NetBlazer V2 Series
High-Speed Portable Field Testers

SMARTER TESTING FOR ALL THINGS 64K TO 100G

The NetBlazer V2 Series is the industry's most complete and portable 64K TO 100G test solution. Optimize your field technicians' tasks with simultaneous coverage of legacy and high speed network interfaces.

KEY FEATURES AND BENEFITS

Platform Highlights

Windows 8.1 (bring your own device, install what you want)

Custom-designed platform with 128GB of onboard memory, including a micro SD card interface (massively expand the memory)

Built-in connectivity—choose between Gigabit interface, Wi-Fi, Bluetooth, and 3G or 4G LTE via USB dongle

Lightweight and portable solution with an ultra-bright, 8-in multitouch screen

High Speed Interfaces

Pluggable CFP4 and QSFP28 optics to facilitate the testing of next-generation 100G networks

Pluggable QSFP+ interface for 40GE

Transport Testing

OTU1, OTU1e/1f, OTU2, OTU2e/2f, OTU3, OTU3e1/e2, OTU4

Electrical SONET and SDH testing STS-1e/3e and STM-0e/1e

DSn testing DS1, DS3 and dual DS1/DS3 RX

Plesiochronous digital hierarchy (PDH) testing: E1, E3 and E4

ISDN PRI for DS1 or E1

Round-trip delay on all interfaces and payload mappings

Service disruption measurements on all interfaces and mappings

Overhead monitoring and modification for all time slots

Pointer adjustment

Ethernet/Fibre Channel/FTTA Testing

Dual-port or quad-port testing up to 10G

Single port testing from 40G to 100G

iSAM: ultra-simple ITU-T Y.1564 and RFC 6349 service activation methodology

10M to 100G multisession transmission control protocol (TCP) testing with bidirectional RFC 6349

Power-over-Ethernet validation within cable test

EtherSAM (Y.1564), RFC 2544, traffic generation and monitoring, EtherBERT, Through Mode, Smart Loopback and second-port loopback tool

Packet synchronization, including IEEE 1588v2 PTP and SyncE

Carrier Ethernet OAM, including ITU-T Y.1731, IEEE 802.1ag, IEEE 802.3ah Link OAM

Packet capture and advanced filtering up to 100G

Fibre Channel 1x, 2x, 4x, 8x, 10x and 16x support

Dual port and Quad Port CPRI testing up to 9.8G

CPRI base-station (BTS) emulation from 1.2G to 9.8G

CPRI remote-radio-head (RRH) emulation from 1.2G to 9.8G

CPRI framed and unframed BER from 1.2G to 9.8G with PRBS stress

Patterns and latency measurements

PLATFORM COMPATIBILITY

Platform
FTB-1 Pro

CHOOSE THE RIGHT NETBLAZER FOR YOU

NETBLAZER V2 MODULES	FTB-870V2	FTB-880V2	FTB-870Q	FTB-880Q	NetBlazer 100G	
					FTB-890	FTB-890NGE
DSn/PDH (DS1/E1)	●	●	●	●		●
ISDN PRI	●	●	●	●		●
DSn/PDH (DS3, E3 and E4)		●		●		●
OTN (OTU1/OTU2)	●	●	●	●	●	●
OTN (OTU3/OTU4)					●	●
SONET/SDH (up to 10G)	●	●	●	●	●	●
SONET/SDH (electrical)		●		●		●
Fibre Channel (1x, 2x, 4x, 8x and 10x)	●	●	●	●	●	●
Fibre Channel (16x)					●	●
1588 PTP/SyncE	●	●	●	●	●	●
Carrier Ethernet OAM	●	●	●	●	●	●
RFC 6349 (up to 10G TCP)	●	●	●	●	●	●
RFC 6349 (up to 100G TCP)					●	●
CPRI (1.2G up to 9.8G)	●	●	●	●	●	●
Dual-port Ethernet & CPRI testing	●	●	●	●		●
Quad-port Ethernet & CPRI testing			●	●		
Simultaneous transport/Ethernet testing			●	●		

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TEST SPEEDS UP TO 100G

FTB-890 NetBlazer

The FTB-890 NetBlazer is the entry level 10M to 100G tester that covers a wide range of technologies including Ethernet, OTN, SONET/SDH, CPRI and Fibre Channel.

FTB-890NGE NetBlazer

The FTB-890NGE NetBlazer is the most comprehensive all-in-one tester, including testing for legacy networks at 64K all the way up to next generation networks at speeds of 100G.

TEST SPEEDS UP TO 10G


FTB-880v2 NetBlazer

The FTB-880v2 NetBlazer is the field technician's go-to solution covering all things 10G. Fully loaded Ethernet testing includes iSAM and RFC 6349 with GigE and 10 GigE dual ports, OTN, SONET/SDH, DSn/PDH, ISDN PRI, fiber-to-the-antenna (FTTA), Fibre Channel and packet synchronization.

FTB-880Q NetBlazer

Double up everything the FTB-880v2 NetBlazer has to offer, and you get the FTB-880Q NetBlazer. The FTB-880Q is designed for maximum field-technician efficiency through accelerated processes running up to four simultaneous tests, as well as completely independent tests with zero restrictions. The FTB-880Q (and the FTB-870Q) are the only handheld testers offering quad-port GigE and quad-port 10 GigE.

STREAMLINED FOR EASE OF USE
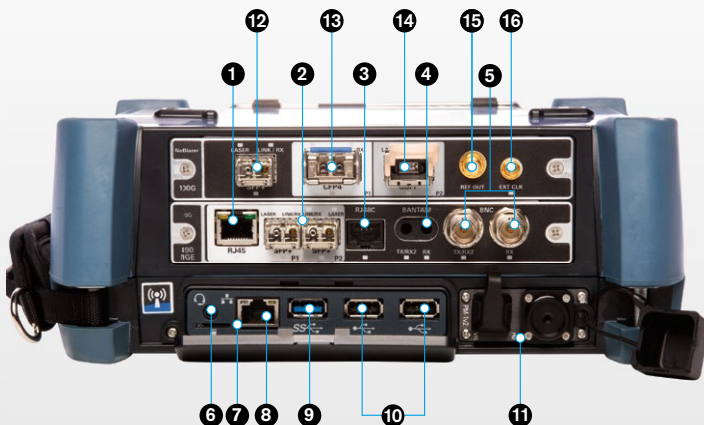
1 ETHERNET
10 to 1000 BASE-T

2 OPTICAL 10G
CPRI 1.2 to 9.8G
OC-192/STM-64,
OC-48/STM-16,
OC-12/STM-4,
OC-3/STM-1,
OC-1/STM-0, OTU1, OTU2,
OTU1e, OTU2e, OTU1f,
OTU2f, 10GE LAN/WAN,
Ethernet 10/100/1000
Base-T, 100M/1G optical,
FC 1x, 2x, 4x, 8x, 10x.

3 DSn/PDH
EXT CLK

4 DSn/PDH
RX2: DS1
EXT CLK

5 Electrical
SONET/SDH
DSn/PDH
RX2: DS1/DS3
EXT CLK

6 Mic/headset jack

7 Micro SD card slot

8 1 GigE port

9 One USB 3.0 port

10 Two USB 2.0 ports

11 Power meter and VFL

12 OPTICAL 10G
Ethernet up to 10 Gbit/s
CPRI 1.2 to 9.8G
OC-192/STM-64,
OC-48/STM-16,
OC-12/STM-4,
OC-3/STM-1,
OC-1/STM-0, OTU1, OTU2,
OTU1e, OTU2e, OTU1f,
OTU2f, 10GE LAN/WAN,
Ethernet 10/100/1000
Base-T, 100M/1G optical,
FC 1x, 2x, 4x, 8x, 10x, 16x

13 HIGH SPEED
CFP4 interface
supporting OTU4, 100GE.

14 HIGH SPEED
QSFP28/QSFP+ interface
supporting OTU4, OTU3,
OTU3e1/e2, 100GE, 40GE.

15 REF CLOCK OUT
SMA interface

16 EXT CLK
SMB interface

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THE ULTRA-PORTABLE CHOICE FOR MULTISERVICE TESTING

The ongoing transition towards a converged network infrastructure for legacy DSn/PDH, ISDN, SONET/SDH, OTN, Fibre Channel, common public radio interface (CPRI) and packet-based high-speed Ethernet services requires a test tool that is capable of covering a wide range of interfaces and rates without sacrificing portability, speed or cost. Leveraging the powerful, intelligent FTB-1 Pro handheld platform, the NetBlazer V2 Series streamlines processes and empowers field technicians to test and validate DSn/PDH, ISDN, SONET/SDH, OTN, Fibre Channel, CPRI and Ethernet circuits efficiently.

Powerful and Fast

The NetBlazer V2 Series is a fully integrated DSn/PDH, ISDN, SONET/SDH, OTN, Fibre Channel, CPRI and high-speed Ethernet handheld tester. It features an 8-inch multitouch screen and unprecedented configuration simplicity. Multiple platform connectivity options including Wi-Fi, Bluetooth, Gigabit Ethernet and USB ports, make it accessible in any environment.

### DSn/PDH, ISDN SONET/SDH, OTN, FIBRE CHANNEL AND CARRIER ETHERNET UP TO 100G

Key Testing Benefits

- Up to 10G SONET/SDH
- OTN bit-error-rate (BER) testing with configurable threshold settings
- Coupled, Decoupled and Through mode testing
- Error and alarm insertion and monitoring
- Overhead monitoring and manipulation
- High-order and low-order mappings
- Tandem connection monitoring (TCM)
- Pointer manipulation, including pointer sequence testing as per Telcordia GR-253, ANSI T1.105-03 and ITU-T G.783
- Performance monitoring as per ITU-T G.821, G.826, G.828, G.829, M.2100 and M.2101
- Frequency analysis and offset generation
- Automatic protection switching
- Service-disruption-time measurements
- Round-trip delay measurements
- DS1/DS3 and E1/E3/E4 testing
- Dual DS1/DS3 receiver (Rx) support
- DS1/DS3 autodetection of line code, framing and pattern
- DS1 loop codes and NI/CSU emulation
- DS1 automated multipattern BER
- DS1/DS0 monitoring, including ABCD signaling bits
- DS1 FDL and DS3 FEAC
- Fractional T1/E1 testing
- ISDN PRI for DS1 or E1 interfaces

- External clock support
- 10Base-T to 100 GigE testing
- Quad-port testing (8XXQ module only)
- Dual-port testing
- 10M to 100G TCP throughput testing as per RFC 6349
- iSAM: ultra-simple ITU-T Y.1564 combined with RFC 6349
- EtherSAM, RFC 2544, traffic generation and monitoring, and EtherBERT
- 1588 PTP supporting G.8265.1 and G.8275.1 profiles and SyncE
- Through mode and Smart Loopback
- Cable testing, including power over Ethernet
- Full line-rate packet capture and advanced filtering from 10M to 100G
- IPv6 testing
- VLANs, including E-VLAN, S-VLAN and C-VLAN
- VLAN Scan
- Multiprotocol label switching (MPLS)
- Asymmetrical testing with Dual Test Set (EtherSAM, RFC 2544, iSAM and RFC 6349)
- Carrier Ethernet OAM (MEF, IEEE 802.1ag, ITU-T Y.1731 and ITU-T G.8113.1 MPLS-TP) and Link OAM (IEEE 802.3ah)
- Fibre Channel 1x, 2x, 4x, 8x, 10x, 16x
- Framed CPRI BTS and RRH emulation from 1.2 Gbit/s to 9.8 Gbit/s
- Unframed and framed CPRI BER from 1.2 Gbit/s to 9.8 Gbit/s with SDT and RTD

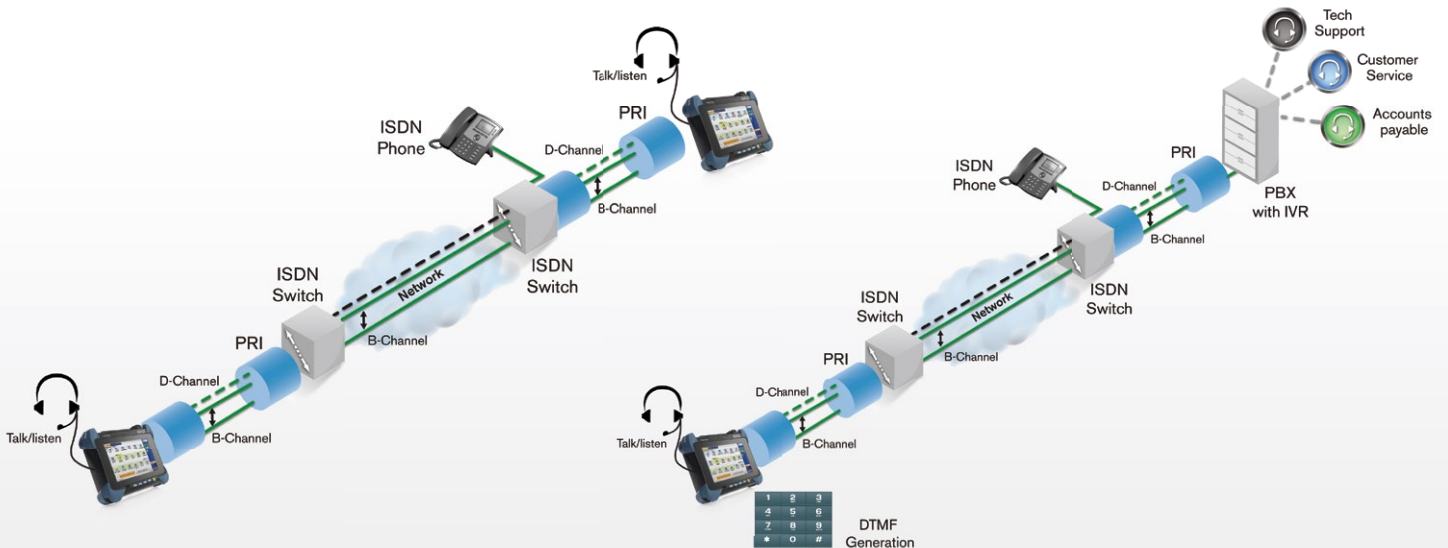**EXFO**

Key DSn/PDH and SONET/SDH Features

Simplified BER Testing

The NetBlazer V2 Series 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.
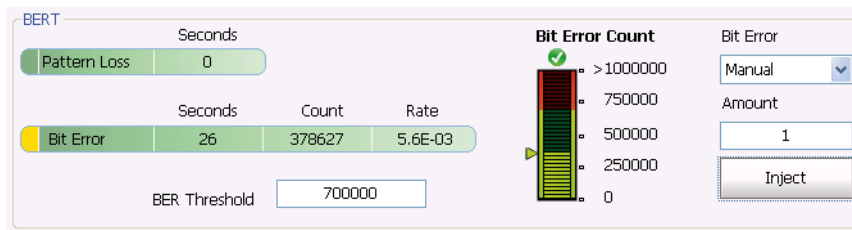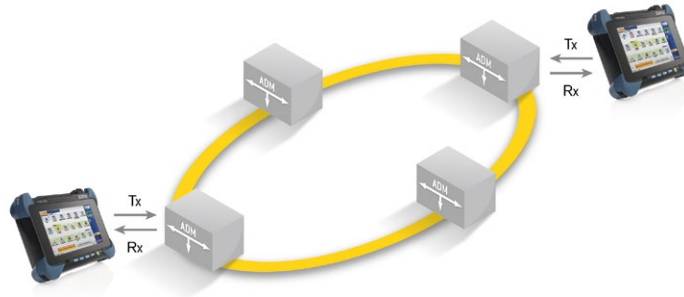

KEY ISDN FEATURES

The NetBlazer V2 Series lets you test and troubleshoot North American or European ISDN PRI configurations, and offers best-in-class ISDN PRI testing by allowing field technicians to call one or all 23 DS1 or 31 E1 PRI channels. Once connected, the user can go channel by channel to perform a BER test on individual or all channels, as well as talk and listen via a headset.

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Key Ethernet Features

Intelligent Network Discovery Mode

Using the NetBlazer V2 Series, 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 NetBlazer V2 Series takes care of everything.
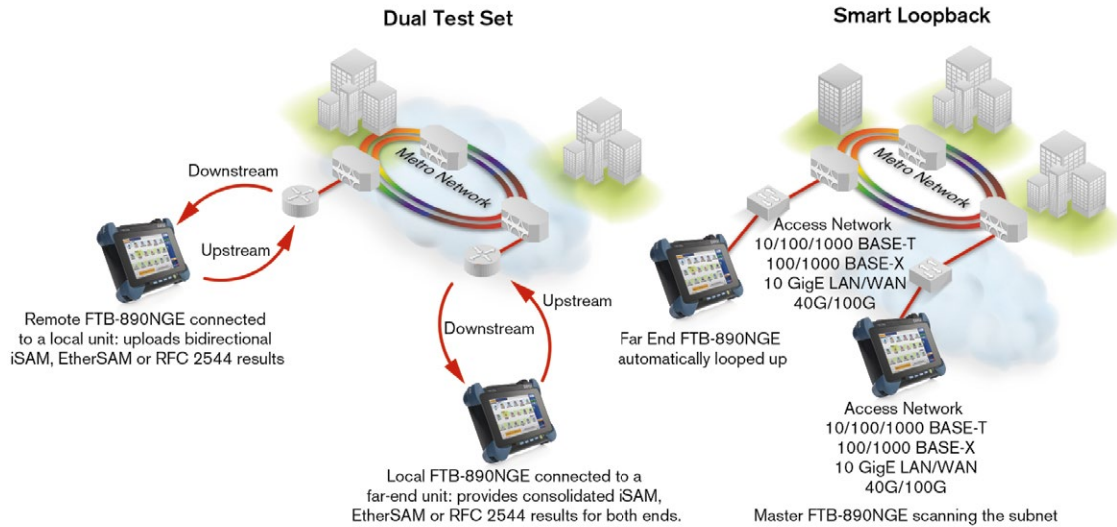


Smart Loopback Flexibility

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 NetBlazer V2 Series 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 NetBlazer V2 Series 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 NetBlazer V2 Series supports virtual-local-area-network (VLAN) tags, Q-in-Q VLAN tags and multiprotocol label switching (MPLS).
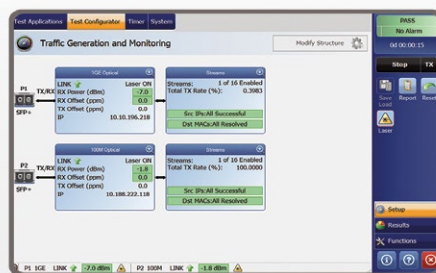
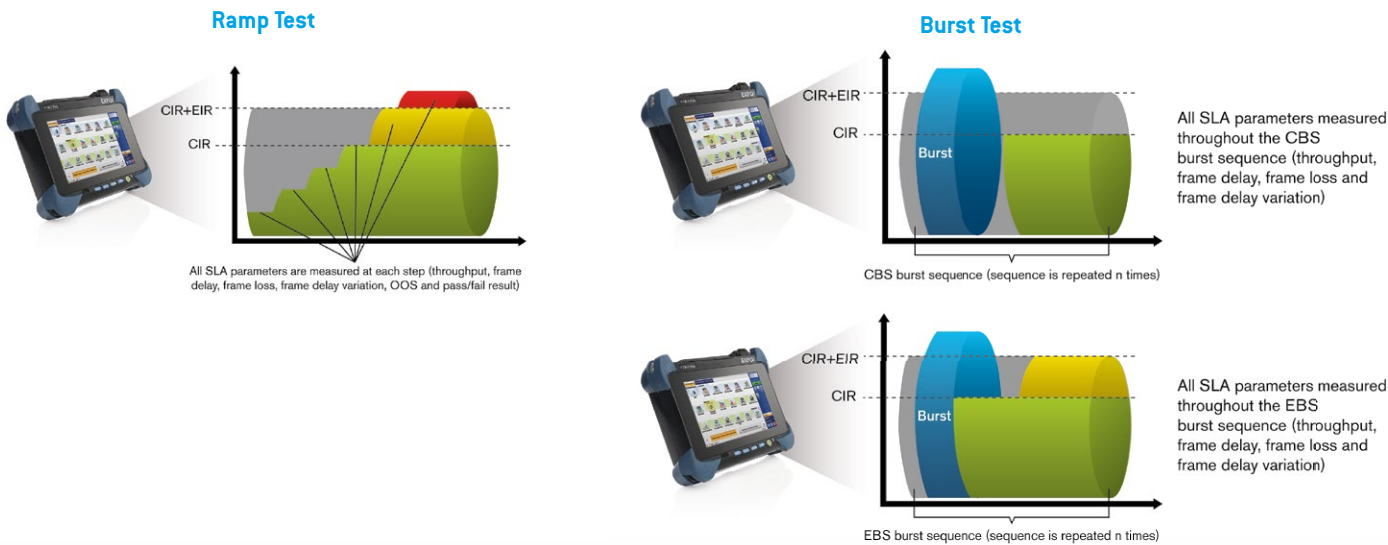## EtherSAM: THE NEW STANDARD IN ETHERNET TESTING

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.
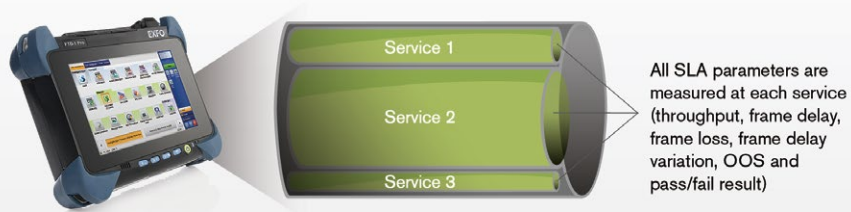
Service Configuration Test

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
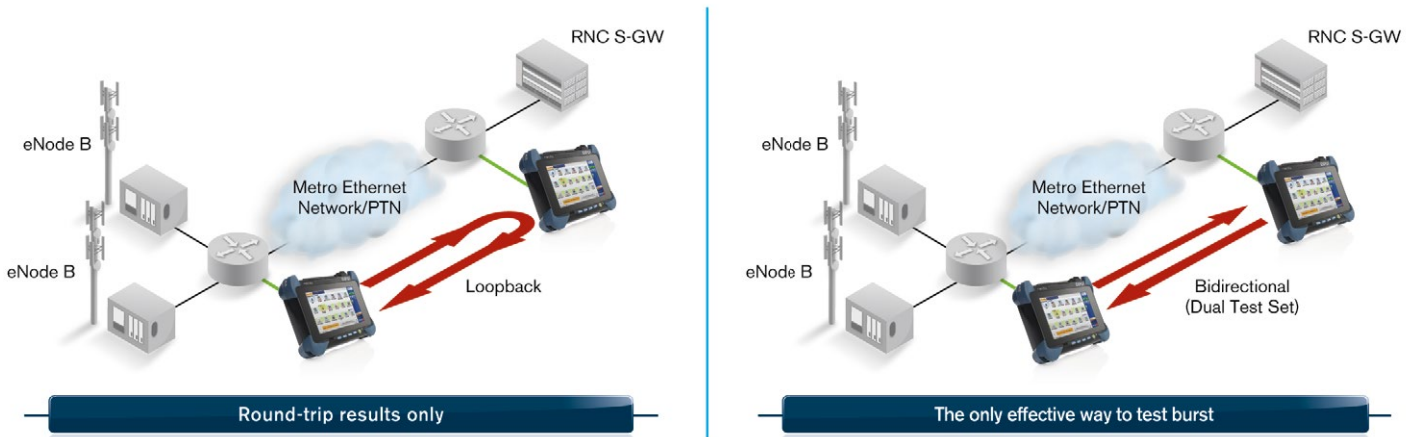
iSAM

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.
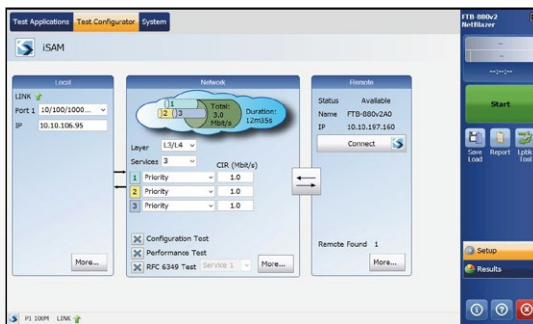
*One-page setup*
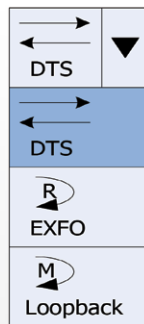
Multiple modes of connection

One-page results

CABLE TEST WITH POWER OVER ETHERNET (PoE)

The cable test helps field technicians quickly and efficiently detect cable issues. Using this feature with the NetBlazer V2 Series, 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 NetBlazer V2 Series fits the bill for basic to critical devices.
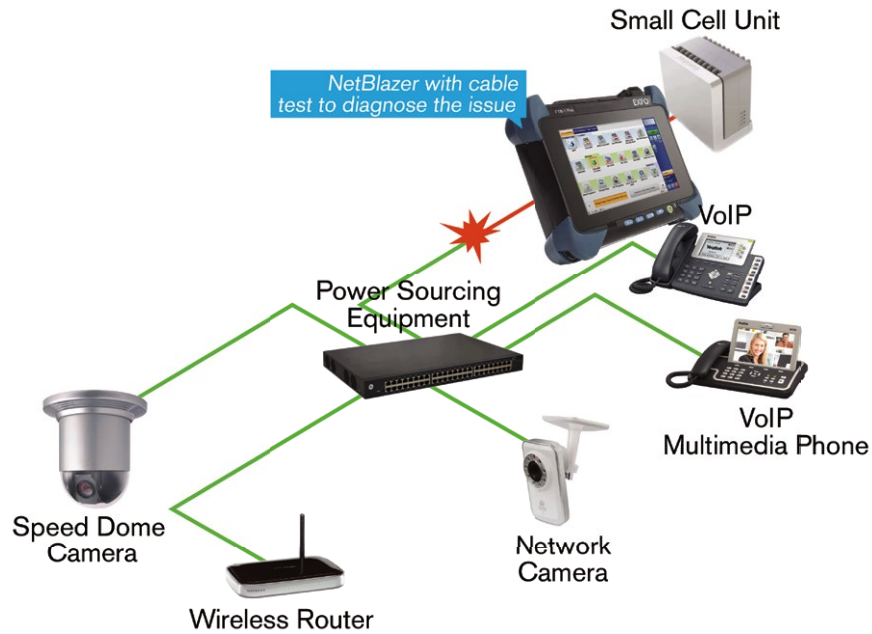
FTTA TESTING

With the NetBlazer V2 Series 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 NetBlazer V2 Series' 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 NetBlazer V2 Series 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 NetBlazer V2 Series is always ready to emulate a CPRI-enabled BTS. Once connected to the RRH, the NetBlazer 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 NetBlazer V2 Series 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 NetBlazer V2 Series test suite better equips field technicians to decipher and solve these basic yet very costly human errors.

Finally, using the NetBlazer V2 Series 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 NetBlazer V2 Series 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.
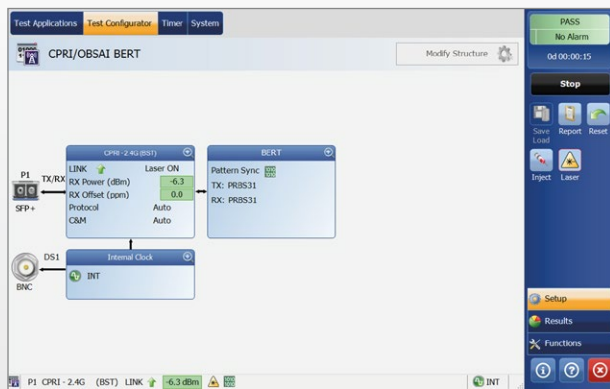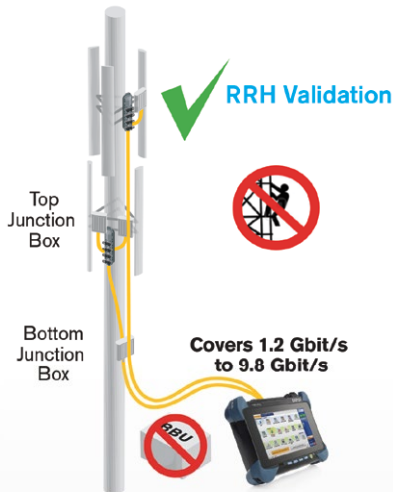
Framed CPRI BER Test
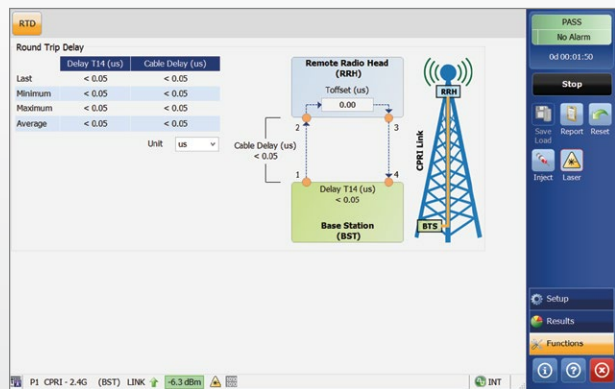
CPRI Round-Trip Delay

TRAFFIC GENERATION AND MONITORING

The NetBlazer V2 Series surpasses the multistream offerings of typical handheld Ethernet testing devices. Up to 64 streams of traffic (available on 870Q or 880Q modules) 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 NetBlazer V2 Series 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.

Visual frame display

Voice/video/data services

← Up to 16 streams

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.
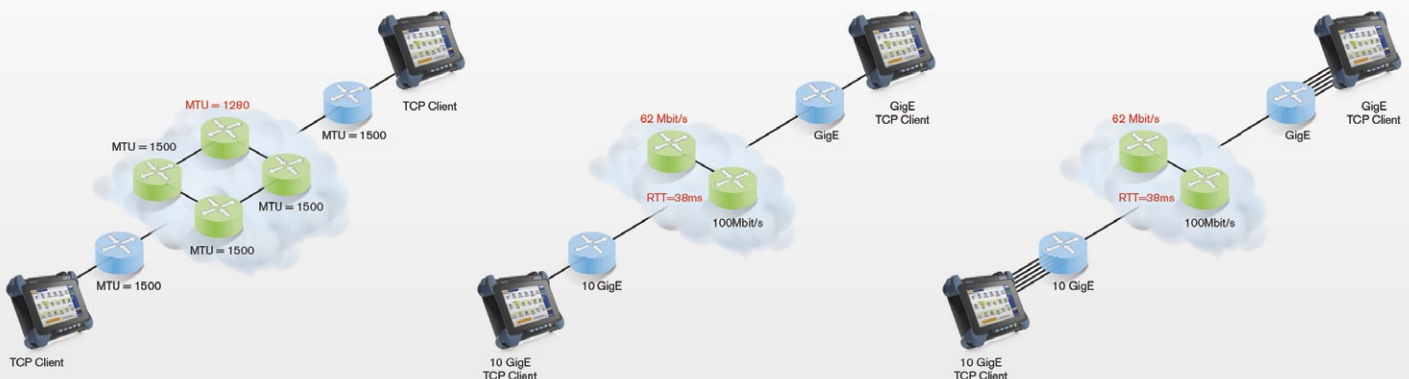
PATH MTU Discovery

*Baseline RTT and Bandwidth to Determine the Ideal Window Size*

Single or Multiple TCP Connections to Enable Full Pipe Testing

**EXFO**

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 NetBlazer V2 Series 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
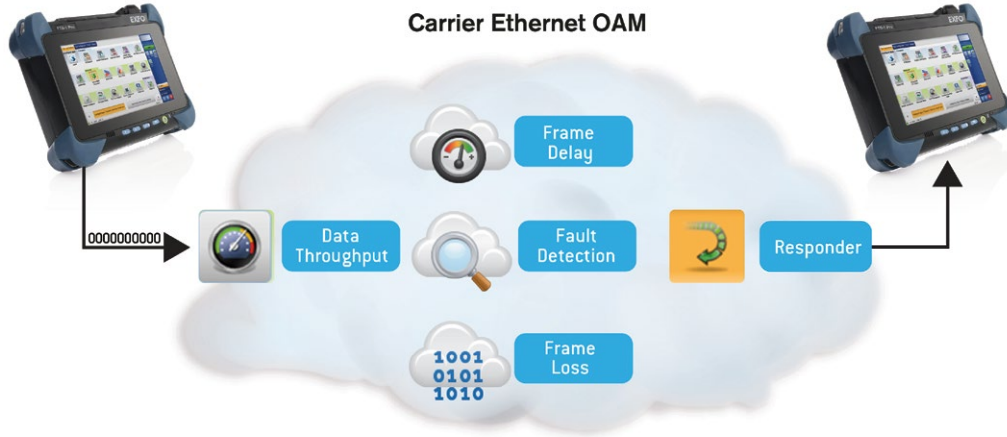
PACKET CAPTURE

The capturing power of EXFO's NetBlazer V2 Series extends far beyond basic capabilities. The NetBlazer V2 Series 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.
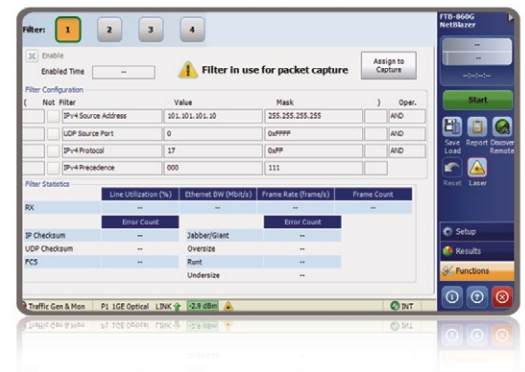
ADVANCED TRAFFIC FILTERING

In some cases, troubleshooting only concerns a particular traffic flow. The advanced traffic-filtering capability of the NetBlazer V2 Series 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.

iOptics

The intelligent Pluggable Optics (iOptics) test application is a first-alert test that can be used in field or lab environments to efficiently evaluate the proper operation of an optical device with minimal user configuration required. This test application performs that validation using several sub-tests in addition to monitoring an optical device's power consumption and temperature; it reports a global and individual verdict for each sub-test and monitoring task. The test application also automatically collects the device manufacturing information enabling the user to determine whether or not the desired device has been tested.

CFP4

QSFP+/
QSFP28

EXFO

EFFICIENTLY ASSESSING THE PERFORMANCE OF FIBRE CHANNEL SERVICES

The NetBlazer V2 Series 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 NetBlazer V2 Series modules provide full wire-speed traffic generation at the FC2 layer, which allows for BER testing for link integrity measurements. The NetBlazer V2 Series 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 NetBlazer V2 Series 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 NetBlazer V2 Series 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.
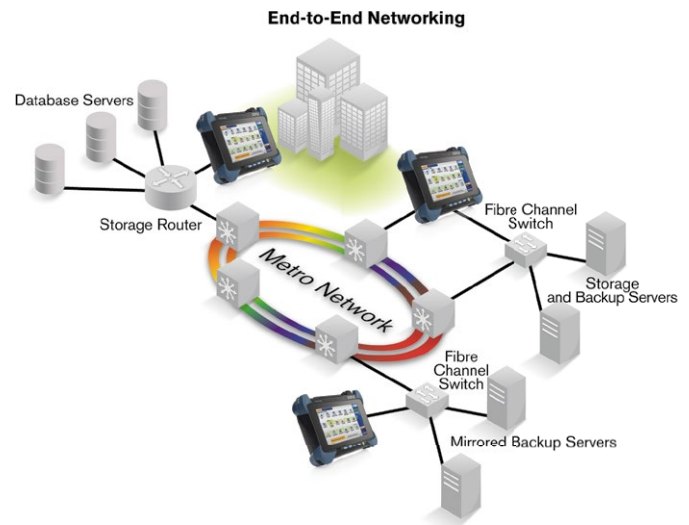
Login Testing

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 NetBlazer V2 Series 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
16X	14.025	1600

End-to-End Networking

Database Servers

Storage Router

Metro Network

Fibre Channel Switch

Storage and Backup Servers

Fibre Channel Switch

Mirrored Backup Servers

Thanks to end-to-end network testing capabilities, EXFO's NetBlazer V2 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.

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EXFO TFv

Test Function Virtualization

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 (e.g., 100G testing) 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-1 PRO PLATFORM

EXpert Test Tools is a series of platform-based software testing tools that enhance the value of the FTB-1 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

FEATURES

HIGH SPEED KEY FEATURES

Detailed compliance testing	› IEEE 802.3bm standard (2010) › CFP MSA CFP4 Hardware Specification Revision 1.1 18 Mar 2015 › CFP MSA Management Interface Specification Version 2.4 (R06b) › ITU-T G.709, G.798 and G.872
Multi-interface support	› Pluggable, MSA-compliant 4 x 10G QSFP+ transceivers › Pluggable, MSA-compliant 4 x 25G CFP4 and QSFP28 transceivers › External timing reference (DS1/E1/2 MHz)
Robust physical-layer validation	› 40G/100G XLAUI/CAUI lane error generation and monitoring › PCS lane mapping and monitoring capability › Per-lane skew generation and measurement › PCS error generation and monitoring per lane › Full MDIO/I2C read/write access
PRBS patterns per lane	Allows users to configure different PRBS patterns on different CAUI/XLAUI lanes in 40G/100G, and on physical lanes in OTU3/OTU4 diagram
Per-wavelength power measurement	Allows users to measure the received optical power per wavelength in the used parallel CFP4 and QSFP+/QSFP28 transceivers
iOptics	› Optical-device I/O interface quick check › Optical Tx power-level range test › Optical Rx signal-presence and power-level range test › BERT Bit Error Test at nominal rates and standard offset › Excessive skew test › Temperature and power/current consumption monitoring
100G and 40G MPLS	› Generates and analyzes streams with up to two layers of labels.
Advanced filtering	› Ability to configure up to 10 filters, each with four fields that can be combined with AND/OR/NOT operations; a mask is also provided for each field value with IPv4 and IPv6 capabilities
Packet capture	› Ethernet packet capture up to 4 Mbits › Configurable triggers including errors and header fields › Data capture in packet capture (PCAP) format; read through Wireshark
40G/100G OTN testing	› OTU4 (112 Gbit/s), OTU3 (43 Gbit/s), OTU3e1 (44.57 Gbit/s) and OTU3e2 (44.58 Gbit/s) unframed and framed BER tests › FEC testing: error insertion and monitoring › OTL 3.4 and 4.4: alarm and error generation and monitoring › OTL lane mapping, and skew generation and measurement › OTU, ODU, OPU overhead manipulation and monitoring › OTU, ODU (including ODU TCM), OPU layer alarm/error generation and analysis › OTU, ODU (including ODU TCM) trace messages › Round-trip delay (RTD) measurement › OTN SDT measurement › Performance monitoring: G.821, M.2100 › Frequency analysis and offset generation

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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), OTU3 (43.018 Gbit/s), OTU3e1 (44.571 Gbit/s), OTU3e2 (44.583 Gbit/s), OTU4 (111.81 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 noninverted)
	Error	Bit error
	Alarm	Pattern loss

ADDITIONAL OTN FUNCTIONS

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 100G. 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 100 GigE full line-rate packet capture and decode. Configuration of capture filters and triggers as well as capture slicing parameters.
Through mode	Sectionalize traffic between a service provider's network and customer premise equipment up to 100G
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 100G 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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FIBRE CHANNEL TEST FEATURES

TESTING 1x, 2x, 4x, 8x, 10x, 16x

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.

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ISDN PRIMARY RATE INTERFACE TEST FEATURES

Supported interfaces	DS1: bantam or RJ48C (SF or ESF) E1: bantam, RJ48C or BNC (PCM31 with or without CRC-4)	Headset support	Talk/listen through a selectable connected voice or 3.1 kHz B-channel
Supported switch types	DS1: national ISDN, Nortel DMS and AT&T 4/5ESS E1: Euro ISDN, Euro VN6 and Q.SIG	D-channel control	D-channel timeslot configuration Rate (64K or 56K) HDLC mode (Normal or Inverted)
Emulation modes	Terminal equipment (TE) Network termination (NT)	Statistics	Call status, CRV, incoming or outgoing calls, call duration BERT (bit error count and rate) with graphical BERT meter on a per B-channel (data) basis Performance monitoring statistics: UAS, EFS, ES and SES Active calls (data, voice, 3.1 kHz) Total call count (connected, cleared, failed/rejected, placed) Frequency (Rx, offset, max +/max − offset)
Call types/rates	Data (56K or 64K), voice or 3.1 kHz (audio)	Alarms	DS1: LOS, frequency, LOC, AIS, OOF, RAI, D-channel down E1: LOS, frequency, LOC, AIS, LOF, RAI, D-channel down Pattern loss (per B-channel injection)
BER test	Configurable test pattern Provides simultaneous BER testing on multiple B-channels configured with data traffic	Errors	DS1: BPV, EXZ, framing bit, CRC-6, D-channel FCS E1: CV, FAS, CRC-4, E-bit, D-channel FCS Bit error (per B-channel injection)
Call setting	Calling party (numbering type, numbering plan and number up to 30 digits) Called party (number type, numbering plan and number up to 30 digits) Network (network transit selection code of up to four digits, and operator system access: None, Principal or Alternate) › All parameters are configurable on a per-call basis › Highlights missing calls or called party numbers	ISDN logger	Logs layer-2 (Q.921) and layer-3 (Q.931) messages Filter: All, layer 2 or layer 3 Information: ID, time, message type, direction, channel number, called number, call type, cause values/definition, status and progress
Call control	Call origination › Establishment of calls prior to starting the test › Automatically initiate single, multiple or all configured calls upon starting a test Call reception › Auto-Answer mode, Auto-Reject or prompt Call release › Hang up individual or all channels	Pass/fail verdict	BERT, call establishment and termination
DTMF injection	Generate DTMF tones for all standard digits, including 0-9, # and * as per Q.23/G.224 Available for one of the connected voice or 3.1 kHz B-channel	Phone book	Easy access to phone book to manage names and associated numbers. Save/load functions to update the phone book and import/export to exchange the phone book with other NetBlazer

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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.
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.
CPRI DUAL PORT	Provides two simultaneous ports of CPRI BBU or RRH emulation with rates from 1.2 to 9.8G Gbit/s.
1588 PTP	Validates 1588 PTP packet network synchronization services, supports G.8265.1 and G.8275.1 profiles, emulates PTP clients, generates and analyzes messages between master/clients, clock quality level and IPDV
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.
Second Port Loopback Tool	Enables any Ethernet test (e.g., EtherSAM, RFC 2544, traffic generation and monitoring, or BERT) to run directly to itself using one self-contained unit with second port loopback.
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.

GENERAL SPECIFICATIONS

MODULE VERSIONS	FTB-880V2	FTB-870V2	FTB-880Q	FTB-870Q
Size (H x W x D)	210 mm x 254 mm x 55 mm (8 ¼ in x 10 in x 2 ³/₁₆ in)		210 mm x 254 mm x 76 mm (8 ¼ in x 10 in x 3 in)	
Weight	0.91 kg (2 lb)	0.85 kg (1.85 lb)	2.1 kg (4.65 lb)	1.84 kg (4.06 lb)
Operating temperature	0 °C to 50 °C (32 °F to 122 °F) up to 2000 m (6561 ft)			
Relative humidity	0 % to 95 %, non-condensing			
Battery duration	Over two hours		Over one hour	
Battery charging time	Two hours			
Languages	English, Chinese, Japanese and Korean			

MODULE VERSIONS	FTB-890	FTB-890NGE
Size (H x W x D)	210 mm x 254 mm x 76 mm (8 1/4 in x 10 in x 3 in)	
Weight	1.85 kg (4.08 lb)	2.2 kg (4.85 lb)
Operating temperature	0 °C to 40 °C (32 °F to 104 °F) up to 2000 m (6561 ft)	
Relative humidity	0 % to 95% non-condensing	
Battery duration	Over one hour	
Battery charging time	Two hours	
Languages	English, Chinese, Japanese and Korean	

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ORDERING INFORMATION

FTB-890-XX-XX-XX-XX-XX-XX-XX

Test options
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) [b]
622M = 622 Mbit/s (OC-12/STM-4) [b]
2488M = 2.5 Gbit/s (OC-48/STM-16) [b]
9953M = 10 Gbit/s (OC-192/STM-64)

Software options
IPV6 = Internet protocol version 6
IPV6_40-100GE = 40GE and 100GE internet protocol
version 6
TCM = Tandem connection monitoring
ETH-THRU = Through mode capability
MPLS = Enables MPLS tags
MPLS_40-100GE = Enables 40GE and 100GE MPLS tags
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
ADV-FILTERS = Advanced filtering
ETH-CAPTURE = Full line-rate packet capture
iSAM = Enables simplified Y.1564 test
RFC6349 = Enables TCP testing as per RFC 6349
RFC6349_40-100GE = 40GE and 100GE enables
TCP testing as per RFC 6349
TRAFFIC-SCAN = Discover and monitor VLAN traffic flows
on a live signal
iOptics = Enables intelligent Pluggable Optic Test Application

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

OTN rate options
OTU1 = OTN optical rate 2.666 Gbit/s [c]
OTU2 = OTN optical rate 10.709 Gbit/s [d]
OTU2-1e-2e = OTN optical rates 11.049/11.096 Gbit/s [d]
OTU2-1f-2f = OTN optical rates 11.270/11.318 Gbit/s [d]
OTU3 = OTN optical rate of 43.018 Gbit/s [e]
OTU3-e1-e2 = OTN optical rates of 44.57 Gbit/s and
44.58 Gbit/s [e]
OTU4 = OTN optical rate of 111.81 Gbit/s [f]

Fibre Channel rate options
FC1X = 1x Fibre Channel interface [c]
FC2X = 2x Fibre Channel interface [c]
FC4X = 4x Fibre Channel interface [c]
FC8X = 8x Fibre Channel interface [d]
FC10X = 10x Fibre Channel interface [d]
FC16X = 16x Fibre Channel interface [d]

Ethernet rate options
100optical = 100 Mbit/s optical [c]
GigE = 1000 Mbit/s optical and electrical [c]
10GigE = 10G LAN and 10G WAN [d]
40GE = Ethernet optical rate of 41.25 Gbit/s [e]
100GE = Ethernet optical rate of 103.125 Gbit/s [f]

Example: FTB-890-SONET-SDH-52M-RFC6349-100GE-OTU3-OTU4

Notes
a. Always included.
b. (155M/622M/2488M) always included with the 2.5G-BUNDLE
c. Requires purchase of SFP
d. Requires purchase of SFP+
e. Requires purchase of QSFP+
f. Requires purchase of CFP4 or QSFP28

EXFO

ORDERING INFORMATION

FTB-890NGE-XX-XX-XX-XX-XX-XX-XX

Test options
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) [b]
622M = 622 Mbit/s (OC-12/STM-4) [b]
2488M = 2.5 Gbit/s (OC-48/STM-16) [b]
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
ISDN-PRI = ISDN primary rate interface
NI-CSU = NI-CSU loopback emulation
Cable_Test = Cable test
IPV6 = Internet protocol version 6
IPV6_40-100GE = 40GE and 100GE IPv6 Internet
                protocol version 6
ETH-THRU = Through mode capability
MPLS = Enables MPLS tags
MPLS_40-100GE = Enables 40GE and 100GE MPLS tags
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
ADV-FILTERS = Advanced filtering
ETH-CAPTURE = Full line-rate packet capture
DUAL-PORT = Dual port testing for any enabled Ethernet rate
iSAM = Enables simplified Y.1564 test
RFC6349 = Enables TCP testing as per RFC 6349
RFC6349_40-100GE = 40GE and 100GE 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
DP-CPRI = Enables two CPRI ports
iOptics = Enables Intelligent Pluggable Optic Test Application

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

OTN rate options
OTU1 = OTN optical rate 2.666 Gbit/s [c]
OTU2 = OTN optical rate 10.709 Gbit/s [d]
OTU2-1e-2e = OTN optical rates 11.049/11.096 Gbit/s [d]
OTU2-1f-2f = OTN optical rates 11.270/11.318 Gbit/s [d]
OTU3 = OTN optical rate of 43.018 Gbit/s [e]
OTU3-e1-e2 = OTN optical rates of 44.57 Gbit/s
             and 44.58 Gbit/s [e]
OTU4 = OTN optical rate of 111.81 Gbit/s [f]

Fibre Channel rate options
FC1X = 1x Fibre Channel interface [c]
FC2X = 2x Fibre Channel interface [c]
FC4X = 4x Fibre Channel interface [c]
FC8X = 8x Fibre Channel interface [d]
FC10X = 10x Fibre Channel interface [d]
FC16X = 16x Fibre Channel interface [d]

Ethernet rate options
100optical = 100 Mbit/s optical [c]
GigE = 1000 Mbit/s optical and electrical [c]
10GigE = 10G LAN and 10G WAN [d]
40GE = Ethernet optical rate of 41.25 Gbit/s [e]
100GE = Ethernet optical rate of 103.125 Gbit/s [f]

Example: FTB-890NGE-SONET-SDH-52M-DSn-RFC6349-100GE-OTU3-OTU4

Notes
a. Always included.
b. (155M/622M/2488M) always included with the 2.5G-BUNDLE
c. Requires purchase of SFP
d. Requires purchase of SFP+
e. Requires purchase of QSFP+
f. Requires purchase of CFP4 or QSFP28

EXFO

ORDERING INFORMATION

FTB-880v2-XX-XX-XX-XX-XX-XX-XX

Test options
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) [b]
622M = 622 Mbit/s (OC-12/STM-4) [c]
2488M = 2.5 Gbit/s (OC-48/STM-16) [b]
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
ISDN-PRI = ISDN primary rate interface
NI-CSU = NI-CSU loopback emulation
Cable_Test = Cable test
IPV6 = Internet protocol version 6
ETH-THRU = Through mode capability
MPLS = Enables MPLS tags
G82751 = Enables ITU-T G.8275.1 profile
TST-OAM = Enables OAM testing within EtherSAM
1588PTP = Generates and analyzes 1588 PTP
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
ADV-FILTERS = Advanced filtering
ETH-CAPTURE = Full line-rate packet capture
DUAL-PORT = Dual port testing for any enabled Ethernet 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
DP-CPRI = Enables two CPRI ports

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

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

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

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

Example: FTB-880v2-SONET-SDH-155m-DSn-GigE

Notes
a. Always included.
b. (155M/622M/2488M) always included with the 2.5G-BUNDLE
c. Requires purchase of SFP
d. Requires purchase of SFP+

ORDERING INFORMATION

FTB-870v2-XX-XX-XX-XX-XX-XX-XX

Test options
SONET-SDH = SONET and SDH testing

Transport rate options
52M = 52 Mbit/s (OC-1/STM-0) [a]
155M = 155 Mbit (OC-3/STM-1) [b]
622M = 622 Mbit/s (OC-12/STM-4) [b]
2488M = 2.5 Gbit/s (OC-48/STM-16) [b]
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
ISDN-PRI = ISDN primary rate interface
NI-CSU = NI-CSU loopback emulation
Cable_Test = Cable test
IPV6 = Internet protocol version 6
ETH-THRU = Through mode capability
MPLS = Enables MPLS tags
G82751 = Enables ITU-T G.8275.1 profile
TST-OAM = Enables OAM testing within EtherSAM
1588PTP = Generates and analyzes 1588 PTP
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
ADV-FILTERS = Advanced filtering
ETH-CAPTURE = Full line-rate packet capture
DUAL-PORT = Dual port testing for any enabled Ethernet 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
DP-CPRI = Enables two CPRI ports

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

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

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

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

Example: FTB-870v2-SONET-155m-IPV6-GigE-FC1X-OTU1

Notes

a. Always included.

b. (155M/622M/2488M) always included with the 2.5G-BUNDLE

c. Requires purchase of SFP

d. Requires purchase of SFP+

EXFO

ORDERING INFORMATION

FTB-880Q-XX-XX-XX-XX-XX-XX-XX

Test options
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) [b]
622M = 622 Mbit/s (OC-12/STM-4) [b]
2488M = 2.5 Gbit/s (OC-48/STM-16) [b]
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
ISDN-PRI = ISDN primary rate interface
NI-CSU = NI-CSU loopback emulation
Cable_Test = Cable test
IPV6 = Internet protocol version 6
ETH-THRU = Through mode capability
MPLS = Enables MPLS tags
G82751 = Enables ITU-T G.8275.1 profile
TST-OAM = Enables OAM testing within EtherSAM
1588PTP = Generates and analyzes 1588 PTP
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
ADV-FILTERS = Advanced filtering
ETH-CAPTURE = Full line-rate packet capture
DUAL-PORT = Dual port testing for any enabled Ethernet 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
DP-CPRI = Enables two CPRI ports

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

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

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

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

Example: FTB-880Q-SONET-SDH-155M-DSn-DUAL-PORT-GigE

Notes
a. Always included.
b. (155M/622M/2488M) always included with the 2.5G-BUNDLE
c. Requires purchase of SFP
d. Requires purchase of SFP+

EXFO

ORDERING INFORMATION

FTB-870Q-XX-XX-XX-XX-XX-XX-XX

Test options
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) [b]
622M = 622 Mbit/s (OC-12/STM-4) [b]
2488M = 2.5 Gbit/s (OC-48/STM-16) [b]
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
ISDN-PRI = ISDN primary rate interface
NI-CSU = NI-CSU loopback emulation
Cable_Test = Cable test
IPV6 = Internet protocol version 6
ETH-THRU = Through mode capability
MPLS = Enables MPLS tags
G82751 = Enables ITU-T G.8275.1 profile
TST-OAM = Enables OAM testing within EtherSAM
1588PTP = Generates and analyzes 1588 PTP
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
ADV-FILTERS = Advanced filtering
ETH-CAPTURE = Full line-rate packet capture
DUAL-PORT = Dual port testing for any enabled Ethernet 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
DP-CPRI = Enables two CPRI ports

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

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

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

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

Example: FTB-870Q-SONET-SDH-155M-DSn-DUAL-PORT-10GigE

Notes
a. Always included.
b. (155M/622M/2488M) always included with the 2.5G-BUNDLE
c. Requires purchase of SFP
d. Requires purchase of SFP+

EXFO

CFP4 TRANSCEIVERS

CFP4-85980 = 100GBASE-LR4/OTU4 Multi-Rate 10 km SMF 4x25/28G LAN WDM EML LC
CFP4-85981 = 100GBASE-LR4/OTU4 Dual-Rate 10 km SMF 4x25/28G LAN WDM LC
CFP4-85982 = 100GBASE-SR4/OTU4 Dual-Rate 100 m MMF 4x25/28G MPO12

QSFP28 TRANSCEIVERS

QSFP-85990 = 100GBASE-LR4 Single-Rate 2 km SMF LAN WDM EML LC
QSFP-85991 = 100GBASE-LR4 Single-Rate 10 km SMF LAN WDM EML LC
QSFP-85992 = 100GBASE-SR4/OTU4 128GFC Multi-Rate 100 m MMF 4x25/28G MPO12

QSFP+ TRANSCEIVER

QSFP-85940 = 40GBASE-LR4/OTU3 Dual-Rate 1310nm 10km SMF 4x10G CWDM LC

SFP MULTIRATE OPTICAL TRANSCEIVERS

FTB-8590 = SFP module GigE/FC/2FC, CPRI/OBSAI 2.45/3.07 Gbit/s at 850 nm, MM, <500 m reach
FTB-8690 = Multirate SFP supporting: GigE, 850 nm, LC connector, MMF, < 500 m reach
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 = Multirate optical transceiver; rates: 155/622 Mbit/s, 2.5/2.7 Gbit/s, GigE, 1550 nm, LC connector, SMF, 80 km reach
FTB-8193 = Multirate SFP supporting: 155/622 Mbit/s, 2.5/2.7 Gbit/s, GigE, 1550 nm, LC connector, SMF, 40 km reach
FTB-85912 = SFP modules: GigE/FC/2FC/4FC at 850 nm, < 500 m reach
FTB-85913 = SFP modules: GigE/FC/2FC/4FC at 1310 nm, 4 km reach
FTB-85914 = SFP modules: GigE/FC/2FC/4FC at 1310 nm, 30 km reach
FTB-85915 = SFP modules: GigE/FC/2FC/4FC at 1550 nm, < 50 km reach
FTB-85919 = SFP copper, multirate 10/100/1000 BASE-T, Cat5 UTP 100 m reach

100M SFP SINGLE-RATE OPTICAL TRANSCEIVERS

FTB-85910 = Single-rate SFP supporting: 100BASE-FX, 1310 nm, LC connector, SMF, 2 km reach
FTB-85911 = Single-rate SFP supporting: 100BASE-FX, 1310 nm, LC connector, SMF, 15 km reach

1000M SFP BIDIRECTIONAL OPTICAL TRANSCEIVERS

FTB-8596 = Bidirectional SFP supporting: 1000BASE-BX10, 1490TX/1310RX, 10 km reach (should be paired and sold with the FTB-8597)
FTB-8597 = Bidirectional SFP supporting: 1000BASE-BX10, 1310TX/1490RX, 10 km reach (should be paired and sold with the FTB-8596)
FTB-8598 = Bidirectional SFP supporting: 1000BASE-BX40, 1310TX/1490/1550RX, 40 km reach (should be paired and sold with the FTB-8599)
FTB-8599 = Bidirectional SFP supporting: 1000BASE-BX40, 1550TX/1310RX, 40 km reach (should be paired and sold with the FTB-8598)

1000M SFP COPPER TRANSCEIVERS

SFP-85919 = SFP copper, multirate 10/100/1000 BASE-T, Cat5 UTP, 100 m reach

10G SFP+ MULTIRATE OPTICAL TRANSCEIVERS

SFP-8600 = SFP+ modules: CPRI 1.228 to 9.83 Gbit/s at 1310 nm, LC connector, 1.4 km reach
SFP-8601 = SFP+ 10G (1.25 Gbit/s to 10.3125 Gbit/s) CWDM at 1471 nm, LC SMF, 10 km reach
SFP-8602 = SFP+ 10G (1.25 Gbit/s to 10.3125 Gbit/s) CWDM at 1511 nm, LC SMF, 10 km reach
FTB-8690 = Multirate SFP+ supporting: 10 GigE LAN/WAN (9.95 to 10.3 Gbit/s), 850 nm, LC connector, MMF, 300 m reach (not rated for SONET/SDH)
FTB-8691 = SFP+ modules: 10 GigE at 1310 nm, 10 km reach
FTB-8693 = Multirate SFP+ supporting: Sonet/SDH, 10 GigE LAN/WAN, OTU2, OTU1e/2e (8.5, 9.95 to 11.3 Gbit/s), 1310 nm, LC connector, SMF, 10 km reach
FTB-8694 = Multirate SFP+ supporting: Sonet/SDH, 10 GigE LAN/WAN (9.95 to 11.1 Gbit/s), 1550 nm, LC connector, SMF, 40 km reach
FTB-8695 = Multirate SFP+ supporting: Sonet/SDH, 10 GigE LAN/WAN, OTU2, OTU1e/2e (9.95 to 11.1 Gbit/s), 1550 nm, LC connector, SMF, 80 km reach

EXFO