FTB-8525/8535
Packet Blazer

NETWORK TESTING–TRANSPORT AND DATACOM

Fully integrated test solution for performance assessment of Fibre Channel and Ethernet networks

- 1x, 2x, 4x and 10x full-line-rate Fibre Channel traffic generation and BER testing
- FC-0, FC-1 and FC-2 logical layer configuration for Fibre Channel port definition, testing and performance analysis
- Round-trip latency measurement and buffer-to-buffer credit estimation
- Ethernet services performance validation through RFC 2544, BER testing and multistream generation and analysis
- 10 Mbit/s to 10 Gbit/s Ethernet testing capabilities

COMPLETE IPv6 TESTING

Platform Compatibility

- FTB-500 Platform
- FTB-400 Universal Test System
- FTB-200 Compact Platform

2004 FROST & SULLIVAN
2005 FROST & SULLIVAN
2006 FROST & SULLIVAN
2007 FROST & SULLIVAN
Global OTDR & OLTS Market Leadership Award

Next-Generation Network Assessment

EXFO
EXPERTISE REACHING OUT

Comprehensive Testing Tool for Fibre Channel and Ethernet Service Characterization

EXFO's FTB-8525/8535 Packet Blazer test modules deliver FC-0, FC-1 and FC-2 logical layer Fibre Channel testing for services delivered via transport protocols such as DWDM, SONET/SDH and dark fiber. They provide valuable timing information as well as buffer credit estimation for Fibre Channel network deployment. These modules support the full range of Fibre Channel interfaces: 1x, 2x, 4x and 10x.

The FTB-8525/8535 modules also offer an optional test suite for complete performance validation of Ethernet services. This allows for fully integrated datacom testing in the industry's smallest form factor including complete Fibre Channel and Ethernet test functionalities.

The FTB-8525/8535 Packet Blazer modules can be housed in the FTB-200 Compact Platform.

The FTB-8525/8535 Packet Blazer modules are also compatible with the FTB-400 Universal Test System and FTB-500 Platform. Here, two FTB-8535 modules are shown in the FTB-400, addressing multichannel applications.

KEY FEATURES

Fibre Channel

- Simultaneous traffic generation and analysis at 100 % wire speed for 1x, 2x, 4x and 10x Fibre Channel rates
- Fully integrated FC-0, FC-1 and FC-2 logical layer testing, enabling fabric and port login
- 10 Mbit/s up to 10 Gbit/s LAN/WAN Ethernet testing
- Round-trip latency measurements for assessing the capability of a link
- Buffer-to-buffer credit estimation for optimal configuration of Fibre Channel nodes
- BER testing of Fibre Channel circuits
- Easy-to-use interface for configuration settings, customization of test routines, and real-time and historical performance reporting

Ethernet

- Bidirectional RFC 2544 (throughput, latency, frame loss and back-to-back) for Ethernet service performance assessment
- EtherBERT™ for bit-error-rate testing of 10, 100, 1000 Mbit/s and 10 Gbit/s Ethernet circuits
- Complete carrier Ethernet services testing portfolio: PBB-TE (MAC-in-MAC), MPLS and IPv4/6
- Q-in-Q capability for up to three layers of stacked VLANs
- Remote control through Visual Guardian Lite software and VNC
- Packet jitter measurements (IP packet delay variation as per RFC 3393) to qualify Ethernet transport networks for transmission of delay-sensitive traffic such as voice-over-IP (VoIP) and video
- Multistream generation and analysis allowing quality of service (QoS) verification through VLAN and TOS/DSCP prioritization testing

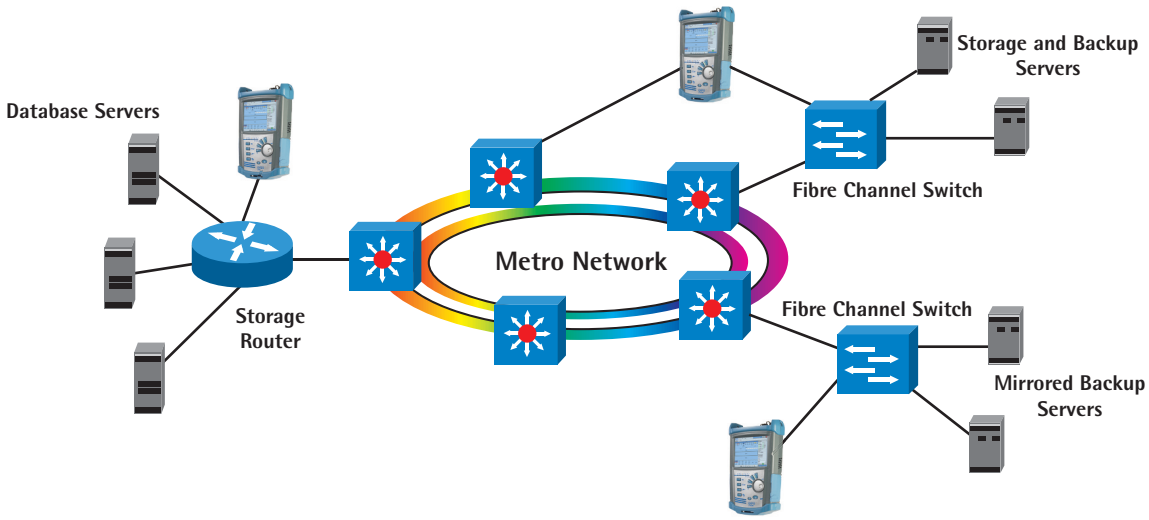
Efficiently Assessing Performance of Fibre Channel Services

FTB-8525/8535 Packet Blazer modules provide comprehensive testing capabilities for Fibre Channel network deployments, supporting multiple Fibre Channel interfaces.

INTERFACE	RATE (GBIT/S)	RATE (MB/S)
1x	1.0625	100
2x	2.125	200
4x	4.25	400
10x (FTB-8535 only)	10.51875	1200

Applications

Since most storage area networks (SANs) cover large distances and Fibre Channel has stringent performance requirements, it is imperative to test at each phase of network deployment to ensure appropriate service levels. EXFO's FTB-8525/8535 modules provide full wire-speed traffic generation at FC-0, FC-1 and FC-2 logical layers, allowing BER testing for link integrity measurements. In addition, latency, buffer-to-buffer credit measurements for optimization as well as login capabilities are supported.



Thanks to end-to-end network testing capabilities, EXFO's FTB-8525/8535 enable fast deployment and configuration of Fibre Channel 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.

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 by processing time inside each piece of network equipment. Latency is the total accumulation of delays between two end points. Some applications such as VoIP, video and storage area networks are very sensitive to excess latency.

It is therefore critical for service providers to properly characterize network latency when offering Fibre Channel services. From the latency measurement that they perform, the FTB-8525/8535 modules estimate buffer-to-buffer credit value requirements.

Efficiently Assessing Performance of Fibre Channel Services (Cont'd)

Buffer-to-Buffer Credit Estimation

In order to regulate traffic flow and congestion, Fibre Channel 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.

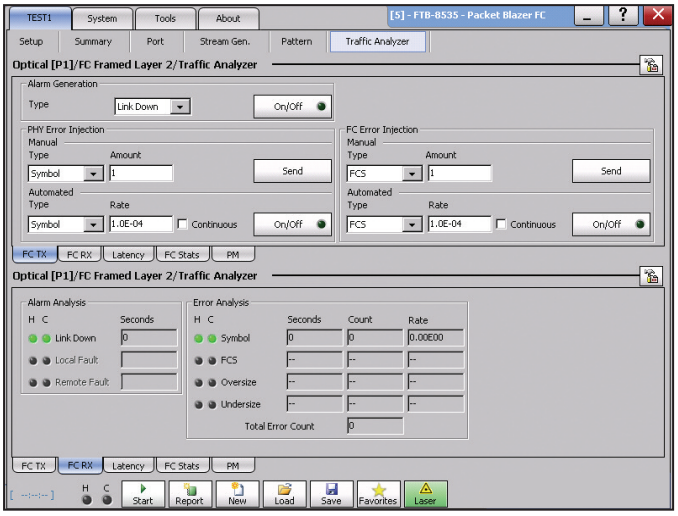
This is a crucial configuration parameter for optimal network performance. Usually, network administrators calculate the value by taking the traveled distance and the data rate into consideration; however, since latency issues are not considered, poor accuracy is to be expected. The FTB-8525/8535 modules 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

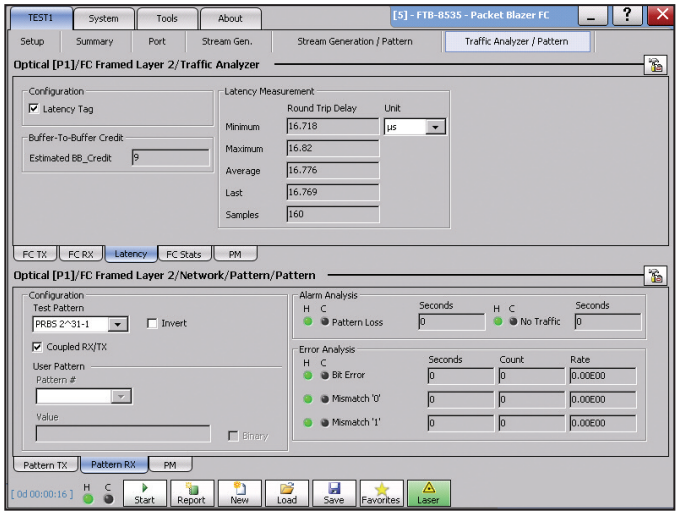
Most new-generation transport devices (xWDM or SONET/SDH mux) supporting Fibre Channel are no longer fully transparent; they also have increased built-in intelligence, acting more as Fibre Channel switches. With switch fabric login ability, the FTB-8525/8535 Packet Blazer modules support connections to a remote location through a fabric or semi-transparent networks.

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



Alarm and error generation and analysis screen



Latency and BERT analysis screen

Ethernet Performance Validation and Reliability

EXFO's FTB-8525/8535 Packet Blazers offer a wide range of Ethernet test functions aimed at performance validation and reliability testing, supporting multiple Ethernet interfaces, both optical and electrical.

ELECTRICAL INTERFACES	OPTICAL INTERFACES
10 Mbit/s	100 Mbit/s
100 Mbit/s	1000 Mbit/s (GigE)
1000 Mbit/s	10 Gbit/s (10 GigE LAN/WAN)–FTB-8535 only

Applications

The FTB-8525/8535 Packet Blazer modules deliver the features required to perform Ethernet service acceptance testing, namely RFC 2544 and BER testing.

RFC 2544 Testing

In cases where the Ethernet service is delivered via switched transport, the RFC 2544 measurements provide a baseline for service providers to define SLAs with their customers. They enable service providers to validate the quality of service (QoS) delivered in order to create value-added services that can be measured and demonstrated to customers. For example, these tests provide performance statistics and commissioning verification for virtual LANs (VLANs), virtual private networks (VPNs) and transparent LAN services (TLS), all of which use Ethernet as an access technology.

The FTB-8525/8535 Packet Blazer modules come with a complete set of RFC 2544 test capabilities, including:

- Throughput testing
- Burst (back-to-back) testing
- Frame loss analysis
- Latency measurement

BER Testing

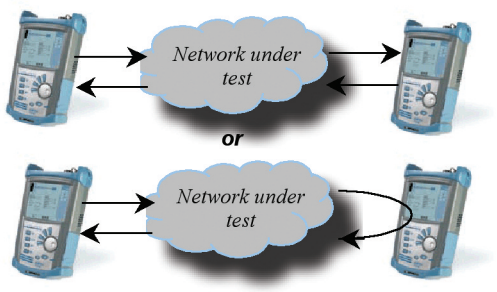
Because the transparent transport of Ethernet services over physical media is becoming common, Ethernet is increasingly carried across a variety of layer 1 media over longer distances. This creates a growing need for the certification of Ethernet transport on a bit-per-bit basis, which can be done using bit-error-rate testing (BERT). BERT uses a pseudo-random binary sequence (PRBS) encapsulated into an Ethernet frame, making it possible to go from a frame-based error measurement to a bit-error-rate measurement.

This provides the bit-per-bit error count accuracy required for acceptance testing of physical-medium transport systems. In addition to BER testing, the FTB-8525/8535 Packet Blazer modules also provide service disruption time (SDT) measurements.

Dual Test Set

The dual test set configuration allows the user to test asymmetrically with two end ports and two test sets while being in direct control of only one test set. Two test sets are required for local/remote testing, also known as head-to-head testing. The user operates one test set, designated as the "local test set", which controls the other, designated as the "remote test set".

This configuration enables the user to carry out RFC 2544 benchmark tests and achieve better visibility of each test direction (local to remote, remote to local) than by only viewing round-trip results. This is especially important for data networks where paths within the network are often different in each direction. It is also possible to perform end-to-end testing using the Smart Loopback configuration. In this case, traffic at the far end will be looped back to the near end providing round-trip results. The loopback function's "intelligence" enables it to switch the source and destination information up to layer 4.



Dual test set and Smart Loopback testing.

Ethernet and IP QoS testing

Data services are making a significant shift toward supporting a variety of applications on the same network. This shift has fuelled the need for QoS testing to ensure the condition and reliability of services. By providing the ability to configure different Ethernet and IP QoS parameters such as VLAN ID (802.1Q), VLAN priority (802.1p), VLAN stacking (802.1ad Q-in-Q), ToS and DSCP on multiple streams, the FTB-8525/8535 allows service providers to simulate and qualify different types of applications running over their Ethernet network. The frame analysis feature enables multi-stream traffic generation and analysis as well as packet jitter measurement (RFC 3393) and out-of-sequence testing. These measurements let service providers efficiently benchmark transport networks when it comes to Ethernet services carrying multiple applications such as triple-play offerings (voice, video and data).

IP Test Tools

The FTB-8525/8535 Packet Blazer modules provide the ping and traceroute tools to execute connectivity tests at the IP layer.

PBB-TE and MPLS: Carrier Ethernet Transport Solution Testing

As technologically-sophisticated business and residential consumers continue to drive demand for premium, high-bandwidth data services such as voice and video, service providers worldwide are evolving their transport infrastructures to support these bandwidth and quality intensive services. No longer is an all-IP core sufficient – providers must now expand their IP convergence to the edge/metro network, in a cost-effective, quality-assured manner. Ethernet has long been accepted as an inexpensive, scalable data networking solution in LAN environments. The stringent quality of service expectations require solutions that tap into the cost-effectiveness of Ethernet without sacrificing the benefits of connection-oriented (albeit it costly) time-division multiplexing (TDM) solutions such as SONET/SDH.

Two Ethernet tunneling technologies address these requirements: Provider Backbone Bridge-Traffic Engineering or PBB-TE (also referred to as PBT) and transport MPLS. These two technologies enable connection-oriented Ethernet, providing carriers with a means of offering scalable, reliable and resilient Ethernet services. The PBB-TE and MPLS options on the FTB-8525/8535 Packet Blazer offer service providers a comprehensive field tool to efficiently qualify Ethernet services from end-to-end, validating metro and core tunneling technologies.

Ethernet Advanced Troubleshooting

The FTB-8525/8535 provides a number of advanced features essential for in-depth troubleshooting in the event of network failures or impairments. The advanced filtering option allows the user to configure up to ten filters each with up to four operands, which will be applied to the received Ethernet traffic. Detailed statistics are available for each configured filter providing the user with critical information required to pinpoint specific problems. Other advanced troubleshooting tools include advanced auto-negotiation, flow control capabilities as well as Ethernet in the first mile 802.3ah support.

Fibre Channel Interfaces

FC-1x/2x/4x

Wavelength (nm)	850	1310	1310	1550
Tx level (dBm)	−9 to −2.5	−8.4 to −3	0 to 5	1 to 5
Rx level sensitivity (dBm)	−15 at FC-4 −18 at FC-2 −20 at FC-1	−18 at FC-4 −21 at FC-2 −22 at FC-1	−18 at FC-4 −21 at FC-2 −22 at FC-1	−16.5 at FC-4 −20.5 at FC-2 −22 at FC-1
Maximum reach (FC-1)	500 m on 50/125 µm MMF 300 m on 62.5/125 µm MMF	4 km	30 km	40 km
Transmission bit rate (Gbit/s)	1.06/2.125/4.25	1.06/2.125/4.25	1.06/2.125/4.25	1.06/2.125/4.25
Reception bit rate (Gbit/s)	1.06/2.125/4.25	1.06/2.125/4.25	1.06/2.125/4.25	1.06/2.125/4.25
Tx operational wavelength range (nm)	830 to 860	1260 to 1350	1285 to 1345	1544.5 to 1557.5
Measurement accuracy (uncertainty)				
Frequency (ppm)	±4.6	±4.6	±4.6	±4.6
Optical power (dB)	±2	±2	±2	±2
Max Rx before damage (dBm)	3	3	3	3
Jitter compliance	ANSI FC-PI-2	ANSI FC-PI-2	ANSI FC-PI-2	ANSI FC-PI-2
FC classification	ANSI FC-PI-2	ANSI FC-PI-2	ANSI FC-PI-2	ANSI FC-PI-2
Laser type	VCSEL	Fabry-Perot	DFB	DFB
Eye safety	Class 1	Class 1	Class 1	Class 1
Connector	LC	LC	LC	LC
Transceiver type	SFP	SFP	SFP	SFP

FC-10x

Wavelength (nm)	850	1310	1310	1550	1550
Tx level (dBm)	−5 to −1	0.5 max	−6 to −1	−1 to 2	0 to 4
Rx level sensitivity (dBm)	−11.1	−12.6	−14.4	−16	−23
Maximum reach	300 m on 50/125 µm MMF	10 km	10 km	40 km	80 km
Transmission bit rate (Gbit/s)	10.5	10.5	10.5	10.5	10.5
Reception bit rate (Gbit/s)	10.5	10.5	10.5	10.5	10.5
Tx operational wavelength range (nm)	840 to 860	1260 to 1355	1290 to 1330	1530 to 1565	1530 to 1565
Measurement accuracy (uncertainty)					
Frequency (ppm)	±4.6	±4.6	±4.6	±4.6	±4.6
Optical power (dB)	±2	±2	±2	±2	±2
Max Rx before damage (dBm)	6	6	6	2	4
Jitter compliance	ANSI FC-PI-3	ANSI FC-PI-3	ANSI FC-PI-3	ANSI FC-PI-3	ANSI FC-PI-3
FC classification	ANSI FC-PI-3	ANSI FC-PI-3	ANSI FC-PI-3	ANSI FC-PI-3	ANSI FC-PI-3
Laser type	VCSEL	DFB	DFB	EML	EML
Eye safety	Class 1	Class 1	Class 1	Class 1	Class 1
Connector	LC	LC	LC	LC	LC
Transceiver type	XFP	XFP	XFP	XFP	XFP

Fibre Channel Functional Specifications

TESTING (1x, 2x, 4x and 10x)

BERT	Unframed, framed FC-1, framed FC-2.
Patterns (BERT)	PRBS 2E31-1, 2E23-1, 2E20-1, 2E15-1, 2E11-1, 2E9-1 CSPAT, CRPAT, CJTPAT, and 10 user-defined 32-bit patterns.
Error insertion	Bit error, symbol error, oversize error, CRC error, undersize error and block error (10x only).
Error measurement	Bit error, symbol error, oversize error and block error, performance management (G.821 and G.826).
Alarm insertion	LOS, pattern loss, link down, local and remote fault (10x only).
Alarm detection	LOS, pattern loss, link down, local and remote fault (10x only).
Buffer-to-buffer credit testing	Buffer-to-buffer credit estimation based on latency.
Latency	Round-trip latency measurement.

ADDITIONNAL TEST AND MEASUREMENT FUNCTIONS (1x, 2x, 4x and 10x)

Power measurement	Support optical power measurement, displayed in dBm.
Frequency measurement	Supports clock frequency measurements (i.e., received frequency and deviation of the input signal clock from nominal frequency).
Frequency offset measurement	Range: ±120 ppm Resolution: 1 ppm Accuracy (uncertainty): ±4.6 ppm

Ethernet Interfaces

ELECTRICAL INTERFACES

	10Base-T	100Base-T	1000Base-T
Tx bit rate	10 Mbit/s	125 Mbit/s	1.25 Gbit/s
Tx accuracy (uncertainty) (ppm)	±100	±100	±100
Rx bit rate	10 Mbit/s	125 Mbit/s	1 Gbit/s
Rx measurement accuracy (uncertainty) (ppm)	±4.6	±4.6	±4.6
Duplex mode	Half and full duplex	Half and full duplex	Full duplex
Jitter compliance	IEEE 802.3	IEEE 802.3	IEEE 802.3
Connector	RJ-45	RJ-45	RJ-45
Maximum reach (m)	100	100	100

100 Mbit/s AND GigE OPTICAL INTERFACES

	100Base-FX	100Base-LX	1000Base-SX	1000Base-LX	1000Base-ZX
Wavelength (nm)	1310	1310	850	1310	1550
Tx level (dBm)	–20 to –15	–15 to –8	–9 to –3	–9.5 to –3	0 to 5
Rx level sensitivity (dBm)	–31	–28	–20	–22	–22
Maximum reach	2 km	15 km	550 m	10 km	80 km
Tx bit rate (Gbit/s)	0.125	0.125	1.25	1.25	1.25
Rx bit rate (Gbit/s)	0.125	0.125	1.25	1.25	1.25
Tx operational wavelength range (nm)	1280 to 1380	1261 to 1360	830 to 860	1270 to 1360	1540 to 1570
Measurement accuracy (uncertainty)					
Frequency (ppm)	±4.6	±4.6	±4.6	±4.6	±4.6
Optical power (dB)	±2	±2	±2	±2	±2
Maximum Rx before damage (dBm)	3	3	6	6	6
Jitter compliance	ANSI X3.166	IEEE 802.3	IEEE 802.3	IEEE 802.3	–
Ethernet classification	ANSI X3.166	IEEE 802.3	IEEE 802.3	IEEE 802.3	–
Laser type	LED	FP	VCSEL	FP	DFB
Eye safety	CLASS 1	CLASS 1	CLASS 1	CLASS 1	CLASS 1
Connector	LC	LC	LC	LC	LC
Transceiver type	SFP	SFP	SFP	SFP	SFP

10 GigE OPTICAL INTERFACES

	10GBase-SW	10GBase-SR	10GBase-LW	10GBase-LR	10GBase-EW	10GBase-ER
Wavelength (nm)	850 Multimode	850 Multimode	1310 Singlemode	1310 Singlemode	1550 Singlemode	1550 Singlemode
Tx level (802.3ae-compliant) (dBm)	–7.3 to –1	–7.3 to –1	–8.2 to 0.5	–8.2 to 0.5	–4.7 to 4.0	–4.7 to 4.0
Rx operating range (dBm)	–9.9 to –1.0	–9.9 to –1.0	–14.4 to 0.5	–14.4 to 0.5	–15.8 to –1.0	–15.8 to –1.0
Transmission bit rate	9.95328 Gbit/s ± 4.6 ppm [a]	10.3125 Gbit/s ± 4.6 ppm [a]	9.95328 Gbit/s ± 4.6 ppm [a]	10.3125 Gbit/s ± 4.6 ppm [a]	9.95328 Gbit/s ± 4.6 ppm [a]	10.3125 Gbit/s ± 4.6 ppm [a]
Reception bit rate	9.95328 Gbit/s ± 135 ppm	10.3125 Gbit/s ± 135 ppm	9.95328 Gbit/s ± 135 ppm	10.3125 Gbit/s ± 135 ppm	9.95328 Gbit/s ± 135 ppm	10.3125 Gbit/s ± 135 ppm
Tx operational wavelength range (802.3ae-compliant) (nm)	840 to 860	840 to 860	1260 to 1355	1260 to 1355	1530 to 1565	1530 to 1565
Measurement accuracy (uncertainty)						
Frequency (ppm)	±4.6	±4.6	±4.6	±4.6	±4.6	±4.6
Optical power (dB)	±2	±2	±2	±2	±2	±2
Maximum Rx before damage (dBm)	0	0	1.5	1.5	4.0	4.0
Jitter compliance	IEEE 802.3ae	IEEE 802.3ae	IEEE 802.3ae	IEEE 802.3ae	IEEE 802.3ae	IEEE 802.3ae
Ethernet classification	IEEE 802.3ae	IEEE 802.3ae	IEEE 802.3ae	IEEE 802.3ae	IEEE 802.3ae	IEEE 802.3ae
Laser type	VCSEL	VCSEL	DFB	DFB	EML	EML
Eye safety	Class 1 laser; complies with 21 CFR 1040.10 and IEC 60825-1	Class 1 laser; complies with 21 CFR 1040.10 and IEC 60825-1	Class 1 laser; complies with 21 CFR 1040.10 and IEC 60825-1	Class 1 laser; complies with 21 CFR 1040.10 and IEC 60825-1	Class 1M laser; complies with 21 CFR 1040.10 and IEC 60825-1	Class 1M laser; complies with 21 CFR 1040.10 and IEC 60825-1
Connector	Duplex LC	Duplex LC	Duplex LC	Duplex LC	Duplex LC	Duplex LC
Transceiver type (compliant with XFP MSA)	XFP	XFP	XFP	XFP	XFP	XFP

Note

a. When clocking is in internal mode.

Ethernet Functional Specifications

TESTING (10 Mbit/s TO GigE)

RFC 2544	Throughput, back-to-back, frame loss and latency measurements according to RFC 2544. Frame size: RFC-defined sizes, user-configurable.
BERT	Unframed, framed layer 1, framed layer 2 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, CRPAT, CSPAT, CJTPAT, Short CRTPAT, Long CRTPAT and up to 10 user patterns. Capability to invert patterns.
Error insertion (BERT)	FCS, bit and symbol.
Error measurement	Jabber/giant, runt, undersize, oversize, FCS, symbol, idle, carrier sense, alignment, collision, late collision, excessive collision, UDP and IP header checksum.
Error measurement (BERT)	Bit error, symbol error, idle error, bit mismatch 0, bit mismatch 1, performance monitoring (G.821 and G.826).
Alarm insertion (BERT)	LOS, pattern loss.
Alarm detection	LOS, link down, pattern loss, no traffic.
Service disruption time measurement (BERT)	Defect or No Traffic mode. Disruption time statistics include shortest, longest, last, average, total and count.
VLAN stacking	Capability to generate one stream with up to three layers of VLAN (including IEEE 802.1ad Q-in-Q tagged VLAN).
Ethernet statistics	Multicast, broadcast, unicast, N-unicast, frame size distribution, bandwidth, utilization, frame rate.
Flow control statistics	Pause time, last pause time, max. pause time, min. pause time, paused frames, abort frames, frames Tx, frames Rx.
Advanced auto-negotiation	Capability to auto-negotiate the rate, duplex and flow control capabilities with another Ethernet port. Configurable auto-negociation parameters. Display of link partner capabilities. Fault injection: offline, link failure, auto-negotiation error.
Remote ENIU configuration	Capability to support the operation, administration and maintenance (OAM) layer between an FTB-8120NGE/8130NGE and ADC ENIUs. This includes detection of ENIUs in the network and sending loopback commands.
Multistream generation	Capability to transmit up to 10 streams. Configuration parameters are packet size, transmission mode (N-Frames, Burst, N-Burst, Ramp, N-Ramp and Continuous), MAC source/destination address, VLAN ID, VLAN priority, IP source/destination address, ToS field, DSCP field, TTL, UDP source/destination port and payload. (Available with Frame-Analyzer software option.)
Traffic analysis	Capability to analyze the incoming traffic and provide statistics according to a set of up to 10 configurable filters. Filters can be configured for MAC source/destination address, VLAN ID, VLAN priority, IP source/destination address, ToS field, DSCP field, TCP source/destination port and UDP source/destination port. VLAN filtering can be applied to any of the stacked VLAN layers. (Available with Frame-Analyzer software option.)
Ethernet statistics	Multicast, broadcast, unicast, N-unicast, pause frame, frame size distribution, bandwidth, utilization, frame rate, frame loss, out-of-sequence frames and in-sequence frames. (Available with Frame-Analyzer software option.)
Jitter statistics generation	Packet-jitter simulation–VoIP G.711, VoIP G.723.1, G.729, user-defined. Analysis: delay variation statistics (ms)–min., max., last, average, number of samples and jitter measurement estimate. (Available with Frame-Analyzer software option.)
PBB-TE	Capability to generate and analyze streams with PBB-TE data traffic including configuration of B-MAC (source and destination), B-VLAN and I-tag (as per 802.1ah) and to filter received traffic by any of these fields.
MPLS	Capability to generate and analyze streams with up to two layers of MPLS labels and to filter received traffic by MPLS label or COS.
IPv6	Capability to perform BERT, RFC 2544, traffic generation and analysis and Smart Loopback tests over IPv6.
Advanced filtering	Capability to enhance the filters with up to four (4) fields each, which can be combined with AND/OR/NOT operations. A mask is also provided for each field value to allow for wildcards. Complete statistics are gathered for each defined filter.

ADDITIONAL TEST AND MEASUREMENT FUNCTIONS (10 Mbit/s TO GigE)

Power measurement	Supports optical power measurement, displayed in dBm.
Frequency measurement	Supports clock frequency measurements (i.e., received frequency and deviation of the input signal clock from nominal frequency).
Frequency offset measurement	Range: ±120 ppm Resolution: 1 ppm Accuracy (uncertainty): ±4.6 ppm
Dual test set	Performs end-to-end, bidirectional performance testing (as required by leading standards bodies)–remote FTB-8120NGE/8130NGE controlled via the LAN connection under test.
DHCP client	Capability to connect to a DHCP server to obtain its IP address and subnet mask for connecting on to the network.
Smart Loopback	Capability to return traffic to the local unit by swapping packet overhead up to layer 4 of the OSI stack.

TESTING (10 GigE)

RFC 2544	Throughput, back-to-back, frame loss and latency measurements according to RFC 2544. Frame size: RFC-defined sizes, user-configurable.
Patterns (BERT)	PRBS 2E9-1, PRBS 2E11-1, PRBS 2E15-1, PRBS 2E20-1, PRBS 2E23-1, PRBS 2E31-1, and up to ten user patterns
Error insertion (BERT)	FCS, bit, 64B/66B Block
Error measurement	LAN/WAN: jabber/giant, runt, undersize, oversize, FCS, 64B/66B Block WAN: B1, B2, B3, REI-L, REI-P UDP, TCP and IP header checksum
Error measurement (BERT)	Bit error, bit mismatch 0, bit mismatch 1, performance monitoring (G.821 and G.826)
Alarm insertion	LOS, link down, local fault, remote fault, pattern loss (BERT) WAN: SEF, LOF, AIS-L, RDI-L, AIS-P, RDI-P, LCD-P, LOP-P, ERDI-PSD, ERDI-PCD, ERDI-PPD, UNEQ-P
Alarm detection	LOS, link down, local fault, remote fault, frequency offset, pattern loss (BERT) WAN: SEF, LOF, AIS-L, RDI-L, AIS-P, RDI-P, LCD-P, LOP-P, ERDI-PSD, ERDI-PCD, ERDI-PPD, PLM-P, UNEQ-P, link (WIS)
Service disruption time measurement (BERT)	Defect or No Traffic mode. Disruption time statistics include shortest, longest, last, average, total and count.
VLAN stacking	Capability to generate one stream with up to three layers of VLAN (including IEEE802.1ad Q-in-Q tagged VLAN).
Ethernet statistics	Multicast, broadcast, unicast, N-unicast, frame size distribution, bandwidth, utilization, frame rate.
Flow control statistics	Pause time, last pause time, max. pause time, min. pause time, paused frames, abort frames, frames Tx, frames Rx.
Multistream generation	Capability to transmit up to 10 streams. Configuration parameters are packet size, transmission mode (N-Frames, Burst, N-Burst, Ramp, N-Ramp and Continuous), MAC source/destination address, VLAN ID, VLAN priority, IP source/destination address, ToS field, DSCP field, TTL, UDP source/destination port and payload. (Available with Frame-Analyzer software option.)
Traffic analysis	Capability to analyze the incoming traffic and provide statistics according to a set of up to 10 configurable filters. Filters can be configured for MAC source/destination address, VLAN ID, VLAN priority, IP source/destination address, ToS field, DSCP field, TCP source/destination port and UDP source/destination port. VLAN filtering can be applied to any of the stacked VLAN layers. (Available with Frame-Analyzer software option.)
Ethernet statistics	Multicast, broadcast, unicast, N-unicast, pause frame, frame size distribution, bandwidth, utilization, frame rate, frame loss, out-of-sequence frames and in-sequence frames. (Available with Frame-Analyzer software option.)
Jitter statistics generation	Packet-jitter simulation–VoIP G.711, VoIP G.723.1, G.729, user-defined. Analysis: delay variation statistics (ms)–min., max., last, average, number of samples and jitter measurement estimate. (Available with Frame-Analyzer software option.)
PBB-TE	Capability to generate and analyze streams with PBB-TE data traffic including configuration of B-MAC (source and destination), B-VLAN and I-tag (as per 802.1ah) and to filter received traffic by any of these fields.
MPLS	Capability to generate and analyze streams with up to two layers of MPLS labels and to filter received traffic by MPLS label or COS.
IPv6	Capability to perform BERT, RFC 2544, traffic generation and analysis and Smart Loopback tests over IPv6.
Advanced filtering	Capability to enhance the filters with up to four (4) fields each, which can be combined with AND/OR/NOT operations. A mask is also provided for each field value to allow for wildcards. Complete statistics are gathered for each defined filter.

ADDITIONAL TEST AND MESUREMENT FUNCTIONS (10 GigE)

Power measurement	Supports optical power measurement, displayed in dBm.
Frequency generation and measurement	Supports clock frequency generation and measurements (i.e., received frequency and deviation of the input signal clock from nominal frequency). Frequency offset generation: Range: ±50 ppm Resolution: ±1 ppm Accuracy (uncertainty): ±4.6 ppm Frequency offset measurement: Range: ±135 ppm Resolution: ±1 ppm Accuracy (uncertainty): ±4.6 ppm
Signal label control and monitoring	Ability to configure and monitor J0 Trace, J1 Trace and payload signal label C2 (WAN).
Dual test set	Performs end-to-end, bidirectional performance testing (as required by leading standards bodies)–remote FTB-8120NGE/8130NGE controlled via the LAN connection under test.
DHCP client	Capability to connect to a DHCP server to obtain its IP address and subnet mask to connect to the network.
Smart Loopback	Capability to return traffic to the local unit by swapping packet overhead up to layer 4 of the OSI stack.

Additional Features

Expert mode	Ability to set thresholds in RFC 2544 and BERT mode to provide a pass/fail status.
Scripting [a]	The built-in Visual Basic .NET scripting engine and embedded macrorecorder provide a simple means of automating test cases and routines. Embedded scripting routines provide a powerful means of creating advanced test scripts.
Event logger	Supports logging of test results, and the ability to print, export (to a file), or export the information contained in the logging tool.
Power up and restore [a]	In the event of a power failure to the unit, the active test configuration and results are saved and restored upon bootup.
Save and load configuration	Ability to store and load test configurations to/from non-volatile memory.
Configurable test views [a]	Allows users to customize their test views; i.e., to dynamically insert or remove test tabs/windows, in addition to creating new test windows, so as to accurately match their testing needs.
Configurable test timer	Allows a user to set a specific start, stop and duration for tests.
Test favorites	Capability to select and load from predefined or user-modified test conditions.
Report generation	Ability to generate test reports in the following user-selectable formats: .pdf, .html, .txt and .csv.
Graph	Allows to graphically display the test statistics of the performance (RFC 2544).
Screen capturing [b]	Capability to gather a snap-shot of the screen for future use.
Logger printing [b]	Capability to send logger messages to a supported local printer.
Remote control	Remote control through Visual Guardian Lite software or VNC.

NOTES

a. Available on the FTB-400 and FTB-500 platforms only.

b. Available on the FTB-200 platform only.

MODEL SPECIFICATIONS

		FTB-8525	FTB-8535
Fibre Channel Rate Options			
FC10x	Fibre Channel 10x rate	Not applicable	Included
FC4x	Fibre Channel 4x rate	Included	Option
FC1x-FC2x	Fibre Channel 1x and 2x rates	Included	Option
Ethernet Rate Options			
10GigE	Ethernet 10 GigE LAN and WAN	Not applicable	Option
GigE	Ethernet 10/100/1000 Base-T and optical GigE	Option	Option
100optical	100 Mbit/s optical Ethernet	Option	Option

GENERAL SPECIFICATIONS

	FTB-8525	FTB-8535
Weight (without transceiver)	0.9 kg (2.0 lb)	0.9 kg (2.0 lb)
Size (H x W x D)	96 mm x 51 mm x 280 mm (3 ¾ in x 2 in x 11 in)	96 mm x 51 mm x 288 mm (3 ¾ in x 2 in x 11 3/8 in)
Temperature		
Operating	0 °C to 40 °C (32 °F to 104 °F)	0 °C to 40 °C (32 °F to 104 °F)
Storage	–40 °C to 60 °C (–40 °F to 140 °F)	–40 °C to 60 °C (–40 °F to 140 °F)

ORDERING INFORMATION

FTB-85XX-XX-XX-XX-XX-XX

Models
FTB-8525 = Fibre Channel and Ethernet test module
FTB-8535 = Fibre Channel and Ethernet test module

Ethernet Rate Options
00 = without rate option
LAN/WAN 10GigE = Ethernet 10GigE LAN and WAN [a]
10M/100M/1000M = Ethernet 10/100/1000 Base-T and optical GigE
100M-0-AP = 100 Mbit/s optical Ethernet [b]

Fibre Channel Rate Options
FC1x, 2x = Fibre Channel 1x and 2x testing [c]
FC4x = Fibre Channel 4x testing [c]
FC10x = Fibre Channel 10x testing [d]

Transceivers SFP Test Port
00 = SFP test port
FTB-85910 = 100Base-FX (1310 nm) MM, LC connectors; optical SFP transceiver module [e]
FTB-85911 = 100Base-LX (1310 nm) SM, LC connectors; optical SFP transceiver module [e]
FTB-85912 = SFP modules GigE/FC/2FC/4FC at 850 nm, MMF, <500 m
FTB-85913 = SFP modules GigE/FC/2FC/4FC at 1310 nm, MMF, <4 km
FTB-85914 = SFP modules GigE/FC/2FC/4FC at 1310 nm, MMF, <30 km
FTB-85915 = SFP modules GigE/FC/2FC/4FC at 1550 nm, MMF, <40 km

Options
Frame-Analyzer = Multiple stream generation and analysis
PBB-TE = PBB-TE testing
MPLS = MPLS testing
Adv_filtering = Advanced filtering capabilities
IPv6 = IPv6 testing capabilities

Transceivers XFP Test Port [a]
FTB-85900 = 10GBase-SR/-SW (850 nm, LAN/WAN PHY) LC connectors; optical XFP transceiver module
FTB-85901 = 10GBase-LR/-LW (1310 nm, LAN/WAN PHY) LC connectors; optical XFP transceiver module
FTB-85902 = 10GBase-ER/-EW (1550 nm, LAN/WAN PHY) LC connectors; optical XFP transceiver module

Example: FTB-8535-10M/100M/1000M-FC10x-85912-85901

Notes

a. Available with the FTB-8535 only.

b. Available only if the 10M/100M/1000 option is selected.

c. Included with the FTB-8525.

d. Included with the FTB-8535.

e. Available with the 100M-0-AP option only.

EXFO Corporate Headquarters > 400 Godin Avenue, Quebec City (Quebec) G1M 2K2 CANADA | Tel.: +1 418 683-0211 | Fax: +1 418 683-2170 | info@EXFO.com

Toll-free: +1 800 663-3936 (USA and Canada) | **www.EXFO.com**

EXFO America	3701 Plano Parkway, Suite 160	Plano, TX 75075 USA	Tel.: +1 800 663-3936	Fax: +1 972 836-0164
EXFO Asia	151 Chin Swee Road, #03-29 Manhattan House	SINGAPORE 169876	Tel.: +65 6333 8241	Fax: +65 6333 8242
EXFO China	No. 88 Fuhua First Road Central Tower, Room 801, Futian District	Shenzhen 518048 P. R. CHINA	Tel.: +86 (755) 8203 2300	Fax: +86 (755) 8203 2306
	Beijing New Century Hotel Office Tower, Room 1754-1755 No. 6 Southern Capital Gym Road	Beijing 100044 P. R. CHINA	Tel.: +86 (10) 6849 2738	Fax: +86 (10) 6849 2662
EXFO Europe	Omega Enterprise Park, Electron Way	Chandlers Ford, Hampshire S053 4SE ENGLAND	Tel.: +44 2380 246810	Fax: +44 2380 246801
EXFO Service Assurance	285 Mill Road	Chelmsford, MA 01824 USA	Tel.: +1 978 367-5600	Fax: +1 978 367-5700

SPFTB8525/8535.3AN

Printed in Canada 09/04

EXPERTISE REACHING OUT