FTBx-8870/8880 Power Blazer Series

10G MULTISERVICE TEST MODULES

EXFO TFv
Test Function Virtualization

EXFO Connect
Compatible

EtherSAM

iSAM

COMPLETE IPv6 TESTING

EXFO | MULTILINK

Versatile 10G multiservice test modules for lab and field applications.

KEY FEATURES

Full range of optical interfaces for different test scenarios

Complete suite of test functionality to address multiple technologies including OTN, Ethernet, SONET/SDH, DSn/PDH, Fibre Channel and CPRI

Dual-port Ethernet testing capability up to 10GE

Unprecedented testing simplicity requiring minimal training for new users and maintaining a consistent experience from the lab to the field

Offers EXFO TFv—Test Function Virtualization, including FTB Anywhere floating licenses and FTB OnDemand time-based licenses for ultimate flexibility

Compatible with EXFO's rackmount LTB-8 platform, featuring hot-swap capability for lab use

Compatible with the compact FTB-2 Pro platform, with its integrated optical tools and battery operation that can run up to two modules simultaneously for up to 4 ports of 10 GigE

Supported by EXFO Multilink, a web-based application for easy multi-user management and remote access

COMPLIMENTARY PRODUCTS AND APPLICATIONS

Platform
FTB-2 Pro

Platform
LTB-8

100G Multiservice Test Module
FTBx-88200NGE

Multi-User Interface
EXFO Multilink

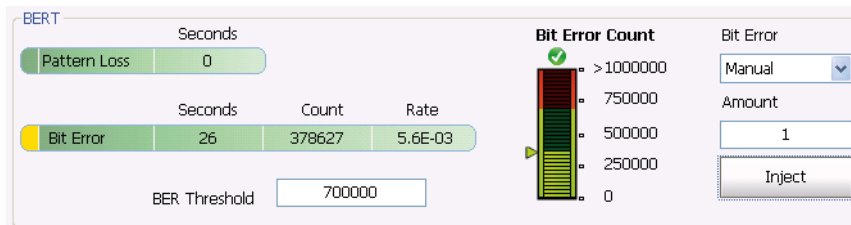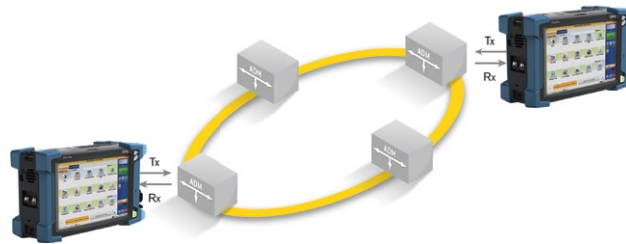**EXFO**

COMPLETE AND AGILE TEST SOLUTION FOR 10G SERVICES

The ongoing transition towards a converged network infrastructure for legacy DSn/PDH, SONET/SDH, OTN, Fibre Channel, CPRI and packet-based Ethernet services requires a test tool that can cover a wide range of interfaces and rates—without sacrificing performance, speed or cost.

The FTBx-8870/8880 Power Blazer Series of modules offer a full suite of test capabilities for a range of technologies up to 10G, addressing different test applications ranging from development in the lab to troubleshooting out in the field.

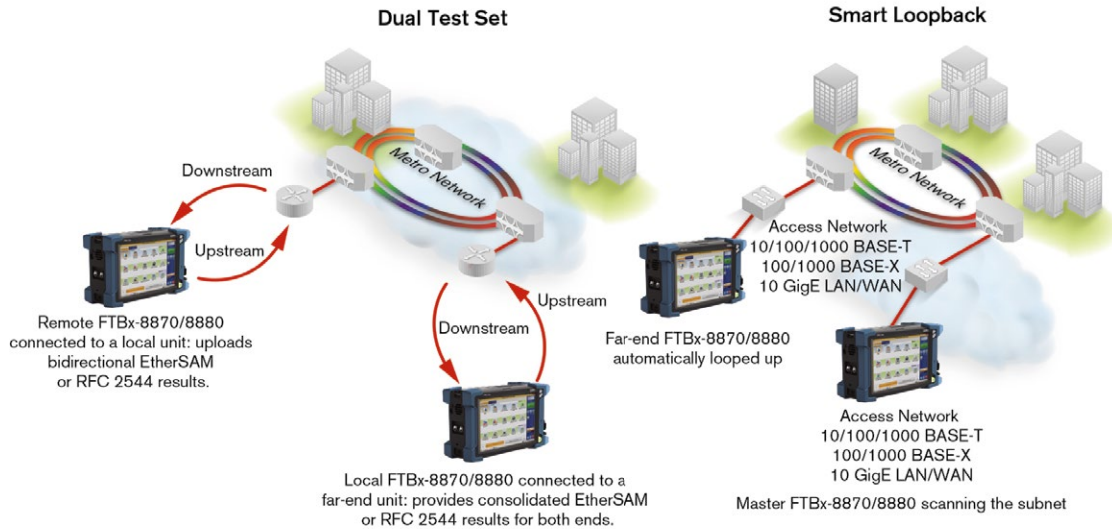## Key DSn/PDH and SONET/SDH Features

Simplified BER Testing

The FTBx-8870/8880 offers the ability to preconfigure bit-error-rate (BER) thresholds that are user-defined prior to running the test. This allows for a simple pass/fail verdict at the conclusion of test, leaving no room for misinterpretation of the test results.

Key Ethernet Features

Intelligent Network Discovery Mode

Using the FTBx-8870/8880, you can single-handedly scan the network and connect to any available EXFO datacom remote tester. Simply select the unit to be tested and choose whether you want traffic to be looped back via Smart Loopback or Dual Test Set mode for bidirectional EtherSAM, RFC 6349 or RFC 2544 results. As such, you no longer need an additional technician at the far end to relay critical information—the FTBx-8870/8880 takes care of everything.

Dual Test Set

Downstream

Upstream

Remote FTBx-8870/8880 connected to a local unit: uploads bidirectional EtherSAM or RFC 2544 results.

Upstream

Downstream

Local FTBx-8870/8880 connected to a far-end unit: provides consolidated EtherSAM or RFC 2544 results for both ends.

Smart Loopback

Access Network
10/100/1000 BASE-T
100/1000 BASE-X
10 GigE LAN/WAN

Far-end FTBx-8870/8880 automatically looped up

Access Network
10/100/1000 BASE-T
100/1000 BASE-X
10 GigE LAN/WAN

Master FTBx-8870/8880 scanning the subnet

Smart Loopback Flexibility

The Smart Loopback functionality has been enhanced to offer five distinct loopback modes. Whether you are looking to pinpoint loopback traffic from a user-datagram-protocol (UDP) or TCP layer, or all the way down to a completely promiscuous mode (Transparent Loopback mode), the FTBx-8870/8880 has the flexibility to adjust to all unique loopback situations.

Dual-Port and Through Mode Testing

With dual-port testing, one technician can use a single FTBx-8870/8880 module to launch either EtherSAM or RFC 2544, and obtain bidirectional results using only one module. With traffic generation and monitoring, and EtherBERT tests, the technician can set up two distinct tests, one on port 1 and the other on port 2. Both ports can also be bound to different interfaces (e.g., 10BASE-T electrical on port 1 and 10 GigE on port 2).

VLAN/MPLS

Today's networks are expected to deliver high performance. To meet such high expectations, service providers must rely on various mechanisms, such as Ethernet tagging, encapsulation and labeling. Thanks to these additions, service providers can enhance security, scalability, reliability and performance. The FTBx-8870/8880 supports virtual-local-area-network (VLAN) tags, Q-in-Q VLAN tags and multiprotocol label switching (MPLS).

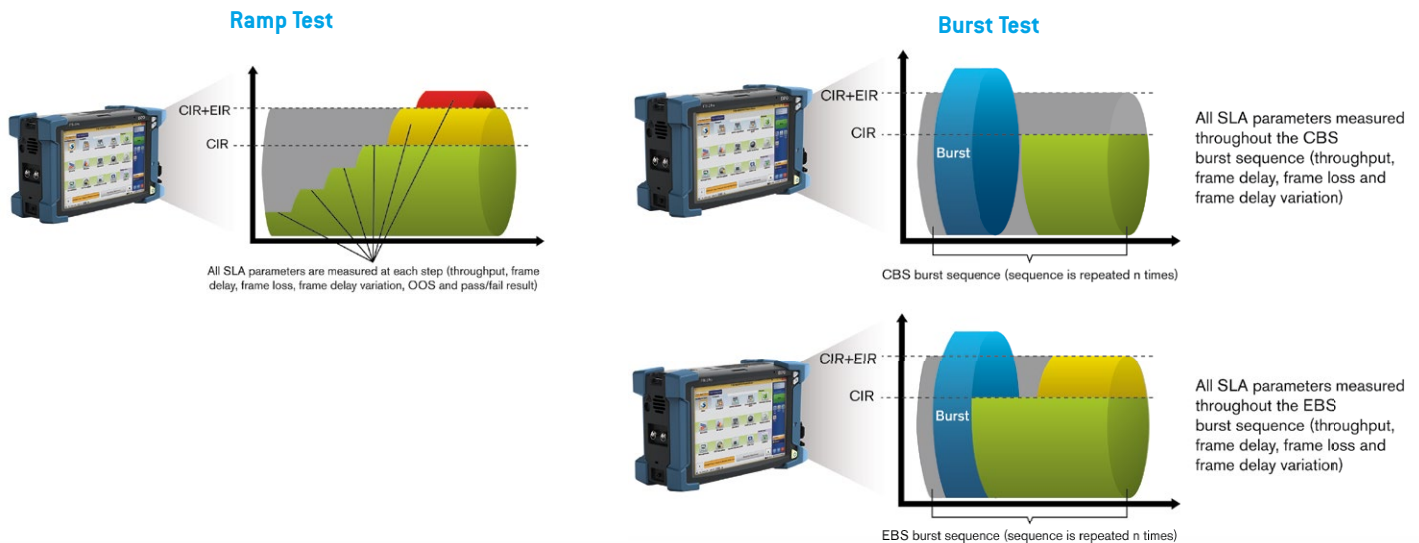

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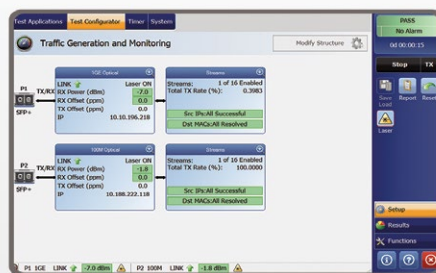
ETHERSAM: THE NEW STANDARD IN ETHERNET TESTING

RFC 2544 used to be the most widespread Ethernet testing methodology. However, it was designed for network-device testing in the lab, not service testing in the field. ITU-T Y.1564, the new standard for turning up and troubleshooting Carrier Ethernet services, has a number of advantages over RFC 2544, including validation of critical service-level agreement (SLA) criteria such as packet jitter and quality-of-service (QoS) measurements. This methodology is also significantly faster, thereby saving time and resources while optimizing QoS.

EXFO's EtherSAM test suite—based on the ITU-T Y.1564 Ethernet service activation methodology—provides comprehensive field testing for mobile backhaul and commercial services.

Contrary to other methodologies, EtherSAM supports new multiservice offerings and can simulate all types of services that will run on the network while simultaneously qualifying all key SLA parameters for each of these services. To prioritize the different service types, EtherSAM validates the QoS mechanisms provisioned in the network, resulting in better troubleshooting, more accurate validation and much faster deployment. EtherSAM consists of two phases, the service configuration test and the service performance test.

Service Configuration Test

The service configuration test involves sequentially testing each service to validate that it is properly provisioned and that all specific key performance indicators (KPIs) or SLA parameters have been met. A ramp test and burst test are performed to verify the committed information rate (CIR), excess information rate (EIR), committed burst size (CBS) and excess burst size (EBS).

Ramp Test

CIR+EIR
CIR

All SLA parameters are measured at each step (throughput, frame delay, frame loss, frame delay variation, OOS and pass/fail result)

Burst Test

CIR+EIR
CIR
Burst

All SLA parameters measured throughout the CBS burst sequence (throughput, frame delay, frame loss and frame delay variation)

CBS burst sequence (sequence is repeated n times)

CIR+EIR
CIR
Burst

All SLA parameters measured throughout the EBS burst sequence (throughput, frame delay, frame loss and frame delay variation)

EBS burst sequence (sequence is repeated n times)

Service Performance Test

Once the configuration of each individual service has been validated, the service performance test simultaneously validates the quality of all the services over time.

Service 1
Service 2
Service 3

All SLA parameters are measured at each service (throughput, frame delay, frame loss, frame delay variation, OOS and pass/fail result)

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ETHERSAM BIDIRECTIONAL RESULTS

EXFO's EtherSAM approach proves even more powerful as it executes the complete ITU-T Y.1564 test with bidirectional measurements. Key SLA parameters are measured independently in each test direction, thus providing 100% first-time-right service activation—the highest level of confidence in service testing.


Round-trip results only

The only effective way to test burst
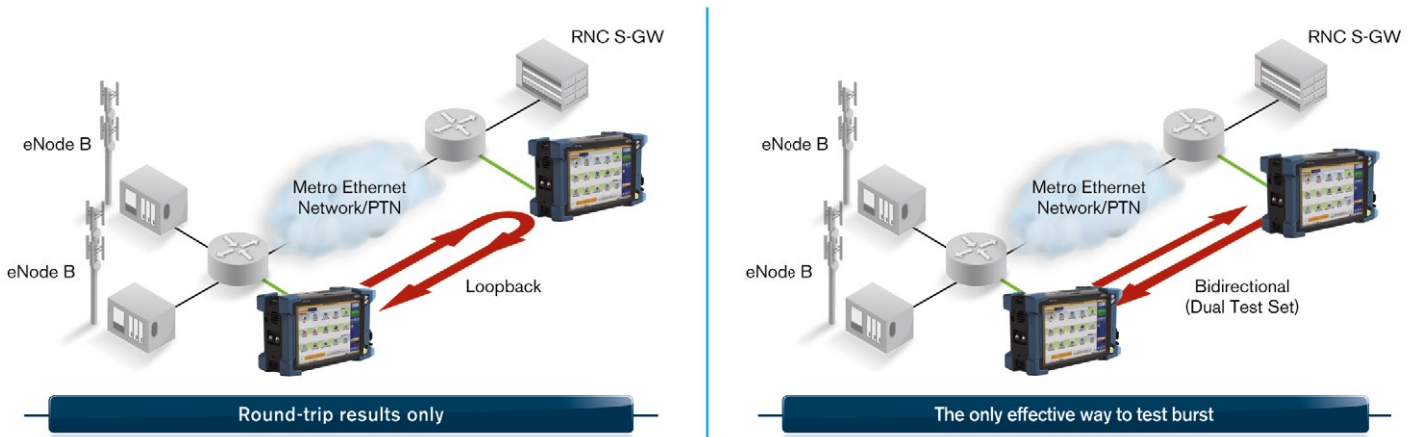
iSAM

With iSAM, which includes Y.1564 (EtherSAM) and RFC 6349, the focus is on minimalism and simplicity, making both tests as simple as possible for all users. This is in sharp contrast with the current situation in the test and measurement market today. One key aspect of iSAM's simplicity lies in its efficiency: it only requires a limited number of steps to set up, run and receive valid test results.

The core objective of iSAM is to remove friction between the user and the testing solution. The end goal is to enable field technicians of any skill level to set up and run an iSAM test, and all of this is done within a one-page setup.

The innovation does not stop there. iSAM also takes the lead in delivering the latest test and measurement standards. iSAM has achieved an industry first by introducing actual Metro Ethernet Forum (MEF) standards and thresholds to guarantee that service providers, mobile network operators and multisystem operators are able to test against the latest MEF 23.1 standard.
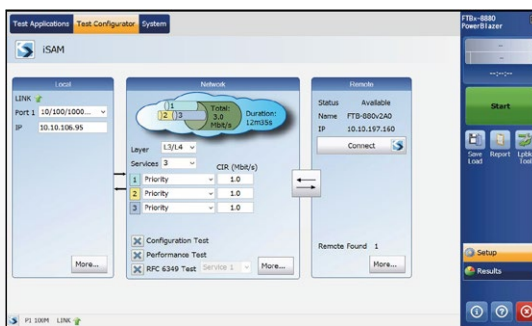
One-page setup
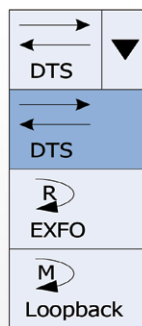
Multiple modes of connection

One-page results

EXFO
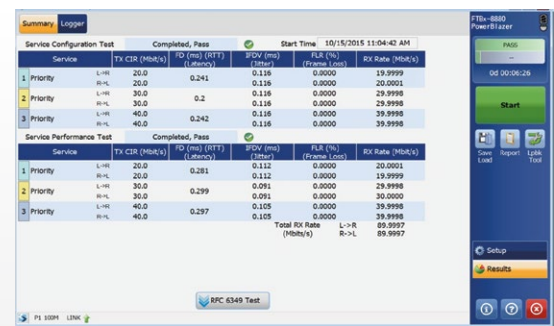
CABLE TEST WITH POWER OVER ETHERNET (PoE)

The cable test helps field technicians quickly and efficiently detect cable issues. Using this feature in conjunction with the FTBx-8870/8880, technicians can troubleshoot any cabling or installation issue by checking the cable's actual pin-out, wire map, cable length, distance-to-fault and propagation delay. With the addition of PoE, technicians can check for the following: presence of power, the power-supply equipment type, power class rating, voltage, current and power in watts. Whether a technician needs to validate a basic component such as a PoE-powered VoIP phone, or an actual PoE-powered small cell, the FTBx-8870/8880 fits the bill for basic to critical devices.

Small Cell Unit

Power Blazer with cable test to diagnose the issue

VoIP

Power Sourcing Equipment

VoIP Multimedia Phone

Speed Dome Camera

Network Camera

Wireless Router

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FTTA TESTING

With the FTBx-8870/8880 modules, field technicians can carry out a variety of FTTA tests. For instance, when installing an RRH, it is critical that all equipment be verified before the riggers have finished the construction phase. The FTBx-8870/8880' CPRI protocol feature verifies that the RRH is fully operational and that the correct small form-factor pluggable (SFP) transceivers are installed and connected correctly.

Using the FTBx-8870/8880 enabled with the layer-2 CPRI protocol, technicians can easily connect to the RRH without having to climb the cell tower. Regardless of whether the cell site's BTS is connected to the RRH, the FTBx-8870/8880 is always ready to emulate a CPRI-enabled BTS. Once connected to the RRH, the Power Blazer is able to supply the field technician with a complete analysis of vital CPRI statistics that includes the following: optical power levels, protocol version, frequency and frequency offset, hyperframe and codeword counts, the negotiated Ethernet or high-level data link control (HDLC) control, and maintenance channels.

Having this information readily accessible enables field technicians to ensure that the RRH is working at the correct, specified line rate, and that it is timed and fully transmitting continuous frames from the top to the bottom of the tower. In addition, the reverse verification can be made by using the FTBx-8870/8880 to emulate the RRH in order to validate the CPRI link with the BTS.

Moving closer toward CPRI-enabled infrastructures, a significant challenge arises as a result of human error occurring between the RRH and the BTS; faulty configurations, bad wiring and incorrect SFPs can lead to problems when trying to initialize the CPRI start-up sequence between the BTS and RRH. The FTBx-8870/8880 test suite better equips field technicians to decipher and solve these basic yet very costly human errors.

Finally, using the FTBx-8870/8880 modules, field technicians can perform an unframed and framed layer-2 CPRI BER test from 1.2 Gbit/s all the way up to 9.8 Gbit/s. The FTBx-8870/8880 modules are able to validate that the fiber from the BTS located at the base of the tower or kilometers away in a Cloud-RAN environment is running with the expected latency and is error-free.
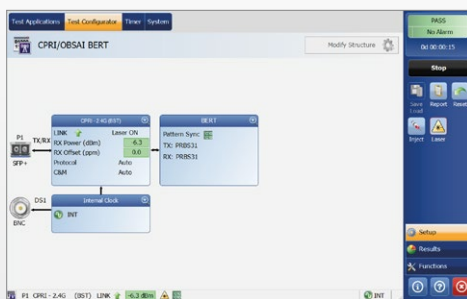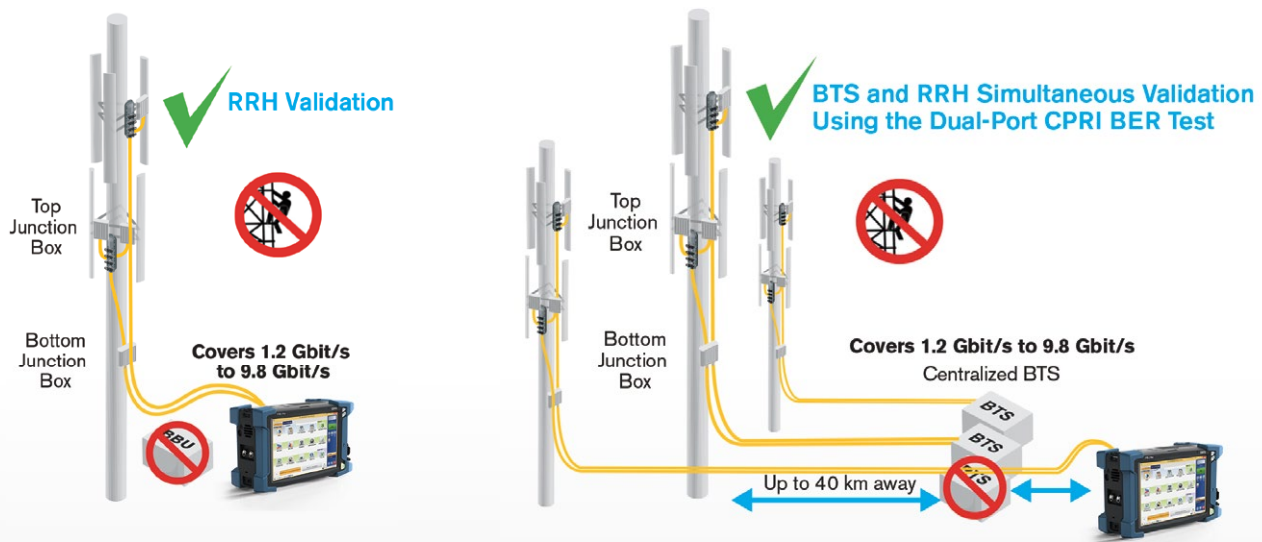
Framed CPRI BER test
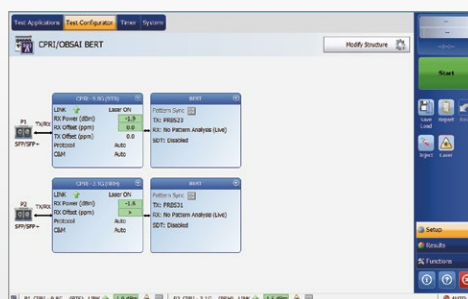
Dual-port CPRI BER test
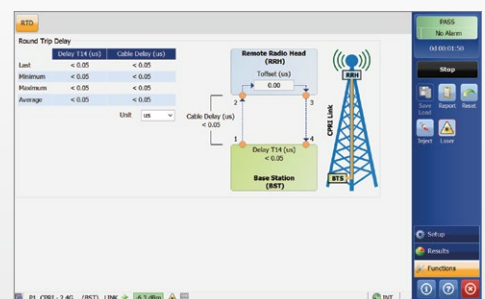
*CPRI round-trip delay*

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TRAFFIC GENERATION AND MONITORING

The FTBx-8870/8880 surpasses the multistream offerings of typical handheld Ethernet testing devices. Up to 32 streams of traffic can be configured by a technician in order to test just about any frame format: Ethernet II, 802.3 SNAP, IPv4, IPv6, three levels of VLANs, MPLS, UDP and TCP. Each stream has an analog visual gauge and user-definable pass/ fail thresholds that instantly show whether the test traffic is in or out of the expected ranges of the SLA.

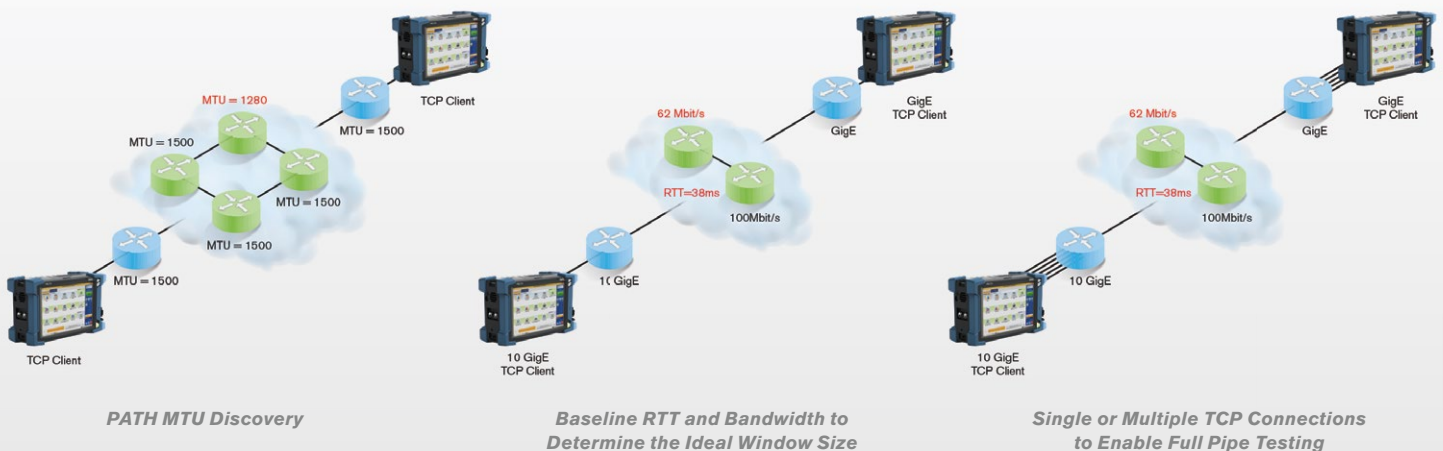### Layer-2 Transparency Testing

The FTBx-8870/8880 uses a new virtual frame display that allows field technicians to easily configure multiple streams and their parameters, including the ability to modify the source medium-access-control (MAC) address and EtherType. This makes it possible to test layer-2 protocols such as Cisco discovery protocol (CDP), VLAN trunking protocol (VTP) and link layer discovery protocol (LLDP). For added simplification, there are also predefined factory configurations capable of automatically loading up to ten layer-2 protocols simultaneously.

← Up to 16 streams

Visual frame display

Voice/video/data services
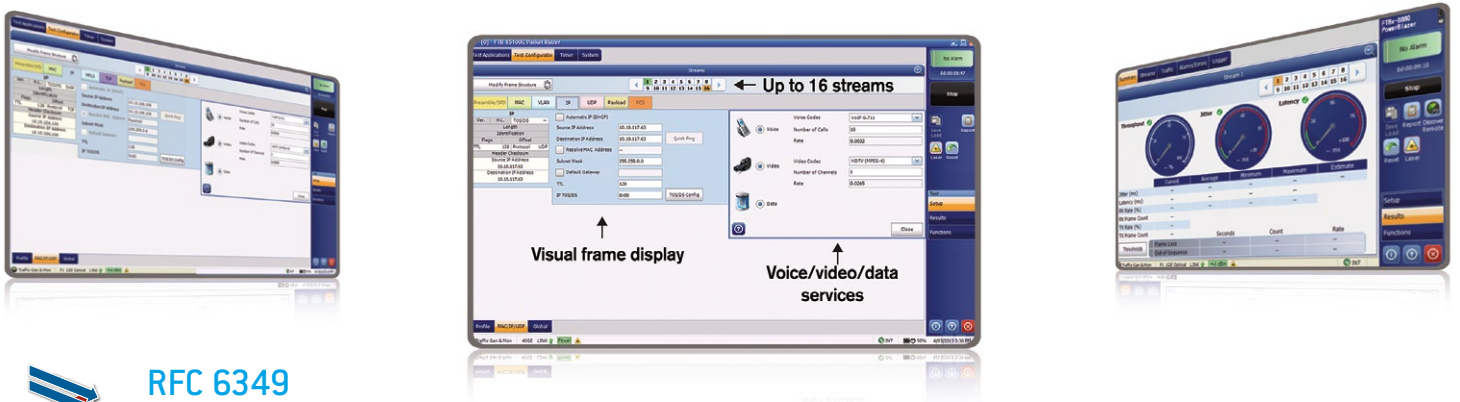
RFC 6349

The Internet Engineering Task Force (IETF) ratified RFC 6349 as a new method for validating an end-to-end TCP service. This new TCP throughput test methodology provides a repeatable standards-based test that validates TCP applications such as web browsing, file transfer, business applications and streaming video. After running the RFC 6349 test, service providers will have all the metrics needed to optimize TCP performance from within their networks or customer premises equipment.

The RFC 6349 test is important, because it includes the following steps that help locate and diagnose TCP issues correctly. The first step consists of finding the maximum transmission unit (MTU) size. This ensures that the network is not fragmenting the traffic. The second step is aimed at determining the baseline round-trip delay, which means letting the technician know that this latency value is the best-case scenario that the network under test can deliver. The third step uses either single or multiple TCP connections to fill the pipe and then report back the actual TCP throughput. Once the test is complete, all TCP metrics are clearly laid out. If changes are required to optimize the TCP performance, the technician will have all the values needed to rectify the situation. In the end, the RFC 6349 test helps to resolve any potential discrepancies occurring between the service provider network and the customer premises equipment.


PATH MTU Discovery

Baseline RTT and Bandwidth to Determine the Ideal Window Size

Single or Multiple TCP Connections to Enable Full Pipe Testing

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CARRIER ETHERNET OAM

Ever since the introduction of metro Ethernet networks, there has been a need to ensure "*five nines*" level of availability, and reliability, as well as a 50 millisecond recovery time from failures. As per PDH, time-division multiplexing (TDM) and SONET/SDH, operations, administration and maintenance (OAM) has become a crucial network component that has enabled the same quality for carrier-class Ethernet.

The FTBx-8870/8880 offers a new application that validates the mechanics of the service operation, administration and maintenance (S-OAM) tools, covering ITU-T Y.1731, IEEE 802.1ag, IEEE 802.3ah, ITU-T G.8113.1 (MPLS-TP) and MEF modes. The features of this application include continuity check generation and monitoring, loopback testing, frame loss, synthetic loss and frame delay. There is also an S-OAM link trace and responder.

Carrier Ethernet OAM
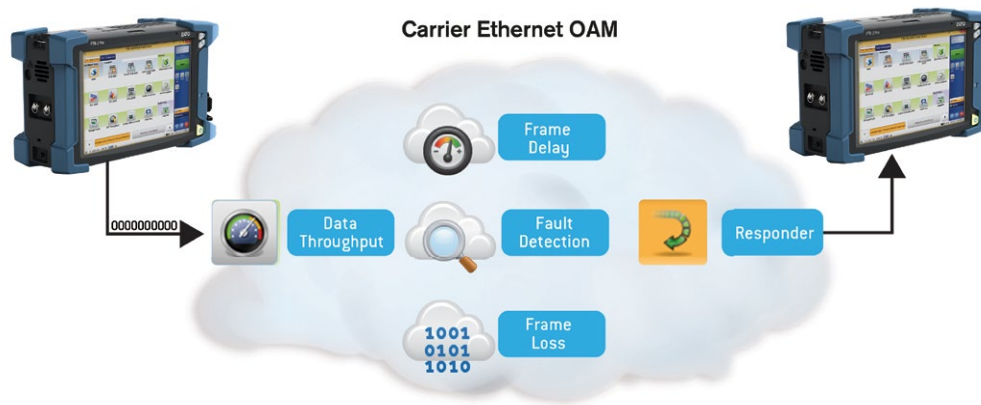
Packet Capture

The capturing power of EXFO's FTBx-8870/8880 extends far beyond basic capabilities. The FTBx-8870/8880 adds extra features and functionalities to boost test cycle efficiency and provide more value. Its packet capture tool offers comprehensive filtering, triggering and truncation methods to target specific traffic and quickly pinpoint issues in the lab and in the field.
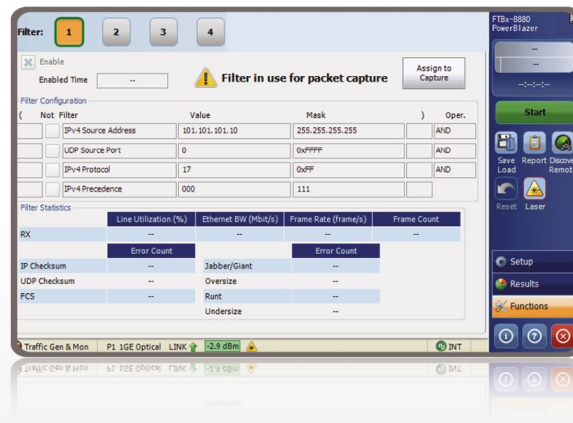
Advanced Traffic Filtering

In some cases, troubleshooting only concerns a particular traffic flow. The advanced traffic-filtering capability of the FTBx-8870/8880 allows you to restrict traffic by using up to four matching fields and operands (and, or, not). A complete set of triggers is available, such as MAC, IP and TCP/UDP fields, as well as VLAN and MPLS fields.

EFFICIENTLY ASSESSING THE PERFORMANCE OF FIBRE CHANNEL SERVICES

The FTBx-8870/8880 modules provide comprehensive testing capabilities for Fibre Channel (FC) network deployments, supporting multiple FC interfaces.

APPLICATIONS

Since most storage area networks (SANs) cover large distances, and because FC has stringent performance requirements, it is imperative to test at each phase of network deployment to ensure appropriate service levels. EXFO's FTBx-8870/8880 modules provide full wire-speed traffic generation at the FC2 layer, which allows for BER testing for link integrity measurements. The FTBx-8870/8880 also supports latency, buffer-to-buffer credit measurements for optimization, as well as login capabilities.

Latency

Transmission of frames in a network is not instantaneous, and is subject to multiple delays caused by the propagation delay in the fiber and the processing time inside each piece of network equipment. Latency is the total accumulation of delays between two endpoints. Some applications, such as VoIP, video and storage area networks, are very sensitive to excess latency.

Therefore, it is critical for service providers to properly characterize network latency when offering FC services. The FTBx-8870/8880 modules estimate buffer-to-buffer credit value requirements from the performed latency measurement.

Buffer-to-Buffer Credit Estimation

In order to regulate traffic flow and congestion, FC ports use *buffers* to temporarily store frames. The number of frames a port can store is referred to as a *buffer credit*. Each time a frame is received by a port, an acknowledgement frame is sent. The buffer-to-buffer credit threshold refers to the amount of frames a port can transmit without receiving a single acknowledgement.

This is a crucial configuration parameter for optimal network performance. Usually, network administrators calculate the value by taking the traveled distance and the data rate into consideration; however, since latency issues are not considered, poor accuracy is to be expected. The FTBx-8870/8880 modules are capable of estimating buffer credit values with respect to latency by calculating the distance according to the round-trip latency time. This value can then be used by network administrators to optimize the network configuration.

Login Testing

Most new-generation transport devices (xWDM or SONET/SDH mux) supporting FC are no longer fully transparent; they also have increased built-in intelligence, acting more as FC switches. With switch fabric login ability, the FTBx-8870/8880 modules support connections to a remote location through a fabric or semitransparent network.

The login process not only permits the unit to connect through a fabric, but it also exchanges some of the basic port characteristics (such as buffer-to-buffer credit and class of service) in order to efficiently transport the traffic through the network.

The login feature allows for automatic detection of port/fabric login, login status (successful login, in progress, failure and logout) and response to remote buffer-to-buffer advertised credit.

COMPLETE SUITE OF FIBRE CHANNEL INTERFACES		
Interface	Signal Rate (Gbit/s)	Data Rate (MB/s)
1X	1.0	100
2X	2.1	200
4X	4.2	400
8X	8.5	800
10X	10.5	1200
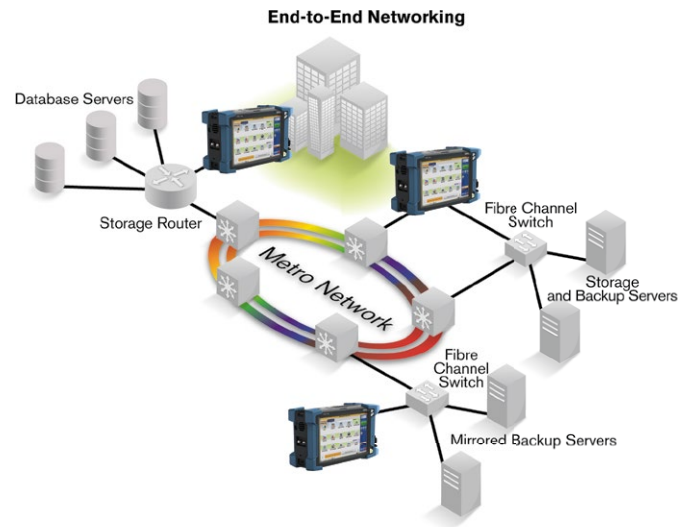
Thanks to end-to-end network testing capabilities, EXFO's FTBx-8870/8880 Power Blazer Series enables fast deployment and configuration of FC networks. Communication between the transport network, interconnection devices and end nodes can be validated with features such as BER testing, latency measurement, buffer-to-buffer credit estimation and port login capabilities.

EXFO

EXFO TFv

EXFO TFv

EXFO TFv—Test Function Virtualization is a cloud-based suite of defined offerings for service providers who are looking to scale their testing requirements to their specific needs. Under the EXFO TFv umbrella are FTB Anywhere floating licenses, and the newly launched FTB OnDemand time-based software licenses.

FTB Anywhere: Floating Test Licenses

FTB Anywhere is an EXFO Connect-enabled offering that allows FTB platform users to share floating test licenses and get the required functionality—anywhere, anytime. In short, the customer owns the software licenses and can share them between FTB platforms.

FTB OnDemand: Time-Based Software Licenses

FTB OnDemand allows customers to activate time-based software licenses covering a wide range of test functionalities to match their exact needs. FTB OnDemand enables users to obtain a license for a specific test for a specific module for a specific period of time. FTB OnDemand is available for a number of best-in-class EXFO test modules. For a complete list of all the available modules, visit our FTB OnDemand web page.

EXFO Connect

AUTOMATED ASSET MANAGEMENT. PUSH TEST DATA IN THE CLOUD. GET CONNECTED.

EXFO Connect pushes and stores test equipment and test data content automatically in the cloud, allowing you to streamline test operation from build-out to maintenance.

EXpert TEST TOOLS ON THE FTB-2 PRO PLATFORM

EXpert Test Tools is a series of platform-based software testing tools that enhance the value of the FTB-2 Pro platform, providing additional testing capabilities without the need for additional modules or units.

EXpert TEST TOOLS	
EXpert VoIP TEST TOOLS	The EXpert VoIP Tools generate a voice-over-IP call directly from the test platform to validate performance during service turn-up and troubleshooting. • Supports a wide range of signaling protocols, including SIP, SCCP, H.248/Megaco and H.323 • Supports mean-opinion-score (MOS) and R-factor quality metrics • Simplifies testing with configurable pass/fail thresholds and RTP metrics
EXpert IP TEST TOOLS	The EXpert IP Tools integrate six commonly used datacom test tools into one platform-based application to ensure that field technicians are prepared for a wide range of testing needs. • Rapidly performs debugging sequences with VLAN scan and LAN discovery • Validates end-to-end ping and traceroute • Verifies FTP performance and HTTP availability
EXpert IPTV TEST TOOLS	This powerful IPTV quality-assessment solution enables set-top box emulation and passive monitoring of IPTV streams, allowing for quick and easy pass/fail verification of IPTV installations. • Real-time video preview • Analyzes up to 10 video streams • Comprehensive QoS and quality-of-experience (QoE) metrics, including MOS score

EXFO

SPECIFICATIONS

FIBRE CHANNEL FUNCTIONAL SPECIFICATIONS

TESTING 1x, 2x, 4x, 8x, 10x

BERT	Framed FC2
Patterns (BERT)	PRBS 2E31-1, 2E23-1, 2E20-1, 2E15-1, 2E11-1, 2E9-1, one user-defined pattern and capability to invert patterns
Error insertion	Bit error, amount and rate
Error measurement	Bit error, symbol error, oversize error, crc error, undersize error and block error (10x only)
Alarm detection	LOS, pattern loss, link down, local and remote fault (10x only)
Buffer-to-buffer credit testing	Buffer-to-buffer credity estimation based on latency
Latency	Round-trip latency

DSN/PDH AND SONET/SDH TEST FEATURES

Frequency measurements	Supports clock frequency measurements (i.e., received frequency and deviation of the input signal clock from nominal frequency), displayed in ppm, for optical and electrical interfaces. Measurements are performed using a local oscillator.
Frequency offset generation	Supports offsetting the clock of the transmitted signal on a selected interface to exercise clock recovery circuitry on network elements.
Dual DSn receivers	Supports two DS1 or DS3 receivers, allowing users to simultaneously monitor two directions of a circuit under test in parallel, resulting in quick isolation of the source of errors.
Performance monitoring	The following ITU-T recommendations, and corresponding performance monitoring parameters, are supported:

ITU-T recommendation	Performance monitoring statistics
G.821	ES, EFS, EC, SES, UAS, ESR, SESR, DM
G.826	ES, EFS, EB, SES, BBE, UAS, ESR, SESR, BBER
G.828	ES, EFS, EB, SES, BBE, SEP, UAS, ESR, SESR, BBER, SEPI
G.829	ES, EFS, EB, SES, BBE, UAS, ESR, SESR, BBER
M.2100	ES, SES, UAS
M.2101	ES, SES, BBE, UAS

Pointer adjustment and analysis	Generation and analysis of HO/AU and LO/TU pointer adjustments as per GR-253, and ITU-T G.707

Generation	Analysis
› Pointer increment and decrement	› Pointer increments
› Pointer jump with or without NDF	› Pointer decrements
› Pointer value	› Pointer jumps (NDF, no NDF)
	› Pointer value and cumulative offset

Service-disruption-time (SDT) measurements	The service disruption time test tool measures the time during which there is a disruption of service due to the network switching from the active channels to the backup channels. Measurements: last disruption, shortest disruption, longest disruption, average disruption, total disruption, and service disruption count.
Round-trip delay (RTD) measurements	The round-trip delay test tool measures the time required for a bit to travel from the NetBlazer transmitter back to its receiver after crossing a far-end loopback. Measurements are provided on all supported NetBlazer interfaces and mappings. Measurements: last, minimum, maximum, average; measurement count: number of successful RTD tests and failed measurement count.
APS message control and monitoring	Ability to monitor and set up automatic protection switching messages (K1/K2 byte of SONET/SDH overhead).
Synchronization status	Ability to monitor and set up synchronization status messages (S1 byte of SONET/SDH overhead).
Signal label control and monitoring	Ability to monitor and set up payload signal labels (C2, V5 byte of SONET overhead).
Tandem connection monitoring (TCM) [a]	Tandem connection monitoring (TCM) is used to monitor the performance of a subsection of a SONET/SDH path routed via different network providers. The NetBlazer supports transmitting and receiving alarms and errors on a TCM link; also, transmission and monitoring of the tandem connection (TC) trace can be generated to verify the connection between TCM equipment. Error generation: TC-IEC, TC-BIP, TC-REI, TC-OEI. Error analysis: TC-IEC, TC-REI, TC-OEI, TC-VIOL (non-standardized alarm). Alarm generation: TC-RDI, TC-UNEQ, TC-ODI, TC-LTC, TC-IAIS. Alarm analysis: TC-TIM, TC-RDI, TC-UNEQ, TC-ODI, TC-LTC, TC-IAIS
Pointer sequence testing	Perform pointer sequence testing as per G.783, GR253 and T1.105-3 standards.
M13 mux/demux	Ability to multiplex/demultiplex a DS1 signal into/from a DS3 signal. (Note: E1 to DS3 mux/demux available with G.747 software option.)
DS1 FDL	Support for DS1 Facility Data Link testing.
DS1 loopcodes	Support for generation of DS1 in-band loopcodes with the availability of up to 10 pairs of user-defined loopcodes.
NI/CSU loopback emulation	Ability to respond to DS1 in-band/out-of-band loopcodes.
DS3 FEAC	Support for DS3 far-end alarms and loopback code words.
DS1/DS3 autodetection	Ability to automatically detect DS1/DS3 line coding, framing and test pattern.
DS1 multipattern	BER test that includes five automated patterns: all ones, 1-in-8, 2-in-8, 3-in-2, QRSS
DS1 signaling bits	Ability to monitor the ABCD signaling bits for all 24 DS0 channels
Through mode	Perform Through mode analysis of any incoming electrical (DSn, PDH, SONET, SDH) and optical line (OC-1/STM-0, OC-3/STM-1, OC-12/STM-4, OC-48/STM-16, OC-192/STM-64) transparently.

Note

a. HOP and LOP supported as per ITU-T G.707 option 2.

OTN TEST FEATURES

OTN	Standards compliance	ITU-T G.709, ITU G.798, ITU G.872
	Interfaces	OTU1 (2.6660 Gbit/s), OTU2 (10.7092 Gbit/s), OTU1e (11.0491 Gbit/s), OTU2e (11.0957 Gbit/s), OTU1f (11.2701 Gbit/s), OTU2f (11.3176 Gbit/s)
OTU layer	Errors	OTU-FAS, OTU-MFAS, OTU-BEI, OTU-BIP-8
	Alarms	LOF, OOF, LOM, OOM, OTU-AIS, OTU-TIM, OTU-BDI, OTU-IAE, OTU-BIAE
	Traces	64-byte trail trace identifier (TTI), as defined in ITU-T G.709
ODU TCM layer	Errors	TCMi-BIP-8, TCMi-BEI (i = 1 to 6)
	Alarms	TCMi-LTC, TCMi-TIM, TCMi-BDI, TCMi-IAE, TCMi-BIAE
	Traces	64-byte trail trace identifier (TTI), as defined in ITU-T G.709
ODU layer	Errors	ODU-BIP-8, ODU-BEI
	Alarms	ODU-AIS, ODU-OCI, ODU-LCK, ODU-TIM, ODU-BDI, ODU-FSF, ODU-BSF, ODU-FSD, ODU-BSD
	Traces	Generates 64-byte trail trace identifier (TTI), as defined in ITU-T G.709
	FTFL [b]	As defined in ITU-T G.709
OPU layer	Alarms	OPU-PLM, OPU-AIS, OPU-CSF
	Payload-type (PT) label	Generates and displays received PT value
Forward error correction (FEC)	Errors	FEC-correctable (codeword), FEC-uncorrectable (codeword), FEC-correctable (symbol), FEC-correctable (bit), and FEC-stress (codeword)
Pattern	Patterns	2E-9, 2E-15, 2E-20, 2E-23, 2E-31, NULL, 32-bit programmable (inverted or non-inverted)
	Error	Bit error
	Alarm	Pattern loss

ADDITIONAL OTN FUNCTION

Frequency measurements	Supports clock frequency measurements (i.e., received frequency and deviation of the input signal clock from nominal frequency), displayed in ppm. Measurements are performed using a local oscillator.
Frequency offset generation	Supports offsetting the clock of the transmitted signal on a selected interface to exercise clock recovery circuitry on network elements.
Performance monitoring	The following ITU-T recommendations and corresponding performance monitoring parameters are supported: **ITU-T recommendation** **Performance monitoring statistics** G.821 ES, EFS, EC, SES, UAS, ESR, SESR, DM M.2100 ES, SES, UAS
Service-disruption-time (SDT) measurements	The service disruption time test tool measures the time during which there is a disruption of service due to the network switching from the active channels to the backup channels. Measurements: last disruption, shortest disruption, longest disruption, average disruption, total disruption, and service disruption count.
Round-trip-delay (RTD) measurements	The round-trip-delay test tool measures the time required for a bit to travel from the transmitter back to its receiver after crossing a far-end loopback. Measurements are supported on all interfaces and mappings. Measurements: last RTD time, minimum, maximum, average, measurement count (number of successful RTD tests) and failed measurement count.
Through mode	Performs Through mode analysis of any incoming OTN signal transparently.

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ETHERNET TEST FEATURES

EtherSAM (ITU-T Y.1564)	Perform service configuration and service performance tests as per ITU-T Y.1564 including EBS, CBS and EMIX. Tests can be performed using remote loopback or Dual Test Set mode for bidirectional results.
iSAM	Simplified ITU-T Y.1564 test that performs service configuration and service performance tests using Remote Loopback or Dual Test Set mode for bidirectional results; an additional, completely automated RFC 6349 test can be run in conjunction with the EtherSAM (Y.1564) tests, or on its own to perform layer-4 TCP testing, with the inclusion of discovering the maximum transmission unit (MTU) and round-trip time (RTT), as well as the actual and ideal TCP throughput of the circuit under test.
RFC 2544	Throughput, back-to-back, frame loss and latency measurements according to RFC 2544; frame size: RFC-defined or user-configurable between one to seven sizes
RFC 6349	Performs TCP testing up with single or multiple TCP connections from 10BASE-T up to 10G. Discovers the MTU, RTT, actual and ideal TCP throughput
Traffic generation and monitoring	Traffic generation and shaping of up to 16 streams of Ethernet and IP traffic including the simultaneous monitoring of throughput, frame loss, packet jitter, latency and out-of-sequence frames. Also includes the ability to generate fixed, random and frame size sweep, as well as MAC flooding.
Carrier Ethernet OAM	Supports four S-OAM modes, MEF, Y.1731, G.8113.1 (MPLS-TP) and 802.1ag. CCM generation and monitoring, loopback, test, frame loss, synthetic loss and frame delay. Alarm generation: AIS, RDI, LCK, CSF(C-LOS, C-RDI, C-FDI, C-DCI). Alarm monitoring: RDI, AIS, LCK, CSF, loss of continuity, mismerge, unexpected MEP, unexpected MEG/MD level, unexpected period supports S-OAM responder, S-OAM link trace, ping and trace route, filters and packet capture.
Packet capture and filters	Ability to perform 10BASE-T all the way up to 10 GigE full line-rate packet capture and decode. Ability to configure filter full line-rate data capture and decoding up to 10G; configuration of capture filters and triggers as well as capture slicing parameters.
Through mode	Sectionalize traffic between a service provider's network and customer premises equipment.
BER testing	Up to layer 4 supported with or without VLAN Q-in-Q.
Patterns (BERT)	PRBS 2E9-1, PRBS 2E11-1, PRBS 2E15-1, PRBS 2E20-1, PRBS 2E23-1, PRBS 2E31-1 and one user pattern. Capability to invert patterns.
Error measurement (BERT)	Bit error, bit mismatch 0, bit mismatch 1.
Traffic Scan	Discover up to three levels of VLAN tagged traffic (C/S/E VLAN) including their ID and priority as well as the total VLAN tagged frame count and associated bandwidth
VLAN stacking	Generates up to three layers of VLAN (including IEEE 802.1ad and Q-in-Q tagged VLAN).
VLAN preservation	Validates that CE-VLAN tags classes of service (CoS), and that ID is passed transparently through the network.
MPLS	Generate and analyze streams with up to two layers of MPLS labels.
Cable testing	The cable test application provides test functions to diagnose UTP cables transmitting Ethernet over twisted pair. It verifies connectivity errors and evaluates cabling performance. The cable test can optionally simulate a PoE powered device to verify if a PoE-powered device to verify whether PoE power-sourcing equipment is capable of delivering adequate power prior to connection of a powered device.
PoE	Applicable rates: 10M to 1000M electrical, meets 802.3at (802.3 Section 33) unloaded and loaded testing, identification of cable pairs carrying power and polarity, voltage/current/power measurement on each pair, and user-configurable power class (0 to 4).
Service disruption time (SDT)	Includes statistics such as longest, shortest, last, average, count, total and pass/fail thresholds.
IPv6 testing	Performs the following tests up to 10G over IPv6, EtherSAM, RFC 2544, BERT, traffic generation and monitoring, Through mode, intelligent auto discovery, ping and traceroute.
10 GigE WAN testing	Includes WAN interface sublayer, J0/J1 trace and C2 label generation, J0/J1 trace and C2 label monitoring.
10 GigE WAN alarm monitoring	Includes SEF, LOF, AIS-L, RDI-L, AIS-P, RDI-P, LCD-P, LOP-P, PLM-P, UNEQ-P, ERDI-P, WIS link down, B1, B2, B3, REI-L, REI-P.
TCP throughput	True wire-speed, TCP throughput test for undisputable SLA reinforcement for Ethernet services.
One-way delay	Measurement of the one-way frame delay at up to 10G as part of EtherSAM (Y.1564) and RFC 2544.
Error measurement	Jabber/giant, runt, undersize, oversize, FCS, symbol, alignment, collision, late collision, excessive collision, IP checksum, UDP checksum, TCP checksum and 10G block error.
Alarm detection	LOS, link down, pattern loss, frequency, LOC, 10G local/remote fault.
Flow control	Inject or monitor pause frames, including frame counts of pause, abort frames and total, last, maximum and minimum pause time.
Batch configuration	Ability to automatically set a specific source IP address, subnet mask, default gateway, DHCP, destination MAC address or destination IP address to one or all EtherSAM services or traffic generation streams.
Dual port	Dual-port testing with EtherSAM (ITU-T Y.1564), RFC 2544, EtherBERT, and traffic generation and monitoring when using 10/100/1000 BASE-T, 100BASE-X, GigE and 10 GigE.

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ADDITIONAL FEATURES

CPRI layer-2 protocol testing	Supports BTS and RRH emulation modes by supporting start-up sequence states, autodetection of protocols, negotiated parameters for control and maintenance, Ethernet and HDLC channels, hyperframe and code word counts, injection and monitoring of layer-1 alarms and frequency and RTD (round trip delay) measurement.
CPRI BER testing	Includes unframed and framed BER measurment, bit error injection, round-trip delay measurement, and pass/fail verdicts for 1.2 to 9.8 Gbit/s rates.
CPRI SDT	Measurements in ms for the longest, shortest, last, average, total and count of disruptions.
1588 PTP	Validates 1588 PTP packet network synchronization services, emulates PTP clients, generates and analyzes messages between master/clients, clock quality level and IPDV.
G82751	Precision-time-protocol profile for phase and time synchronization with full timing support from the network.
SyncE	Validates SyncE frequency, ESMC messages and clock quality levels.
Power measurement	Supports power measurement at all times, displayed in dBm (dBdsx for DS1 and DS3), for optical and electrical interfaces.
Power-up and restore	In the event of power failure to the unit, the active test configuration and test logger are saved and restored upon boot-up.
Save and load configuration	Store and load test configurations to/from a non-volatile USB memory stick or internal flash.
Pass/fail analysis	Provides a pass/fail outcome with user-adjustable thresholds, based on bit error rate and/or service disruption time.
Alarm hierarchy	Alarms are displayed according to a hierarchy based on root cause. Secondary effects are not displayed. This hierarchy serves to facilitate alarm analysis.
Report generation	Generate test reports with customizable selections, company logos and clear pass/fail color-coded analysis, in both HTML and PDF formats, and save them directly on the unit, on a USB stick or via EXFO Connect.
Event logger	Log test results with absolute or relative time and date, details and duration of events, color-coded events and pass/fail outcome.
Remote control	Remote control via VNC or Remote Desktop.
Remote loopback	Detects other NetBlazer/PowerBlazer units and sets them to Smart Loopback mode.
Dual Test Set	Detects and connects to other NetBlazer/Power Blazer units to perform bidirectional EtherSAM, RFC 6349 and RFC 2544 testing.
IP tools	Performs ping and traceroute functions.
Smart Loopback	Return Ethernet traffic to the local unit by swapping packet overhead up to layer 4.
Test timer	Select a predefined duration or enter start and stop times.

UPGRADES

SFP upgrades	FTB-8590	SFP module GigE/FC/2FC, CPRI/OBSAI 2.45/3.07 Gbit/s at 850 nm, MM, <500 m
	FTB-85910	SFP modules 100BASE-FX, 1340 nm, MM, 2 km
	FTB-85911	SFP modules 100BASE-LX10, 1310 nm, SM, 15 km
	FTB-85912	SFP modules GigE/FC/2FC/4FC at 850 nm, <500 m
	FTB-8190	SFP module; rates: 155/622 Mbit/s, 2.5/2.7 Gbit/s, GigE/FC/2FC, CPRI/OBSAI 2.45/3.07 Gbit/s at 1310 nm, LC connector, 15 km reach
	FTB-8191	SFP module; rates: 155/622 Mbit/s, 2.5/2.7 Gbit/s, GigE/FC/2FC; CPRI/OBSAI 2.45/3.07 Gbit/s at 1310 nm, LC connector, 40 km reach
	FTB-8192	SFP module; rates: 155/622 Mbit/s, 2.5/2.7 Gbit/s, GigE/FC/2FC; 1550 nm, LC connector, 80 km reach
	FTB-8193	SFP module; rates: 155/622 Mbit/s, 2.5/2.7 Gbit/s, GigE/FC/2FC; 1550 nm, LC connector, 40 km reach
	FTB-85913	SFP modules GigE/FC/2FC/4FC at 1310 nm, 4 km
	FTB-85914	SFP modules GigE/FC/2FC/4FC at 1310 nm, 30 km
	FTB-85915	SFP modules GigE/FC/2FC/4FC at 1550 nm, <50 km
	FTB-85919	SFP copper, multirate 10/100/1000 BASE-T, Cat5 UTP 100 m reach
SFP+ upgrades	SFP-8600	SFP+ modules CPRI 1.228 to 9.83 Gbit/s at 1310 nm, LC connector, 1.4 km
	SFP-8601	SFP+ 10G (1.25 Gbit/s to 10.3125 Gbit/s) CWDM at 1471 nm, LC SMF, 10 km
	SFP-8602	SFP+ 10G (1.25 Gbit/s to 10.3125 Gbit/s) CWDM at 1511 nm, LC SMF, 10 km
	FTB-8690	SFP+ modules 10FC/10 GigE at 850 nm, MM, 300 m
	FTB-8691	SFP+ modules 10 GigE at 1310 nm, 10 km
	FTB-8693	SFP+ modules 9.953 to 10.709/11.3, 8FC/10FC/10 GigE at 1310 nm, SMF, 10 km
	FTB-8694	SFP+ modules 8FC/10FC/10 GigE at 1550 nm, 40 km
	FTB-8695	SFP+ modules 8FC/10FC/10 GigE at 1550 nm, 80 km
Bidirectional SFP upgrades	FTB-8596	SFP modules: bidirectional 1490 Tx 1310 Rx 1000BASE-BX10
	FTB-8597	SFP modules: bidirectional 1310 Tx 1490 Rx 1000BASE-BX10
	FTB-8598	SFP modules: bidirectional 1310 Tx 1490/1550 Rx 1000BASE-BX
	FTB-8599	SFP modules: bidirectional 1550 Tx 1310 Rx 1000BASE-BX

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GENERAL SPECIFICATIONS

MODULE VERSIONS	FTBx-8880	FTBx-8870
Size (H x W x D)	118 mm x 25 mm x 160 mm (4 ⅝ in x 1 in x 6 ⅜ in)	
Weight	0.41 kg (0.9 lb)	0.35 kg (0.75 lb)
Temperature 　Operating 　Storage	0 ℃ to 40 ℃ (32 ℉ to 104 ℉)) −40 ℃ to 70 ℃ (−40 ℉ to 158 ℉)	

ORDERING INFORMATION

FTBx-8880-XX-XX-XX-XX-XX-XX-XX

Test options ■
SONET = SONET testing
SDH = SDH testing
SONET-SDH = SONET and SDH testing

Transport rate options ■
52M = 52 Mbit/s (OC-1/STM-0) [a]
155M = 155 Mbit/s (OC-3/STM-1)
622M = 622 Mbit/s (OC-12/STM-4)
2488M = 2.5 Gbit/s (OC-48/STM-16)
9953M = 10 Gbit/s (OC-192/STM-64)

Software options ■
DS3-G747 = G.747 test capability
DS1-FDL = DS1 FDL test capability
DUAL-RX = DS1/DS3 dual Rx testing
DS3-FEAC = DS3 FEAC test capability
TCM = Tandem connection monitoring
DSn = DSn test capability
PDH = PDH test capability
NI-CSU = NI-CSU loopback emulation
Cable_test = Cable test
IPV6 = Internet protocol version 6
ETH-THRU = Through mode capability
MPLS = Enables MPLS
1588PTP = Generates and analyzes 1588 PTP
G82751 = Enables ITU-T G.8275.1 profile
SyncE = Generates and analyzes SyncE protocol
TCP-THPUT = TCP throughput
ETH-OAM = Enables Y.1731, G.8113.1 (MPLS-TP), 802.1ag and MEF
LINK-OAM = Enables 802.3ah Link OAM
TST-OAM = Enables OAM testing within EtherSAM application
ADV-FILTERS = Advanced filtering
ETH-CAPTURE = Full line-rate packet capture
DUAL-PORT = Dual-port testing for any enabled Ethernet rate
DP-CPRI = Dual-port testing for any enabled CPRI rate
iSAM = Enables simplified Y.1564 test
RFC6349 = Enables TCP testing as per RFC 6349
POE = Enables Power over Ethernet capability
TRAFFIC-SCAN = Discover and monitor VLAN traffic flows on a live signal

CPRI/OBSAI rate options ■
CPRI-OBSAI = Enables 1.2G to 3.1G CPRI, and 3.1G OBSAI [b]
CPRI-4.9G [c]
CPRI-6.1G [c]
CPRI-9.8G [c]

OTN rate options ■
OTU1 = OTN optical rate 2.666 Gbit/s
OTU2 = OTN optical rate 10.709 Gbit/s
OTU2-1e-2e = OTN optical rates 11.049/11.096 Gbit/s
OTU2-1f-2f = OTN optical rates 11.270/11.318 Gbit/s

Fibre Channel rate options ■
FC1X = 1x Fibre Channel interface [b]
FC2X = 2x Fibre Channel interface [b]
FC4X = 4x Fibre Channel interface [b]
FC8X = 8x Fibre Channel interface [c]
FC10X = 10x Fibre Channel interface [c]

Ethernet rate options ■
100optical = 100 Mbit/s optical
GigE = 1000 Mbit/s optical and electrical
10GigE = 10G LAN and 10G WAN

Example: FTBx-8880-SONET-SDH-155m-DSn-GigE

Notes
a. Always included.
b. Requires purchase of SFP.
c. Requires purchase of SFP+.

EXFO

ORDERING INFORMATION

FTBx-8870-XX-XX-XX-XX-XX-XX-XX

Test options
SONET = SONET testing
SDH = SDH testing
SONET-SDH = SONET and SDH testing

Transport rate options
52M = 52 Mbit/s (OC-1/STM-0) [a]
155M = 155 Mbit/s (OC-3/STM-1)
622M = 622 Mbit/s (OC-12/STM-4)
2488M = 2.5 Gbit/s (OC-48/STM-16)
9953M = 10 Gbit/s (OC-192/STM-64)

Software options
DS1-FDL = DS1 FDL test capability
TCM = Tandem connection monitoring
DSn = DSn test capability
PDH = PDH test capability
NI-CSU = NI-CSU loopback emulation
Cable_test = Cable test
IPV6 = Internet protocol version 6
ETH-THRU = Through mode capability
MPLS = Enables MPLS
1588PTP = Generates and analyzes 1588 PTP
G82751 = Enables ITU-T G.8275.1 profile
SyncE = Generates and analyzes SyncE protocol
TCP-THPUT = TCP throughput
ETH-OAM = Enables Y.1731, G.8113.1 (MPLS-TP), 802.1ag and MEF
LINK-OAM = Enables 802.3ah Link OAM
TST-OAM = Enables OAM testing within EtherSAM application
ADV-FILTERS = Advanced filtering
ETH-CAPTURE = Full line-rate packet capture
DUAL-PORT = Dual-port testing for any enabled Ethernet rate
DP-CPRI = Dual-port testing for any enabled CPRI rate
iSAM = Enables simplified Y.1564 test
RFC6349 = Enables TCP testing as per RFC 6349
POE = Enables Power over Ethernet capability
TRAFFIC-SCAN = Discover and monitor VLAN traffic flows on a live signal

CPRI/OBSAI rate options
CPRI-OBSAI = Enables 1.2G to 3.1G CPRI, and 3.1G OBSAI [b]
CPRI-4.9G [c]
CPRI-6.1G [c]
CPRI-9.8G [c]

OTN rate options
OTU1 = OTN optical rate 2.666 Gbit/s
OTU2 = OTN optical rate 10.709 Gbit/s
OTU2-1e-2e = OTN optical rates 11.049/11.096 Gbit/s
OTU2-1f-2f = OTN optical rates 11.270/11.318 Gbit/s

Fibre Channel rate options
FC1X = 1x Fibre Channel interface [b]
FC2X = 2x Fibre Channel interface [b]
FC4X = 4x Fibre Channel interface [b]
FC8X = 8x Fibre Channel interface [c]
FC10X = 10x Fibre Channel interface [c]

Ethernet rate options
100optical = 100 Mbit/s optical [b]
GigE = 1000 Mbit/s optical and electrical [b]
10GigE = 10G LAN and 10G WAN [c]

Example: FTBx-8870-SONET-SDH-155m-IPV6-GigE-FC1X-OTU1

Notes
a. Always included.
b. Requires purchase of SFP.
c. Requires purchase of SFP+.

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