

# FTB-8830NGE Power Blazer

## 10G MULTISERVICE TEST MODULE



Comprehensive test suite for the turn-up, circuit validation and troubleshooting of Ethernet, SONET/SDH, OTN, Fibre Channel and SyncE/1588 PTP services up to 10G.

### KEY FEATURES AND BENEFITS

Comprehensive testing for SONET/SDH, OTN and Ethernet interfaces up to 10G

Dual-port Ethernet testing up to 10 Gigabit Ethernet

OTN testing (as per ITU-T G.709) including forward error correction (FEC)

Efficiently assesses Fibre Channel networks with best-in-class coverage via 1x, 2x, 4x, 8x, 10x and 16x interfaces

Packet synchronization turn-up and troubleshooting (SyncE/1588 PTP)

True wire-speed, stateful TCP throughput based on RFC 6349 for undisputable SLA enforcement of Ethernet services

Faster Ethernet service activation with bidirectional EtherSAM (ITU-T Y.1564) and RFC 2544 test suites, multistream traffic generation, Through mode and bit-error-rate (BER) testing

OTN, SONET/SDH, FC and Ethernet bit-error-rate testing (BERT) with real-time pass/fail status, quick action buttons, clear results and assorted notifications

Simpler reporting thanks to integrated Wi-Fi and Bluetooth connectivity capabilities

FTB ecosystem and EXFO Connect-compatible with software upgrade manager as well as automated cloud-based asset and test data management capabilities

Housed in either the FTB-500, FTB-2 or FTB-2 Pro platform complete with integrated optical tools, battery operation, power-up and restore, remote access, GPS capabilities and test reports

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

### PLATFORM COMPATIBILITY



Platform  
FTB-500



Platform  
FTB-2 or FTB-2 Pro



## THE POWERFUL CHOICE FOR MULTISERVICE TESTING

The ongoing transition towards a converged network infrastructure for SONET/SDH, OTN, Fibre Channel and packet-based Ethernet services requires a test tool that can cover a wide range of interfaces and rates without sacrificing portability, speed or cost. Leveraging the intelligent FTB-2, FTB-2 Pro or the FTB-500 platform, the FTB-8830NGE Power Blazer streamlines processes and empowers technicians to customize their testing solution in order to efficiently validate SONET/SDH, OTN, Fibre Channel and Ethernet circuits.

The FTB-500, FTB-2 and FTB-2 Pro Windows-based platforms are accessible in any environment and at any time, thanks to unmatched connectivity via Wi-Fi, Bluetooth, Gigabit Ethernet and USB.

### POWERFUL YET SIMPLE

Since next-generation networks are becoming more and more complex, the FTB-8830NGE Power Blazer module is designed to cover all testing needs up to 10G without sacrificing simplicity. Thanks to a highly intuitive graphical user interface (GUI), streamlined procedures and predefined configurations, new users will be able to master this tool with little-to-no training. By combining the FTB-8830NGE Power Blazer module with any EXFO optical module for fiber characterization and OSNR qualification, technicians can run them simultaneously, and speed up both the testing and time to service.

#### What you need for any SONET/SDH, OTN, Fibre Channel or Ethernet application

- › Installation, commissioning and maintenance of access and metro networks
- › Turn-up of SONET/SDH circuits
- › Performance assessment of Carrier Ethernet services
- › Validation of OTN networks and services
- › Installation, activation and maintenance of metro Ethernet networks
- › Deployment of active Ethernet (point-to-point) access services
- › Installation and activation of Fibre Channel networks
- › Testing and troubleshooting
- › In-service troubleshooting of live traffic
- › Performance monitoring of SONET/SDH and OTN circuits
- › Round-trip delay assessment of transport circuits
- › BER testing up to 11.3 Gbit/s

#### SONET/SDH, OTN, FIBRE CHANNEL AND ETHERNET UP TO 10 Gbit/s

The FTB-8830NGE is the perfect solution for multiservice testing up to 11.3 Gbit/s.

- › RJ-45 port for electrical 10/100/1000M Ethernet
- › SFP port for OC-1/3/12/48 or STM-0/1/4/16, OTU1 and Fibre Channel 1x, 2x, 4x or 100/1000M Ethernet
- › SFP+ port for OC-192, STM-64, 10 GigE LAN/WAN or Fibre Channel 8x, 10x, 16x, OTU2, OTU1e/2e and OTU1f/2f

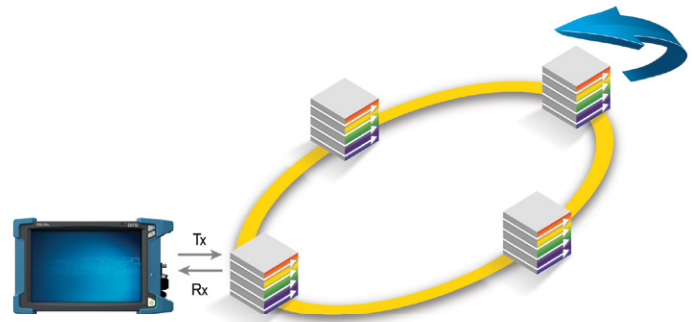
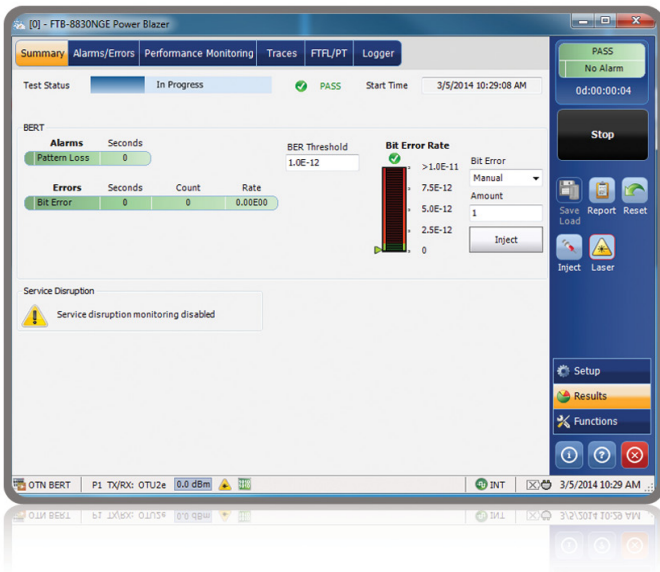
- › SONET/SDH and OTN BER testing with configurable threshold settings
- › Coupled, Decoupled and Through mode testing
- › Error and alarm insertion and monitoring
- › Overhead monitoring and manipulation
- › High-order and low-order mappings
- › Tandem connection monitoring (TCM)
- › Pointer manipulation, including pointer sequence testing as per Telcordia GR-253, ANSI T1.105-03 and ITU G.783
- › Performance monitoring as per G.821, G.826, G.828, G.829, M.2100, M.2101
- › Frequency analysis and offset generation
- › Automatic protection switching
- › Service-disruption time measurements
- › Round-trip delay measurements
- › External clock sync support
- › 10Base-T to 10 GigE testing

- › EtherSAM (ITU-T Y.1564) (bidirectional)
- › RFC 2544 (bidirectional)
- › Traffic generation and monitoring
- › Through mode
- › Dual-port testing
- › Intelligent autodiscovery
- › IPv6 testing
- › VLAN stacking MPLS
- › Ping/Traceroute
- › Cable testing
- › Dual Test Set mode
- › Smart loopback
- › Fibre Channel 1x, 2x, 4x, 8x, 10x, 16x
- › One-way latency
- › Carrier Ethernet OAM including MPLS-TP OAM (G8113.1), Y.1731, 802.1ag and MEF OAM
- › Ethernet MAC flooding

## SIMPLIFIED BER TESTING

With the FTB-8830NGE Power Blazer, you can preconfigure OTN (from OTU1 or OTU2, including standard overclocked rates), Ethernet (from 10M to 10G), SONET/SDH (from OC-3/STM-1 to OC-192/STM-64), and Fibre Channel (1x, 2x, 4x, 8x, 10x, 16x) bit-error-rate (BER) test parameters prior to arrival at the test site, and then load them from the Favorites menu with one click.

Furthermore, the preconfigured "Favorites" can be copied from one platform to another or even sent to technicians out in the field via e-mail, where they can load them using the USB port on their platform. Once the BER test has started, the FTB-8830NGE provides clear results, assorted notifications and real-time pass/fail status via text or icons. Clicking on the pass/fail indicator maximizes this important status to full screen, providing instant, easily understood notification, whether a given unit is in your hand or across the room.



## ETHERNET PERFORMANCE ASSESSMENT

The FTB-8830NGE offers an automated RFC 2544 test suite for all supported Ethernet interfaces at all frame sizes and at full line rate, delivering repeatable test results and error-free circuit certification at 100% utilization.

RFC 2544 is complemented by five Smart Loopback modes. So, whether you are looking to pinpoint loopback traffic from a UDP or TCP layer, or all the way down to a completely promiscuous mode (Transparent Loopback), the FTB-8830NGE can adjust to all loopback situations where the remote unit will return traffic to the local unit by swapping packet overhead up to layer 4 of the OSI stack. The Ethernet performance assessment capabilities of the FTB-8830NGE also include test reports with detailed throughput, frame loss, back-to-back and latency measurements, and clear histograms for future reference regarding specific service-level agreements (SLAs).



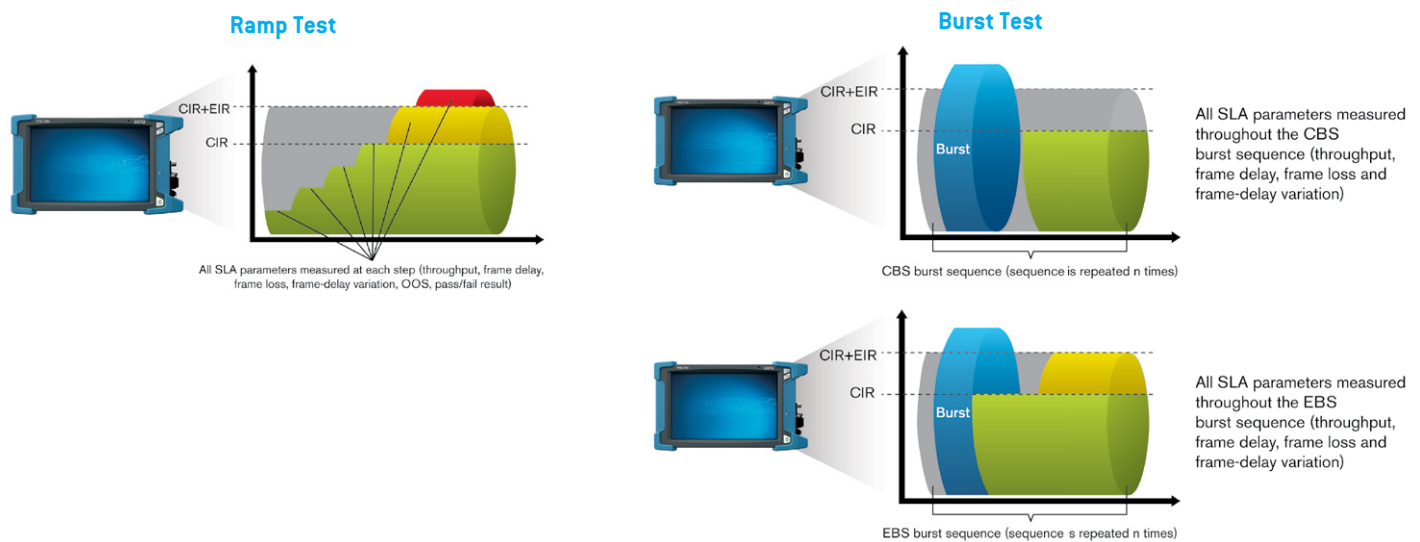
## ETHERSAM: ITU-T Y.1564 ETHERNET SERVICE ACTIVATION

With more and more Ethernet services being activated today, the new ITU-T Y.1564 standard addresses the growing demand for turning up and troubleshooting Carrier Ethernet services. Supported on the FTB-8830NGE Power Blazer module for 10M-to-10G Ethernet client services, this new methodology brings numerous advantages, including validation of critical SLA criteria such as packet jitter and QoS measurements, as well as faster time to service. 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. It can simulate all types of services that will run on the network and simultaneously qualify all key SLA parameters for each of these services.

Moreover, it validates the QoS mechanisms provisioned in the network to prioritize the different service types, resulting in better troubleshooting, more accurate validation and much faster deployment. EtherSAM is comprised of two phases: the service configuration test and the service performance test.

### Service Configuration Test

The service configuration test consists in sequentially testing each service in order to validate that each is properly provisioned and that all specific KPIs or SLA parameters are met. A ramp test and a burst test are performed to verify the committed information rate (CIR), excess information rate (EIR), committed burst size (CBS) and excess burst size (EBS).



### Service Performance Test

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



## DUAL TEST SET

Whether the customer is using RFC 2544 or Y.1564 (EtherSAM) for service activation, both tests can be executed in Dual Test Set mode. In this case, two test sets, one designated as local and the other as remote, are used to communicate and independently run tests per direction. The dual-test-set approach is a more accurate test scenario. In this case, two units perform an asymmetrical SLA measurement, providing test results per direction. This scenario's main strength is that it quickly pinpoints which direction has not been configured properly or is at fault, while providing performance metrics for each direction.

Results from both directions are sent and displayed on the local unit to ensure that the entire test routine can be completed by a single person in control of a single unit, thus resulting in shorter test time and reduced manpower. This flexibility also guarantees that different units can be set as a remote unit. The most interesting scenario is a centralized unit that is always configured as a remote unit with fixed addresses. The carrier can simply dispatch a single test person to a test site, following which the tester can quickly discover and execute service turn-up and burn-in quickly and efficiently without requiring an extra worker in the central office.

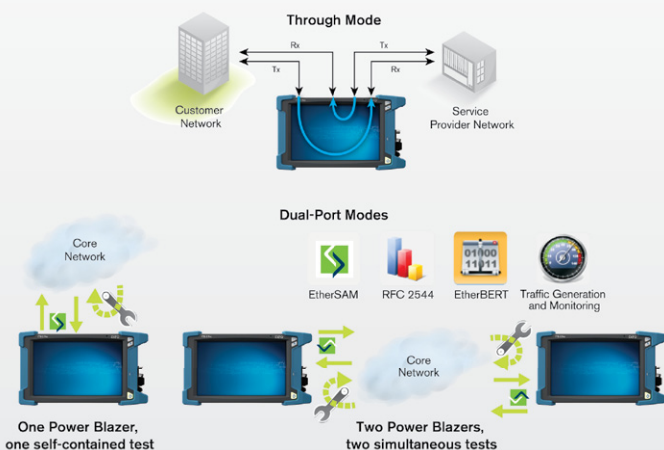
The dual test-set approach also provides the capability to segment the network and quickly pinpoint in which direction issues occur. This is especially important in cases where the bandwidth differs between the upstream and downstream directions. In such instances, using a loopback tool will always yield the same results, because the measurement will be affected by the lowest throughput, and the test results will not reflect that one direction has higher performance than the other. The same scenario will occur if a network misconfiguration is present in only one direction of the service. Depending on the error, the problem will not be identified with round-trip measurements. This often results in customer complaints and additional truck rolls. With the dual test-set approach, both directions are independently analyzed at the same time, and pass/fail results are provided per direction, yielding the highest level of confidence in service testing.

## ETHERNET TRAFFIC GENERATION AND MONITORING

Multiservice offerings such as triple-play services have fuelled the need for QoS testing to ensure the condition and reliability of each service and qualify SLA parameters. The FTB-8830NGE Power Blazer, with the traffic generation and monitoring application, allows service providers to simultaneously simulate and qualify different applications. Up to 16 streams can be configured with 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. Traffic simulation also includes traffic shaping with burst and ramp capabilities. In the same line, a MAC flooding capability is available for switch-addressable memory testing, where the range of MAC addresses can be cycled, forcing the switch to learn each of these MAC addresses. The FTB-8830NGE also offer the flexibility to define one configuration profile and apply it to as many streams as required. From there, it is just a matter of tweaking them to each stream. The FTB-8830NGE also simultaneously measures throughput, latency, packet jitter (RFC 3393), frame loss and out-of-sequence errors in all streams, yielding fast and in-depth qualification of all SLA criteria. Results are displayed in tabular format and on analog visual gauges to ensure that test outcomes are quickly and easily interpreted.

## CARRIER ETHERNET OAM

Metro Ethernet networks with carrier-class Ethernet services demand performance measurements for proper system maintenance. Ethernet service operations, administration and management (OAM) covers the end-to-end measurements and standards needed for systems maintenance. OAM utilizes a variety of protocols for installing, monitoring and troubleshooting networks, including network discovery, link monitoring, remote fault detection, and remote loopback. This in turn simplifies Ethernet service deployments as Ethernet moves to mass deployment. Carrier Ethernet OAM is also a mechanism for monitoring and validating SLAs that eliminates finger-pointing between carriers. Most service providers are focusing today on implementing connectivity fault management and performance monitoring OAM protocols, including Ethernet (Y.1731, 802.1ag, MEF) and MPLS-TP(G.8113.1) OAMs.



## DUAL-PORT AND THROUGH MODE TESTING

The FTB-8830NGE Power Blazer series is equipped for both Through mode or dual-port testing. Through mode allows traffic to pass through the Power Blazer's two ports for in-service troubleshooting of live traffic between the carrier/service provider network and the customer's network. This allows technicians to access circuits under test without the need for a splitter. With dual-port testing, the technician can use a single Power Blazer module to launch the test and perform the loopback. With two Power Blazer modules, the dual-port feature also enables users to run two simultaneous tests to maximize time and efficiency.



## 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 FTB-8830NGE supports virtual local area network (VLAN) tags, Q-in-Q VLAN tags and multiprotocol label switching (MPLS).

## IP CONNECTIVITY TOOLS

As part of the IP connectivity tools, the ping tool is used to verify that the user can reach a specific address within or outside of a subnetwork. The traceroute tool is a modified version of the ping tool and is used to determine the route or the number of hops that are required to reach a destination host. These basic tools are essential when testing through routed networks. These test results can pinpoint critical configuration issues within the network.

## SIMPLIFIED ERROR INJECTION

This FTB-8830NGE feature enables the user to inject errors with a single click from any screen, allowing technicians to ensure circuit continuity prior to starting a test. Furthermore, the error injection functionality can be preprogrammed for any given type of error, and not just for bit errors.



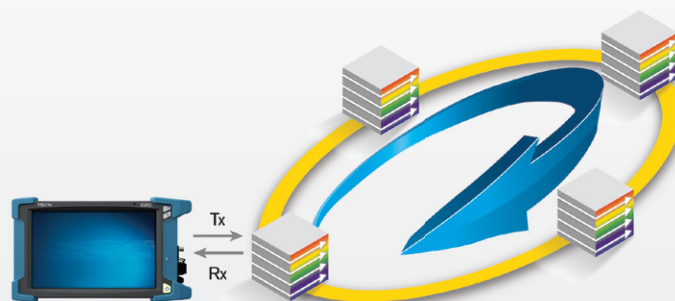
## COMPLETE OVERHEAD MANIPULATION AND MONITORING

EXFO's FTB-8830NGE module allows for complete OTN and SONET/SDH overhead manipulation and monitoring for advanced testing and troubleshooting. Furthermore and consistent with this module's simplified testing approach, the overhead manipulation and monitoring capability is categorized under "Functions" in the GUI and apart from the default setup and results pages. The Functions category offers various testing capabilities required for advanced troubleshooting.

## DELAY MEASUREMENT

Today, carriers have an opportunity to turn optical networks into a competitive advantage by guaranteeing low-latency traffic transmission for delay-sensitive applications including video, cloud computing and financial trading applications. With this in mind, the FTB-8830NGE Power Blazer module enables OTN, SONET/SDH and Ethernet delay measurements across all supported testing interfaces, enabling carriers to solidify their competitive advantage when building low-latency optical transport networks, and guarantee the speed of service to their end customers.

This functionality measures the time required for a bit to travel from the transmitter of the FTB-8830NGE and back to the receiver after crossing a far-end loopback, thereby providing complete delay results including delay measurement and min./max./average delay statistics.



## EFFICIENTLY ASSESSING PERFORMANCE OF FIBRE CHANNEL SERVICES

The Power Blazer Series modules provide comprehensive testing capabilities for Fibre Channel network deployments, supporting multiple Fibre Channel interfaces.

### APPLICATIONS

Since most storage area networks (SANs) cover large distances, and because Fibre Channel has stringent performance requirements, it is imperative to test at each phase of network deployment to ensure appropriate service levels. EXFO's Power Blazer Series modules provide full wire-speed traffic generation at the FC-2 layer, which allows for BER testing for link integrity measurements. The Power Blazer 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.

It is therefore critical for service providers to properly characterize network latency when offering Fibre Channel services. The Power Blazer 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, 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 Power Blazer 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.

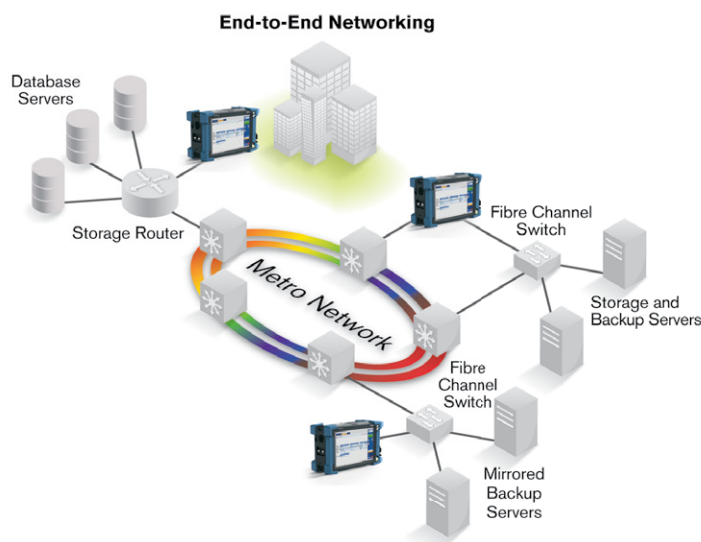
#### Login Testing

Most new-generation transport devices (xWDM or SONET/SDH mux) supporting 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 Power Blazer 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 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  | 14.0                 | 1600             |



*Thanks to end-to-end network testing capabilities, EXFO's Power Blazer enables 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.*



**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 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.



## 10M-T0-100G KEY FEATURES

### Ethernet

|                                     |  |
|-------------------------------------|--|
| Rates                               | 10/100/1000M Base-T, 100M (optical) GigE, 10 GigE LAN/WAN  |
| Power measurement                   | Optical channel power measurement with color indicators  |
| Frequency measurement               | Clock frequency measurements displayed in Hz   |
| EtherSAM (ITU-T Y.1564)             | Performs service configuration and service performance tests as per ITU-T Y.1564 including EBS, CBS and EMIX; use remote loopback or dual test set mode for bidirectional results  |
| 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   |
| Smart loopback                      | Returns Ethernet traffic to the local unit by swapping packet overhead up to layer 4   |
| Dual test set                       | Complementing RFC 2544 and EtherSAM (ITU-T Y.1564) for bidirectional measurements, including one-way latency   |
| Intelligent autodiscovery           | Offers intelligent autodiscovery of other EXFO modules, allowing a single user to perform end-to-end testing   |
| BER testing                         | Up to layer 4 supported with or without VLAN Q-in-Q.   |
| 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, including MAC flooding for source and destination MAC addresses   |
| Frame size                          | Fixed (from 64 to 16 000 bytes), Random and Sweep (from 64 to 16 000 bytes)  |
| VLAN stacking                       | Generates up to three layers of VLAN (including IEEE 802.1ad Q-in-Q tagged VLAN)   |
| 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  |
| Packet jitter statistics            | Delay variation statistics (ms): min., max., last, average and jitter measurement estimate (RFC 3393)  |
| Flow control statistics             | Injects or monitors pause frames, including frame counts of pause, abort frames and total, last, maximum and minimum pause time.   |
| Service disruption time (SDT)       | No Traffic mode up to 10G; disruption time statistics include shortest, longest, last, average, total and count  |
| Auto-negotiation                    | Capability to auto-negotiate the rate, duplex and flow control capabilities with another Ethernet port   |
| Traffic filtering                   | Incoming traffic analysis and 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 |
| Advanced filtering                  | Capability to enhance the filters with up to four fields each, which can be combined with AND/OR/NOT operations; a mask is also provided for each field value to allow for wild cards; complete statistics are gathered for each defined filter  |
| Data capture                        | Full-line-rate data capture and decoding at up to 10G; configuration of detailed capture filters and triggers, as well as capture slicing parameters   |
| MPLS                                | Generates and analyzes streams with up to two layers of MPLS labels.   |
| IPv6 testing                        | Performs the following tests up to 10G over IPv6, EtherSAM, RFC 2544, BERT, traffic generation and monitoring, through mode, intelligent auto discovery, ping and trace route  |
| IP tools                            | Performs ping and traceroute functions.  |
| Signal label control and monitoring | Configuration and monitoring of J0 trace, J1 trace and payload signal label C2 (WAN) for 10 GigE   |
| DHCP client                         | Connection to a DHCP server to obtain its IP address and subnet mask to connect to the network   |
| TCP throughput                      | True wire-speed, stateful TCP throughput test based on RFC 6349 for undisputable SLA enforcement of Ethernet services  |
| Cable testing                       | Category 5 cable (or better), 100 UTP/STP cable, ≤120 meters   |
| Through mode                        | Sectionalizes traffic between a service provider's network and customer premises equipment   |
| 1588 PTP                            | Validates 1588 PTP packet network synchronization services, 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  |
| Carrier Ethernet OAM                | Fault-management and performance monitoring Ethernet and MPLS-TP OAM protocols, including Y.1731, 802.1ag, MEF, and G.8113.1 OAMs. Addresses metro Ethernet networks. Supports Continuity Check, Loopback, Link Trace, Test, Frame Delay, Frame Loss, Synthetic Loss functions, and AIS, CSF, RDI, and LCK alarms generation and monitoring.                           |
| Pass/Fail verdicts                  | Provides a pass/fail outcome with user-adjustable thresholds, based on bit error rate and/or service disruption time   |

**10M-TO-100G KEY FEATURES (CONT'D)**

|                                      |  |
|--------------------------------------|--|
| <b>OTN</b>                           |  |
| Rates                                | OTU1 (2.7 Gbit/s), OTU2 (10.7 Gbit/s), OTU1e (11.0491 Gbit/s), OTU2e (11.0957 Gbit/s), OTU1f (11.2701 Gbit/s), OTU2f (11.3176 Gbit/s)                          |
| Power measurement                    | Optical channel power measurement with color indicators  |
| Frequency measurement                | Clock frequency measurements displayed in Hz   |
| Frequency offset                     | Offsetting of the transmitted signal's clock on a selected interface, and monitoring to exercise clock recovery circuitry on network elements                  |
| Alarms and errors                    | Generation and analysis of OTL, OTU, ODU and OPU alarms and errors   |
| Forward error correction (FEC)       | Generation and analysis of FEC correctable and uncorrectable errors  |
| Service disruption time (SDT)        | Measures the time during which there is a disruption of service due to the network switching from the active channels to the backup channels                   |
| Round-trip delay (RTD)               | Measures the time required for a bit to travel from the transmitter back to the receiver after crossing a far-end loopback                                     |
| Through mode                         | Ability to perform intrusive and transparent Through mode analysis of any OTN signal   |
| <b>SONET/SDH</b>                     |  |
| Rates                                | OC-1/STM-0, OC3/STM-1, OC-12/STM-4, OC-48/STM-16, OC-192/STM-64  |
| High-order mappings                  | STS-1/3c/12c/48c/192c and AU-3/AU-4/AU-4-4c/16c/64c  |
| Low-order mappings                   | VT1.5, TU-11/12/3  |
| Power measurement                    | Optical channel power measurement with color indicators  |
| Frequency measurement                | Clock frequency measurements displayed in Hz   |
| Frequency offset                     | Offsetting of the transmitted signal's clock on a selected interface, and monitoring to exercise clock recovery circuitry on network elements                  |
| Performance monitoring               | G.821, G.826, G.828, G.829, M.2100, M.2101   |
| Pointers                             | Generation and analysis of STS/AU and VT/TU pointer adjustments as per GR-253, and ITU-T G.707   |
| Service disruption time (SDT)        | The SDT 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 |
| Round-trip delay (RTD)               | The RTD test tool measures the time required for a bit to travel from the transmitter back to the receiver after crossing a far-end loopback                   |
| Automatic protection switching (APS) | Ability to monitor and set up automatic protection switching messages (K1/K2 byte of SONET/SDH overhead)   |
| Programmable errors/alarms           | Ability to inject errors/alarms in the following modes: Manual, Constant Rate, Burst (Periodic and Continuous)   |
| Through mode                         | Ability to perform intrusive and transparent Through mode analysis of any SONET/SDH signal   |
| Payload block and replace            | Ability to terminate and analyze a specific high-order path element and replace it with a PRBS pattern on the Tx side  |

## ORDERING INFORMATION

## FTB-8830NGE-XX-XX-XX-XX-XX-XX

**Model** ■

FTB-8830NGE = Base HW model  
 FTB-8830NGE-16X = HW option for FC16X support

**Ethernet Rate Options** ■

GigE Bundle = 10/100/1000 BASE-T, 100BASE-FX (optical), 1000BASE-X (optical)  
 10GigE = 10G LAN and 10G WAN

**SONET/SDH Rate Options** <sup>a</sup> ■

2.5G Bundle = OC-1/STM-0, OC3/STM-1, OC-12/STM-4, OC-48/STM-16  
 9953M = OC-192/STM-64

**Fibre Channel Rate Options** ■

00 = No Fibre Channel option  
 FC1X = 1x Fibre Channel interface <sup>b</sup>  
 FC2X = 2x Fibre Channel interface <sup>b</sup>  
 FC4X = 4x Fibre Channel interface <sup>b</sup>  
 FC8X = 8x Fibre Channel interface <sup>c</sup>  
 FC10X = 10x Fibre Channel interface <sup>c</sup>  
 FC16X = 16x Fibre Channel interface <sup>d</sup>

**OTN Rate Options** ■

00 = No OTN option  
 OTU1 = OTN optical rate of 2.666 Gbit/s  
 OTU2 = OTN optical rate 10.709 Gbit/s  
 OTU2-1e-2e = OTN optical rates of 11.049/11.096 Gbit/s  
 OTU2-1f-2f = OTN optical rates of 11.270/11.318 Gbit/s

**Ethernet Options**

00 = No Ethernet option  
 ADV-FILTERS = Advanced filtering  
 ETH-CAPTURE = Full-line-rate packet capture  
 ETH-OAM = Enables four OAM modes, including Y.1731, 802.1ag, MEF and G.8113.1 <sup>e</sup>  
 IPV6 = Internet protocol version 6 <sup>e</sup>  
 ETH-THRU = Through mode capability <sup>f</sup>  
 MPLS = Enables MPLS <sup>e</sup>  
 1588PTP = Generates and analyzes 1588 PTP <sup>e</sup>  
 SyncE = Generates and analyzes SyncE protocol <sup>e</sup>  
 Cable\_Test = Cable test <sup>f</sup>  
 TCP-THPUT = Enables TCP throughput measurements <sup>f</sup>

**SONET/SDH Options and Mapping**

00 = Without SONET/SDH software option  
 SONET = SONET-BASE and mapping <sup>g</sup>  
 SDH = SDH-BASE and mapping <sup>g</sup>  
 SONET-SDH = SONET and SDH combo software <sup>g</sup>  
 TCM = Tandem connection monitoring <sup>h</sup>

Example: FTB-8830NGE-10GigE-9953M-FC10X-OTU2-SONET-SDH-ETH-CAPTURE

**Notes**

- Requires SONET, SDH or SONET-SDH option.
- Requires purchase of SFP.
- Requires purchase of SFP+.
- Requires FTB-8830NGE-16X HW.
- Requires GigE bundle or 10 GigE.
- Requires GigE bundle.
- Requires enabling at least one of the following rate options: OTU1, OTU2, 2.5G Bundle or 9953M.
- Requires enabling 2.5G bundle or 9953M rate.

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