection is not established.

- **Service Configuration/Performance Test:** Tap **Service Configuration Test** or **Service Performance Test** button to view the result summary of the corresponding test.
  - **Service** indicates the service's number and name. For **Service Configuration Test**, the number/name is highlighted in red per service when VLAN mismatch occurred; in **Dual Test Set**, the direction is also highlighted; in Dual Test Set, the **R -> L** direction label is gray when **VLAN Preservation** is not supported by the remote module.
  - **Direction**, available with **Dual Test Set**, indicates results from local to remote (**L->R**) and remote to local (**R->L**).
  - **Service Performance Test** column displays the pass/fail verdict icon indicating if the service complies to the configured SLA parameters.
  - **Service Configuration Test** column displays the pass/fail verdict icon indicating if the service complies to the configured SLA parameters.

## Test Results

Summary (EtherSAM)

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### Committed

- **Frame Loss Rate** indicates the rate of frames that are lost. The reported value is the maximum rate of Frame Loss from all burst sequences and ramp steps excluding the **CIR+EIR**, **EBS**, and **Traffic Policing** steps. Frame Loss is displayed as a percentage value when the remote module does not support exponential notation.
- **Max. Jitter (ms)** indicates the maximum measured delay variation.
- **Max Latency (ms)** indicates the maximum measured round-trip latency (delay). For **Dual Test Set** a single round-trip value is reported.
- **Avg RX Rate**, for **Service Performance Test**, indicates the measured average utilization throughput.

### Excess

- Max RX Rate**, for **Service Configuration Test**, indicates the measured maximum utilization throughput.
- **VLAN Preservation** indicates if any VLAN mismatch occurred during any step of a Ramp or Burst tests as follows:
  - Grey: Undefined
  - Green: No Mismatch detected
  - Red: Mismatch detected

## Summary (iOptics)

From the **Test** menu, tap **Results**, and the **Summary** tab.

**Start Time** indicates the date and time the test was started. The date and time reset every time the test is restarted.

If at any point during a sub-test execution an unexpected condition is detected, an abort message is displayed as follows:

Test Status	Description
Aborted, <reason>	Sub-test sequence has been aborted and a reason is displayed: <b>Missing Optic, Invalid Optic, Laser Off, LOS, Optic Ovrlrd (overload), Device Pulled, Failed, or User Stopped.</b>

## Sub-Test Sequence

The progress status and pass/fail verdict are displayed for each sub-test sequence as follows:

Test Status	Description
"--"	Sub-test is not running or results are not available.
Running <details>	Sub-test is running and progress details are displayed.
Completed, Pass/Fail	Sub-test is completed with Pass or Fail verdict.
Aborted, Fail	Sub-test sequence has been aborted with a fail verdict.

- **I/O Interface Quick Check:**
  - Validates the operation of the MDIO/I2C interface by sending specific commands to the transceiver.
  - Validates the information provided by a status pin and stimulates a control pin of the transceiver.
- **Optical TX Power Test (dBm)** reports the minimum and maximum optical TX power values; in-range values are displayed in green while out-of-range are in red.

## Test Results

### Summary (iOptics)

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- **Optical RX Power Test** (dBm) reports the minimum and maximum optical RX power values; in-range values are displayed in green while out-of-range are in red.
- **Bit Error Test** reports the bit error count; count value smaller or equal to the BER threshold is displayed in green while bigger value is in red.
- **Excessive Skew Test** reports the highest skew value monitored during the sub-test. Excessive Skew is reported if the threshold is crossed otherwise there is no excessive skew.

## Monitoring

- **Temperature** graphically displays a meter representing the transceiver temperature in °C.

The current (**Actual**) and maximum temperature values are also displayed.

**Note:** *The green region is delimited from 0 to the Threshold corresponding to a **PASS** verdict. The red region beyond the threshold corresponds to a **FAIL** verdict.*



## Summary (iSAM)

From the **Test** menu, tap **Results**, and the **Summary** tab.

- **Start Time** indicates the date and time the test was started. The date and time is reset every time the test is restarted.
- **Configuration/Performance Results** and **RFC 6349 Results** buttons are used to respectively display summary results for **Service Configuration Test** and **Service Performance Test**, or **RFC 6349 Test** when results don't fit on one page.

## Service Configuration Test and Service Performance Test

- The actual test status is displayed as follows:

<b>Test Status</b>	<b>Description</b>
"_"	Test has not started.
<b>Disabled</b>	Test/subtests is/are disabled.
<b>Running</b>	Test/subtest is currently running.
<b>Data Transfer</b>	Test/subtest is running but no test traffic is being transmitted.
<b>Completed, &lt;Verdict&gt;</b>	Test/subtest has completed with the test pass/fail verdict. A fail verdict is declared when a Link Down or LOS is detected, or when any SLA parameter fails.
<b>Aborted, &lt;reason&gt;</b>	Test/subtest has been aborted either manually (Stop) or automatically from an alarm and the reason why the test has been aborted is also displayed as follows: <b>Link down alarm, LOS alarm, Timeout during execution, DTS connection failed, Loss of remote connection (DTS), Unresolved addresses, Stopped</b>

## Test Results

### Summary (iSAM)

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For **Dual Test Set** the following values are reported for both local to remote (**L->R**) and remote to local (**R->L**).

- **Service** indicates the service's number and name.  
The pass/fail verdict icon is displayed next to the service name indicating if the service complies to the configured SLA parameters.
- **TX CIR (Mbit/s)** indicates the transmitted Committed Information Rate.
- **FD (ms) (RTT<sup>1</sup>) (Latency)** indicates the maximum measured round-trip latency (Frame Delay). The pass/fail verdict is also displayed.
- **IFDV (ms) (Jitter)** indicates the maximum measured Inter Frame Delay Variation. The pass/fail verdict is also displayed.
- **FLR (%) (Frame Loss)** indicates the maximum percentage of frames that are lost (Frame Loss Ratio) from the CIR step. The pass/fail verdict is also displayed.
- **RX Rate (Mbit/s)** indicates either the measured maximum utilization throughput for **Service Configuration Test** or the measured average utilization throughput for **Service Performance Test**. The pass/fail verdict is also displayed.
- **Total RX Rate**, available for **Service Performance Test**, indicates the average utilization throughput for all services (both directions are displayed for **Dual Test Set**).

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1. RTT is only displayed for Dual Test Set.

## RFC 6349 Test

- **Test Status** indicates the actual test status as follows.

Test Status	Description
"--"	Test has not started.
In Progress	The test is running.
Completed, <Verdict>	Test has completed and the test pass/fail verdict is displayed when enabled. A fail verdict is declared if any of the following conditions occurs: Link Down, LOS, TCP Throughput verdict failed, or an abort condition (Timeout, DTS connection lost, unresolved address, user stopped, configuration synchronization error, invalid MTU).
Aborted, <reason>	Test has been aborted either manually (Stop) or automatically from an alarm and the reason is displayed as follows: <b>Link down alarm, LOS alarm, Timeout during execution, DTS connection failed, Invalid Configuration, Unresolved addresses, Invalid MTU, User Stopped</b>

- **MTU (bytes)** is the validated Maximum Transfer Unit.
- **Minimum RTT (ms)** is the minimum time between the first bit of a segment sent and the last bit of the corresponding acknowledge.
- **TCP Throughput**
  - **Service** indicates the service's number and name. The pass/fail verdict icon is displayed next to the service name. A fail verdict is declared if any of the following conditions occurs: Link Down, LOS, TCP Throughput verdict failed, or an abort condition (Timeout, DTS connection lost, unresolved address, user stopped, configuration synchronization error, invalid MTU).
  - **L->R** and **R->L** indicates respectively the direction from local to remote and remote to local.
  - **Window** indicates the total Max Window (1 KiB = 1024 bytes) followed by the number of connections and KiB per connection in parenthesis as follows: (n conn.@ n KiB).

## Test Results

### *Summary (iSAM)*

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- **Ideal L4** indicates the ideal TCP throughput metric.
- **Actual L4** indicates the average of actual TCP Throughput metric. The pass/fail verdict icon is displayed next to the this metric. A value greater or equal to the defined threshold gives a pass verdict.
- **TCP Efficiency (%)** indicates the TCP Efficiency metric based on transmitted and retransmitted bytes.
- **Buffer Delay (%)** indicates the Buffer Delay percentage metric which represents the increase in RTT during a TCP Throughput test versus the **Minimum RTT**.

## Summary (Multi-Channel OTN)

From the **Test** menu, tap **Results**, and the **Summary** tab.

- **Status** indicates the actual test status as follows.
  - “--”: The test is not running or results are not available.
  - **In Progress**: The test is running.
  - **Completed**: The test is completed, stopped at the planned time, or manually stopped when there is no set timer.
- **Start Time** indicates the date and time the test was started. The date and time is reset every time the test is restarted or reset.
- **Test/Power Recovery: Test Recovery** (Windows 8 or above) or **Power Recovery** (Windows XP), when displayed, indicates that the test has automatically recovered from a power failure. The number of occurrences is also displayed next to the **Test/Power Recovery** field. Refer to *Power Failure Recovery* on page 389.
- **Logger Full**, when displayed, indicates that the logger is full. Refer to *Logger* on page 259.

## Alarms/Errors, Traces, and Payload Type

The results displayed are for the first channel by default. Tap on one of the button described on the next page to select the results to be displayed. The selected button has an amber background.

When a channel button is selected:

- The channel number is displayed indicating the selected channel.
- A channel selector becomes available when zooming a result block allowing to select a specific channel.

## Test Results

Summary (Multi-Channel OTN)

---

### Interface / OTL / OTU4, ODU4, and Channel Buttons

**Note:** Refer to Alarms/Errors on page 215 for more information on alarms/errors and alarms/errors injection.

- **Interface / OTL / OTU4** displays alarms/errors for **Interface** (see page 229), **Clock** (see page 218), **OTL** (see page 238), and **OTU4** (see page 239) as well as the received **SM TTI Traces** (see page 301).
- **ODU4** displays alarms/error at **ODU4** (see page 231) and **OPU4** (see page 236) levels as well as the received **PM TTI Traces** (see page 301) and received **Payload Type** (see page 252).
- **1, 2**, up to **80**, depending on the OTN multiplexing, displays alarms/error for a specific channel including: **ODU<sub>x</sub>** (see page 231), **OPU<sub>x</sub>** (see page 236), **ODTU4.1 - GMP** (see page 228), **BERT** (see page 278), **SDT** (see page 280), received **PM TTI Traces** (see page 301), and received **Payload Type** (see page 252).

Buttons use different background colors representing current and history alarms/errors. An orange background indicates the selected button.

Background color	Alarm/ Error <sup>a</sup>	Description
Gray	Current	No test result available.
	History	
Green	Current	No alarm/error has occurred in the last second.
	History	No alarm/error has occurred during the test.
Red	Current	An alarm/error occurred in the last second.
	History	
Amber	History	At least one alarm/error has occurred during the test.

- a. History background color is presented on the left side of the button while Current background color is covering the rest of the button.

## Summary (RFC 2544)

From the **Test** menu, tap **Results**, and the **Summary** tab.

- **Start Time** indicates the date and time the test was started. The date and time is reset every time the test is restarted or reset. For **Dual Test Set**, this is the only information available on the remote module.
- **Test/Power Recovery: Test Recovery** (Windows 8 or above) or **Power Recovery** (Windows XP), when displayed, indicates that the test has automatically recovered from a power failure. The number of occurrences is also displayed next to the **Test/Power Recovery** field. Refer to *Power Failure Recovery* on page 389.
- **Logger Full**, when displayed, indicates that the logger is full. Refer to *Logger* on page 259.
- **Remote unit in use and locked for Dual Test Set** indicates that this module is used for **Dual Test Set** as the remote module.
- **Remote unit in Dual Test Set Mode** indicates that this module is set as remote but the DTS Connection is not established.

### Throughput, Back-to-Back, Frame Loss, and Latency Subtests

- **Throughput, Back-to-Back, Frame Loss, and Latency**

For each subtest, its status (-- (Idle), **In Progress**, **Completed**, or **Aborted** - (reason)) and duration are displayed.
- **TX Frames**<sup>1</sup> and **RX Frames**<sup>1</sup> display the transmitted and received frame counts of the subtest in progress. For **Dual Test Set**, frame counts are available for both directions: from local to remote (**L->R**) and remote to local (**R->L**).
- **Trial #**<sup>1</sup> displays the current trial iteration of the subtest in progress when applicable.
- **Val. #**<sup>1</sup> displays the current validation iteration of the subtest in progress when applicable.
- **Step**<sup>1</sup> displays the current step of the subtest in progress when applicable.
- **Displayed Results:** Select the displayed result mode: **Current**, **Minimum** (default), **Maximum**, or **Average**.
- **Throughput/Back-to-Back/Frame Loss/Latency** table.

Each frame size used for the test is displayed with its subtest statistics. Statistics values are displayed based on the **Displayed Results** setting.

“--” indicates that the result is not available because the test has not run yet. While testing, one of the following messages is displayed for each frame size: **Initializing**, **Learning**, **Testing**, **Waiting**, **Not measurable**, **Aborted**, **Link is Down**, or **MAC not resolved**.

**Dir.** (Direction), available with **Dual Test Set**, indicates results from local to remote (**L->R**) and remote to local (**R->L**).

---

1. Only displayed once the test is started.



- **Unit:** Select the subtest result unit:
  - For Throughput: **Mbit/s, Gbit/s, frame/s**, and %.
  - For Back-to-Back: **Mbit/s, Gbit/s, frame/burst**, and %.
  - Frame Loss: %.
  - Latency: **ms**, and **μs**.
  
- **Layer:** For Throughput and Back-to-Back subtests, select the subtest layers used to calculate the throughput.
  - All** (default): Layer 1,2,3 contains the Idle, Preamble, Start of Frame Delimiter, MAC address, IP address, and data.
  - Ethernet:** Layer 2,3 contains the MAC layer, IP layer, and data.
  - IP:** Layer 3 contains the IP layer, and data.
  
- **Step:** For Frame Loss subtest, selects the step (%) of the testing rate to be displayed.
  
- **Mode:** For Latency subtest, selects the propagation time mode.
  - Cut Through** (default) allows the calculation of the propagation time of a bit (Bit Latency).
  - S. & F.** (Store and Forward) allows the calculation of the propagation time of a frame (Frame Latency).

## Test Results

Summary (RFC 6349)

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### Summary (RFC 6349)

From the **Test** menu, tap **Results**, and the **Summary** tab.

- **Status** indicates the actual test status as follows.

Test Status	Description
"--"	Test has not started.
In Progress	The test is running.
Completed, <Verdict>	Test has completed and the test pass/fail verdict is displayed when enabled. A fail verdict is declared if any of the following conditions occurs: Link Down, LOS, TCP Throughput verdict failed, or any abort condition.
Aborted, <reason>	Test has been aborted either manually (Stop) or automatically due to an abort condition, and the reason is displayed as follows: <b>Link down alarm, LOS alarm, DTS connection failed, Timeout during execution, Invalid Configuration, Unresolved addresses, Invalid MTU, User Stopped</b>

- **Start Time** indicates the date and time the test was started. The date and time is reset every time the test is restarted or reset. This is the only information available on the remote module.
- **Test/Power Recovery: Test Recovery** (Windows 8 or above) or **Power Recovery** (Windows XP), when displayed, indicates that the test has automatically recovered from a power failure. The number of occurrences is also displayed next to the **Test/Power Recovery** field. Refer to *Power Failure Recovery* on page 389.

- **Logger Full**<sup>1</sup>, when displayed, indicates that the logger is full. Refer to *Logger* on page 259.
- **Remote unit in use and locked for Dual Test Set**<sup>2</sup> indicates that this module is used for **Dual Test Set** as the remote module.
- **Remote unit in Dual Test Set Mode**<sup>2</sup> indicates that this module is set as remote but the DTS Connection is not established.

**MTU (bytes)** is the validated Maximum Transfer Unit.

**Minimum RTT (ms)** is the minimum time between the first bit of a segment sent and the last bit of the corresponding acknowledge.

## Window Sweep

- **L->R** and **R->L** indicates respectively the direction from local to remote and remote to local.
- **Actual L4** indicates for each step the average TCP throughput metric.

## TCP Throughput

- **L->R** and **R->L** indicates respectively the direction from local to remote and remote to local.
- **Window (KiB)** indicates the total Max Window (1 KiB = 1024 bytes) followed by the number of connections and KiB per connection in parenthesis as follows: (n conn.@ n KiB).
- **Ideal L4** indicates the ideal TCP throughput metric.
- **Actual L4** indicates the average of actual TCP Throughput metric. The pass/fail verdict icon is displayed next to the this metric when enabled. A value greater or equal to the defined threshold gives a pass verdict.
- **TCP Efficiency (%)** indicates the TCP Efficiency metric based on transmitted and retransmitted bytes.

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1. Displayed on local module only.

2. Displayed on Remote module only.

## Test Results

*Summary (RFC 6349)*

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- **Buffer Delay (%)** indicates the Buffer Delay percentage metric which represents the increase in RTT during a TCP Throughput test versus the **Minimum RTT**.
- **TCP Throughput Threshold (% of ideal)** allows to enter the TCP Throughput as a percentage of the defined CIR that will be used to declare the pass/fail verdict for both directions: **0** to **100** %; default is **95** %. The calculated throughput based on the selected threshold is displayed for both directions.

## Summary (Traffic Gen & Mon)

From the **Test** menu, tap **Results**, and the **Summary** tab.

- **Test Status** indicates the actual test status as follows. The global test pass/fail verdict is displayed next to the **Test Status** when enabled (see *QoS Metrics* on page 199).
  - “--”: The test is not running or results are not available.
  - **In Progress**: The test is running.
  - **Completed**: The test is completed, stopped at the planned time, or manually stopped when there is no set timer.
- **Start Time** indicates the date and time the test was started. The date and time is reset every time the test is restarted or reset.
- **Test/Power Recovery: Test Recovery** (Windows 8 or above) or **Power Recovery** (Windows XP), when displayed, indicates that the test has automatically recovered from a power failure. The number of occurrences is also displayed next to the **Test/Power Recovery** field. Refer to *Power Failure Recovery* on page 389.
- **Logger Full**, when displayed, indicates that the logger is full. Refer to *Logger* on page 259.

## Stream

The following statistics are available for each stream.

- **Current Throughput**: See *Streams - Throughput* on page 277.
- **Frame Loss Rate**: See *Streams - Frame Loss / Out-of-Sequence* on page 275.
- **Jitter**: See *Streams - Jitter* on page 275.
- **Latency**: See *Streams - Latency* on page 276.

## Test Results

Summary (Traffic Gen & Mon)

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- **Out-of-Sequence:** See *Streams - Frame Loss / Out-of-Sequence* on page 275.
- **Stream** indicates the stream number and provides stream detailed statistics when tapping on its button.

The following statistics are displayed for the selected stream.

- **Stream Selection:** Select a stream by either using the left/right arrow or by tapping over the stream numbers area then tapping on a specific stream number. An orange background indicates the selected stream.
- **Throughput, Jitter,** and **Latency** meters display respectively the measured Throughput, Jitter, and Latency for the selected stream.

**Note:** *The green region is delimited from 0 to the Threshold corresponding to a **PASS** verdict. The red regions beyond the threshold corresponds to a **FAIL** verdict. The Pass/Fail verdict is only displayed when enabled (see QoS Metrics on page 199).*

- **Jitter:** See *Streams - Jitter* on page 275.
- **Latency:** See *Streams - Latency* on page 276.
- **RX Rate:** See *Streams - Throughput* on page 277.
- **RX Frame Count** indicates the number of frame received matching the selected stream.
- **TX Rate:** See *Streams - Throughput* on page 277.
- **TX Frame Count** indicates the number of transmitted frames matching the selected stream.
- **Frame Loss and Out-of-Sequence:** See *Streams - Frame Loss / Out-of-Sequence* on page 275.

## Traces - OTN

From the **Test** menu, tap **Results**, **Traces**, and the **OTN** sub-tab.

### Channel

Available with Multi-Channel OTN lower ODU layer, allows the selection of the channel number.

### OTU<sub>x</sub>, ODU<sub>x</sub>, and TCM Buttons

Tap on either OTU<sub>x</sub>, or an ODU<sub>x</sub> button. For ODU<sub>x</sub> when TCM is enabled (see Modify TCM on page 186), tap on a TCM<sub>x</sub> button to select a TCM level. TCM is not available with Multi-Channel OTN.

### SM/PM TTI Traces

#### Received Message

- **SAPI** indicates the received TTI (Trail Trace Identifier) Source Access Point Identifier.
- **DAPI** indicates the received TTI Destination Access Point Identifier.
- **Operator Specific** indicates the received TTI Operator Identifier.

#### Expected Message

**Note:** *The TTI Traces are configurable for SM (OTU<sub>x</sub>), PM (ODU<sub>x</sub>), and TCM (ODU<sub>x</sub> when TCM is enabled; refer to Modify TCM on page 186). The following settings are coupled with the Expected Message from Traces (OTN) on page 205.*

- **SAPI** allows editing the expected Source Access point Identifier (TTI bytes 0 to 15). Available when the SAPI OTU/ODU-TIM check box is selected.

## Test Results

### Traces - OTN

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- **DAPI** allows editing the expected Destination Access point Identifier (TTI bytes 16 to 31). Available when the DAPI OTU/ODU-TIM check box is selected.
- **SAPI OTU/ODU-TIM** check box<sup>1</sup>, when selected (cleared by default), allows editing the expected Source Access Point Identifier (SAPI) and also enables OTU/ODU-TIM alarm monitoring.
- **DAPI OTU/ODU-TIM** check box<sup>1</sup>, when selected (cleared by default), allows editing the expected Destination Access Point Identifier (SAPI) and also enables the OTU/ODU/TCM-TIM alarm monitoring.
- **Copy RX/Global Copy RX**<sup>2</sup> uses the received SAPI/DAPI message as the expected SAPI/DAPI. For Multi-Channel OTN lower ODU layer, use the arrow button next to the **Copy RX** or **Global Copy RX** to switch from one button to the other; **Global Copy RX** uses the current channel received SAPI/DAPI message as the expected SAPI/DAPI for all channels while **Copy RX** only affects the selected channel.

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1. For Multi-Channel OTN lower ODU layer, the SAPI and DAPI ODU-TIM check boxes are only configurable from the test setup.

2. Only available for Multi-Channel OTN lower ODU layer.



## Traces - SONET/SDH

From the **Test** menu, tap **Results**, **Traces**, and the **SONET/SDH** sub-tab.

**Note:** *Selecting a Trace byte to be generated will automatically update the corresponding OH byte. Refer to OH - SONET/SDH on page 351 for more information.*

### Traces

➤ **Section/RS (J0), and STS/AU/TU-3 Path (J1)**

Displays the received J0/J1 value in 16 or 64-bytes format. The <crc7> represents the CRC-7 for a 16-bytes format. The last two bytes of a 64-bytes format, <C<sub>R</sub>> and <L<sub>F</sub>>, represent respectively a carriage return and a line feed.

➤ **TIM-S/RS-TIM, TIM-P/HP-TIM:** Enables the corresponding Trace Identifier Mismatch for the expected message defined. These settings are coupled with the Traces configuration from *Traces (SONET/SDH)* on page 209.

**Copy RX** allows to use the received TIM message as the expected one.

### TCM Access Point Identifier

**Note:** *Available when TCM is enabled (refer to page 187).*

➤ **STS/AU/TU Path (N1)**

Displays the received N1 value.

➤ **TC-TIM-P/HPTC-TIM:** Enables the corresponding TCM Access Point Identifier for the expected message defined. These settings are coupled with the Traces configuration from *Traces (SONET/SDH)* on page 209.

**Copy RX** allows to use the received TIM message as the expected one.

# Traffic - Ethernet

From the **Test** menu, tap **Results**, **Traffic**, and the **Ethernet** tab.

## Traffic

- **Line Utilization (%)** indicates the current percentage of the transmitting/receiving line rate utilization.
- **Ethernet BW (Mbit/s)** indicates the current transmitting/receiving data rate expressed in Mbit/s.
- **Frame Rate (frame/s)** indicates the current transmitted/received number of frames (including bad frames, Broadcast frames and Multicast frames) in frame per second.
- **Frame Count** indicates the total number of transmitted/received valid and invalid frames.

## Frame Type

Displays the TX and RX count of the following frame types.

- **Multicast** indicates the number of multicast frames transmitted/received without FCS errors. Broadcast frames are not counted as multicast frames.
- **Broadcast** indicates the number of broadcast frames transmitted/received without FCS errors.

- **Unicast** indicates the number of unicast frames transmitted/received without FCS errors.
- **Non-Unicast** indicates the number of multicast and broadcast frames transmitted/received without FCS errors.
- **Total** indicates the total number of all frames transmitted/received without FCS error.

## Frame Size

Displays the RX count of each received frame size (valid and invalid), and 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 (no VLAN), 1522 (1 VLAN tag), 1526 (2 VLAN tags), or 1530 (3 VLAN tags) bytes.
- **> 1518**: frames with more than 1518 (no VLAN), 1522 (1 VLAN tag), 1526 (2 VLAN tags), or 1530 (3 VLAN tags) bytes.
- **Total** indicates the total count of all received frames (valid and invalid).

# Traffic - Flow Control

From the **Test** menu, tap **Results**, **Traffic**, and the **Flow Control** tab.

## Frame Count - RX

- **Pause Frames** indicates the number of received valid flow-control frames. Frames that have a type/length field equal to 0x8808 will be counted as a pause frame.
- **Abort Frame** indicates the number of received pause frames with a Quanta equal to zero; cancelling the pause frames.
- **Total Frame** indicates the total number of pause time received from the link partner.

## Pause Time

Indicates respectively the total, last, maximum, and minimum pause time received from the link partner in **Quanta** (default) or **Microsecond** ( $\mu s$ ).

## Pause Injection

**Note:** *Pause injection is only available for Traffic Gen & Mon test application.*

- **Packet Pause Time:** Enter the pause time value to be transmitted in **Quanta** or **Microsecond** (default is **100** Quanta).

Interface	Range	
	Quanta	$\mu$ s
40 Gbit/s	0 to 65535	0 to 838.848
100 Gbit/s	0 to 65535	0 to 335.5392

**Note:** *When entering a value in  $\mu$ s it will be rounded to the closest multiple of , 0.0128 for 40 Gbit/s, and 0.00512 for 100 Gbit/s.*

- **Inject** button allows to generate the defined packet pause time.
- **Destination MAC Address** check box, when selected (cleared by default), enables and allows to set the destination MAC address. The default destination MAC address is the control protocol multicast address: **01:80:C2:00:00:01**.

## Test Results

### *Traffic - Graph*

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## Traffic - Graph

From the **Test** menu, tap **Results**, **Traffic**, and the **Graph** tab.

The graph displays the received line utilization. The X axis shows the time in seconds while the Y axis shows the percentage utilization.

## Window Sweep

Displays the graph showing the Ideal L4 and Actual L TCP Throughput measured for each Window Sweep step. The number of connections and KiB per connection is also displayed in parenthesis as follows:  
(n conn.@ n KiB)

From the **Test** menu, tap **Results**, and the **Window Sweep** tab.





# 10 Test Functions

The Test Functions menu offers the following structure:

Transport Test Applications

Tab - Sub Tab	Available with				Page
	OTN BERT	Multi-Channel OTN	OTN SONET/SDH BERT	SONET/SDH BERT	
40/100G Advanced - CFP/CFP2 Control	X	X	X	X	313
40/100G Advanced - Lanes Mapping & Skew	X	-	X	-	316
40/100G Advanced - Pre-Emphasis	X	-	X	-	321
APS	-	-	X	X	323
Client Offset	X	-	-	-	326
GMP	X	X	X	-	339
OH - GFP-F/GFP-T	X	-	-	-	340
OH - OTN	X	-	X	-	345
OH - SONET/SDH	-	-	X	X	351
Pointer Adjustment	-	-	X	X	365
RTD	X	-	X	X	366

## Test Functions

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### Ethernet Test Applications

Tab - Sub Tab	Available with	Available with		Page
	EtherSAM RFC 6349 RFC 2544 Smart Loopback	EtherBERT	Traffic Gen & Mon	
40/100G Advanced - CFP/CFP2 Control <sup>a</sup>	X	X	X	313
40/100G Advanced - Lanes Mapping & Skew	X	X	X	316
40/100G Advanced - Pre-Emphasis <sup>a</sup>	X	X	X	321
Filters	-	X	X	329
Packet Capture	-	X	X	333
Ping & Trace Route	X	X	X	360
Traffic Scan	-	-	X	369

a. Not available with Internal Loopback connector.

## 40/100G Advanced - CFP/CFP2 Control

**Note:** Not available with **Internal Loopback** connector.

From the **Test** menu, tap **Functions**, **40/100G Advanced**, and the **CFP/CFP2 Control** tab.

### CFP/CFP2 Reference Clock (MHz)

Allows to select the reference clock that will be used for the clock output low speed (Clock Out Low Speed port).

Interface/Rate	1/64 Electrical Lane Rate (default - recommended)	1/16 Electrical Lane Rate
OTU4	174.7031 MHz	698.8123 MHz
OTU3e2	174.1537 MHz	696.6149 MHz
OTU3e1	174.1054 MHz	696.4215 MHz
OTU3	168.040 MHz	672.1627 MHz
40GE/100GE	161.1328 MHz	644.5313 MHz
OC-768/STM-256	155.52 MHz	622.08 MHz

### CFP/CFP2 Power Class

Indicates the power class of the inserted CFP/CFP2 module.

## Test Functions

### 40/100G Advanced - CFP/CFP2 Control

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## CFP/CFP2 Control Pins

Allows the following CFP/CFP2 control pin settings. Refer to the CFP MSA standard for more information.

**Note:** *To apply any control, first select its check box then clear it; the control is applied only when the selected check box is cleared.*

- **TX & RX IC RST** check box (cleared by default).
- **Connector Power Rating**, choices are:

Connector	Power Rating
CFP	Power Class 1 (<= 8W) Power Class 2 (<= 16W) Power Class 3 (<= 24W) Power Class 4 (<= 32W) (default)
CFP2	Power Class 1 (<= 3W) Power Class 2 (<= 6W) Power Class 3 (<= 9W) Power Class 4 (<= 12W) (default)

- **TX Disable** check box (cleared by default).
- **Module Low Power Mode** check box (cleared by default).
- **Module Reset** check box (cleared by default).
- **Module Power Shutdown** check box (cleared by default).

## CFP/CFP2 Status Pins

Gives the following CFP's pin status (refer to the CFP MSA standard for more information): **Hi Power On, Module Ready, Module Fault, Module Absent, RX Loss of Signal, Global Alarm.**

## CFP/CFP2CFP4 MDIO Access Interface

### ➤ MDIO - Bulk Read

- **MDIO Start Address** allows the selection of the MDIO start address **0x0000** (default) to **0xFFFF**.
- **MDIO End Address** allows the selection of the MDIO end address **0x0000** to **0xFFFF**; default is **0x00FF**.
- **Bulk Read** button reads and displays the data based on the specified MDIO range (MDIO Start Address to MDIO End Address).  
**Save to CSV** button allows to save the read MDIO's addresses and data to a CSV file.

**Note:** *The bulk read size is limited to 1024 addresses.*

### ➤ MDIO - Read/Write

- **MDIO Address** allows the selection of the MDIO address, **0x0000** (default) to **0xFFFF**.
- **MDIO Data** allows to either select (write) or read the MDIO data, **0x0000** (default) to **0xFFFF**.

**MDIO Read** button reads the data of the specified **MDIO Address**.

**MDIO Write** button writes the specified **MDIO DATA** value to the specified **MDIO Address**.

## CFP/CFP2 TX Status

For parallel interface, indicates the CFP transmission status for each optical lane. For serial interface, indicates the CFP transmission laser status.

# 40/100G Advanced - Lanes Mapping & Skew

**Note:** Only available with parallel interface.

From the **Test** menu, tap **Functions**, **40/100G Advanced**, and the **Lanes Mapping & Skew** tab.

## TX

- **PCS/Logical Lane**, for Ethernet test applications, indicates the PCS (Ethernet test applications) or Logical (Transport Test applications) lane markers. To change the PCS/Logical lane order, see *Default/Random/Manual Mapping* on page 318.
- **Skew (Bits)** indicates the TX relative delay in bit time for each PCS/Logical lane. To change the skew values, see *Reset/Manual Skew* on page 319.

## CAUI/Physical Lane

Indicates the CAUI (Ethernet test applications) or Physical (Transport Test applications) Lane numbers.

## RX

- **Skew (bits)** indicates the delay in bit time between the earliest PCS/Logical lane and the current lane for the one to zero transition of the alignment marker sync bits. The received skew accuracy is  $\pm 100$  bits.
- **PCS/Logical Lane** indicates received PCS/Logical Lane markers.

**Note:** If a PCS/Logical Lane marker is detected more than once, a red background is used to highlight all occurrences of this PCS/Logical Lane marker. **Duplicate** is also displayed on a red background.

## **PCS/Logical Lane**

Allows to order the PCS/Logical Lane markers in either **Ascending** (1,2,3...) or **Coupled to RX**.

## **Alarms**

For a description of each alarm, refer to *OTL* on page 238 for Transport and *Ethernet - PCS Lanes* on page 221 for Ethernet.

## **Errors**

For a description of each error, refer to *OTL* on page 238 for Transport and *Ethernet - PCS Lanes* on page 221 for Ethernet.

The error values are displayed in seconds by default. Tapping on the unit allows to select either **Seconds**, **Count**, or **Rate**.

**Total** indicates the total of all lanes when **Count** or **Rate** unit is selected.

### Default/Random/Manual Mapping

Allows to change the PCS/Logical lane mapping that will be used for the test.

- **Default Mapping** sets the TX mapping to the default numerical order value which corresponds to the ascending PCS/Logical lane order.
- **Random Mapping** sets the TX mapping in a random order. Each time the button is tapped, random alignment markers are assigned to each PCS/Logical lane.
- **Manual Mapping** allows to manually set the TX mapping.
  - **PCS/Logical Lane** and **Assigned Status**: The PCS/Logical Lane buttons allow to assign the corresponding Lane Marker to the selected PCS/Logical to CAUI/XLAUI/Physical Lane mapping (the one pointed by the arrow). The **Assigned Status** column displays a check mark next to the assigned PCS/Logical Lanes. Range is from **0** to **19** for OTU4/100G and **0** to **3** for OTU3/OTU3e1/OTU3e2/40G.
  - **PCS/Logical Lane** and **CAUI/XLAUI/Physical Lane** columns indicate the target PCS/Logical to CAUI/XLAUI/Physical mapping.
  - **Clear All** clears the PCS/Logical to CAUI /XLAUI/Physical Lane assignments.
  - **OK** accepts the new PCS/Logical to CAUI/XLAUI/Physical lane mapping. All target PCS/Logical Lane fields must contain an assignation, including duplicates, to give access to the **OK** button.

**Note:** *A PCS/Logical Lane marker can be assigned more than once, if this is the case a red background is used to highlight all occurrences of this PCS/Logical Lane marker.*



## Reset/Manual Skew

Allows the selection of a relative delay in bit time that will be introduced for each PCS/Logical lane.

- **Reset Skew** sets all TX skew (bit time) values to 0.
- **Manual Skew** allows to manually set the skew value for each PCS/Logical lane.
  - **All Lanes**, when selected, applies the change(s) to all PCS/Logical Lane at once.
  - **Skew Inc/Dec Size (bits)** allows to set the increment/decrement value that will be used when changing the TX Skew (bits) values using the “+” and “-” buttons. Range is from **0** to **2047** for 100G/OTU4 and **0** to **4095** for 40G/OTU3/OTU3e1/OTU3e2.
  - **PCS/Logical Lane** indicates the PCS/Logical Lane numbers and **All** which represents the value for all PCS/Logical Lane when the **All Lanes** check box is selected.
  - **Skew (bits)** allows to set the skew value for each lane. Enter directly the skew value in the field or use the “+” and “-” buttons to respectively increment or decrement the skew value using the defined **Skew Inc/Dec Size** value. Tapping and holding the “+” or “-” button increments/decrements successively allowing to reach the desired value faster. using the defined **Skew Inc/Dec Size** value. Range is from **0** to **2047** for 100G/OTU4 and **0** to **4095** for 40G/OTU3/OTU3e1/OTU3e2.

## Test Functions

### *40/100G Advanced - Lanes Mapping & Skew*

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#### **Laser ON/OFF**

Allows to activate the laser control per optical lane or for all lanes.

Optical lane numbers are from **0** to **3** or from **0** to **9** depending on the selected interface/rate.

- **All Lanes** check box, when selected, applies the change(s) to all optical lanes at once.
- **Optical Lane** indicates the optical lane numbers and **All** which represents the setting for all optical lanes when the **All Lanes** check box is selected.
- **Laser** check box, when selected, indicates that the corresponding optical laser lane is activated and emitting an optical laser signal.

#### **Skew Alarm Threshold (bits)**

Allows to set the threshold value that will be used to declare a skew alarm (see **Ex. Skew** on page 238).

**Default** button restores the default alarm threshold value.

## 40/100G Advanced - Pre-Emphasis

**Note:** *Only available with parallel interface using CFP transceiver (not supported with CFP2). Not available with **Internal Loopback** connector.*

From the **Test** menu, tap **Functions, 40/100G Advanced**, and the **Pre-Emphasis** tab.

TX and RX parameters allow to respectively adjust the transmit and receive transceiver signal level and shape per channel.

- **All Lanes** check box, when selected (cleared by default), applies the change(s) to all channels at once.
- **Channel** indicates the channel numbers. **All** applies the values to all channels when the **All Lanes** check box is selected.

**Note:** *To restore the pre-emphasis values to their default setting, either tap the restore defaults test application button (available with Transport tests; refer to Restore < Test Application > Defaults on page 78 or Restore EtherSAM Defaults on page 97) or the restore default button of the whole unit (refer to Factory Default on page 201).*

## Test Functions

### 40/100G Advanced - Pre-Emphasis

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#### TX

- **VOD (mv)** allows to change the channel's signal amplitude. The default setting is **800** mV.
- **Pre-Emphasis Pre-tap 0t, Post-tap 1t, Post-tap 2t**, which essentially pre-distorts or modifies the energy/frequency content of signal transitions, compensates for signal degradation by effectively reducing reflections and crosstalk, while improving inter-symbol interference (ISI). It is key to apply a known level of energy or pre-distortion on the transition or bits, to help minimize high-frequency effects and allow the signal to reach its destination at the receiver with improved detection ability.

Pre-emphasis can be set with multiple taps—a tap being the coefficient that will be added to the corrected bit. A one-, two- or three-tap selection can be used to determine the right amplitude to be applied to the corrected bit. A similar analysis can be conducted for post- or de-emphasis where the correction will be applied to the post-bits.

The default setting is **0**.

#### RX

**Equalizer Control** and **Equalizer Gain (dB)** allow to enhance the receiver's detection capabilities. This process offsets the high-frequency effects of the transmission path by applying the reverse transfer function of the frequency-energy content of the signal compromised by the transmission path. Non-linear amplification of the degraded frequency components in the signal is applied in an amount that is inversely proportional to the loss or distortion in which the components were affected by the signal transmission medium.

The default setting is **0**.

## APS

From the **Test** menu, tap **Functions**, and the **APS** tab.

### TX/RX

- **Switching Mode**, available for both TX and RX, selects the switching mode: **Linear** (default) or **Ring**.

- **K1**

**Request:** Bits 1 through 4 of the K1 byte.

Bits 1 to 4	Request	
	Linear mode	Ring mode
0000	No Request <sup>a</sup>	No Request (default) <sup>a</sup>
0001	Do Not Revert	Reverse Request - Ring
0010	Reverse Request	Reverse Request - Span
0011	Unused	Exerciser - Ring
0100	Exerciser	Exerciser - Span
0101	Unused	Wait-to-Restore
0110	Wait-to-Restore	Manual Switch - Ring
0111	Unused	Manual Switch - Span
1000	Manual Switch	Signal Degrade - Ring
1001	Unused	Signal Degrade - Span
1010	Signal Degrade - Low Priority	Signal Degrade (Protection)
1011	Signal Degrade - High Priority	Signal Fail - Ring
1100	Signal Fail - Low Priority	Signal Fail - Span
1101	Signal Fail - High Priority	Force Switch - Ring
1110	Force Switch	Force Switch -Span
1111	Lockout of Protection	Lockout of Protection - Span/SF - P

a. Default value.

## Test Functions

APS

**Channel (Linear switching mode) or  
Destination Node ID (Ring switching mode):**  
Bits 5 through 8 of the K1 byte.

Bits 5 to 8	Channel ID (Linear mode)	Destination Node ID (Ring mode)	Bits 5 to 8	Channel ID (Linear mode)	Destination Node ID (Ring mode)
0000	0 - Null <sup>a</sup>	0 <sup>a</sup>	1000	8	8
0001	1	1	1001	9	9
0010	2	2	1010	10	10
0011	3	3	1011	11	11
0100	4	4	1100	12	12
0101	5	5	1101	13	13
0110	6	6	1110	14	14
0111	7	7	1111	15 - Extra Traffic	15

a. Default value.

➤ K2

**Protected Channel (Linear switching mode) or  
Source Node ID (Ring switching mode):**  
Bits 1 through 4 of the K2 byte.

Bits 1 to 4	Protected Channel (Linear mode)	Source Node ID (Ring mode)	Bits 1 to 4	Protected Channel (Linear mode)	Source Node ID (Ring mode)
0000	0 - Null <sup>a</sup>	0 <sup>a</sup>	1000	8	8
0001	1	1	1001	9	9
0010	2	2	1010	10	10
0011	3	3	1011	11	11
0100	4	4	1100	12	12
0101	5	5	1101	13	13
0110	6	6	1110	14	14
0111	7	7	1111	15 - Extra Traffic	15

a. Default value.

**Architecture (Linear switching mode) or Bridge Request (Ring switching mode):**  
 Bit 5 of the K2 byte. The default setting is **1+1** for Linear switching mode and **Short Path Request** for Ring switching mode.

Bit 5	Architecture (Linear mode)	Bridge Request (Ring mode)
0	1+1 <sup>a</sup>	Short Path <sup>a</sup>
1	1:n	Long Path

a. Default value.

**Operation Mode:** Bits 6 through 8 of the K2 byte.

Bits 6 to 8	Linear mode	Ring mode
000	Reserved <sup>a</sup>	Idle <sup>a</sup>
001	Reserved	Bridged
010	Reserved	Bridged and Switched
011	Reserved	Extra Traffic - Protection
100	Unidirectional	Reserved
101	Bidirectional	Reserved
110	RDI-L <sup>b</sup> /MS-RDI <sup>c</sup>	RDI-L <sup>b</sup> /MS-RDI <sup>c</sup>
111	AIS-L <sup>b</sup> /MS-AIS <sup>c</sup>	AIS-L <sup>b</sup> /MS-AIS <sup>c</sup>

- a. Default value.
- b. Operation mode for SONET.
- c. Operation mode for SDH.

## Client Offset

**Note:** Available with OTN BERT test application with **1GbE** client and **Pattern** client with **ODUflex** multiplexing.

From the **Test** menu, tap **Functions**, and the **Client Offset** tab.

## TX Frequency

**Note:** TX Frequency is not available in **Through** / **Through Intrusive** topology.

- **Frequency (GHz)** indicates the frequency (nominal frequency + port frequency offset + client frequency offset) used for transmission.
- **Offset (ppm)** check box, when selected (cleared by default), allows to set the client frequency offset that will be generated. Use the “+” or “-” button to respectively increment or decrement the client frequency offset value based on the defined **Increment/Decrement Size**, or directly type the frequency offset value in the field.
- **Increment/Decrement Size (ppm)** allows to set the increment/decrement value (from 0.1 to either 115) that will be used when changing the frequency offset using the “+” or “-” button.

Client	Nominal Frequency	Offset <sup>a</sup>
1GbE	1250000000 bps	± 115 ppm
Pattern in ODUflex	Nominal bit rate configured (refer to <i>Nominal Bit Rate</i> on page 186).	± 115 ppm <sup>b</sup>

- a. The Client frequency offset range is guaranteed for a clock source signal at 0 ppm offset. In the event that the clock source signal already has an offset, the output signal may exhibit an offset larger than the range specified. For example, if the clock source signal has an offset of +20 ppm (configured on the Signal interface), the Client frequency offset could be up to 135 ppm (115 ppm + 20 ppm).
- b. The Client offset function does not allow the generation of a signal with a rate above 100 % of the TX rate. For example, if the TX Rate is set to 100 %, the allowed offset range will be -115 ppm to 0 ppm.



## RX Frequency

- **Frequency (GHz)** indicates the frequency of the input signal.

Client	Measurement range
1GbE	1250000000 ±120 ppm
Pattern in ODUflex	Expected Frequency ±120 ppm (see page 328)

- **Offset (ppm)** indicates the frequency offset between the standard rate specification and the rate at the input signal.

**Note:** For both **Frequency** and **Offset** a background color is used to indicate if the received client signal rate meets the standard rate specifications. Not available with Pattern in ODUflex when the **Frequency Offset Analysis** check box is cleared.

Background color	Description
Green	The frequency is in range.
Red	The frequency is out-of-range or there is a LOC Lane condition. <b>LOC</b> is also displayed.
Gray	Pending state.

Client	Standard Rate Specification
1GbE	1250000000 ±12500 bps (±100 ppm)
Pattern in ODUflex	Expected Frequency ±100 ppm (see page 328)

- **Max. Negative Offset (ppm)** indicates the maximum negative frequency offset between the standard rate specification and the rate from the received signal.

## Test Functions

### Client Offset

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- **Max. Positive Offset (ppm)** indicates the maximum positive frequency offset between the standard rate specification and the rate from the received signal.

**Note:** *The following parameters are only available with ODUflex mapped to pattern.*

- **Frequency Offset Analysis** check box, when selected, enables the frequency offset measurements. This setting is enabled by default for **Coupled** topology, and disabled for **Through / Through Intrusive** topology.
- **Expected Frequency (GHz)** is available when the **Frequency Offset Analysis** check box is selected.

For **Coupled** topology, the frequency is set to the configured **TX Rate** (refer to page 74).

For **Through / Through Intrusive** topology, enter the expected frequency in GHz.

## Filters

Allows gathering statistics according to the programmed filters. Filters provide the capability to analyze a specific stream's behavior in order to monitor a single protocol's behavior, perform SLA verification, or precisely troubleshoot unwanted behavior. Up to 10 filters having up to four operands each can be defined and enabled.

From the **Test** menu, tap **Functions**, and the **Filters** tab.

### Filters

Allows the selection of the filter number (1 to 10). The filter criteria, if defined, will be displayed. A filter used (enabled) for data capture will not be configurable and the message **Filter in use for data capture** is displayed.

### 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. It is not possible to modify or disable a filter that is already in use for capture until either another filter or **Interface** (see *Capture Source* on page 333) is assigned to capture.

### Enabled Time

Indicates the time during which the filter is enabled.

## Assign to Capture

**Note:** *Only available when the ETH-CAPTURE software option is enabled. Refer to Software Option on page 23 for more information.*

Assigns the selected filter for packet capture. See *Packet Capture* on page 333.

## Filter Configuration

**Note:** *Multiple filter criteria is only available when the ADV-FILTERS option is enabled; otherwise only one criterion is possible. Refer to Software Option on page 23 for more information.*

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 cleared.

- “(“ and “)”“, the open and close parenthesis controls 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 has precedence over a logical OR.
- **Not** check box when selected, adds the logical negation (not equal) operator for the operand filter defined at its right.

- **Filter** specifies the filter to be used (**None** by default).

Category	Filter
Ethernet	MAC Destination Address, MAC Source Address, EtherType <sup>a</sup> , C-VLAN ID, S-VLAN ID, E-VLAN ID, C-VLAN Priority, S-VLAN Priority, E-VLAN Priority
IPv4	IPv4 Destination Address, IPv4 Source Address, IPv4 TOS, IPv4 Precedence, IPv4 Protocol, IPv4 DiffServ
IPv6 <sup>b</sup>	IPv6 Destination Address, IPv6 Source Address, IPv6 Flow Label, IPv6 Next Header <sup>c</sup> , IPv6 Traffic Class, IPv6 Precedence, IPv6 DiffServ
Higher Layer	UDP Destination Port, UDP Source Port
MPLS <sup>d</sup>	MPLS Label 1, MPLS Label 2, MPLS COS 1, MPLS COS 2

- a. Applies only to the last EtherType occurrence when VLAN is used.
- b. Available when the corresponding software option is enabled (refer to page 23).
- c. Applies only to the last next header occurrence when extension headers are used.

- **Value** is the value associated to the selected filter.

## Test Functions

### Filters

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- **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.** specifies the logical operator (AND or OR) used between two operands.

## Filter Statistics

Indicates throughput statistics of frame matching the configured filter's criteria.

- **Line Utilization** gives the percentage of line rate utilization.
- **Ethernet BW** (Bandwidth) gives the receiving data rate expressed in Mbit/s.
- **Frame Rate** gives the receiving number of frames (including bad frames) in frame/s.
- **Frame Count** indicates the number of frame matching the configured filter's criteria.
- **Error Count** indicates respectively the number of frames matching the configured filter's criteria having **IP Checksum**, **UDP Checksum**, **TCP Checksum**, **FCS**, **Jabber**, **Oversize**, **Runt**, or **Undersize** errors. Refer to *Ethernet* on page 219 and *IP/UDP* on page 230 for more information on errors.

## Packet Capture

Capture is used to analyze all or filtered data traffic and save complete or truncated frames into a buffer. It allows to precisely observe network truncated data, or to understand errors and unwanted behavior.

From the **Test** menu, tap **Functions**, and the **Packet Capture** tab.

### Capture Source

Specifies what kind of data to be captured.

- **Interface** captures all received frames and saves them in the capture buffer.
- **Filter x** captures only frames that match the selected filter and saves them in the capture buffer. Select the filter number from the list. Only enabled filters are available, see *Filters* on page 329.

The selected filter will be reserved for data capture and will not be available for filter configuration.

## Frame Length

Specifies 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 tap 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 (default) to 1536 bytes.

**Truncation Calculator** allows to easily determine at what byte to truncate the frame captured by selecting the desired frame header components.

- **Header Layer** specifies the header layer level: **Layer 2 (Ethernet)**, **Layer 3 (IP)**, or **Layer 4 (TCP/UDP)**.
- **IP Version** specifies the IP version: **IPv4** or **IPv6**.
- **Encapsulation** parameters are optional and not selected by default.

**VLAN** check box, when selected, enables VLAN and allows to select the number of VLANs: 1, 2, or 3.

**MPLS** check box, when selected, enables MPLS and allows to select the number of labels: 1 or 2.

- **Additional Payload (bytes)** allows to optionally select the number of additional payload bytes (1 to 1400 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 (**Truncated** field).



## Trigger

- **Trigger Type** defines 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 starts the frame capture when the Capture button is on (green LED) and the test is started (refer to *Start/Stop | TX Button* on page 388).
  - **On Error** starts the frame capture when the selected error occurs.

**FCS**

**Jabber**

**Oversize** (Available when **Oversize Monitoring** is enabled)

**Runt**

**Undersize**

**IP Checksum**

**UDP Checksum**

**TCP Checksum**

**Any Type** (Any of the above errors).

- **Field Match** starts the frame capture when the configured field match is encountered. Use the **Configuration** button to select the field match criteria (see **Filter Configuration** from the **Filters** tab).

**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.

## Test Functions

### Packet Capture

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- **Trigger Position** selects the triggered frame position within the buffer.
  - **Post-Trigger** for a trigger frame located at the beginning of the buffer. The buffer will contain the triggered frame with the following frames.
  - **Mid-Trigger** for a trigger frame located at the middle of the buffer. The buffer will contain the triggered frame with the preceding and following frames.
  - **Pre-Trigger** for a trigger frame located at the end of the buffer. 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.
- **Buffer Usage** indicates the percentage of the buffer capacity used.
- **Triggered Error** is available when trigger on error is selected and indicates the error that activated the trigger.

- **Triggered Frame - Details** gives details on the triggered frame.

The triggered frame corresponds to the first received frame that matches the filter and the trigger settings.

**Frame Number** indicates the triggered frame position in the buffer.

The framing MAC/IP/UDP source and destination addresses are displayed in a table.

- **Capture** button allows to start/stop the data capture. The test must be running (refer to *Start/Stop | TX Button* on page 388) 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 512 KBytes or a maximum of 8192 frames for rates 40GE and 100GE.

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, available when the test application is stopped, allows to export the data captured 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:

*d:|ToolBox|User Files|<Product Name>|Capture Data*

*d:|IQSManager|User Files|<Product Name>|Capture Data*

## Test Functions

### Packet Capture

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- **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.

Tapping 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.

## GMP

**Note:** Available with Transport test applications with either payload type 21 (PT21) or EoOTN client.

From the **Test** menu, tap **Functions**, and the **GMP** tab.

### Channel

Available with Multi-Channel OTN, allows the selection of the channel number.

### Generic Mapping Procedure

- **TX Cm** indicates the minimum and maximum Cm value transmitted during the test.
- **TX CnD** indicates the minimum and maximum CnD value transmitted during the test.
- **RX Cm** indicates the minimum and maximum Cm value captured during the test.
- **RX CnD** indicates the minimum and maximum CnD value captured during the test.

### OH - GFP-F/GFP-T

**Note:** Available with OTN BERT test application with **1GbE (GFP-T)**, **10GbE (GFP-F)**, or **Ethernet (flex/GFP-F)** client.

From the **Test** menu, tap **Functions**, **OH** tab, and **GFP-F/GFP-T** sub tab.

➤ **Core Header**

**PLI** and **cHEC** are not configurable.

➤ **Type Header**

The following settings are available for **Client Data** and **Client Management** frame types.

- **PTI** (Payload Type Identifier) allows overwriting the Payload Type Identifier.

PTI	Description
000	Client Data Frame
100	Client Management Frame
001, 010, 011, 101, 110, and 111	Reserved

- **PFI** (Payload Frame Check Sequence Identifier) allows overwriting the Payload FCS Indicator.

PFI	Description
0	FCS Absent
1	FCS Present

- **EXI** (Extension Header Identifier) allows overwriting the Extension Header Identifier.

<b>EXI</b>	<b>Description</b>
0000	Null Extension Header
0001	Linear Frame
0010	Ring Frame
0011 to 1111	Reserved

- **UPI** (User Payload Identifier) allows overwriting the User Payload Identifier.

<b>UPI</b>	<b>Description for PTI = 000</b>	<b>Description for PTI = 100</b>
0000 0000 1111 1111	Reserved and not available	Reserved
0000 0001	Frame-Mapped Ethernet	Client Signal Fail (Loss of Client Signal)
0000 0010	Mapped PPP Frame	Client Signal Fail (Loss of Character Synchronization)
0000 0011	Transparent Fibre Channel	Client Defect Clear Indication (DCI)
0000 0100	Transparent FICON	Client Forward Defect Indication (FDI)
0000 0101	Transparent ESCON	Client Reverse Defect Indication (RDI)
0000 0110	Transparent GbE	
0000 0111	Reserved for future use	
0000 1000	Frame-Mapped Multiple Access Protocol over SDH (MAPOS)	
0000 1001	Transparent DVB ASI	
0000 1010	Framed-Mapped IEEE 802.17 Resilient Packet Ring	
0000 1011	Frame-Mapped Fibre Channel FC-BBW	
0000 1100	Asynchronous Transparent Fibre Channel	
0000 1101	Framed MPLS Unicast	
0000 1110	Framed MPLS Multicast	
0000 1111	Framed IS-IS	
0001 0000	Framed IPv4	
0001 0001	Framed IPv6	

## Test Functions

OH - GFP-F/GFP-T

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UPI	Description for PTI = 000	Description for PTI = 100
0001 0010	Framed DVD-ASI	
0001 0011	Framed 64B/66B Ethernet	
0001 0100	Framed 64B/66B Ethernet Ordered Set	
0001 0101 through 1110 1111	Reserved for future standardization	
1111 0000 through 1111 1110	Reserved for proprietary use	
0000 0110 through 1101 1111		Reserved for future use
1110 0000 through 1111 1110		Reserved for proprietary use

- **Extension Header: CID** and **Spare** are only available when EXI is set to **Linear** (refer to **EXI** on page 106) and are available for **Client Data** and **Client Management** frame types.
  - **CID** (Channel IDentifier) allows to overwrite the communication channel used for the signal transmission set from CID on page 106. Choices are from **00000000** through **11111111** (0 to 255). The default setting is 00000000.
  - **Spare** allows to set the extension header Spare field. Choices are from **00000000** through **11111111** (0 to 255).

### Default all OH

Returns all TX overhead bytes to their factory default values.



## RX

**Note:** *The following **Core Header**, **Type Header**, and **Extension Header** parameters are available for **Client Data**, **Client Management**, and **Reserved PTI** frames. The details of the selected OH field is displayed in the **OH Details** section on the bottom-right of the screen.*

### ► Core Header

- **PLI** (Payload Length Indicator) indicates the number of octets in the GFP payload area.
- **cHEC** (Core Header Error Control) indicates the CRC-16 error control code that protects the integrity of the contents of the core header by enabling both single-bit error correction and Multi-bit error detection.
- **Type Header:** See Type Header *on page 340* for **PTI**, **PFI**, **EXI**, and **UPI** possible values.
  - **PTI** (Payload Type Identifier) indicates the type of GFP client frame.
  - **PFI** (Payload Frame Check Sequence Indicator) displays the Payload FCS Indicator.
  - **EXI** (Extension Header Identifier) indicates the Extension Header Identifier.
  - **UPI** (User Payload Identifier) indicates the User Payload Identifier.
  - **tHEC** (Type Header Error Control) indicates the CRC-16 error control code that protects the integrity of the contents of the type field by enabling both single-bit error correction and multi-bit error detection.

## Test Functions

### OH - GFP-F/GFP-T

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- **Extension Header: CID, Spare, and eHEC** are only available when EXI is set to **Linear** (refer to EXI on page 106).
  - **CID** (Channel IDentifier) indicates the communication channel used by the signal. Possible values are 00000000 through 11111111 (0 to 255).
  - **Spare** indicates the extension header Spare field. Possible values are 00000000 through 11111111 (0 to 255).
  - **eHEC** (Type Header Error Control) indicates the CRC-16 error control code that protects the integrity of the contents of the extension header by enabling both single-bit error correction (optional) and multi-bit error detection.

## OH Details

Displays the details of the selected OH byte. The first column indicates the selected OH byte. The second column indicates respectively from top to bottom the bit numbers used, the byte value in binary, and the interpretation of the byte when applicable.

## OH - OTN

For **OTN BERT**, from the **Test** menu, tap **Functions**, and the **OH** tab.

For **OTN SONET/SDH BERT**, from the **Test** menu, tap **Functions**, **OH**, and the **OTN** sub tab.

Allows to respectively modify the overhead information to be transmitted or to view the overhead information received.

### OTU<sub>x</sub>/ODU<sub>x</sub> and ODU<sub>x</sub> Buttons

Tap on either the **OTU<sub>x</sub>/ODU<sub>x</sub>** or the **ODU<sub>x</sub>** button to select the OH level.

### Default OTN OH

Returns all TX overhead bytes to their factory default values.

### TX/RX

Overhead bytes are organized using rows and columns structure as per G.709 standard.

Row 1

- **OA1** and **OA2**, columns 1-6, OTU FAS: All the Frame Alignment Signal **OA1** bytes and **OA2** bytes are individually configurable from **00** to **FF**. The default values are **F6** for all **OA1** bytes and **28** for all **OA2** bytes.
- **MFAS**, column 7, OTU MFAS: The Multi-Frame Alignment Signal byte is not configurable.
- **SM**, columns 8-10, OTU OH: The Section Monitoring contains the following bytes.

The first SM byte (column 8) contains the TTI multiframe byte that is only configurable from *Traces (OTN)* on page 205.

The second SM byte (column 9) contains the BIP-8 byte that is automatically generated for each frame. This byte is not configurable.

## Test Functions

### OH - OTN

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The third SM byte (column 10) contains the following sub-fields. This byte is configurable from **00** (default) to **FF**.

Bit 1-4	Bit 5	Bit 6	Bit 7-8
BEI/BIAE	BDI	IAE	RES

- **GCC0**, columns 11-12, OTU OH: The two General Communication Channel-0 bytes are configurable from **00** (default) to **FF**.
- **RES**, columns 13-14, OTU OH: The two Reserved (RES) bytes are configurable from **00** (default) to **FF**.
- **JC4** or **RES**<sup>1</sup>  
**JC4**, column 15, OPU OH: Bits 1-3 set to all-0s, and bits 4-8 are controlled by GMP function. This byte is not configurable.  
**RES**, column 15, OPU OH: The Reserved (RES) byte is configurable from **00** (default) to **FF**.
- **JC1** or **JC**<sup>1</sup>  
**JC1**, column 16, OPU OH: Controlled by GMP function. This byte is not configurable.  
**JC**, column 16, OPU OH:
  - Bits 1-6, Reserved (RES), are configurable from binary **000000** (default) to **111111**.
  - Bits 7-8, Justification Control (JC), are configurable from binary **00** (default) to **11**. Not available with ODU mux. Changing the JC value will corrupt the payload.

---

1. Depending on the test MUX/Mapping.

Row 2

- **RES**, columns 1-2, ODU OH: The two Reserved (RES) bytes are configurable from **00** (default for each byte) to **FF**.
- **PM & TCM**, column 3, ODU OH: The Path Monitoring and Tandem Connection Monitoring byte is configurable from **00** (default) to **FF**.
- **TCM ACT**, column 4, ODU OH: The Tandem Connection Monitoring Activation is configurable from **00** (default) to **FF**.
- **TCM6/TCM5/TCM4**, column 5-13, ODU OH: The Tandem Connection Monitoring overhead contains the following bytes.

The first TCMi byte contains the TTI multiframe byte and is only configurable from *Traces (OTN)* on page 205.

The second TCMi byte contains the BIP-8 byte and is automatically generated for each frame. This byte is not configurable.

The third TCMi byte contains the following sub-fields. This byte is configurable from **00** to **FF**. The default value is **00** when TCMi is disabled, and **01** when enabled.

Bit 1-4	Bit 5	Bit 6-8
BEI/BIAE	BDI	STAT

- **FTFL**, column 14, ODU OH: The Fault Type Fault Location multiframe byte is only configurable from *FTFL/PT and PT* on page 102.
- **JC5** or **RES**<sup>1</sup>

**JC5**, column 15, OPU OH: Bits 1-3 set to all-0s, and bits 4-8 are controlled by GMP function. This byte is not configurable.

**RES**, column 15, OPU OH: The Reserved (RES) byte is configurable from **00** (default) to **FF**.

## Test Functions

OH - OTN

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➤ **JC2 or JC<sup>1</sup>**

**JC2**, column 16, OPU OH: Controlled by GMP function. This byte is not configurable.

**JC**, column 16, OPU OH:

- Bits 1-6, Reserved (RES), are configurable from binary **000000** (default) to **111111**.
- Bits 7-8, Justification Control (JC), are configurable from binary **00** (default) to **11**. Not available with ODU mux. Changing the JC value will corrupt the payload.

Row 3

- **TCM3/TCM2/TCM1**, columns 1-9, ODU OH: See *TCM6/TCM5/TCM4* on page 347 for more information.

- **PM**, column 10-12, ODU OH: The Path Monitoring overhead contains the following bytes.

The first PM byte (column 10) contains the TTI byte that is not configurable.

The second PM byte (column 11) contains the BIP-8 byte and is automatically generated for each frame. This byte is not configurable.

The third PM byte (column 12) contains the following sub-fields. This byte is configurable from **00** to **FF**. The default value is **01**.

Bit 1-4	Bit 5	Bit 6-8
BEI	BDI	STAT

- **EXP**, column 13-14, ODU OH: The two Experimental overhead bytes are configurable from **00** (default for each byte) to **FF**.

➤ **JC6 or RES<sup>1</sup>**

**JC6**, column 15, OPU OH: Bits 1-3 set to all-0s, and bits 4-8 are controlled by GMP function. This byte is not configurable.

**RES**, column 15, ODU OH: The Reserved (RES) bytes are configurable from **00** (default) to **FF**.

➤ **JC3 or JC<sup>1</sup>**

**JC3**, column 16, OPU OH: Controlled by GMP function. This byte is not configurable.

**JC**, column 16, OPU OH:

➤ Bits 1-6, Reserved (RES), are configurable from binary **000000** (default) to **111111**.

➤ Bits 7-8, Justification Control (JC), are configurable from binary **00** (default) to **11**. Not available with ODU mux. Changing the JC value will corrupt the payload.

Row 4

➤ **GCC1**, column 1-2, ODU OH: The two General Communication Channel-1 bytes are configurable from **00** (default for each byte) to **FF**.

➤ **GCC2**, column 3-4, ODU OH: The two General Communication Channel-2 bytes are configurable from **00** (default for each byte) to **FF**.

➤ **APS/PCC**, column 5-8, ODU OH: The Automatic Protection Switching / Protection Communication Channel overhead bytes are defined in the ITU-T G.709 standard. These bytes are configurable from **00** (default) to **FF**.

➤ **RES**, column 9-14, ODU OH: The six Reserved (RES) bytes are configurable from **00** (default for each byte) to **FF**.

## Test Functions

### OH - OTN

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- **PSI, column 15, OPU/ODU OH:** Tap the PSI field to configure (TX) or display (RX) the Payload Structure Identifier.
  - **TX:** Select any TX byte from the list and its content is displayed below the list. Tap the **Edit** button to change its value.
  - **RX:** Select any RX byte from the list and its content is displayed below the list.
  - **Link TX/RX Scrolling**, when selected (cleared by default), allows to synchronize both TX and RX table allowing to see the same TX and RX PSI byte numbers when scrolling from either TX or RX table.
  - **Foreground Signal Label:** Indicates the status of the MSI for each PSI#, either **MSI TX** (black), **Expected MSI RX** (green), or **MSI Mismatch** (red).
- **OMFI or NJO**
  - OMFI**, column 16, OPU OH: OPU Multi-Frame Identifier is only available for OPU4 of a mapped signal. This byte is not configurable.
  - NJO**, column 16, ODU OH: The Negative Justification Opportunity byte is not configurable. Available either for non-concatenated signal or on the LO of a concatenated signal.

## RX

- **RX OH Byte Details** displays the content of the selected OH RX byte. Tap on any OH RX byte to see its content
- **Legend TX/RX** indicates the path level for all OH bytes.



## OH - SONET/SDH

The SONET/SDH OH page allows to modify (TX) the overhead information to be transmitted and to view (RX) the overhead information received.

For **SONET/SDH BERT**, from the **Test** menu, tap **Functions**, and the **OH** tab.

For **OTN-SONET/SDH BERT**, from the **Test** menu, tap **Functions**, **OH**, and the **SONET/SDH** sub tab.

Tap on any overhead byte in TX to modify its value.

Tap on any overhead byte in RX to see its detailed content/value.

**Note:** *A byte in TX that has no value displayed or is grayed out, is not configurable from the OH tab.*

### TX and RX Buttons (SDH)

Tap on the TX or RX button to respectively access the overhead bytes in transmission or receive mode.

### STS-1 Timeslot/STM-1 Channel

Allows to select the timeslot number for the Transport OH bytes. The STS/AU/TU-3 overhead bytes are always for the timeslot selected in the test configuration. Furthermore when modifying the Transport OH bytes H1 SS bits, the modification applies to all timeslots when the test topology is **Coupled**. Choices are **1** (default) to **768** (SONET) / **256** (SDH) depending on the OC-N/STM-N interface selected.

### Transport OH - Section/RS

- **A1 and A2:** Framing. The value should be hexadecimal **F6** for A1 and **28** for A2. They must appear in every STS-1/STM-1 frame of a composite signal.

SONET: Provide frame alignment of each STS-1 frame within a composite signal (STS-1 to STS-n).

SDH: Indicate the beginning of the STM-N frame.

- **J0/Z0**

- **J0:** The J0 (Trace) byte is used to trace the origin of an STS-1/STM-1 frame as it travels across the SONET/SDH network. This byte is only defined for the first STS-1/STM-1 frame of a composite signal. Available when the Trace format is set to 1 Byte (refer to *Traces (SONET/SDH)* on page 209).

- **Z0:** Growth.

SONET: The Z0 byte was used to uniquely identify the STS in question. This byte has to be defined in every STS-1 to STS-n frame of a composite signal. This byte is only defined for the STS-1 #2 to STS-1 #N of a OC-N signal.

SDH: These bytes are reserved for future international standardization. They are located at positions S[1,6N+2] to S[1,7N] of an STM-N signal (N > 1).

- **B1:** BIP-8 (Bit-Interleaved Parity) byte provides section error monitoring. This byte is only defined for the first STS-1/STM-1 frame of a composite signal. The byte is calculated by performing a routine even-parity check over all bits of the previous STS-N/STM-N frame of a composite signal.
- **E1:** Orderwire. Provides a 64 Kbit/s voice channel for communication between two STEs (Section Terminating Equipment). This byte is only defined for the first STS-1/STM-1 frame of a composite signal.

- **F1:** User/User Channel. This byte is reserved for user purposes. This byte is only defined for the first STS-1/STM-1 frame of a composite signal.
- **D1, D2, and D3:** Data Communications Channel (DCC). Provides a 192 Kbit/s data communication between two STEs for operation functions such as OAM&P. These bytes are only defined for the first STS-1/STM-1 frame of a composite signal.

### **Transport OH - Line/MS**

- **H1 and H2:** Pointer.

SONET: H1 and H2 bytes are combined to form a pointer indicating where the path overhead begins within each SPE.

SDH: H1 and H2 bytes are combined to form a pointer indicating where the VC (Virtual Container) frame begins within each SPE.

Bits 5 and 6 of the H1 byte represent the SS bits and are configurable as follows.

SS Bits	Description
00	SONET
01	Undefined
10	SDH
11	Undefined

- **H3:** Pointer Action. H3 is an extra byte used to compensate for the SPE timing variation. The H1 and H2 pointer tell the receiver when the H3 pointer is used.

SONET: This byte must be defined in every STS-1 to STS-n frame of a composite signal.

SDH: This byte must be defined in every STM-1 of an STM-N signal in the event of negative justification, otherwise it is not defined.

## Test Functions

### OH - SONET/SDH

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➤ **B2: BIP-8**

SONET: The BIP-8 (Bit-Interleaved Parity) byte provides line error monitoring. This byte is only defined for the first STS-1/STM-1 frame of a composite signal. The byte is calculated by performing a routine even-parity check over all bits of the LOH and the STS-1 frame capacity of the previous frame of a composite signal (STS-1 to STS-n). Note that the SOH is not used to calculate the parity check.

SDH: The MS BIP-N\*24 (Bit-Interleaved Parity) byte provides line error monitoring. The byte is calculated by performing a routine even-parity check over all bits of the MSOH and the STM-N frame of the previous STM-N frame. Note that the RSOH is not used to calculate the parity check.

➤ **K1 and K2: Automatic Protection Switching (APS):** The K1 and K2 bytes communicate APS between two LTE. These bytes are only defined for the first STS-1/STM-1 frame of a composite signal.

➤ **D4 through D12: Data Communications Channel (DCC):** The D4 through D12 bytes provide a 576 Kbit/s data communications channel between two LTEs for administration, monitoring and other communications. These bytes are only defined for the first STS-1/STM-1 frame of a composite signal.

➤ **S1/Z1 (SONET)**

**S1: Synchronization Status:** The S1 byte is used to carry the synchronization status of the SONET device. This byte is only defined for the first STS-1/STM-1 frame of a composite signal.

**Z1: Growth.** This byte is located in the second STS-1 through STS-n frame of a composite signal (STS-1 #2, STS-1 #3, up to STS-1 #N of a OC-N (N>3) signal).

➤ **S1 (SDH): Synchronization Status.** Bits 5 to 8 of the S1 byte are used to carry the synchronization messages of the SDH device. This byte is only defined for the first STS-1/STM-1 frame of a composite signal.

➤ **M0 or M1 (SONET)**

**M0:** REI-L: The M1 byte is used for line Remote Error Indication (REI-L)

The M0 bytes located in the STS-1 #4 indicates BIP violations when combined with the M1 byte (see M1 byte below for more information).

**M1:** REI-L. The M1 byte is used for line Remote Error Indication (REI-L).

- For OC-768: The combination of the M1 byte located in the STS-1 #7 and the M0 byte indicates BIP violations.

<b>M0 Located in STS-1 #4</b>	<b>M1 Located in STS-1 #7</b>	<b>Indicates</b>
0000 0000	0000 0000	0 BIP violation
0000 0000	0000 0001	1 BIP violation
:	:	:
0001 1000	0000 0000	6144 BIP violations
0001 1000 to 1111 1111	0000 0001 to 1111 1111	0 BIP violation

**Undefined “--”** for all other timeslots not covered by M0, and M1.

➤ **M0 or M1 (SDH)**

**M0:** MS-REI. STM-1 channel #1 of a STM-0 signal; channel #2 of an STM-64/STM-256 signal.

**M1:**MS-REI. STM-1 channel #1 of a STM-1 signal; channel #3 of an STM-N signal (N>1).

**Undefined “--”** for all other channels not covered by M0, and M1.

- **E2:** Orderwire. Provides a 64 Kbit/s voice channel for communication between LTEs. This byte is only defined for the first STS-1/STM-1 frame of a composite signal.

### STS/AU/TU-3

- **J1:** Trace. Available when the Trace format is set to 1 Byte (refer to *Traces (SONET/SDH)* on page 209).

SONET: The J1 Trace byte provides a 16 or 64 byte fixed string to verify connection between path transmitting equipment and path receiving equipment.

SDH: The higher-order (AU) VC-N path trace byte provides a 64 byte fixed string to verify connection between path transmitting equipment and path receiving equipment.

- **B3:** BIP-8. The BIP-8 (Bit-Interleaved Parity) byte provides path error monitoring. The byte is calculated by performing an even-parity check over all bits of the previous SPE.

- **C2: Signal Label.** Entering a C2 byte value will automatically update the Path Signal Label (C2) selection and vice versa. Refer to *STS/AU Path (C2)* on page 112 for more information.

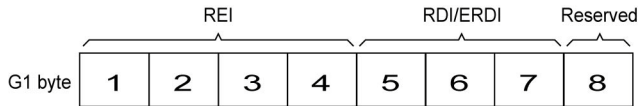
C2 (Hex.)	Description	
	SONET	SDH
00 <sup>a</sup>	Unequipped	UNEQ or supervisory-UNEQ
01	Equipped - Non-Specific	RES (Equipped - Non-Specific)
02	Floating VT Mode (Default)	TUG Structure
03	Locked VT Mode	Locked TU-n
04	Async Mapping for DS3	Async Mapping of 34M/45M in C-3
05	Mapping under development	Experimental Mapping
12	Async Mapping for 140M (DS4NA)	Async Mapping of 140M in C-4
13	Mapping for ATM	ATM Mapping
14	Mapping for DQDB	MAN DQDB
15	Async Mapping for FDDI	FDDI [3]-[11] Mapping
16	Mapping of HDLC over SONET	Mapping of HDLC/PPP
17	SDL with self-sync scrambler	RES (SDL self-synch scrambler)
18	Mapping of HDLC/LAPS	Mapping of HDLC/LAPS
19	SDL with a set-reset scrambler	RES (SDL set-reset scrambler)
1A	10 Gbit/s Ethernet (IEEE 802.3)	10 Gbit/s Ethernet (IEEE 802.3)
1B	GFP	GFP
1C	Not supported	Mapping 10 Gbit/s FC
20	Not supported	Async Mapping of ODUk
CF	RES (Obsolete HDLC/PPP framed)	RES (obsolete HDLC/PPP framed)
E1 <sup>a</sup> to FC <sup>a</sup>	STS-1 w/1 VTx PD, STS-1 w/2 VTx PD, ... STS-1 w/28 VTx or STS-n/nc PD	Not supported
FE	Test Signal, ITU-T 0.181	Test Signal, ITU-T 0.181
FF <sup>a</sup>	STS SPE AIS (TCM)	VC-AIS (TCM)

- a. These values cannot be selected as Expected Path Signal Label.

## Test Functions

OH - SONET/SDH

- **G1:** Path Status. The G1 byte provides a method to communicate the far-end path status back to the path originating equipment.



REI:

Bits 1 to 4 of G1	Description
0000	No error
0001	1 error
0010	2 errors
:	:
1000	8 errors
1001 to 1111	No error

RDI/ERDI:

Bits 5, 6, 7 of G1	Description
000, 001, 011	No defect
100, 111	RDI
010	ERDI-PD
101	ERDI-SD
110	ERDI-CD

- **F2:** User Channel. The User Channel provides a 64 Kbit/s channel for communication between two PTEs. This byte is only defined for the first STS-1/STM-1 frame of a composite signal.
- **H4:** Multiframe Indicator. The H4 byte provides a multiframe phase indication of a VT/TU payload.



- **Z3 and Z4:**  
SONET only: Growth.
- **F3:**  
SDH only: User Channel. The Path User Channel provides a channel for communication purposes between path elements and is payload dependent.
- **K3:**  
SDH only: Automatic Protection Switching (APS). Bits 1 to 4 of the K3 byte are used for APS signaling. K3 bits 5 to 8 are reserved for future use.
- **N1:**  
SONET: The N1 byte (formerly referred to as the Z5 byte) is allocated for Tandem Connection Maintenance (TCM) and the Path Data Channel.  
  
SDH: (Network operator byte) The N1 byte is allocated to provide a Higher-Order Tandem Connection Monitoring (HO-TCM) function.

## **Default all OH**

Returns all TX overhead bytes to their factory default values.

# Ping & Trace Route

From the **Test** menu, tap **Functions**, and the **Ping & Trace Route** tab.

## Source IP Address

Displays the configured **Source IP Address**. Refer to *MAC/IP/UDP* on page 116 for RFC 2544 and EtherBERT tests, and to *Smart Loopback* on page 190 for Smart Loopback test.

## Destination IP Address

Enter the **Destination IP Address** of the network device to be detected. The destination IP address is configurable only with **IPv4 Network Layer** (refer to *Modify Structure Button* on page 63). The accepted range for IPv4 is **0.0.0.0** (default) to **255.255.255.255**.

The default setting for IPv6 is **2001:0000:0000:0000:0000:0000:0000:0000** or is set automatically to the IP address of the target module from the Remote Loopback mode. The destination IP address is configured only when **Ethernet/IPv6/UDP** is selected. The **IPv6 Address** can either be the **Link-Local IPv6 Address** or the **Global IPv6 Address**. The acceptable range for IPv6 is from **000:0000:0000:0000:0000:0000:0000:0001** to **FFFF:FFFF:FFFF:FFFF:FFFF:FFFF:FFFF:FFFF**.

## Stream

**Stream** is available with EtherSAM and Traffic Gen & Mon and allows to select a stream/service to use its source and destination IP addresses for the Ping and Trace Route tests.

## Use Stream

**Use Stream** is available with test application using stream/services and allows to use the source and destination IP of the defined or selected stream/services.

## Ping

- **Data Size (Bytes):** Enter the data size that will be sent to the network device to be detected. Choices are **0 to 1452 bytes; 32 bytes** by default.
- **TTL for IPv4 and Hop Limit (TTL) for IPv6:** Enter the maximum number of hops the packet can go through. Choices are **1 to 255; 128** by default.
- **IP TOS/DS for IPv4 and Traffic Class (TOS/DS) for IPv6:** Enter the type of service. Choices are **00** (default) to **FF**.
- **Flow Label (IPv6) value acceptable range is from 0 (default) to 1048575.**
- **Timeout (ms):** Enter the maximum time allowed between an ICMP echo and response. Choices are **200 ms to 10000 s; 4000 ms** by default.
- **Delay (ms):** Enter the delay between each attempt (PING). Choices are **100 to 10000 ms; 1000 ms** by default.
- **Attempts:** Select **n-Attempts** to specify the number of ping requests to send following a ping activation or select **Continuous** to ping continuously until manually stopped. If **n-Attempts** is selected, enter the number of ping attempts from **1 to 100**. The default setting is **n-Attempts** with **4** attempts.
- **Ping** button starts the ping tool with the specified settings.

## Trace Route

- **Max Hop Count:** Enter the maximum network device the packet is allowed to go through. Choices are **1** to **255**; **128** by default.
- **Timeout (ms):** Enter the maximum time allowed between an ICMP echo and response at each hop. Choices are **200 ms** to **10000 ms**; **4000 ms** by default.
- **Trace Route** button starts the trace route tool with the specified settings.

## Results

To succeed, a ping command shall be acknowledged by the network device within a given delay (**Timeout**). 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.

To succeed, a trace route command shall be acknowledged by the network device within a given delay (Timeout). 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 ping and trace route results are displayed with the following columns:

- **No.:** Indicates the attempt number.

➤ **Status:** Indicates the status of the attempt as follows:

Status	Description
<b>Successful</b>	Valid ICMP echo reply received.
<b>User Aborted</b>	When a user has manually stopped the ping/trace route function before the end of attempts.
<b>Time Out</b>	When an ICMP echo reply was not received within the defined timeout.
<b>Destination Invalid</b>	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).
<b>TTL Expired (ping test)</b>	When the number of TTL was insufficient to reach the destination host.
<b>Hop Reached (trace route test)</b>	When a Time Exceeded message is received from a host while executing the trace route function.
<b>Destination Unreachable</b>	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).
<b>Data Corrupted</b>	Parameter problem message is received or data corruption is found for IPv4.
<b>Discarded</b>	Congestion has been detected and the request cannot be transmitted.
<b>Packet Too Big</b>	Packet Too Big message is received in response to a packet that the router cannot forward because the packet is larger than the MTU of the outgoing link. It is only applicable for the <b>IPv6 version</b> .
<b>Undefined</b>	For any other errors in ping/trace route that do not fall into one of the above description.

## Test Functions

### *Ping & Trace Route*

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#### ➤ **Replied Details**

For ping, indicates the IP address of the replier, the buffer size of the ICMP echo response, the time of response in milliseconds, and the TTL of the ICMP echo response.

For trace route, indicates the IP address of the replier, and the time of response in milliseconds.

#### **Statistics**

➤ **Packets Transmitted** indicates the number of sent packets.

➤ **Packets Received** indicates the number of received packets.

The following statistics are only available for the ping test.

➤ **Percentage Lost (%)** indicates the percentage of packets lost.

➤ **Min Round Trip Time (ms)** indicates the minimum time recorded for a ping request to be answered.

➤ **Max Round Trip Time (ms)** indicates the maximum time recorded for a ping request to be answered.

➤ **Avg. Round Trip Time (ms)** indicates the average time required for a ping request to be answered.

## Pointer Adjustment

From the **Test** menu, tap **Functions**, and the **Pointer Adjustment** tab.

### TX Pointer Adjustment

#### Step

➤ **Value**

Select the number of positive (Increment) or negative (Decrement) pointer adjustments to include into the STS-n (SONET) or AU-n (SDH): **1** (default) to **1000**. For multiple pointer adjustments, the pointer adjustment rate is 1 adjustment at every 4 frames.

- **Increment** button sends the positive pointer adjustment defined.
- **Decrement** button sends the negative pointer adjustment defined.
- **Pointer Value** indicates the current pointer value.

#### Jump

- **New Pointer** allows to select a new pointer value:

For STS/AU: **0** (default) to **782**

- **Inject** button sends the new pointer value.
- **New Data Flag** (NDF) check box when selected inserts a New Data Flag with the pointer adjustment when the Inject button is tapped.

For STS/AU: When NDF is enabled, bits 1 to 4 of the pointer word (H1 and H2 bytes) are set to **1001** when executing a pointer jump.

## RTD

**Note:** *Available with Pattern client. Not available in Decoupled, or Through mode.*

Round Trip Delay (RTD) measurements are needed to quantify the time it takes for a signal to cross the network and come back. Usually, transport delay is due to two factors: long configured paths and transit times through the network elements along the path. Therefore, RTD measurements are significant in systems that require two-way interactive communication, such as voice telephony, or data systems where the round-trip time directly affects the throughput rate.

From the **Test** menu, tap **Functions**, and the **RTD** tab.

**Note:** *To do Round Trip Delay test, the remote NE should be configured to provide a loopback.*

**Note:** *Be aware that RTD requires error free operation conditions to provide reliable results. Therefore, RTD results could be affected by error injection or error introduced by the network.*

## Mode

Allows the selection of the round trip delay test mode. Choices are **Single** (default) and **Continuous**.

- **Single** allows testing the round trip delay once.
- **Continuous** allows testing the round trip delay continuously in a repetitive manner (one RTD measurement every 2 seconds).



## Measure Delay Button

Allows enabling the round trip delay measurement.

For **Single** mode, the test is performed once and stops (the **Measure Delay** button turns off by itself). The **Measure Delay** button is only available when the test is running.

For **Continuous** mode, the test is performed continuously until the RTD test or the test case itself is stopped. However, the measurement will only start if the test is running or when it will be started. The **Measure Delay** button turns off by itself when the auto-calibration fails.

**Note:** *The Round Trip Delay (RTD) auto-calibration generates some bit errors when turning on the RTD measurement while the test is running or when starting the test while the **Measure Delay** button is enabled. A far end testing equipment will detect those bit errors.*

## Status

Indicates the test status of the RTD test. The status is only available when the test case is running.

- **Ready** indicates that the last calibration sequence has been successful and the test is now ready to perform RTD measurement.
- **Running** indicates that the RTD test is running.
- **Cancelled** indicates that the RTD test has been stopped before its completion.
- **Calibration Failed** indicates that the test calibration failed due to at least one of the following conditions:
  - Internal errors.
  - Presence of high number of bit errors.

Therefore the RTD statistics becomes unavailable since the test does not allow RTD testing.

## Test Functions

### RTD

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- **Disabled:** Indicates that the RTD feature is disabled.
- **--:** Indicates that the RTD measurement is not ready.

### Reset

Resets the RTD results and measurement counts.

### Delay

Indicates the time required for a bit to travel from the transmitter back to its receiver after crossing a far-end loopback.

- **Last** indicates the result of the last Round Trip Delay measurement.
- **Minimum** indicates the minimum Round Trip Delay recorded.
- **Maximum** indicates the maximum Round Trip Delay recorded.
- **Average** indicates the average Round Trip Delay value.
- **Unit** measurement selections are **ms** (default) and **μs**.

### Count

Indicates the total number of successful and failed measurements.

**Successful:** A measurement is declared successful when the RTD is smaller or equal to 2 seconds.

**Failed:** A measurement is declared failed when the RTD is > 2 seconds.

## Traffic Scan

The traffic scan tool provides the capability to discover and monitor VLAN traffic flows on the network.

From the **Test** menu, tap **Functions**, and the **Traffic Scan** tab.

### Level

Allows the selection of the criteria that will be used to filter the incoming VLAN traffic flows. The default setting is **All**. Choices are:

Level	Description
All	Monitors untagged frames and up to 3 levels of stacked VLAN frames
Untagged	Monitors untagged frames only (no 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 an E-VLAN (TPID of 0x8100, 0x88A8, 0x9100, 0x9200, or 0x9300)

## Test Functions

### Traffic Scan

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#### 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.

#### Link Rate (Mbit/s)

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 regardless if the traffic flow was ignored due to the limit reached (see *Limit Reached*). The rate is expressed either in **Line Utilization** or **Ethernet Bandwidth** depending on the **Rate Layer** selected.

#### Limit Reached

Up to 128 different traffic flows can be monitored, the **Limit Reached** text appears with a red background next to the **Discovered** field when the limit is reached.

#### Scan

Starts/stops the traffic scan test.

## Monitored Frames Table

Statistics are gathered for each different traffic flow matching the scan criteria. Each different monitored traffic flow creates a separate entry in the scan table. When the limit is reached, new traffic flows are not considered in the table but the existing traffic flows are still monitored.

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 will create a separated entry in the table. PBB-TE frames are ignored.

**Note:** *Scan statistics are cleared when restarting the scan.*

➤ **E-VLAN / S-VLAN / C-VLAN**

- **ID** indicates the VLAN ID of the received traffic flow.
- **Priority** indicates the VLAN Priority of the received traffic flow.

**Note:** *The TPID indicating the Tag Protocol Identifier of the received traffic flow is reported in the test report.*

➤ **Statistics**

- **Frame Count** indicates for each traffic flow, the number of frames matching the selected scan criteria.

**Total** indicates the total number of frames matching the selected scan criteria.

- **Rate (Mbit/s)** indicates for each traffic flow, the rate of frames matching the selected scan criteria. The rate is expressed either in **Line Utilization** or **Ethernet Bandwidth** (see *Rate Layer*).

**Total** indicates the total rate of frames matching the selected scan criteria.



# 11 Test Control

This chapter describes the test control buttons available on the right navigation bar of the application.

Button	For more information, see:
Discover Remote	Discover Remote Button <i>on page 374</i>
Inject	Inject Button <i>on page 377</i>
Laser	Laser Button <i>on page 377</i>
Report	Report Button <i>on page 378</i>
Reset	Reset Button <i>on page 383</i>
Save/Load	Save/Load Button <i>on page 384</i>
Start/Stop TX	Start/Stop TX Button <i>on page 388</i>

# Discover Remote Button

The Discover Remote function allows to perform Ethernet tests in conjunction with a second test set (module) by scanning and connecting to any available EXFO Datacom remote module. The remote module is used to loop back the traffic via Smart Loopback or **Dual Test Set (DTS)** for simultaneous bidirectional RFC 2544, RFC 6349, or EtherSAM results.

**Note:** *Only available with **EtherSAM**, **EtherBERT**, **RFC 2544**, **RFC 6349**, and **Traffic Gen & Mon** test applications.*

## Remote Modules Discovery

- **Target** defines how to perform the scan to discover remote modules.
  - **Subnet** indicates to perform the scan based on the current subnet.
  - **Specific IP** indicates to perform the scan for a specific remote module IP address. Enter the IP address of the target module.
    - **Quick Ping** tests if the destination IP address can be reached. A message displays if the ping attempt is **Successful** or **Failed**.
- **Scan** button scans the subnet or a specific IP (see **Target**) to discover remote EXFO compatible module(s).

The discovered modules are listed in the table with their **IP Address**, **Remote ID**, **Capabilities**, and **Status** information. **Remote ID**, **Capabilities**, and **Status** are only available for remote 88000 Series, and 85100G modules.

- **Capabilities** indicates the loopback capabilities of the remote module using the following test application icons:  
Smart Loopback, RFC 2544, RFC 6349, and/or EtherSAM.



- **Status** indicates the status of the remote module.

Status	Description
<b>Idle</b> -<test application> <sup>a</sup>	The specified test application is selected but not running.
<b>Busy</b> -<test application> <sup>b</sup>	The specified test application is running.
<b>Not Responding</b>	No response from the specified IP address (only possible when <b>Target</b> is set to <b>Specific IP</b> ).

- a. Possible test applications: EtherSAM, RFC 2544, RFC 6349, EtherBERT, Traffic Gen & Mon, Smart Loopback, Through Mode, TCP Throughput, Carrier Ethernet OAM, Cable Test, 1588 PTP, or SyncE.
- b. Possible test applications: EtherSAM, RFC 2544, RFC 6349, EtherBERT, Traffic Gen & Mon, Smart Loopback, TCP Throughput, Carrier Ethernet OAM, 1588 PTP, or SyncE.

- **Loop Up and Loop Down** buttons (Not available with RFC 6349 test application)

- **Loop Up** establishes the connection with the selected remote module and sets the remote module into **Smart Loopback** test application.

If a remote module is in any busy status a user confirmation is required to proceed with the Loop Up command.

Following a successful loop up, the IP address of the remote module will be used as the destination IP address for the test.

Once the connection is established with the remote module, the local module can be set for EtherSAM, RFC 2544, EtherBERT, or Traffic Gen & Mon testing.

- **Loop Down** ends the connection between the local and the remote modules.

## Test Control

### *Discover Remote Button*

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- **Connect** and **Disconnect** buttons are only available with RFC 2544, RFC 6349, and EtherSAM test applications.
- **Connect** establishes the connection with the selected remote module and sets the remote module into either DTS RFC 2544, DTS RFC 6349, or DTS EtherSAM test application, depending on the active test on the local module.

If a remote module is in any busy status a user confirmation is required to proceed with the Loop Up command.

Following a successful connection, the IP address of the remote module will be used as the destination IP address for the test.

- **Disconnect** ends the connection between the local and the remote modules.

## Local Module Identification



**Module ID** is used to easily identify this module in case another Packet Blazer is performing a discovery scan. Up to 16 alpha-numeric characters are allowed.

## Inject Button

Injects alarms/errors based on settings from the *Inject Button* on page 249.

## Laser Button

The **Laser** button enables or disables the laser for optical interfaces.

Laser Button	Border Color	Description
	Black	Laser is off.
	Red	Laser is on.

# Report Button

The report contains all information about the current test including its setup and results.

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

The **Report** button is available when the test is running or stopped, but the report generation is only possible when the test is stopped. It is possible to save, open, import, export, and delete test report(s).

## File Location

- **Public Documents:**  
Users\Public\Documents\PB85100G\Reports
- **My Documents:**  
Users\- **Others**, use **Browse** to select a specific file location that will be displayed under **Others**.
- **Removable Drives** is only available when there is a removable disk/key connected to the platform USB port.

## Config/Save Tab

The **Config/Save** tab allows to configure the report parameters and generate/save the report.

Tap the **Report** button and the **Config/Save** tab.

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

**Restore Default** reverts all **Job Information** parameters back to the default values.

- **Report Headlines and Content** parameters are used to identify the report and are not mandatory. Up to 30 characters are allowed for each parameter.
  - **Report Header** could be the company name.
  - **Report Title** could be the name of the product, name of test, test number, etc.
  - **Optional Content** allows to choose the optional content that can be part of the report:
    - All** (default) includes all optional content to the report.
    - None** excluded all optional content from the report.
    - Custom** allows to select the optional content to be part of the report.
  - **Choose Content**, available when the **Optional Content** is set to **Custom**, allows to select what will be part of the custom content.

#### ► Save Report

- **Auto-Generate File Name** check box, when selected (default), automatically generates the report file name which contains the name of the test, the date (YY.MM.DD), and time (HH.MM.SS). Clear the **Auto-Generate File Name** check box to enter a specific file name.

**File Name** is the name of the report to be generated.

- **Save To** is the file location where the report file will be saved (see *File Location* on page 378).
- **Display Report after Saving** check box when selected (default) automatically displays the report once it is generated.

**Note:** *Once generated, the report can be opened from the Open Tab on page 381.*

- **Turn on Report Generation Prompt** check box when selected (default) displays a pop-up every time a test case is stopped or completed to ask if a report generation is desired.
- **Format** is the file format for the report: **PDF** (default), **HTML**, and **Text**.
- **Logo** check box when selected (default) allows to include a logo to the report. Only available with the PDF and HTML file format. Select the logo picture that will be displayed on the report.
- To select another logo, first add a new logo by either copying the logo picture file to the following folder or by using the Import/Export (see page 382) then select the new logo from the list.  
**Documents\PB85100G\Reports\Images**  
Supported picture file formats are jpg, gif, bmp, and png.
- **Save Report** button generates and saves the report on the selected media (**Save to**).

## **Open Tab**

Report files can be opened from this page.

Tap the **Report** button and the **Open** tab.

### ***To open a saved report:***

- 1.** Select the file location (see *File Location* on page 378).
- 2.** Select the report file from the list.
- 3.** Tap the **Open** button.

### Import/Export Tab

Allows to transfer and delete report files from an external USB media. Also allows to import images that can be used as the Logo for reports.

Tap the **Report** button and select the **Import/Export** tab.

#### **To import/export a report or image:**

1. Select either **Report** or **Image** as **File Type**.
2. Select the file location (see *File Location* on page 378).
3. From the **Copy To** drop list, select where the file(s) will be copied.
4. Select the file(s) to be copied by selecting its corresponding check box or tap the **(Un)Select All** button to select or unselect all files in the list.
5. Tap the **Copy** button.
6. A confirmation is displayed, tap **OK**.

#### **To delete a report or image:**

1. Select either **Report** or **Image** as **File Type**.
2. Select the file location (see *File Location* on page 378).
3. Select the file(s) to be deleted by selecting its corresponding check box or tap the **(Un)Select All** button to select or unselect all files.
4. Tap the **Delete** button.
5. Tap **YES** to confirm the deletion.



## **Reset Button**

Tap the **Reset** button to clear results, statistics, and logger content. The **Reset** button is only available when the test is running.

**Note:** *The **Reset** button is not available for EtherSAM, RFC 2544, RFC 6349, and Smart Loopback test applications.*

# Save/Load Button

The **Save/Load** button allows to save, load, import, export, and delete configuration file(s).

**Note:** *Save/Load is only possible when the test is stopped.*

## File location

- **My Documents** offers two file locations: use **Favorites** for most commonly used configuration files or **Configurations** for others.

Users\<<User>\Documents\PB85100G\Configuration  
Users\<<User>\Documents\PB85100G\Configuration\Favorites

- **Public Documents** offers two file locations: use **Favorites** for most commonly used configuration files or **Configurations** for others.

Users\Public\Documents\PB85100G\Configuration  
Users\Public\Documents\PB85100G\Configuration\Favorites

- **Others** offers two file locations: use **Factory Defined** for factory defined configuration files or select **Browse** to create a user defined file location.
- **Removable Drives** is only available when there is a removable disk/key connected to the platform USB port.

## Save/Load Tab

Tap the **Save/Load** button and the **Save/Load** tab.

The save function stores the configuration of the Packet Blazer including all test settings to a file.

### **To save a configuration:**

1. Select the file location (see *File location* on page 384).
2. Tap on the **Save** button.
3. Type the name of the configuration file to be saved and a description (**Config Summary**) if needed.
4. Select the **Add to Favorites** check box to save the configuration file in the **Favorites** list.
5. Tap **OK**.

The load function opens and applies the test configuration from a previously saved configuration file.

### **To load a configuration:**

1. Select the file location (see *File location* on page 384).
2. Select the file from the list.
3. Select or clear the **Overwrite report settings** check box as required. The **Overwrite report settings** check box when selected (default) replaces the current report settings by those from the configuration that is loaded.
4. Tap the **Load** button.

**Note:** *Configuration file has a limited backward compatibility (Typically the backward compatibility period is one year or three software releases).*

## Test Control

### *Save/Load Button*

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#### **To rename a configuration file:**

1. Select the file location (see *File location* on page 384).
2. Select the file from the list.
3. Tap the **Rename** button.
4. Change the name of the configuration file.
5. Select the **Add to Favorites** check box to save the configuration file in the **Favorites** list.
6. Tap **OK**.

#### **To delete a configuration file:**

1. Select the file location (see *File location* on page 384).
2. Select the file from the list.
3. Tap the **Delete** button.
4. Tap **Yes** to confirm the deletion.

#### **To add a configuration file to the Favorites list:**

1. Select **Configuration** from either **My Documents** or **Public Documents**.
2. Select the file from the list.
3. Tap the **Add to Favorites** button. The file will be moved into the **Configurations** folder of its corresponding location (either **My Documents** or **Public Documents**).

#### **To remove a configuration file from the Favorites list:**

1. Select **Favorites** from either **My Documents** or **Public Documents**.
2. Select the file from the list.
3. Tap the **Remove from Favorites** button. The file will be moved into the **Configurations** folder of its corresponding location (either **My Documents** or **Public Documents**).

## **Import/Export Tab**

Configuration files can be transferred to and from an external USB media as well as deleted.

Tap the **Save/Load** button and the **Import/Export** tab.

### **To import/export a test configuration:**

- 1.** Select the source file location (see *File location* on page 384).
- 2.** From the **Copy To** drop list, select a destination file location.
- 3.** Select the file(s) to be copied by selecting its corresponding check box or tap the **(Un)Select All** button to select or unselect all files in the list.
- 4.** Tap the **Copy** button.
- 5.** A confirmation is displayed, tap **OK**.

### **To delete a test configuration:**

- 1.** Select the file location (see *File location* on page 384).
- 2.** Select the file(s) to be deleted by selecting its corresponding check box or tap the **(Un)Select All** button to select or unselect all files in the list.
- 3.** Tap the **Delete** button.
- 4.** Tap **YES** to confirm the deletion.

### Start/Stop | TX Button

The **Start/Stop | TX** button allows to manually start or stop any test as well as to enable traffic generation (Traffic Gen & Mon).

**To start the test:**

Tap the **Start** button to start the test. **Start** is available when the test is not running.

**To stop the test:**

Tap the **Stop** button to stop the test; the traffic generation (Traffic Gen & Mon) also stops if it was enabled (TX button). **Stop** is available when the test is running.

By default, a message is displayed when the test stops asking to generate a report. To disable this feature, see *Turn on Report Generation* on page 380. Nothing prevents the configuration and alarm/error injection setup while the test has been stopped; thus, if a report is required, it should be saved before changing any test parameters to avoid discrepancy between the configuration and results. See *Report Button* on page 378 to generate and save a report file.

**To enable traffic generation (available with Traffic Gen & Mon):**

Tap the **TX** button to enable traffic generation for all enabled streams; the test is also started if it was not running. While the test is running the **TX** button is available to enable/disable traffic generation. Some conditions, such as ARP not resolved, link down, etc., may prevent the stream to be transmitted.

## 12 Power Failure Recovery

The automatic power failure recovery is used to select, configure, and restart<sup>1</sup> the test that was running before the power failure; a test that was not running will be selected and configured but not started. To provide this level of protection, the configuration of the current test is automatically saved; the logger, injections, and configuration are periodically saved.

A power failure occurs when the AC power is down (LTB-8, FTB, and IQS) while the unit's battery (FTB) has not sufficient power to keep the unit running. Pressing the platform power button for 5 seconds performs a power down reset and is also considered as a power failure condition. For a platform running Windows 8, the **Hibernate** or **Sleep** mode is also considered as a power failure condition.

When the power returns, the automatic power failure recovery restarts the platform, the Packet Blazer, then selects, configures, and starts the test if it was running before the power failure. *The IQS-600 does not support the automatic power failure recovery.*

**Note:** *If the automatic power failure recovery is not used, restarting the Packet Blazer after a power failure automatically selects, configures, and starts the test if it was running before the power failure.*

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1. Not applicable for iSAM, EtherSAM, and RFC 2544 applications; these tests must be started manually.

# Enabling Power Failure Recovery

**To enable the automatic power failure recovery:**

1. Enable launching the application when starting the platform (refer to the platform user guide for more information):  
  
Windows 8: From ToolBox / ToolBox X, tap on the **System Settings** button, the **Startup Applications** button, and select the corresponding module's check box.  
  
Windows XP: From ToolBox, tap on the **Setup** button, the **Application Startup** tab, and select the corresponding module's check box.
2. Enable the platform automatic power on feature (refer to the platform user guide for more information):
  - 2a. Windows 8: From ToolBox / ToolBox X, tap on the **System Settings** button and the **ToolBox / ToolBox X** button.  
  
Windows XP: Tap on the **Setup** button, the **Tools** tab, and the **Platform Settings** icon.
  - 2b. Select the **Power on the unit when AC outlet is connected or after power outage** check box.
3. Make sure that Windows does not require a user name and password. The platform is set to require user name and password by default. To disable Windows user name and password:
  - 3a. Windows 8: From ToolBox / ToolBox X, tap on the **System Settings** button and the **Automatic Logon** button.  
  
Windows XP: From Windows, logon as **Supervisor**, tap **Start**, **Programs**, **Accessories**, **System Tools**, **User Accounts (Advanced)**, select a user account.
  - 3b. Clear the **User must enter a user name and password to use this computer** check box and enter the password to confirm.

**Note:** *The power failure recovery is not used when the application closes normally.*



## When Using the Test Timer

Refer to *Timer* on page 203 for more information on test timer.

The test that was running will be re-created and started after a power failure if conditions described above are met in addition with the following test time conditions:

- The start time has not expired during the power failure.
- The stop time or the duration has not expired during the power failure.



# 13 *Suspend and Resume*

**Note:** *Suspend and Resume is not available on the IQS-600.*

Suspend and Resume allow respectively the platform and its running applications to stop (Suspend) and to be quickly re-initialized (Resume) when the unit is turned back on.

**Note:** *For a platform running Windows 8, the resume operation after **Hibernate** or **Sleep** mode perform a power up and restore instead of a resume. Refer to Power Failure Recovery on page 389.*

## **Suspend Mode**

To enter the suspend mode, refer to the platform user guide. In Suspend Mode, the Packet Blazer module is directly turned off and its configuration and injection information are kept. The Suspend Mode remains active as long as battery power or AC power is available. If the battery is drained the information is lost and the Resume operation is no more possible.

The following conditions prevent the activation of the Suspend Mode:

- A firmware download is in-progress
- Resume operation is in-progress.

**Note:** *The test will be stopped when entering the suspend mode meaning that the test logger content will be lost.*

## Suspend and Resume

### *Resume Operation*

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## Resume Operation

To enter the resume operation, turn on the platform by pressing the power button. During the resume operation, the module is re-initialized.

**Note:** *In the event a manual shutdown of the platform occurs, while the resume operation is in-progress, the resume operation is terminated and all the test configuration information is lost.*

The following conditions prevent the resume operation:

- The module status has changed (mismatch in serial number or module is missing).
- A module failure is detected.

**Note:** *The Ping and Trace Route are disabled after a resume operation.*

# 14 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

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

## **Cleaning LC/SC/MPO-24 Connectors**

Under normal circumstances the cleaning of the LC/SC/MPO-24 connector is not required. However if the connector shows signs of debris or contamination, cleaning may be required.

### ***To clean a LC/SC/MPO-24 connector***

- 1.** Use a clean dry air (CDA) or a air gun to blow out the dust or contamination.
- 2.** Re-inspect the connector. For MPO-24 optical connector, re-inspect the connector under magnification to make sure that it is clean.
- 3.** If the connector is still not clean, use a commercial cleaner recommended by the CFP/CFP2 manufacturer.

**Note:** *Refer to the transceiver manufacturer for more detailed cleaning recommendations and instructions.*

## **Recalibrating the Unit**

EXFO manufacturing and service center calibrations are based on the ISO/IEC 17025 standard (*General Requirements for the Competence of Testing and Calibration Laboratories*). This standard states that calibration documents must not contain a calibration interval and that the user is responsible for determining the re-calibration date according to the actual use of the instrument.

The 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, as well as the specific requirements for your application. All of these elements must be taken into consideration when determining the appropriate calibration interval of this particular EXFO unit.

Under normal use, the recommended interval for your FTB/IQS-85100G is: 2 years.

For newly delivered units, EXFO has determined that the storage of this product for up to six months between calibration and shipment does not affect its performance (EXFO Policy PL-03).

## Maintenance

*Recycling and Disposal (Applies to European Union Only)*

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To help you with calibration follow-up, EXFO provides a special calibration label that complies with the ISO/IEC 17025 standard and indicates the unit calibration date and provides space to indicate the due date. Unless you have already established a specific calibration interval based on your own empirical data and requirements, EXFO would recommend that the next calibration date be established according to the following equation:

**Next calibration date = Date of first usage (if less than six months after the calibration date) + Recommended calibration period (2 years)**

To ensure that your unit conforms to the published specifications, calibration may be carried out at an EXFO service center or, depending on the product, at one of EXFO's certified service centers. Calibrations at EXFO are performed using standards traceable to national metrology institutes.

**Note:** *You may have purchased a FlexCare plan that covers calibrations. See the Service and Repairs section of this user documentation for more information on how to contact the service centers and to see if your plan qualifies.*

## Recycling and Disposal (Applies to European Union Only)

For complete recycling/disposal information as per European Directive WEEE 2012/19/UE, visit the EXFO Web site at [www.exfo.com/recycle](http://www.exfo.com/recycle).



# 15 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 connector is not generating the signal.	The <b>Laser On</b> option is disabled.	Ensure that the <b>Laser</b> button is enabled (On).
	There is a configuration mismatch between the inserted CFP and the rate selected for the test case.	Ensure that the CFP is supporting the rate used for the test case.
	The CFP is not compatible with the FTB/IQS-85100G.	Ensure to use a compatible CFP. Refer to <i>Modify Structure Button</i> on page 63 and <i>Specifications</i> on page 405.

## Troubleshooting

### *Contacting the Technical Support Group*

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## Contacting the Technical Support Group

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

### **Technical Support Group**

400 Godin Avenue  
Quebec (Quebec) G1M 2K2  
CANADA

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

For detailed information about technical support, and for a list of other worldwide locations, visit the EXFO Web site at [www.exfo.com](http://www.exfo.com).

If you have comments or suggestions about this user documentation, you can send them to [customer.feedback.manual@exfo.com](mailto:customer.feedback.manual@exfo.com).

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

## Transportation

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

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

# 16 Warranty

## General Information

EXFO Inc. (EXFO) warrants this equipment against defects in material and workmanship for a period of one year for FTB-85100G and two years for IQS-85100G 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.

## Warranty

### *Liability*

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## 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

In the case of products equipped with optical connectors, EXFO will charge a fee for replacing 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 404). 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 404).

## **Warranty**

*EXFO Service Centers Worldwide*

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### **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  
[support@exfo.com](mailto:support@exfo.com)

#### **EXFO Europe Service Center**

Winchester House, School Lane  
Chandlers Ford, Hampshire S053 4DG  
ENGLAND

Tel.: +44 2380 246800  
Fax: +44 2380 246801  
[support.europe@exfo.com](mailto:support.europe@exfo.com)

#### **EXFO Telecom Equipment (Shenzhen) Ltd.**

3rd Floor, Building C,  
FuNing Hi-Tech Industrial Park, No. 71-3,  
Xintian Avenue,  
Fuyong, Bao'An District,  
Shenzhen, China, 518103

Tel: +86 (755) 2955 3100  
Fax: +86 (755) 2955 3101  
[support.asia@exfo.com](mailto:support.asia@exfo.com)

# A Specifications



## IMPORTANT

The following general specifications can change without notice. The information presented in this section is provided as a reference only. To obtain this product's most recent technical specifications, visit the EXFO Web site at [www.exfo.com](http://www.exfo.com).



## CAUTION

The operation and storage temperatures, as well as the altitude, humidity and IP rating of some modules may differ from those specified for your platform. In this case, always ensure that you comply with the most restrictive conditions (either module or platform).

## Specifications

### General Specifications

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## General Specifications

### FTB/IQS-85100G

Size (H x W x D)	96 mm x 152 mm x 292 mm (3 3/4 in x 6 in x 11 1/2 in)
Weight (without transceiver)	1.9 kg (4.2 lb)
Temperature	Operating: 0 °C to 40 °C (32 °F to 104 °F) Storing: -40 °C to 70 °C (-40 °F to 158 °F)
Relative humidity	0 % to 95 %, non-condensing
Maximum operation altitude	5000 m (16000 ft)
Pollution degree	3
Measurement category	Not rated for measurement categories II, III, or IV

### CFP-to-CFP2 Adapter

Size (H x W x D)	82 mm x 17 mm x 163 mm (3 1/2 in x 11/16 in x 6 7/16 in)
Weight (without transceiver)	0.2 kg (0.4 lb)
Temperature	Operating: 0 °C to 40 °C (32 °F to 104 °F) Storing: -40 °C to 70 °C (-40 °F to 158 °F)



## 40G/100G Pluggable Transceivers (CFP)

The TX operational wavelength (nm) range per Lane is as follows.

	100GBASE-LR10	40GBASE-LR4	100GBASE-LR4
Lane 0	1521 to 1525	1264.5 to 1277.5	1294.53 to 1296.59
Lane 1	1529 to 1533	1284.5 to 1297.5	1299.02 to 1301.09
Lane 2	1537 to 1541	1304.5 to 1317.5	1303.54 to 1305.63
Lane 3	1545 to 1549	1324.5 to 1337.5	1308.09 to 1310.19
Lane 4	1553 to 1557		
Lane 5	1561 to 1565		
Lane 6	1569 to 1573		
Lane 7	1577 to 1581		
Lane 8	1585 to 1589		
Lane 9	1593 to 1597		

## 100G Pluggable Transceivers (CFP2)

The TX operational wavelength (nm) range per Lane is as follows.

	100GBASE-SR10	100GBASE-LR4
Lane 0	840 to 860	1294.53 to 1296.59
Lane 1	840 to 860	1299.02 to 1301.09
Lane 2	840 to 860	1303.54 to 1305.63
Lane 3	840 to 860	1308.09 to 1310.19
Lane 4	840 to 860	
Lane 5	840 to 860	
Lane 6	840 to 860	
Lane 7	840 to 860	
Lane 8	840 to 860	
Lane 9	840 to 860	



# **B** *Glossary*

## **Acronym List**

?	Help
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### **A**

AC	Alternating Current
ACT	Activity
AIS	Alarm Indication Signal
AMI	Alternate Mark Inversion
ATM	Asynchronous Transfer Mode
AU-n	Administrative Unit-n
AUI	Attachment Unit Interface

### **B**

B8ZS	Bipolar with 8 zero substitution
BBE	Background Block Error
BBER	Background Block Error Ratio
BDI	Backward Defect Indication
BDP	Bandwidth Delay Product
BEI	Backward Error Indication
BER	Bit Error Rate
BERT	Bit Error Rate Test
BIAE	Backward Incoming Alignment Error
BIP	Bit-Interleaved Parity
bit/s	Bit per second
BSD	Backward Signal Degrade
BSF	Backward Signal Fail

## Glossary

### Acronym List

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#### C

C	Current
C-VLAN	Client/Customer Virtual Local Area Network
CAUI	100 Gbit/s Attachment Unit Interface
CAGE	Commerce And Government Entities
CBR	Constant Bit Rate
CE	Congestion Encountered
CE	European Conformity
CLK	Clock
CORR	Correctable
CRC	Cyclic Redundancy Check
CRC-4	Cyclic Redundancy Check on 4 bits
CRITIC	Critical
CSF	Client Signal Fail
CSV	Comma Separated Value
CV	Code Violation
CW	Code Word

#### D

DA	Destination MAC Address
DAPI	Destination Access Point Identifier
dBm	Decibel - milliwatts
DS1	Digital Signal-level 1 (1.544 Mbit/s)
DST	Destination
DTE	Data Terminal Equipment
DUT	Device Under Test

**E**

E-VLAN	Extended Virtual Local Area Network
E1	European standard for digital transmission-level 1 (2.048 Mbit/s).
ECN	Explicit Congestion Notification
ECT	ECN Capable Transport
EoOTN	Ethernet over OTN
ESF	Extended Superframe
EUI	EXFO Universal Interfaces
EXT CLK	External Clock

**F**

FAS	Frame Alignment Signal
FC	Fibre Channel
FCC	Federal Communications Commission
FCS	Frame Check Sequence
FCC	Federal Communications Commission
FD	Frame Delay
FEC	Forward Error Correction
FLR	Frame Loss Ratio
fps	Frame Per Second
FSD	Forward Signal Degrade
FSF	Forward Signal Fail

## Glossary

### Acronym List

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#### G

GE	Gigabit Ethernet
Gbit/s	Gigabit per second
GCC	General Communication Channel
GFP	Generic Framing Procedure
GFP-F	GFP - Framed
GFP-T	GFP - Transparent
GHz	Giga Hertz
GMP	Generic Mapping Procedure
GMP OOS	GMP Out of Synchronization
GUA	Global IPv6 Address
GUI	Graphical User Interface

#### H

H	History
HDB3	High Density Bipolar 3 Code
HDMI	High Definition Multimedia Interface
Hi-BER	High-Bit Error Ratio
Hi-BER1027B	High-Bit Error Ratio 1027 Blocks
Hz	Hertz

#### I

IAE	Incoming Alignment Error
ID	Identification
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical & Electronics Engineers
IFDV	Inter-Frame Delay Variation

IN	Input
IP	Internet Protocol
IPG	Interframe Gap
IPv4	Internet Protocol version 4
IPv6	Internet Protocol version 6

**J**

JC	Justification Control
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**L**

LAN	Local Area Network
LCK	Locked
LED	Light-Emitting Diode
lb	Pound
LBO	Line Build Out
LLA	Link-Local IPv6 Address
LLM	Logical Lane Marker
LOA	Loss Of Alignment
LOAML	Loss of Alignment Marker Lock
LOAML1027B	Loss of Alignment Marker Lock 1027 Blocks
LOBL	Loss of Block Lock
LOBL1027B	Loss of Block Lock 1027 Blocks
LOC	Loss Of Clock
LOC Lane	Loss Of Clock Lane
LOF	Loss Of Frame
LOFLOM	Loss of Frame Loss Of Multiframe
LOL	Loss of Lane Alignment

## Glossary

### Acronym List

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LOM	Loss Of Multiframe
LOOMFI	Loss of OPU Multi-Frame Identifier
LOR	Loss Of Recovery
LOS	Loss Of Signal
LSS	Loss of Sequence Synchronization
LTC	Loss of Tandem Connection

### M

m	Minute
m	Meter
MAC	Media Access Control
MDIO	Management Data Input/Output
MFAS	Multiframe Alignment Signal
MHz	Megahertz
MPLS	Multiprotocol Label Switching
MSA	Multisource Agreement
MSEQV	Marker Sequence Violation
MSIM	Multiplex Structure Identifier Mismatch
MTU	Maximum Transfer Unit

### N

NATO	North Atlantic Treaty Organization
nAUI	CAUI or XLAUI
NJO	Negative Justification Opportunity
nm	Nanometer



O

OCI	Open Connection Indication
ODU	Optical Data Unit
OH	Overhead
OLA	Out-of-Lane-Alignment
OMFI	OPU Multi-Frame Identifier
OOMFI	Out of OPU Multi-Frame Identifier
OOF	Out-Of-Frame
OOM	Out-Of-Multiframe
OOR	Out-Of-Recovery
OOS	Generic Mapping Procedure Out Of Synchronization
OOS	Out-Of-Sequence
OPU	Optical Payload Unit
OTL	Optical channel Transport Lane
OTN	Optical Transport Network
OTU	Optical Transport Unit
OUT	OUTput

P

PC	Personal Computer
PCS	Physical Coding Sublayer
PDI	Payload Defect Indication
PHY	Physical Layer Device
PLM	Payload Label Mismatch
POS	Position Field
POSV	Position Field Violation
ppm or PPM	parts per million
PRBS	Pseudo Random Bit Sequence

## Glossary

### Acronym List

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PSI	Payload Structure Identifier
Ptr. Incr.	Pointer Increment
Ptr. Decr.	Pointer Decrement

## Q

QoS	Quality of Service
QSFP	Quad Small Form Factor Pluggable

## R

RES	Reserved
RMA	Return Merchandise Authorization
RTD	Round Trip Delay
RTT	Round Trip Time
RX	Receive

## S

s	second
-S	Section
S-VLAN	Service Virtual Local Area Network
SAPI	Source Access Point Identifier
SB	Superblock
SDH	Synchronous Digital Hierarchy
SEQV	Sequence Violation
SF	Superframe
SI	International System
SM	Section Monitoring
SMA	Sub-Miniature A Connector

SOF	Start Of Frame
SONET	Synchronous Transport Signal
SP	Service Provider
SRC	Source
STM	Synchronous Transport Module
STS	Synchronous Transport Signal
SYMB	Symbol

**T**

TCM	Tandem Connection Monitoring
tHEC	type Header Error Check
TIM	Trace Identifier Mismatch
TOS	Type Of Service
TTI	Trail Trace Identifier
TU	Tributary Unit
TX	Transmit

**U**

UNCORR	Uncorrectable
UPM	User Payload Mismatch
$\mu$ s	microsecond
USA	United States of America

**V**

V	VT
VLAN	Virtual Local Area Network
VT	Virtual Tributary

## Glossary

### Acronym List

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#### W

WAN	Wide Area Network
WIS	WAN Interface Sublayer

#### X

XLAUI	40 Gbit/s Attachment Unit Interface
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## 10G Ethernet Client

The OTN Overclocked technology provides the capability to transparently transport 10G base-R Ethernet signals into OPU2 as specified in ITU-T. Two optical rates are provided:

- 11.0957 Gbits/s, +/- 100 ppm, designated OTU2e
- 11.0491 Gbits/s, +/- 100 ppm, designated OTU1e

The OTU2e uses the mapping scheme of CBR10G into OPU2 as defined in G.709. The client signal, 10GE LAN and the OPU fixed stuff bytes are accommodated into an OPU-like signal designated OPU2e. This signal is then wrapped in an ODU2e and then in an OTU2e signal.

The OTU1e uses the mapping scheme of CBR2G5 into OPU1 as defined in G.709. The client signal, 10GE LAN is accommodated into an OPU-like signal designated OPU1e (note that the fixed stuff bytes are not left free) this is why the 10GE signal can be transported at a lower rate than OTU2e. This signal is then wrapped in an ODU1e and then in an OTU1e signal.

The transparent transport of the 10G base-R means that the full 10G Ethernet data rate i.e. 10.3125 Gbit/s is transported over OTN. This means that the following information is transported:

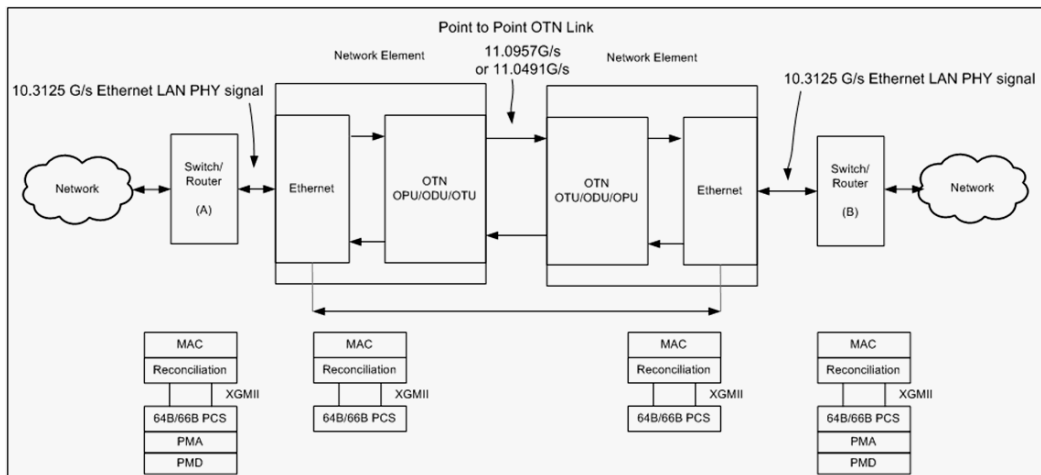
- PCS 64B/66B coded information
- IPG (inter-frame filler), MAC FCS, Preamble and SFD (start of frame delimiter) and Ordered Sets (Remote Fault indication)

The OTN clocking is derived from the Ethernet client signal which is +/- 100 ppm, this is outside the clock tolerance allocated by the G.709 standard which translates in unspecified jitter performance thus limiting the application to Point to Point data path.

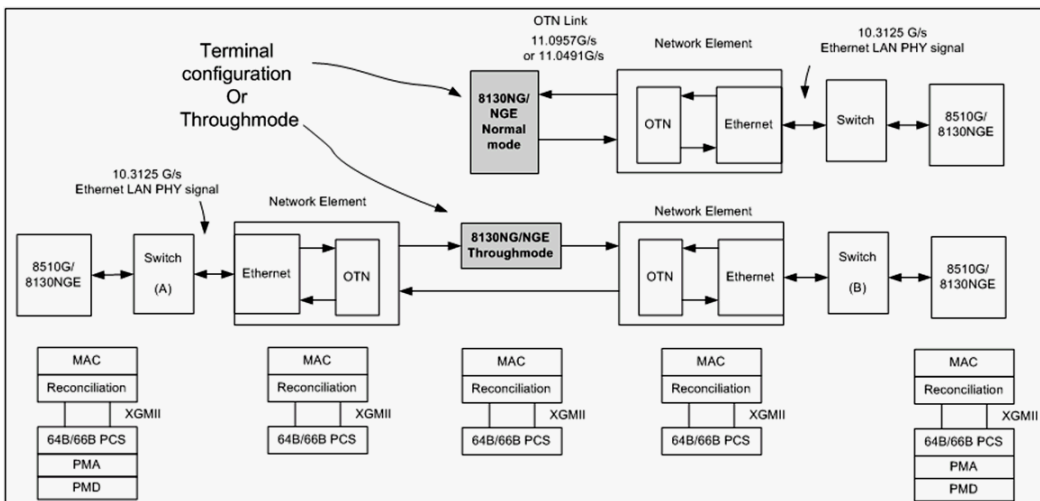
# Glossary

## 10G Ethernet Client

The following figure presents a typical network application.



The following figure presents a typical test application.



The Ethernet layer provides the equivalent functionality of the BERT Framed Layer 2 Test application supported on EXFO’s Datacom product family with the particularity that there is no Ethernet Physical port as such. The Ethernet frame has its Ethertype field set to 0x88B7.

# **G.709 Optical Transport Network (OTN)**

## **Overview**

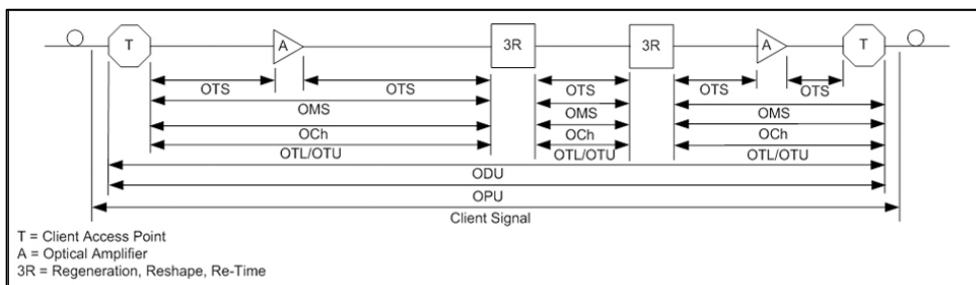
The optical transport network (OTN) combines the benefits of SONET/SDH technology with the bandwidth expansion capabilities offered by dense wavelength-division multiplexing (DWDM) technology.

The OTN consists of the following layers:

- Optical Transport Section (OTS)
- Optical Multiplex Section (OMS)
- Optical Channel (OCh)
- Optical channel Transport Lane (OTL)
- Optical Transport Unit (OTU)
- Optical Data Unit (ODU)
- Optical Channel Payload Unit (OPU)



Each of these layers and their functions are distributed along the network and activated when they reach their termination points, which are illustrated in the following figure.



OTN Layer Termination Points

The termination of the OTS, OMS and OCh layers is performed at the optical level of the OTN. It is at the termination of the OTU layer that further functionality can be added. This layer is the digital layer—also known as the “digital wrapper”—and offers specific overhead to manage the OTN’s digital functions. The OTU also introduces a new dimension to optical networking by adding forward error correction (FEC) to the network elements, allowing operators to limit the number of required regenerators used in the network which, in turn, lowers its cost.

FEC allows an increase in the optical link budget by providing a new method to correct errors, thereby reducing the impact of network noise and other optical phenomena experienced by the client signal traveling through the network.

The OTU also encapsulates two additional layers—the ODU and the OPU—which provide access to the payload (SONET, SDH, etc.). These layers are normally terminated at the same location.

## Glossary

### G.709 Optical Transport Network (OTN)

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The OTU, ODU (including the ODU tandem connection) and OPU layers can all be analyzed and monitored. As per ITU G.709, current test solutions offer these possibilities using the following line rates:

- OTU1 ( $255/238 \times 2.488\ 320$  Gbit/s  $\approx 2.666057143$  Gbit/s) also referred to as 2.7 Gbit/s
- OTU2 ( $255/237 \times 9.953280$  Gbit/s  $\approx 10.709225316$  Gbit/s) also referred to as 10.7 Gbit/s
- OTU3 ( $255/236 \times 39.813120$  Gbit/s  $\approx 43.018413559$  Gbit/s) also referred to as 43 Gbit/s
- OTU4 ( $255/227 \times 99.532\ 800$  Gbit/s  $\approx 111.809973568$  Gbit/s) also referred to as 112 Gbit/s.

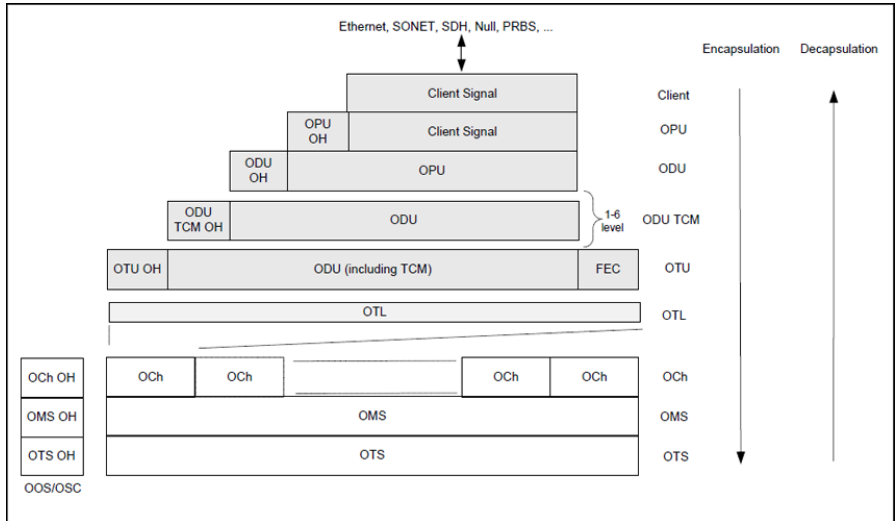
The following non standard rates are also defined:

- OTU3e1 ( $255/236 \times 4 \times 10.3125$  Gbit/s  $\approx 44.570974576$  Gbit/s)
- OTU3e2 ( $243/217 \times 16 \times 2.488320$  Gbit/s  $\approx 44.583355576$  Gbit/s)

Each line rate is adapted to service different client signals:

- OC-48/STM-16 is transported via OTU1
- OC-192/STM-64 is transported via OTU2
- OC-768/STM-256 is transported via OTU3
- Null Client (All 0s) is transported via OTU<sub>k</sub> ( $k = 3, 3e1, 3e2, 4$ )
- PRBS31 is transported via OTU<sub>k</sub> ( $k = 3, 3e1, 3e2, 4$ )

In order to map client signals via ITU G.709, they are encapsulated using the structure illustrated in the following figure.



**Basic OTN Transport Structure**

## Glossary

### G.709 Optical Transport Network (OTN)

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As depicted above, to create an OTU frame, a client signal rate is first adapted at the OPU layer. The adaptation consists of adjusting the client signal rate to the OPU rate. Its overhead contains information to support the adaptation of the client signal. Once adapted, the OPU is mapped into the ODU. The ODU maps the OPU and adds the overhead necessary to ensure end-to-end supervision and tandem connection monitoring (up to six levels). Finally, the ODU is mapped into an OTU, which provides framing as well as section monitoring and FEC.

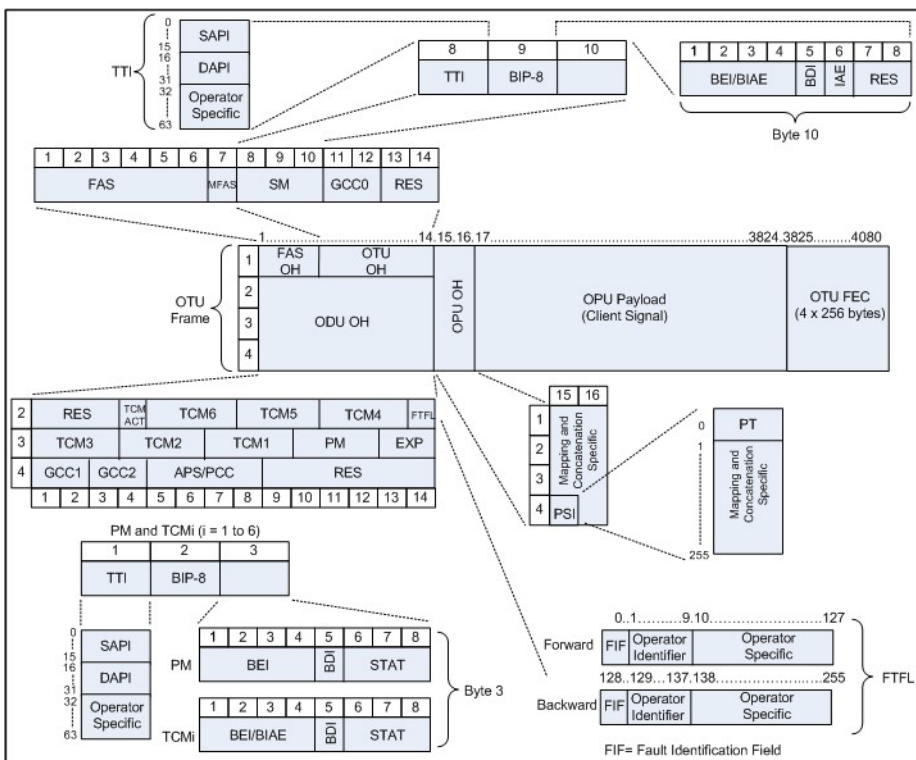
Following the OTN structure presented in figure *Basic OTN Transport Structure* on page 425, OTUks ( $k = 1, 2, 3$ ) are transported using the OCh; each unit is assigned a specific wavelength of the ITU grid. Several channels can be mapped into the OMS and then transported via the OTS layer. The OCh, OMS and OTS layers each have their own overhead for management purposes at the optical level. The overhead of these optical layers is transported outside of the ITU grid in an out-of-band channel called the optical supervisory channel (OSC).

When the OTU frame structure is complete (OPU, ODU and OTU), ITU G.709 provides OAM&P functions that are supported by the overhead.

## OTU Frame Structure and Overhead

As shown in the figure below, the OTU frame is broken down into the following components:

- Framing
- OTL, OTU, ODU, OPU overhead
- OTU FEC



OTU Frame Description

## Glossary

### G.709 Optical Transport Network (OTN)

---

➤ Framing

The OTU framing is divided into two portions: FAS and MFAS.

The frame alignment signal (FAS) uses the first six bytes and, similarly to SONET/SDH, it is used to provide framing for the entire signal. In order to provide enough 1/0 transitions for synchronization, scrambling is used over the entire OTU frame, except for the FAS bytes.

The multiframe alignment signal (MFAS) byte is used to extend command and management functions over several frames. The MFAS counts from 0 to 255, providing a 256 multiframe structure.

➤ Overhead

Each portion of the OTU frame has its own specific overhead functions. They are displayed in figure *OTU Frame Description* on page 427, and are briefly described below. Further details can be found about these overhead fields in the ITU G.709 standard.

➤ Optical channel Transport Lane (OTL)

The Optical channel Transport Lane (OTL) is an adaptation layer whose purpose is to re-use the modules developed for Ethernet 40GBASE-R and 100GBASE-LR4. These modules have a four-lane WDM interface to and from a transmit/receive pair of G.652 optical fibers, and connect to the host board via a 4-lane (OTL3.4) or 10-lane (OTL4.10) electrical interface.

The OTL layer is responsible for mapping the serial OTU signal onto a parallel path designated lanes. In the case of OTU4 the signal is distributed over 20 logical lanes and for OTU3 the signal is distributed over 4 logical lanes.

➤ **Optical Transport Unit (OTU)**

The OTU overhead is comprised of the SM, GCC0 and RES bytes.

The section monitoring (SM) bytes are used for the trail trace identifier (TTI), parity (BIP-8) and the backward error indicator (BEI), or backward incoming alignment error (BIAE), backward defect indicator (BDI), and incoming alignment error (IAE). The TTI is distributed over the multiframe and is 64 bytes in length. It is repeated four times over the multiframe.

General communication channel 0 (GCC0) is a clear channel used for transmission of information between OTU termination points.

The reserved (RES) bytes are currently undefined in the standard.

## Glossary

### G.709 Optical Transport Network (OTN)

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➤ Optical Data Unit (ODU)

The ODU overhead is broken into several fields: RES, PM, TCMi, TCM ACT, FTFL, EXP, GCC1/GCC2 and APS/PCC.

The reserved (RES) bytes are undefined and are set aside for future applications.

The path monitoring (PM) field is similar to the SM field described above. It contains the TTI, BIP-8, BEI, BDI and Status (STAT) field.

There are six tandem connection monitoring (TCMi) fields, which contain the BEI/BIAE, BDI and STAT fields. The STAT field is used in the PM and TCMi fields to provide an indication of the presence or absence of maintenance signals.

The tandem connection monitoring activation/deactivation (TCM ACT) field is currently undefined in the standards.

The fault type and fault location reporting communication channel (FTFL) is a message spread over a 256-byte multiframe that provides the ability to send forward and backward path-level fault indications.

The experimental (EXP) field is a field that is not subject to standards and is available for network operator applications.

General communication channels 1 and 2 (GCC1/GCC2) fields are very similar to the GCC0 field except that each channel is available in the ODU.

The automatic protection switching and protection communication channel (APS/PCC) supports up to eight levels of nested APS/PCC signals, which are associated to a dedicated-connection monitoring level depending on the value of the multiframe.



➤ **Optical Payload Unit (OPU)**

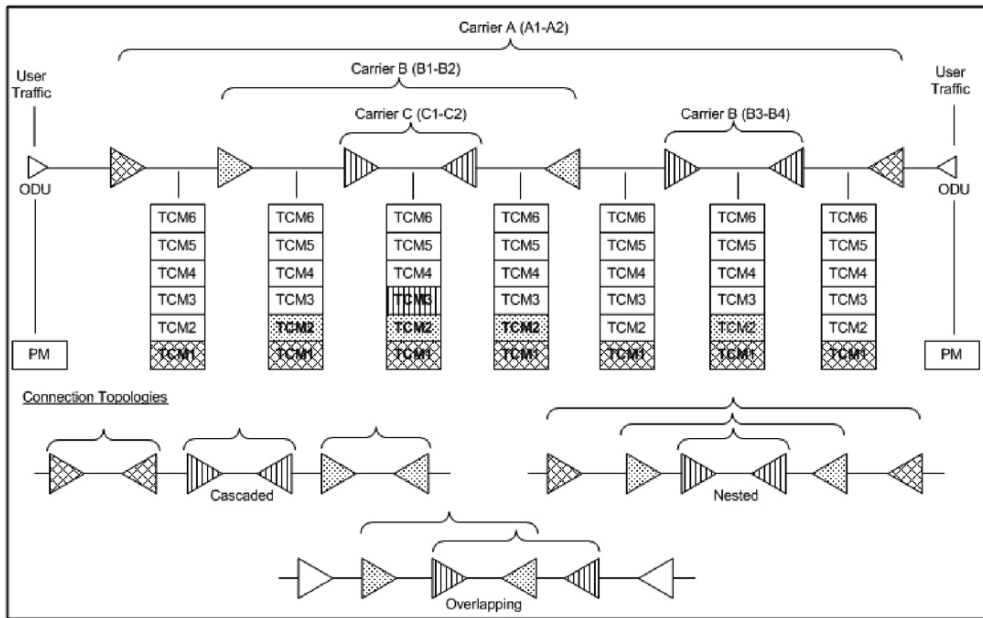
The primary overhead field associated to the OPU is the Payload Structure Identifier (PSI). This is a 256 bytes multi-frame where its first byte is defined as the Payload Type (PT). The remaining 255 bytes are currently reserved.

The other fields in the OPU overhead are dependent on the mapping and concatenation capabilities associated to the OPU. For an asynchronous mapping (the client signal and OPU clock are different) Justification Control (JC) bytes are available to compensate for clock rate differences, two methods are supported Asynchronous Mapping Procedure (AMP) and Generic Mapping Procedure (GMP). For a purely Bit-Synchronous Mapping Procedure (BMP) (client source and OPU clock are the same), the JC bytes become reserved (set to 0). Concatenation bytes are also available as described in ITU G.709.

# Glossary

## Tandem Connection Monitoring (TCM)

TCM enables the user and its signal carriers to monitor the quality of the traffic that is transported between segments or connections in the network. SONET/SDH allowed a single level of TCM to be configured, while ITU G.709 allows six levels of tandem connection monitoring to be configured. The assignment of monitored connections is currently a manual process that involves an understanding between the different parties. There are various types of monitored connection topologies: cascaded, nested and overlapping. Examples of these topologies are provided in the following figure.



Tandem Connection Monitoring

Each of the six TCMi fields in the ODU overhead is assigned to a monitored connection. There can be from zero to six connections that can be configured for each connection. In the figure *Tandem Connection Monitoring* on page 432, there are three different connections that are actually monitored. Carrier C, due to its location, can monitor three TCM levels as the ODU passes through its portion of the network.

In addition to monitoring maintenance signals, using the STAT field associated with each TCM level, the TCM connection also monitors the BIP-8 and BEI errors for each connection level. Maintenance signals are used to advertise upstream maintenance conditions affecting the traffic and errors provide an indication of the quality of service offered at each segment of the network, which provides a valuable tool for the user and carrier to isolate faulty sections of the network.

## **Forward Error Correction (FEC)**

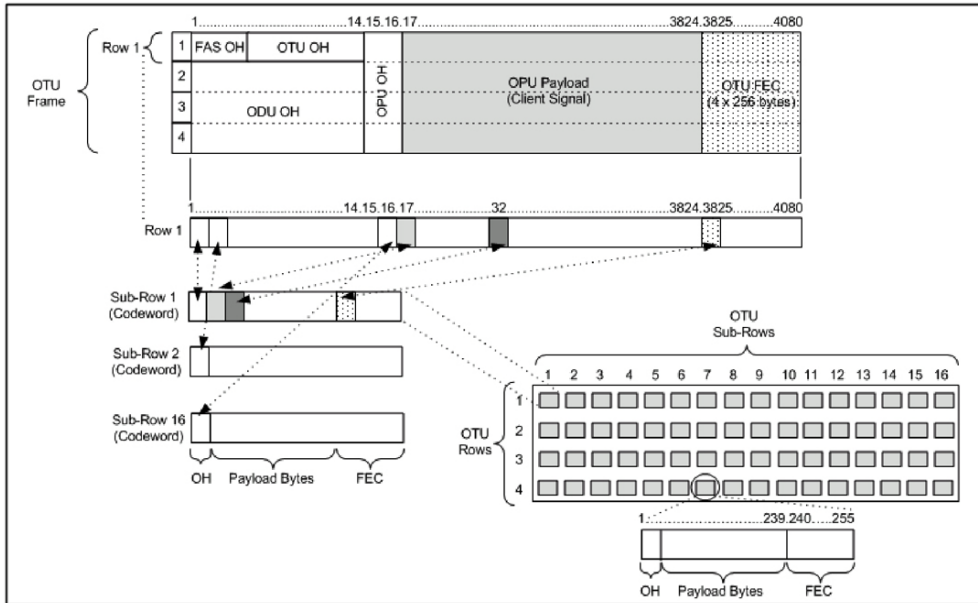
The ITU G.709 standard supports forward error correction (FEC) in the OTU frame and is the last part added to the frame before the frame is scrambled. FEC provides a method to significantly reduce the number of transmitted errors due to noise, as well as other optical phenomena that occur at high transmission speeds. This enables providers to support longer spans in between optical repeaters.

An OTU frame is divided into four rows. Each row is broken down into 16 sub-rows comprised of 255 bytes each, as shown in figure *Forward Error Correction* on page 434. A sub-row is composed of interleaved bytes. The interleave is executed so that the first sub-row contains the first overhead (OH) byte, the first payload byte and the first FEC byte, and so on for the remaining sub-rows of each row in the frame. The first FEC byte starts at position 240 for all sub-rows.

# Glossary

## G.709 Optical Transport Network (OTN)

The FEC uses a Reed-Solomon RS (255/239) coding technique. This means that 239 bytes are required to compute a 16-byte parity check. The FEC can correct up to eight (bytes) errors per sub-row (codeword) or detect up to 16 byte errors without correcting any. Combined with the byte interleave capability included in ITU G.709 implementation, the FEC is more resilient in regards to error burst, where up to 128 consecutive bytes can be corrected per OTU frame row.



Forward Error Correction

## ODU Multiplexing

The ODU multiplexer is a function that allows the multiplexing of ODU tributary signals into higher OTN signal rates. The G.709 standard supports 2 types of ODU multiplexer which can be classified as follows:

- Legacy architecture is based on multi-stage architecture to bring an ODUk client to a higher OTN interface rate. This multiplexer is identified by Payload Type 20 (PT 20).
- New architecture uses a single stage architecture to bring an ODUk client to any higher OTN interface rate. This method supports the ODUflex client signal. The multiplexer is identified by Payload Type 21 (PT 21).

**Note:** *Refer to the OTN BERT on page 33 or OTN-SONET/SDH BERT on page 35 for the ODU multiplexing capabilities.*

The multiplexing strategy is based on the concept of tributary slots, which is similar in concept to the SONET timeslot. The multiplexing of 4 ODU1 in one ODU2 is made by distributing the ODU1 structure in a repetitive sequence of 4 ODU2 Tributary slots, a similar strategy is used for ODU3 multiplexing where the repetitive sequence is made of 16 ODU3 tributary slots, refer to G.709 standard for detailed information.

## Glossary

### *G.709 Optical Transport Network (OTN)*

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The main attributes of the ODU multiplexer functionality are as follows:

- The Asynchronous Mapping Procedure (AMP) is used for multiplexing the tributary signals; this method uses a modified Justification Control mechanism which has 2 positive Justification Control bytes and one negative Justification Control byte.
- The new multiplex method also supports the Generic Mapping Procedure as the Justification Control mechanism is still using the OPU OH JC bytes.
- The Multiplex Structure Identifier (MSI) provides information that is specific to each type of multiplexer provided.
- Can handle multiplex signals with frequency offset of +/- 20 ppm on every layer for the legacy architecture while the new architecture (using GMP) can handle frequency offset of +/-100 ppm.

## ODUflex

ODUflex provides the capability to carry client payload of variable size with a container size of 1.244 Gbit/s granularity. An ODUflex (L) signal can be transported once multiplexed in an ODUk (H) signal, the multiplexer in this case handles tributary slots of 1.244 Gbit/s and has a Payload Type 21. The ODUflex function can be used to transport 2 signal categories mapped in ODTUk.ts using GMP:

➤ Ethernet in ODUflex over GFP-F signal

The Ethernet packets are mapped in GFP-F as specified in G.7041, the packets are processed as follows:

- The Start of Frame Delineation bytes are terminated
- Inter Frame Gaps bytes are terminated
- PCS coding is terminated
- GFP overhead bytes added

Since the PCS coding is terminated, it is not possible to transport the Ethernet Link status transparently but it is accommodated by the Forward Defect Indication (FDI) and Remote Defect Indication (RDI) alarms over GFP. The RDI is used to carry the Remote Fault alarm while the FDI is used to carry the Local Fault.

GFP-F provides rate adaptation between the incoming Ethernet signal and the outgoing OPUflex transport signal. This brings the fact that GMP is operated at a fixed Cm value close to the maximum server capacity.

➤ CBR over ODUflex signal

ODUflex can transport Constant Bit Rate signal (bulk filled Test pattern) as Client of the ODUflex CBR function. This CBR function needs a Pattern generator that can operate at a data rate specified by the user, the range of the available data rates is qualified by the Bandwidth management function.

## Glossary

*G.709 Optical Transport Network (OTN)*

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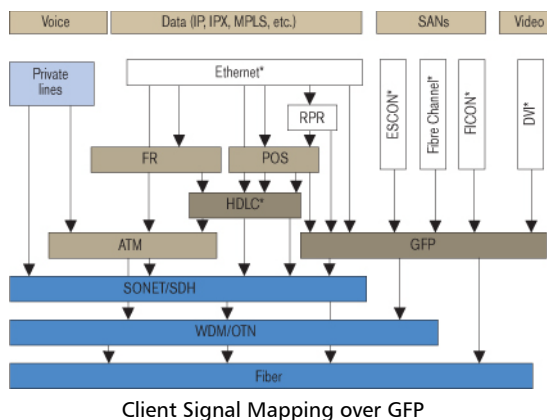
### OTN Signal Rates

Rate	Signal
2.666057143 Gbit/s	OTU1
10.709225316 Gbit/s	OTU2
11.0491 Gbit/s	OTU1e
11.0957 Gbit/s	OTU2e
43.018413559 Gbit/s	OTU3
44.571 Gbit/s	OTU3e1
44.583 Gbit/s	OTU3e2
111.81	OTU4



## Generic Framing Procedure (GFP)

Generic framing procedure (GFP), defined in ITU recommendation G.7041/Y.1303, is a framing mechanism to transport packet-based client signals, such as Ethernet, Fibre Channel, ESCON, FICON, over fixed-data-rate optical channels. As such, GFP provides a single, flexible mechanism to map these client signals into SONET/SDH and OTN networks, as shown in figure below.



Prior to the introduction of GFP, several methods had been used to transport packet services over SONET/SDH networks. The first method was Asynchronous Transfer Mode (ATM) Adaptation Layer 5 (AAL 5) over SONET/SDH. ATM is a very efficient switching and multiplexing technology, whose transfer rates scale with SONET/SDH rates. However, ATM does not make the most efficient use of bandwidth because the payload data is separated into groups of 48 bytes, called cells, with an additional 5-byte header of software overhead. It became immediately apparent that almost 10 % of the bandwidth would be lost. In addition, certain types of data required even more ATM overhead.

## **Glossary**

### *Generic Framing Procedure (GFP)*

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Other methods have focused on using point-to-point protocol (PPP). The IP traffic coming to an Ethernet port is encapsulated over a PPP link and multiple ports can be encapsulated over multilink PPP (ML-PPP) links. By using an HDLC framing, the PPP traffic is transported over the SONET/SDH payload. These methods have been standardized within the IETF through the following Requests for Comments (RFC): RFC 1662, RFC 1990 and RFC 2615. The ITU-T expanded this work by specifying the use of LAPS (very similar protocol to PPP/HDLC) and specifying IP over LAPS in X.85/Y.1321 and Ethernet over LAPS in X.86/Y.1323. All these methods for encapsulating traffic suffer from the weaknesses of HDLC framing; i.e., limited protection from frame corruption and the introduction of variable packet sizes because of its trailer.

GFP has been standardized to better optimize the transport of Ethernet and other data services over SONET/SDH networks, taking into account both the pros and cons of ATM and PPP/HDLC and leveraging two new emerging SONET/SDH capabilities, VCAT and LCAS, that will be discussed later in this document.

## GFP Mapping

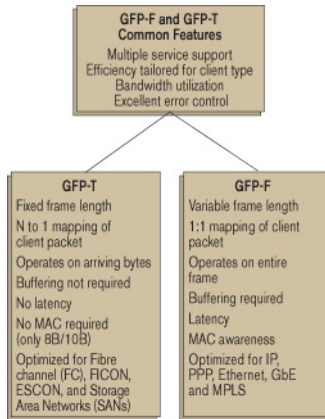
Two types of mapping are currently available for GFP: framed-mapped (GFP-F) and transparent-mapped (GFP-T), whose mappings keep the same basic frame structure, as will be shown in the next sections. The decision on which mode to use is dependent on the underlying service to be transported.

- **Frame-Mapped GFP (GFP-F):** mapping mechanism in which one client signal frame is received and mapped in its entirety into one GFP frame. Therefore, with this adaptation mode, the GFP-F frame size is variable as it is directly related to the incoming client payload. In fact, with GFP-F, the entire client frame must be buffered in order to determine its length. GFP-F is usually used to support Layer 2 frames like Ethernet MAC that are tolerant to some latency. The ITU G.7041 defines the following frame-mapped user payloads supported through GFP-F:
  - Frame-Mapped Ethernet
  - Frame-Mapped PPP
  - Frame-Mapped Multiple Access Protocol over SDH (MAPOS)
  - Frame-Mapped IEEE 802.17 Resilient Packet Ring
  - Frame-Mapped Fibre Channel FC-BBW
- **Transparent-Mapped GFP (GFP-T):** mapping mechanism that facilitates the transport of 8B/10B block-coded client signals like Gigabit Ethernet (GbE), Fibre Channel, ESCON, FICON, and DVB-ASI. With GFP-T, individual characters of a client signal are decoded from the client signal and then mapped into fixed-size GFP frames (64B/65B coded superblocks). This approach avoids the buffering of an entire client frame before it can be mapped into a GFP frame, which reduces latency and in turn makes it ideally suited for SAN applications that require very low transmission latency.

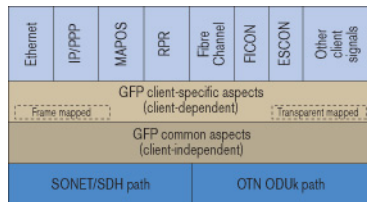
# Glossary

## Generic Framing Procedure (GFP)

The figure *GFP-T vs GFP-F Features* below provides a functional comparison between GFP-F and GFP-T, while figure *GFP-T vs. GFP-F Frames* below provides a comparison of the GFP frames for both modes.



GFP-T vs GFP-F Features



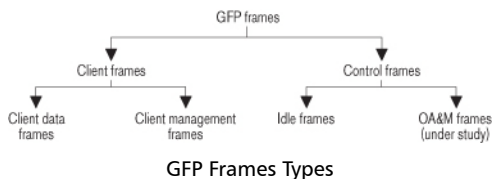
GFP-T vs. GFP-F Frames

Functionally, GFP consists of both common and client-specific aspects. Common GFP aspects apply to all GFP-adapted traffic (i.e., both GFP-F and GFP-T) and cover functions such as packet data unit (PDU) delineation, data link synchronization and scrambling, client PDU multiplexing, and client-independent performance monitoring. Client-specific aspects of GFP cover issues such as mapping of the client PDU into the GFP payload, client-specific performance monitoring, as well as operations, administration, and maintenance (OA&M). This is illustrated in figure *Client Signal Mapping over GFP* on page 439.

## GFP Frame Structure

As illustrated in figure below, Two basic GFP frame types have been defined: GFP client frames and GFP control frames. GFP client frames are categorized into two types: client data frames (CDFs) and client management frames (CMFs). CDFs are used to transport the client data, while CMFs are used to transport information associated with the management of the client signal or GFP connection.

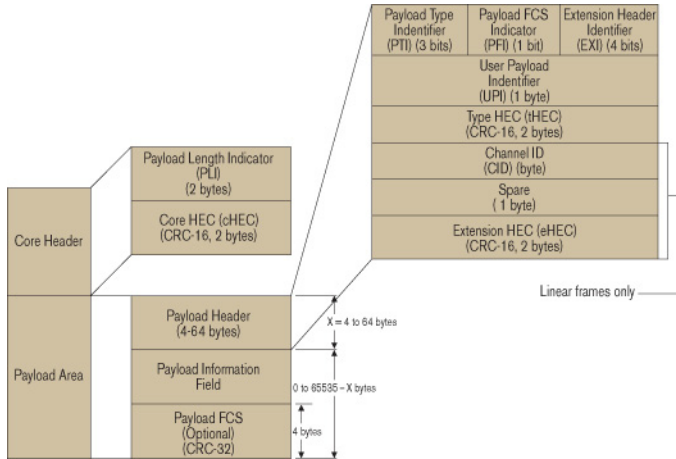
As for GFP control frames, at this time, only one category has been defined by the standard so far; i.e., GFP idle frames.



# Glossary

## Generic Framing Procedure (GFP)

The GFP generic frame structure is presented in figure below.



GFP Generic Frame Structure

Each GFP frame type consists of three main components: the core header, the payload header, and the payload information field.

The core and payload headers form the GFP header, whereas the payload information field represents the customer traffic carrying the data services. The payload header carries information about the payload type (i.e., Ethernet, Fibre Channel, etc.) that it is carrying, while the core header carries information about the size of the GFP frame itself.

Each header contains a header error correction (HEC) calculation, allowing for the correction of single errors; that is, any errors that occur in the core header or in the payload header can potentially be corrected by the HEC, through the network element. This creates a very robust mapping scheme, which ensures that GFP frames can get transported across a network without customer traffic loss.

➤ **Core Header**

The GFP core header consists of a two-octet length field, specifying the length of the GFP frame's payload area in octets, and a two-octet field containing a CRC-16 error-check code.

- **Payload Length Indicator (PLI):** The PLI is a two-byte field indicating the size in bytes of the GFP payload area. It indicates the beginning of the next GFP frame in the incoming bit-stream as an offset from the last byte in the current GFP core header. PLI values in the range of 0 to 3 are reserved for GFP internal use and are referred to as GFP control frames. All other frames are referred to as GFP client frames.
- **Core HEC (cHEC):** The cHEC is a two-byte field containing a cyclic redundancy check (CRC-16) sequence that protects the integrity of the core header. The cHEC sequence is computed over the core header bytes using standard CRC-16. The CRC-16 enables both single-bit error correction and multibit error detection.

➤ **Payload Header**

The payload header is a variable-length area, 4 to 64 octets long, intended to support data-link management procedures specific to the transported client signal. The payload header contains two mandatory fields, the Type field and Type Header Error Correction (tHEC) field. The payload header also supports an additional variable number of subfields referred to, as a group, as the extension header.

- **Payload Type Identifier (PTI):** A three-bit subfield that identifies the type of GFP client frame. The following table lists the currently defined user frames.

PTI	Description
000	Client Data Frame
100	Client Management Frame
Others	Reserved

## Glossary

### Generic Framing Procedure (GFP)

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- **Payload FCS Indicator (PFI):** A one-bit subfield indicating the presence (1) or absence (0) of the payload FCS field. The following table lists the currently defined PFI values.

PFI	Description
0	FCS Absent
1	FCS Present

- **Extension Header Identifier (EXI):** A four-bit subfield identifying the type of GFP extension header. Three kinds of extension headers are currently defined:

EXI	Description	Function
0000	Null Extension Header	Indicates that no extension header is present.
0001	Linear Extension Header	A two-octet extension header that supports sharing of the GFP payload across multiple clients in a point-to-point configuration. The linear extension header consists of an eight-bit channel ID (CID) field, used to indicate one of 256 communication channels (i.e. clients) at a GFP termination point, and an eight-bit spare field reserved for future use.
0010	Ring Extension Header	The use of this field is under consideration. Similar to linear, the current proposal being considered is to allow the sharing of the GFP payload across multiple clients; however, this would only apply to ring configurations.
0011 to 1111	Reserved	

- **User Payload Identifier (UPI):** An eight-bit field identifying the type of payload conveyed in the GFP payload information field:

UPI	Client Data	Client Management
0000 0000 1111 1111	Reserved and not available	Reserved
0000 0001	Mapped Ethernet Frame	Client Signal Fail (Loss of Client Signal)



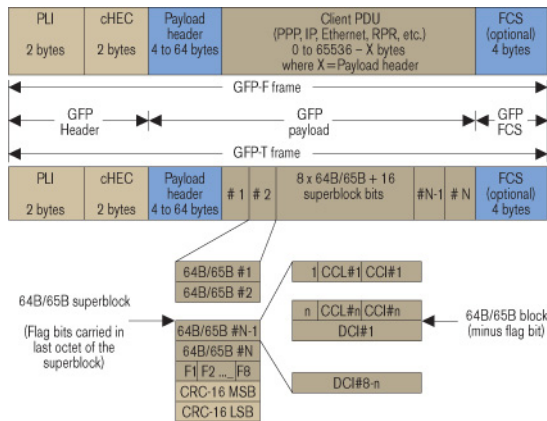
<b>UPI</b>	<b>Client Data</b>	<b>Client Management</b>
0000 0010	Mapped PPP Frame	Client Signal Fail (Loss of Character Synchronization)
0000 0011	Transparent Fibre Channel	Client Defect Clear Indication (DCI)
0000 0100	Transparent FICON	Client Forward Defect Indication (FDI)
0000 0101	Transparent ESCON	Client Reverse Defect Indication (RDI)
0000 0110	Transparent GbE	
0000 0111	Reserved for future use	
0000 1000	Frame-Mapped IEEE 802.17 Resilient Packet Ring	
0000 1011	Frame-Mapped Fibre Channel FC-BBW	
0000 1100	Asynchronous Transparent Fibre Channel	
0000 1101	Framed MPLS Unicast	
0000 1110	Framed MPLS Multicast	
0000 1111	Framed IS-IS	
0001 0000	Framed IPv4	
0001 0001	Framed IPv6	
0001 0010	Framed DVD-ASI	
0001 0011	Framed 64B/66B Ethernet	
0001 0100	Framed 64B/66B Ethernet Ordered Set	
0001 0101 through 1110 1111	Reserved for future standardization	
1111 0000 through 1111 1110	Reserved for proprietary use	
0000 0110 through 1101 1111		Reserved for future use
1110 0000 through 1111 1110		Reserved for proprietary use

# Glossary

## Generic Framing Procedure (GFP)

- **Type HEC (tHEC) Field:** A two-octet field that contains a CRC-16 sequence to protect the integrity of the type field. The tHEC sequence is computed over the core header bytes using standard CRC-16. As with the cHEC, CRC-16 enables both single-bit error correction and multibit error detection.
- **Channel Identifier (CID):** A one-byte field that is only available when the EXI field is configured to Linear. The CID byte is used to indicate one of 256 communication channels at a GFP termination point.
- **Spare:** A one-byte field that is only available when the EXI field is configured to Linear. This field is reserved for future use.
- **Extension HEC (eHEC):** A two-byte field that contains a CRC-16 check sequence that protects the integrity of the contents of the extension. CRC-16 enables both single-bit correction and multibit error detection.

The figure below explains how (in GFP-F) the transmitter encapsulates one entire frame of the client data.



GFP-F vs. GFP-T Frame Structure

► **Payload Information Field**

The payload area (also referred to as payload information field) contains the framed client signal. This variable-length field may include from 0 to 65,535 – X octets, where X is the size of the payload header (including the extension header, if present) and the payload FCS field (if present).

Figure *GFP-T vs. GFP-F Frames* on page 442 shows the GFP-T and GFP-F frame structures. As shown, Both GFP-T and GFP-F frame types share a common core header, payload header, and payload FCS (optional), and they differ in the way in which the client is mapped into this payload area.

► **Payload FCS (pFCS)**

This is an optional four-octet-long frame-check sequence. It contains a CRC-32 check sequence that is designed to validate the entire content of the payload area. The FCS field presence is signalled by the PFI bit located in the Type field of the payload header. The FCS does not correct any errors; it just indicates the presence of error(s).

In GFP-F, the transmitter encapsulates one entire frame of the client data into one GFP frame. In this case, the basic frame structure of a GFP client frame is used, including the required payload header.

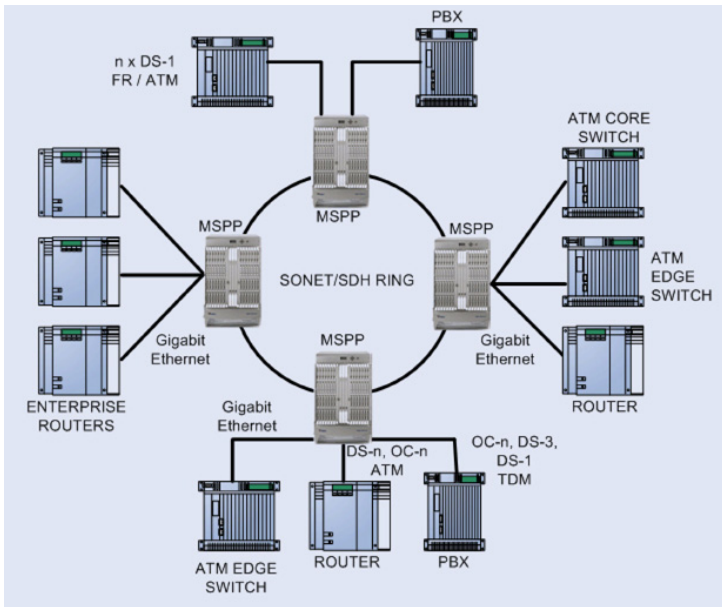
In GFP-T, however, rather than buffering an entire client-data frame, the individual characters of the client signal are demapped from the client block codes and then mapped into periodic fixed-length GFP frames. The transparent GFP client frame uses the same structure as the frame-mapped GFP, including the required payload header.

## Glossary

### Generic Framing Procedure (GFP)

## GFP Summary

GFP has been standardized to better optimize the transport of Ethernet and other data services over SONET, taking into account both the pros and cons of ATM and PPP/HDLC framing mechanisms. As described in this section, GFP represents a robust mapping mechanism that allows for the mapping of multiple client-data types into SONET/SDH payload (SPEs). This technology has been embraced by network equipment and service providers as it provides an efficient way of providing interoperable data-services transport over the existing SONET/SDH install base. The versatility provided by GFP allows SONET/SDH networks to offer transport services for a multiple of services, as shown in figure below.



Multiservice SONET/SDH Network

## MPLS Labels

The MPLS labels are listed in the following table.

<b>Label</b>	<b>Description</b>
0	IPv4 explicit null
1	Router alert
2	IPv6 explicit null
3	Implicit null
14	OAM alert
4 to 13, and 15	Unassigned
16 to 1048575	Label ID

## SONET/SDH

### SONET/SDH Nomenclature

The GUI will use the International or European nomenclature based on the SONET and SDH software options installed on the FTB/IQS-85100G.

Software option	Nomenclature
SONET only	International
SDH only	European
SONET and SDH	International

### Signal Rates

Rate	SONET	SDH	
		International	European
39.81312 Gbit/s	OC-768	STM-256	STM-256

## **SONET/SDH High Path Nomenclature**

<b>Path Type</b>	<b>SDH</b>	<b>SONET</b>
Low Order	TUG-3	-
	TUG-2	VTG
	TU-11	VT1.5
	TU-12	VT2
	TU-3	-

## SONET/SDH Alarms and Errors Nomenclature

Layer	SONET	SDH
Physical	BPV/CV	CV
Section / Regenerator Section	LOF-S	RS-LOF
	SEF	RS-OOF
	TIM-S	RS-TIM
	FAS-S	RS-FAS
	B1	B1
Line / Multiplex Section	AIS-L	MS-AIS
	RDI-L	MS-RDI
	B2	B2
	REI-L	MS-REI
High Order Path	AIS-P	AU-AIS
	LOP-P	AU-LOP
	H4-LOM	H4-LOM
	PDI-P	-
	RDI-P	HP-RDI
	ERDI-PCD	ERDI-CD
	ERDI-PPD	ERDI-PD
	ERDI-PSD	ERDI-SD
	PLM-P	HP-PLM
	UNEQ-P	HP-UNEQ
	TIM-P	HP-TIM
	B3	B3
	REI-P	HP-REI



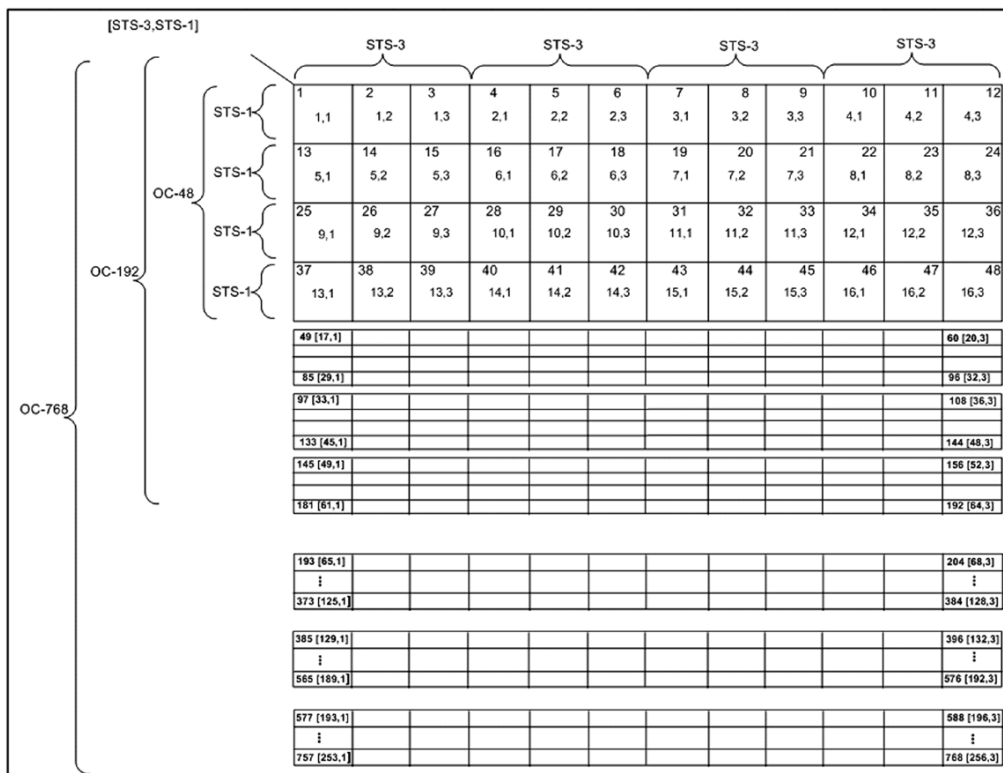
<b>Layer</b>	<b>SONET</b>	<b>SDH</b>
Low Order Path	AIS-V	TU-AIS
	LOP-V	TU-LOP
	RDI-V	LP-RDI
	ERDI-VCD	ERDI-CD
	ERDI-VPD	ERDI-PD
	ERDI-VSD	ERDI-SD
	RFI-V	LP-RFI
	UNEQ-V	LP-UNEQ
	TIM-V	LP-TIM
	PLM-V	LP-PLM
	BIP-2	BIP-2
	REI-V	LP-REI

## SONET Numbering Convention

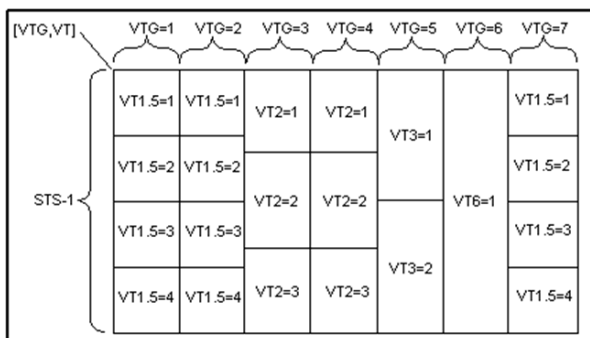
The FTB/IQS-85100G supports the Timeslot (default) and hierarchical two-level numbering conventions as per GR-253.

Hierarchical Notation:

The FTB/IQS-85100G supports numbering SONET high order path STS-1s and STS-3c using the two-level “STS-3#,STS-1#” convention in an OC-N. For example: STS-1 [2,3].



The FTB/IQS-85100G supports numbering SONET low order path using the two-level “VTGroup#,VT#” convention for numbering VTs within an STS-1. For example: VT1.5 [1,3], VT2 [3,2], VT6 [6,1].



The FTB/IQS-85100G supports numbering SONET high order path STS-nc within an OC-N using the two-level “STS-3#,STS-1#”. For example: STS-12c [5,1].

## SDH Numbering Convention

As per ITU G.707, the high order paths are defined using a 2 to 5 level convention E,D,C,B,A depending on the rate of the STM-n used.

- E: the AUG-64 are numbered 1 to 4
- D: the AUG-16 are numbered 1 to 4
- C: the AUG-4 are numbered 1 to 4
- B: the AUG-1 are numbered 1 to 4
- A: the AU-3 are numbered 1 to 3

# Glossary

SONET/SDH

Naming is as follows for each of the following rates:

- [E,D,C,B,A] for STM-256
- [D,C,B,A] for STM-64
- [C,B,A] for STM-16
- [B,A] for STM-4
- [0] for AU-4 in STM-1
- [A] for AU-3 in STM-1

		B=1			B=2			B=3			B=4			
E=1	D=1	C=1	1 A=1	2 A=2	3 A=3	4 A=1	5 A=2	6 A=3	7 A=1	8 A=2	9 A=3	10 A=1	11 A=2	12 A=3
		C=2	13 A=1	14 A=2	15 A=3	16 A=1	17 A=2	18 A=3	19 A=1	20 A=2	21 A=3	22 A=1	23 A=2	24 A=3
		C=3	25 A=1	26 A=2	27 A=3	28 A=1	29 A=2	30 A=3	31 A=1	32 A=2	33 A=3	34 A=1	35 A=2	36 A=3
		C=4	37 A=1	38 A=2	39 A=3	40 A=1	41 A=2	42 A=3	43 A=1	44 A=2	45 A=3	46 A=1	47 A=2	48 A=3
	D=2		[1,2,1,1,1]											[1,2,1,4,3]
			[1,2,4,1,1]											[1,2,4,4,3]
			[1,3,1,1,1]											[1,3,1,4,3]
			[1,3,4,1,1]											[1,3,4,4,3]
	D=3		[1,4,1,1,1]											[1,4,1,4,3]
			[1,4,4,1,1]											[1,4,4,4,3]
	D=4		[2,1,1,1,1]											[2,1,1,4,3]
			[2,4,4,1,1]											[2,4,4,4,3]
	E=2		⋮											⋮
			[2,4,4,1,1]											[2,4,4,4,3]
	E=3		[3,1,1,1,1]											[3,1,1,4,3]
			[3,4,4,1,1]											[3,4,4,4,3]
E=4		⋮											⋮	
		[4,4,4,1,1]											[4,4,4,4,3]	

The low order paths are defined using a 2 or 3 level convention K,L,M depending on the rate of the AU-4 or AU-3 used to multiplex the low order signals.

- K: the TUG-3 are numbered 1 to 3
- L: the TUG-2 are numbered within the TUG-3 0 or from 1 to 7
- M: the TU-2, TU-12, TU-11 are numbered within the TUG-2 1, 1 to 3, 1 to 4 respectively

Examples for AU-4 (3 level convention)

TU-3: [K,0,0]

TU-2: [K,L,0]

TU-12:[K,L,M] where M = 1 to 3

TU-11:[K,L,M] where M = 1 to 4

Example for AU-3 (2 level convention)

TU-2: [L,0]

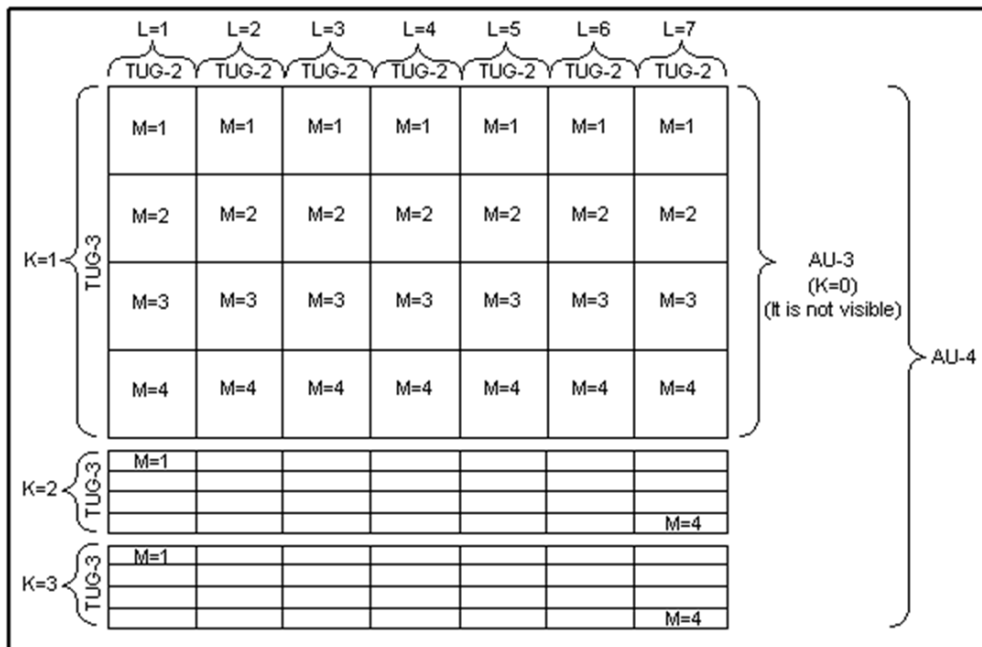
TU-12: [L,M] M is numbered 1 to 3

TU-11: [L,M] M is numbered 1 to 4

# Glossary

SONET/SDH

The GUI Grid indicates the TUG-2 [x] and TUG-3 [x] values.



## VLAN ID and Priority

Special VID values (IEEE Std 802.1Q-1998)

ID	Description
0	The null VLAN ID. Indicates that the tag header contains only user priority information; no VLAN identifier is present in the frame. This VID value must not be configured as a PVID, configured in any Filtering Database entry, or used in any Management operation.
1	The default PVID value used for classifying frames on ingress through a Bridge Port. The PVID value can be changed on a per-Port basis.
4095	Reserved for implementation use. This VID value shall not be configured as a PVID, configured in any Filtering Database entry, used in any Management operation, or transmitted in a tag header.

VLAN Priority

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

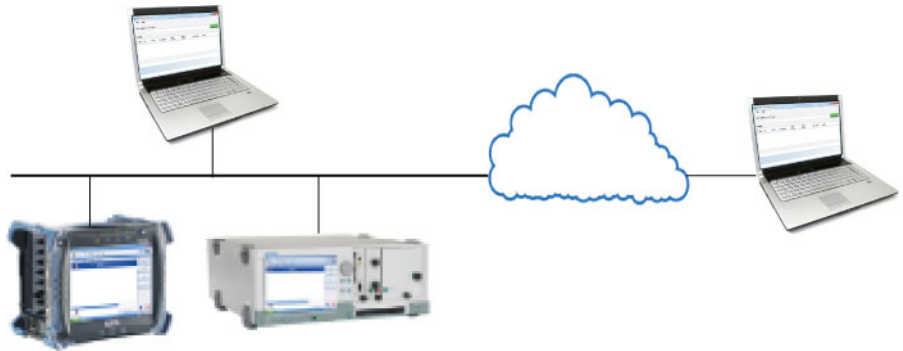




# C Remote Toolbox

## Overview

The **Remote Toolbox** application allows to remotely control a module installed on a platform using a remote PC. Remote users are connected to the platform using an Ethernet connection.



**Note:** *The remote control feature has to be enabled for the module on its specific slot on the platform. Refer to the Controlling Modules Remotely section from the platform user guide for more information.*

The **Remote Toolbox** allows to start one or several module application(s). Once a module application is started, the application is independent and does not require the **Remote Toolbox** anymore. Thus, the **Remote Toolbox** application can be closed or can be disconnected from the platform using the **Disconnect** button without affecting the running remote module applications.

## Remote ToolBox

### Overview

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A remote module application offers the same level of control as if the module is locally controlled with the following behaviors.

➤ Multi-user behaviors:

Up to five connections including the local and/or remote sessions are allowed per module. Beyond five connections, the performance to service the connections may decrease.

Each user is able to individually navigate through the module application without affecting the other users. However, any changes to the operation of the test (**Start, Stop, Reset**, etc.) or to any test parameter will be applied to all users.

➤ File location behaviors:

The save, load, report, and data capture functions are associated with the location of the session initiated; for Remote ToolBox it will be on the local PC. The files are not duplicated on the platform platform.

➤ The **Save/Load** configurations are saved in the following folder:  
Document\PB85100G\Configuration

➤ The **Reports** are saved in the following folder:  
Document\PB85100G\Reports

If a report is being generated, no user will be able to start the test case until the report generation is completed.

➤ The **Data Capture** files are saved in the following folder:  
Document\PB85100G\CaptureData

If a capture file is being generated, all users will be able to stop the capture but only the user that initiates the capture will be able to see the captured data file after generation.

## Remote ToolBox Installation

### Requirements

The following system requirements must be met before installing the **Remote ToolBox** software.

- 10 or 10/100 Mbit/s network interface card.
- Windows XP/Vista/7/8 operating system.

**Note:** *Some Windows applications such as PDF reader, Excel, etc. may be required to open the generated reports.*

### Installation

Download the **Remote ToolBox** application from **EXFO STORE** at [www.exfo.com](http://www.exfo.com). Run the **Setup.exe** application and follow the on-screen instructions to complete the installation.

A shortcut of the **EXFO Remote ToolBox** will be created on the PC desktop.

# Starting and Using the Remote ToolBox Application

Start the **Remote ToolBox** application, either by using the desktop **EXFO Remote ToolBox** shortcut, or by clicking on the **EXFO Remote ToolBox** application from **All Programs - EXFO**.

## File Menu

The **File-Exit** menu allows to quit the **Remote ToolBox** application.

## Help Menu

The **Help** menu displays the help information about the **Remote ToolBox** application.

## Server Address or Host Name

Allows to enter the platform IP address or the Host Name. The IP address format is IPv4 (xxx.xxx.xxx.xxx) where xxx are values from 0 to 255. For example: 192.168.1.1.

To find the IP address of the platform, refer to the platform user guide.

## Connect/Disconnect Button

- **Connect** establishes the connection with the platform specified by the selected IP address or the Host Name.
- **Disconnect**, closes the connection with the selected platform allowing to establish a connection with another platform.

## Modules

Once connected to the platform, lists the modules installed on the platform regardless of the remote control feature being enabled or not. The following information is displayed for each module.

- **Type** displays the module's icon.
- **Slot** indicates the platform slot number where the module is inserted.
- **Module** indicates the name of the module.
- **Description** displays the description given to the module. Refer to the platform user guide for more information.
- **Serial Number** indicates the serial number of the module.
- **Remote Control** indicates if the remote control feature is enabled for this module. Refer to the *Controlling Modules Remotely* section from the platform user guide for more information.
- **Standalone** indicates if the standalone feature is possible for this module. Refer to the *Controlling Modules Remotely* section from platform platform user guide for more information.
- **Version** indicates the software version of the module application.

### Applications for...

**Note:** *The application icon is only available if the selected module has its **Remote Control** enabled and is only displayed if the module is supported by the **Remote ToolBox** application.*

Click on the icon to start the application.

The application is automatically started when the same version of the application is installed on the local PC.

The application is downloaded from the platform and installed on the local PC when either the application is not installed or the versions are different. Once installed, the application is automatically started. While downloading the application, the **Cancel** button allows to cancel the download and the installation process.

**Note:** *Multiple versions of a module application may be installed on the same PC. Use the Windows - Control Panel - Add/Remove tool to remove non-required versions from the PC.*









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CHINESE REGULATION ON RESTRICTION OF HAZARDOUS SUBSTANCES (RoHS)

中国关于有害物质限制的规定

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及含量

Part Name 部件名称	Lead 铅 (Pb)	Mercury 汞 (Hg)	Cadmium 镉 (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 电子和电气组件	X	O	X	O	X	X
Optical sub-assembly <sup>a</sup> 光学组件 <sup>a</sup>	X	O	O	O	O	O
Mechanical sub-assembly <sup>a</sup> 机械组件 <sup>a</sup>	O	O	O	O	O	O

Note:

注:

This table is prepared in accordance with the provisions of SJ/T 11364.

本表依据 SJ/T 11364 的规定编制。

O: Indicates that said hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement of GB/T 26572.

O: 表示该有害物质在该部件所有均质材料中的含量均在 GB/T 26572 标准规定的限量要求以下。

X: indicates that said hazardous substance contained in at least one of the homogeneous materials used for this part is above the limit requirement of GB/T 26572. Due to the limitations in current technologies, parts with the "X" mark cannot eliminate hazardous substances.

X: 表示该有害物质至少在该部件的某一均质材料中的含量超出 GB/T 26572 标准规定的限量要求。



标记 "X" 的部件, 皆因全球技术发展水平限制而无法实现有害物质的替代。

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 <sup>a</sup> 电池	5	

a. If applicable.  
如果适用。



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