Performance assurance for Ethernet-based services

- LAN and WAN PHY capability in a single module
- Fully integrated functionality for assessing the performance of Ethernet transport networks
- Packet jitter measurement to qualify Ethernet transport networks for transmission of delay-sensitive traffic such as video and voice-over-IP (VoIP)
- Throughput, back-to-back, latency and frame loss measurements as per RFC 2544 (bidirectional)
- EtherBERT™ test functionality for assessing the integrity of 10 Gigabit Ethernet running on WDM networks
- Multistream generation and analysis, allowing quality of service (QoS) verification through VLAN and TOS/DSCP prioritization testing
- MPLS and PBB-TE support for complete carrier Ethernet validation

Platform Compatibility

- FTB-400 Universal Test System
- FTB-200 Compact Platform
The Choice for 10 Gigabit Ethernet

Performance Assurance

EXFO’s FTB-8510G Packet Blazer™ offers performance assurance for 10 Gigabit Ethernet-based services. Its suite of test applications provides all the measurements required for validating service-level agreements (SLAs) between service providers and their customers. Housed in the FTB-400 Universal Test System or FTB-200 Compact Platform, the FTB-8510G module tests connectivity in its native format: 10GBASE-xR or 10GBASE-xW used for transport of Ethernet-based LAN-to-LAN services. It can also be used to test next-generation SONET/SDH, hybrid multiplexers, dark fiber or xWDM networks running 10 Gigabit Ethernet interfaces.

Combined with its rack-mounted manufacturing/R&D-environment counterpart, the IQS-8510G Packet Blazer, the FTB-8510G simplifies and speeds up the deployment of Ethernet services.

Key Features

- Measures throughput, back-to-back, latency and frame loss as per RFC 2544 (bidirectional)
- EtherBERT™ for bit-error-rate testing of 10 Gigabit Ethernet circuits
- Performs packet jitter measurement (IP packet-delay variation as per RFC 3393) to qualify Ethernet transport networks for transmission of delay-sensitive traffic such as video and voice-over-IP (VoIP)
- Q-in-Q capability with the ability to go up to three layers of stacked VLANs
- LAN PHY and WAN PHY available in a single module
- Simultaneous traffic generation and reception at 100 % wire speed for 10GBASE-SR, -ER, -LR, -SW, -EW or -LW full-duplex interfaces at all valid frame sizes
- Transmits and analyzes up to 10 streams, perfect for installing, commissioning and maintaining Ethernet networks
- UDP, TCP and IP header integrity validation
- Dual test set
- Expert mode capability for defining test pass/fail thresholds
- Easy-to-use smart user interface (SUI) for configurable screens, customization of test suites, as well as real-time and historical performance reporting
- Capability to remote control the Packet Blazer test module with the Visual Guardian Lite software or VNC
- Advanced filtering capability for in-depth network troubleshooting
- PBB-TE and MPLS support for carrier Ethernet
- Smart Loopback

* Patent-pending

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Ethernet Performance Validation

The Internet Engineering Task Force (IETF) has put together a test methodology to address the issues of layers 2 and 3 performance verification. RFC 2544, a “Benchmarking Methodology for Network Interconnect Devices,” specifies the requirements and procedures for testing throughput (performance availability), back-to-back frames (link burstability), frame loss (service integrity) and latency (transmission delay).

These measurements provide a baseline for service providers to define customer SLAs. They enable service providers to validate quality of service (QoS), allowing them 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.

RFC 2544 Test Suite
The FTB-8510G Packet Blazer can perform the RFC 2544 test suite for 10/100/1000Base-T and optical 100 Mbit/s and GigE interfaces at all frame sizes and at full line rate, allowing the provider to certify that the circuit is efficient and error-free at 100 % utilization.

The Packet Blazer supports automated RFC 2544 testing, which helps ensure repeatable results. Automation also provides ease of use for field technicians by enabling accurate, efficient measurements and results through a clear and simple pass/fail indication. In addition, the Packet Blazer delivers reports that can be given to customers for future reference related to their specific SLAs.

Throughput
Throughput is the maximum rate at which none of the offered frames are dropped by the device under test (DUT) or network under test (NUT). For example, the throughput test can be used to measure the rate-limiting capability of a switch. The throughput is essentially equivalent to the bandwidth.

The throughput test allows vendors to report a single value, which has proven to be useful in the marketplace. Since even the loss of one frame in a data stream can cause significant delays while waiting for the higher level protocols to time out, it is useful to know the actual maximum data rate that the device can support. Measurements should be taken over an assortment of frame sizes.

Burst (Back-to-Back)
In this test, fixed-length frames are presented at a rate such that there is the minimum legal separation for a given medium between frames over a configurable period of time, starting from an idle state. The back-to-back value is the number of frames in the longest burst that the DUT/NUT will handle without the loss of any frames.
Frame Loss
Frame loss is the percentage of frames that should have been forwarded by a network device under steady state (constant) loads that were not forwarded due to lack of resources. This measurement can be used in reporting the performance of a network device in an overloaded state. This can be a useful indication of how a device would perform under pathological network conditions such as broadcast storms.

Latency
Round-trip latency is the time it takes a bit (cut-through devices) or a frame (store and forward devices) to come back to its starting point. Variability of latency can be a problem. With technologies like voice- and video-over-IP, a variable or long latency can cause significant degradation in quality.

Efficient Testing Leads to Reliable Performance

TCP Throughput
The Internet protocol (IP) and transmission control protocol (TCP) together form the essence of TCP/IP networking. While IP deals with the delivery of packets, TCP provides the integrity and assurance that the data packets transmitted by one host are reliably received at the destination. Applications such as hypertext transfer protocol (HTTP), e-mail or file transfer protocol (FTP) depend on TCP as their delivery assurance mechanism within networks.

Customers deploying such applications expect not only physical and link level SLAs from their service providers, but assurance that their TCP traffic requirements will be supported across the network. The TCP Throughput feature on the Packet Blazer™ offers Ethernet service providers the capability of measuring and validating that the services offered to their customers support the TCP traffic performance they expect.

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) 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-8510G Packet Blazer offer service providers a comprehensive field tool to efficiently qualify Ethernet services from end-to-end, validating metro and core tunneling technologies.
EtherBERT™

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. BERT-over-Ethernet should usually be used when Ethernet is carried transparently over layer 1 media, in cases such as:

- Ethernet-over-DWDM
- Ethernet-over-CWDM
- Ethernet-over-dark fiber

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 Packet Blazer allows service providers to simulate and qualify different types of applications running over their Ethernet network.

This FTB-8510G Packet Blazer frame analysis feature enables multistream traffic generation and analysis allowing for the troubleshooting of Ethernet circuits as well as customer-traffic analysis and error identification. Thanks to its packet jitter measurement capability (RFC 3393), the FTB-8510G lets service providers efficiently benchmark transport networks when it comes to delay-sensitive traffic such as voice- and video-over-IP.

Flexible End-to-End Testing

With the FTB-8510G Packet Blazer, the user can perform end-to-end testing through control of the remote unit via the LAN connection under test. This unique approach gives service providers access to test results for each direction of test, which is essential to fully qualify Ethernet services. It is also possible to perform end-to-end testing by using the Smart Loopback mode where the remote unit will return traffic to the local unit by swapping packet overhead up to layer 4 of the OSI stack.

Ethernet Advanced Troubleshooting

The FTB-8510G 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 with each 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.
## Functional Specifications

### OPTICAL INTERFACES

<table>
<thead>
<tr>
<th>Wavelength</th>
<th>10BASE-SW</th>
<th>10BASE-SR</th>
<th>10BASE-LW</th>
<th>10BASE-LR</th>
<th>10BASE-EW</th>
<th>10BASE-ER</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Multimode</strong></td>
<td>850 nm</td>
<td>850 nm</td>
<td>1310 nm</td>
<td>1310 nm</td>
<td>1550 nm</td>
<td>1550 nm</td>
</tr>
<tr>
<td><strong>Singlemode</strong></td>
<td>850 nm</td>
<td>850 nm</td>
<td>1310 nm</td>
<td>1310 nm</td>
<td>1550 nm</td>
<td>1550 nm</td>
</tr>
</tbody>
</table>

| **Tx level (802.3ae-compliant)** | –7.3 to –1 dBm | –7.3 to –1 dBm | –8.2 to +0.5 dBm | –8.2 to +0.5 dBm | –4.7 to +4.0 dBm | –4.7 to +4.0 dBm |
| **Rx level sensitivity** | –9.9 to –1.0 dBm | –9.9 to –1.0 dBm | –14.4 to +0.5 dBm | –14.4 to +0.5 dBm | –15.8 to –1.0 dBm | –15.8 to –1.0 dBm |


| **Tx operational wavelength range** | 840 nm to 860 nm | 840 nm to 860 nm | 1260 nm to 1355 nm | 1260 nm to 1355 nm | 1530 nm to 1565 nm | 1530 nm to 1565 nm |

| **Measurement accuracy** | ±4.6 ppm | ±4.6 ppm | ±4.6 ppm | ±4.6 ppm | ±4.6 ppm | ±4.6 ppm |

| **Maximum Rx before damage** | 0 dBm | 0 dBm | +1.5 dBm | +1.5 dBm | +4.0 dBm | +4.0 dBm |

| **Jitter compliance** | IEEE 802.3ae | IEEE 802.3ae | IEEE 802.3ae | IEEE 802.3ae | IEEE 802.3ae | IEEE 802.3ae |

| **Etherton 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 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 |

| **Connector** | Duplex LC | Duplex LC | Duplex LC | Duplex LC | Duplex LC | Duplex LC |

| **Transceiver type** | XFP | XFP | XFP | XFP | XFP | XFP |

* When clocking is in internal mode.

### SYNCHRONIZATION INTERFACES

#### DS1/E1 external input clock interface

<table>
<thead>
<tr>
<th>Parameter</th>
<th>DS1</th>
<th>E1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rx level sensitivity (short haul only)</td>
<td>1.544 Mbit/s ± 50 ppm</td>
<td>2.048 Mbit/s ± 50 ppm</td>
</tr>
<tr>
<td>Reception bit rate</td>
<td>1.544 Mbit/s ± 50 ppm</td>
<td>2.048 Mbit/s ± 50 ppm</td>
</tr>
<tr>
<td>Input jitter tolerance</td>
<td>AT&amp;T PUB 62411, GR-499 section 7.3</td>
<td>HDB3 and AMI</td>
</tr>
<tr>
<td>Line coding</td>
<td>AMI and B8ZS</td>
<td>AMI and B8ZS</td>
</tr>
<tr>
<td>Input impedance</td>
<td>100 ohms ± 5%, balanced</td>
<td>120 ohms ± 5%, balanced</td>
</tr>
<tr>
<td>Connector type</td>
<td>BANTAM</td>
<td>BANTAM</td>
</tr>
</tbody>
</table>

#### Clock out interface

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tx pulse amplitude</td>
<td>600 mVpp ± 130 mV</td>
</tr>
<tr>
<td>Transmission frequency/ Clock divider</td>
<td>LAN = 644.53 MHz</td>
</tr>
<tr>
<td></td>
<td>Clock divider = 32 = 322.26 MHz</td>
</tr>
<tr>
<td></td>
<td>Clock divider = 64 = 161.133 MHz</td>
</tr>
<tr>
<td>Output configuration</td>
<td>AC coupled</td>
</tr>
<tr>
<td>Load impedance</td>
<td>50 ohms</td>
</tr>
<tr>
<td>Maximum cable length</td>
<td>3 meters</td>
</tr>
<tr>
<td>Connector type</td>
<td>SMA</td>
</tr>
</tbody>
</table>
**Functional Specifications (Cont’d)**

### OPTICAL INTERFACES

- **Optical interfaces**
  - 10 GigE LAN and 10 GigE WAN *
- **Available wavelengths**
  - 850, 1310 and 1550 nm

### ELECTRICAL INTERFACES

- **Electrical interfaces**
  - External clock DS1/E1 and clock output
- **Framing**
  - DS1: SF and ESF
  - E1: PVC30, PVC30CRC, PVC31 and PVC31CRC
- **Clocking**
  - Internal, external (BITS) and recovered

### ADDITIONAL TEST AND MEASUREMENT FUNCTIONS

#### POWER MEASUREMENT

Power measurement
- Supports optical power measurement, displayed in dBm.
- Frequency measurement
- Supports clock frequency offset generation and measurements (i.e., received frequency and deviation of the input signal clock from nominal frequency).

#### FREQUENCY OFFSET GENERATION

- **Range**
  - ±120 ppm
- **Resolution**
  - ±1 ppm
- **Accuracy**
  - ±4±ppm

#### SIGNAL LABEL CONTROL AND MONITORING

- **Ability to configure and monitor J0 trace, J1 trace and payload signal label C2 (WAN).**
- **Performance monitoring (G.821 and G.826).**
- **Analysis:** delay variation statistics (ms): min., max., last, average, number of samples, jitter measurement estimate.

#### FRAUD DETECTION AND MONITORING

- **Ability to configure and monitor J0 trace, J1 trace and payload signal label C2 (WAN).**
- **Performance monitoring (G.821 and G.826).**
- **Analysis:** delay variation statistics (ms): min., max., last, average, number of samples, jitter measurement estimate.

#### CLOCKING

- **Clocking**
  - Internal, external (BITS) and recovered
- **Termination**
  - DS1/E1: Term, AMI and HDB3
- **Line coding**
  - FCS, bit, 64B/66B Block.
- **Error correction**
  - LAN/WAN: jabber/gant, run, undersize, oversize, FCS, 64B/66B Block.
- **Error detection**
  - LAN/WAN: LOF, link down, local fault, remote fault, process, (LSS) BERT
- **Packet loss (G.821 and G.826).**
- **Traffic analysis**
  - Multicast, broadcast, unicast, N-unicast, pause frame, frame size distribution, bandwidth, utilization, frame rate, frame loss, out-of-sequence frames, in-sequence frames.
- **Alarm detection**
  - LOS, link down, local fault, remote fault, frequency offset, (LSS) BERT.
- **Traffic analysis**
  - Multicast, broadcast, unicast, N-unicast, pause frame, frame size distribution, bandwidth, utilization, frame rate, frame loss, out-of-sequence frames, in-sequence frames.
- **Alarm detection**
  - LOS, link down, local fault, remote fault, frequency offset, (LSS) BERT.
- **Traffic analysis**
  - Multicast, broadcast, unicast, N-unicast, pause frame, frame size distribution, bandwidth, utilization, frame rate, frame loss, out-of-sequence frames, in-sequence frames.
- **Alarm detection**
  - LOS, link down, local fault, remote fault, frequency offset, (LSS) BERT.
- **Traffic analysis**
  - Multicast, broadcast, unicast, N-unicast, pause frame, frame size distribution, bandwidth, utilization, frame rate, frame loss, out-of-sequence frames, in-sequence frames.

### ADDITIONAL FEATURES

- **Expert mode**
  - Ability to set thresholds in RFC 2844 and BERT mode to provide a PASS/FAIL status.
- **Scripting**
  - The built-in Visual Basic .NET scripting engine and embedded macro recorder provide a simple means of automating test cases and routines.
- **Event logger**
  - Embedded scripting routines provide a powerful means of creating advanced test scripts.
- **Power up and restore**
  - In the event of a power failure to the unit, the active test configuration and results are saved and restored upon reboot.
- **Save and load configuration**
  - Ability to store and load test configurations to/from non-volatile memory.
- **Configurable test views**
  - 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 and stop time for tests.
- **Test favorites**
  - Ability 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, .xml and .csv.
- **Graph**
  - Allows for graphical display of the test statistics of the performance (RFC 2844) and frame analysis tables.
- **Screen capturing**
  - capability to capture a snapshot of the screen for future use.
- **Logger printing**
  - Capability to send log messages to a supported local printer.
- **Remote control**
  - Remote control through Visual Guardian Lite software or VNC.

### NOTES

- Available as an option.
- Available on the FTB-200 platform only.
- Available on the FTB-400, IQS-500 and IQS-600 platforms only.

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**NEW FEATURES**

- **New features added in the latest version.**
- **Improved accuracy and reliability.**

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# FTB-8510G

## 10 Gigabit Ethernet Test Module

### MODULE SPECIFICATIONS

<table>
<thead>
<tr>
<th></th>
<th>FTB-8510G-LAN</th>
<th>FTB-8510G-WAN</th>
<th>FTB-8510G-LAN/WAN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Port</td>
<td>One 10 Gigabit Ethernet port</td>
<td>One 10 Gigabit Ethernet port</td>
<td>One 10 Gigabit Ethernet port</td>
</tr>
<tr>
<td>Connector type</td>
<td>LC</td>
<td>LC</td>
<td>LC</td>
</tr>
<tr>
<td>Optical transceiver</td>
<td>850 nm optics (10GBASE-SR)</td>
<td>1310 nm optics (10GBASE-LR)</td>
<td>1550 nm optics (10GBASE-ER)</td>
</tr>
<tr>
<td>Port capacity</td>
<td>Full-line-rate traffic generation and analysis</td>
<td>Full-line-rate traffic generation and analysis</td>
<td>Full-line-rate traffic generation and analysis</td>
</tr>
<tr>
<td>Ethernet testing</td>
<td>RFC 1242, RFC 2544, RFC 3393, multistream traffic generation and analysis, EtherBERT</td>
<td>RFC 1242, RFC 2544, RFC 3393, multistream traffic generation and analysis, EtherBERT</td>
<td>RFC 1242, RFC 2544, RFC 3393, multistream traffic generation and analysis, EtherBERT</td>
</tr>
</tbody>
</table>

### GENERAL SPECIFICATIONS

- **Size (H x W x D):** 25 mm x 96 mm x 260 mm (1 in x 3 in x 10 in)
- **Weight (without transceiver):** 0.5 kg (1.2 lb)
- **Temperature:**
  - Operating: 0 °C to 40 °C (32 °F to 104 °F)
  - Storage: −40 °C to 60 °C (−40 °F to 140 °F)

### ORDERING INFORMATION

**Model**

- FTB-8510G-LAN = Packet Blazer 10 GigE, 1 port 10 Gigabit Ethernet LAN PHY (10.3125 Gbit/s)
- FTB-8510G-WAN = Packet Blazer 10 GigE, 1 port 10 Gigabit Ethernet WAN PHY (9.953 Gbit/s)
- FTB-8510G-LAN/WAN = Packet Blazer 10 GigE, 1 port 10 Gigabit Ethernet LAN and WAN PHY (10.3125 and 9.953 Gbit/s)

**Example:** FTB-8510G-LAN-MPLS

**Other options**

- 00 = Without other options
- FTB-8585 = Software option converting an FTB-8510G-LAN or FTB-8510G-WAN to a FTB-8510G-LAN/WAN model.
- PBB-TE = PBB-TE testing
- MPLS = MPLS testing
- Adv_filtering = Advanced Filtering Capabilities

### TRANSCIEVER

- FTB-85900 = 10GBase-SR/-SW (850 nm, LAN/WAN PHY) LC connectors; optical XFP transceiver module for 8510G Packet Blazer
- FTB-85901 = 10GBase-LR/-LW (1310 nm, LAN/WAN PHY) LC connectors; optical XFP transceiver module for 8510G Packet Blazer
- FTB-85902 = 10GBase-ER/-EW (1550 nm, LAN/WAN PHY) LC connectors; optical XFP transceiver module for 8510G Packet Blazer

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EXFO is certified ISO 9001 and attests to the quality of these products. This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation. EXFO has made every effort to ensure that the information contained in this specification sheet is accurate. However, we accept no responsibility for any errors or omissions, and we reserve the right to modify design, characteristics and products at any time without obligation. Units of measurement in this document conform to SI standards and practices. In addition, all of EXFO's manufactured products are compliant with the European Union’s WEEE directive. For more information, please visit [www.EXFO.com/recycle](http://www.EXFO.com/recycle).

For the most recent version of this spec sheet, please go to the EXFO website at [http://www.EXFO.com/specs](http://www.EXFO.com/specs).

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