

# FTB-880 NetBlazer Multiservice Tester

POWERFUL, COMPREHENSIVE AND  
FAST MULTISERVICE TESTING



EtherSAM



Comprehensive, yet simple test suites for field technicians to easily turn up, validate and troubleshoot DSn/PDH, SONET/SDH and Ethernet services up to 10 Gbit/s.

## KEY FEATURES AND BENEFITS

Comprehensive testing for DSn/PDH, SONET/SDH and Ethernet interfaces up to 10 Gbit/s

Simplified BER testing with pass/fail indicators based on user-defined thresholds

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

Unprecedented configuration simplicity with hybrid touchscreen/keypad navigation and data entry

Higher technician autonomy and productivity with intelligent discovery of remote EXFO Ethernet testers, as well as in-service Ethernet testing via dual-port Through mode

No data interpretation errors with revolutionary new GUI on 7-inch TFT screen, historical event logger, visual gauges and 3D-icon depictions of pass/fail outcomes

Simpler reporting with integrated Wi-Fi and Bluetooth connectivity capabilities

Centralized support for injection/monitoring of errors and alarms, trace messaging, overhead monitoring/manipulation and performance monitoring statistics

Integrated applications to test VoIP services, and additional IP test utilities, including VLAN scan and LAN discovery via EXpert VoIP and EXpert IP test tools

Support for packet capture and analysis, wireless troubleshooting and TCP throughput testing

Extended field autonomy with compact, lightweight platform equipped with long-duration battery pack

## PLATFORM COMPATIBILITY



Platform  
FTB-1

## THE ULTRA-PORTABLE CHOICE FOR MULTISERVICE TESTING

The ongoing transition towards a converged network infrastructure for legacy DSn/PDH, SONET/SDH 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 powerful, intelligent FTB-1 handheld platform, the FTB-880 NetBlazer streamlines processes and empowers field technicians to test and validate DSn/PDH, SONET/SDH and Ethernet circuits efficiently.

### Powerful and Fast

The FTB-880 NetBlazer is a fully integrated DSn/PDH, SONET/SDH and Ethernet handheld tester. It offers the industry's largest touchscreen with unprecedented configuration simplicity via hybrid touchscreen/keypad navigation. Platform connectivity is abundant via Wi-Fi, Bluetooth, Gigabit Ethernet or USB ports, making it accessible in any environment.

#### What You Need for Any DSn/PDH or SONET/SDH Application

- › Installation, commissioning and maintenance of access and metro networks
- › Turn-up of DSn/PDH or SONET/SDH circuits
- › Performance assessment of Carrier Ethernet services
- › Installation, activation and maintenance of metro Ethernet networks
- › Deployment of active Ethernet (point-to-point) access services
- › In-service troubleshooting of live traffic
- › Performance monitoring of DSn/PDH and SONET/SDH circuits
- › Round-trip delay assessment of transport circuits
- › BER testing up to OC-192/STM-64

#### DSn/PDH, SONET/SDH AND ETHERNET UP TO 10 GBIT/S

If the need is for multiservice testing up to 10 Gbit/s, then the FTB-880 is the perfect solution.

- › RJ-45 port for electrical 10/100/1000M Ethernet
- › SFP port for OC-3/12/48 or STM-1/4/16 and optical 100/1000M Ethernet
- › SFP+ port for OC-192, STM-64 or 10 GigE LAN/WAN
- › RJ-48C and bantam port for DS1 or E1
- › BNC port for DS3 or E1/E3/E4 or STS-1e/STS-3e or STM-0e/STM-1e

- › DS1/DS3 and E1/E3/E4 testing
- › OC-3/12/48/192 and STM-1/4/16/64 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
- › Dual DS1/DS3 receiver (Rx) support
- › DS1 loop codes and NI/CSU emulation
- › DS1/DS3 autodetection of line code, framing and pattern
- › DS1 FDL and DS3 FEAC
- › Fractional T1/E1 testing
- › External clock sync support
- › 10 Base-T to 10 GigE testing
- › EtherSAM (ITU-T Y.1564) (bidirectional)
- › RFC 2544 (bidirectional)
- › Traffic generation and monitoring
- › Through mode
- › Intelligent autodiscovery
- › IPv6 testing
- › Ping/Trace Route
- › Cable testing
- › Dual Test Set mode
- › Smart loopback

## Setting a New GUI Standard: Unprecedented Simplicity in Configuration Setup and Navigation

The FTB-880 NetBlazer's intelligent situational configuration setup feature guides technicians through complete, accurate testing processes (suggestion prompts, help guides, etc.). It reduces navigation by combining associated testing functions on a single screen, and offers intelligent autodiscovery that allows a single technician to perform end-to-end testing.

### Dedicated Quick-Action Buttons

- › Remote discovery to find all the other EXFO units
- › Laser on/off
- › Test reset to clear the results and statistics while running a test
- › Report generation
- › Save or load test configurations
- › Quick error injection

### Assorted Notifications

- › Clear indication of link status for single or dual ports
- › Negotiated speed display for single or dual ports
- › Power status available at all times for single or dual ports
- › Pass/fail indication at all times
- › Pattern and clock synchronization
- › Frequency offset with valid-range color indicator
- › Overhead overwrite indicator
- › Error/alarm injection
- › Alarm hierarchy pinpointing the root-cause (when possible)

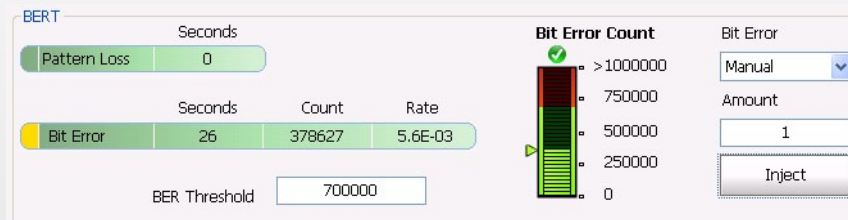
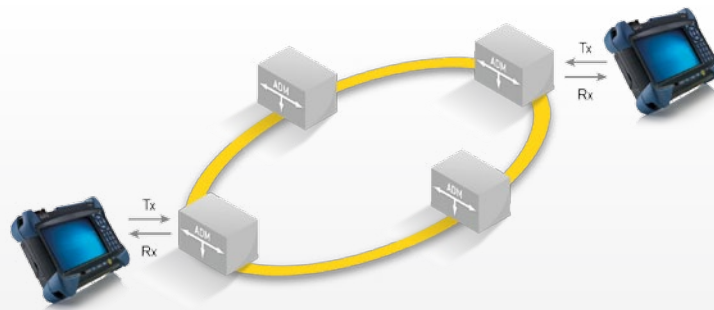
### Streamlined Navigation

- › Remote discovery button available at all times; no reason to leave your current location to scan for a remote unit
- › Testing status can be maximized to fill the entire screen by simply clicking on the alarm status button; whether the unit is in your hand or across the room, test results can be easily determined with a simple glance at the display screen
- › RFC 2544 configuration is maximized in a single page; no need to navigate through multiple screens to configure individual subtests
- › RFC 2544 results and graphs are also maximized in a single page; no need to navigate through multiple screens to view individual RFC subtest results
- › Simplified test structure definition using task-based test application selection, signal configuration front end and smart timeslot selection
- › Centralized functions: error/alarm management, performance monitoring and overhead manipulation/monitoring

## Key DSn/PDH and SONET/SDH Features

### Simplified BER Testing

The FTB-880 NetBlazer provides the ability to pre-configure bit-error-rate (BER) thresholds that are user-defined prior to running the test. This allows for a simple pass/fail verdict at the conclusion of the test, leaving no room for misinterpretation of the test results.



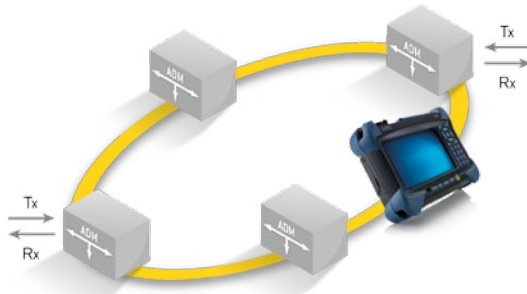
### Decoupled Mode

The Decoupled mode enables the user to independently configure the Tx and Rx ports of the FTB-880 NetBlazer module. This allows to test the mapping and demapping functionality of a network element or at cross-connect points in the network.



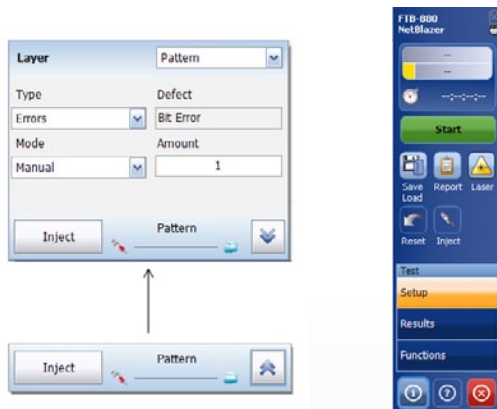
### Through Mode

This mode is required for in-service monitoring of the network. The FTB-880 NetBlazer can be inserted in-line on a specific link, and can then monitor and analyze the errors and alarms on that link while remaining non-intrusive.



### Simplified Error Injection

This FTB-880 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 pre-programmed for any given type of error, and not just for bit errors.



### Complete Overhead Monitoring

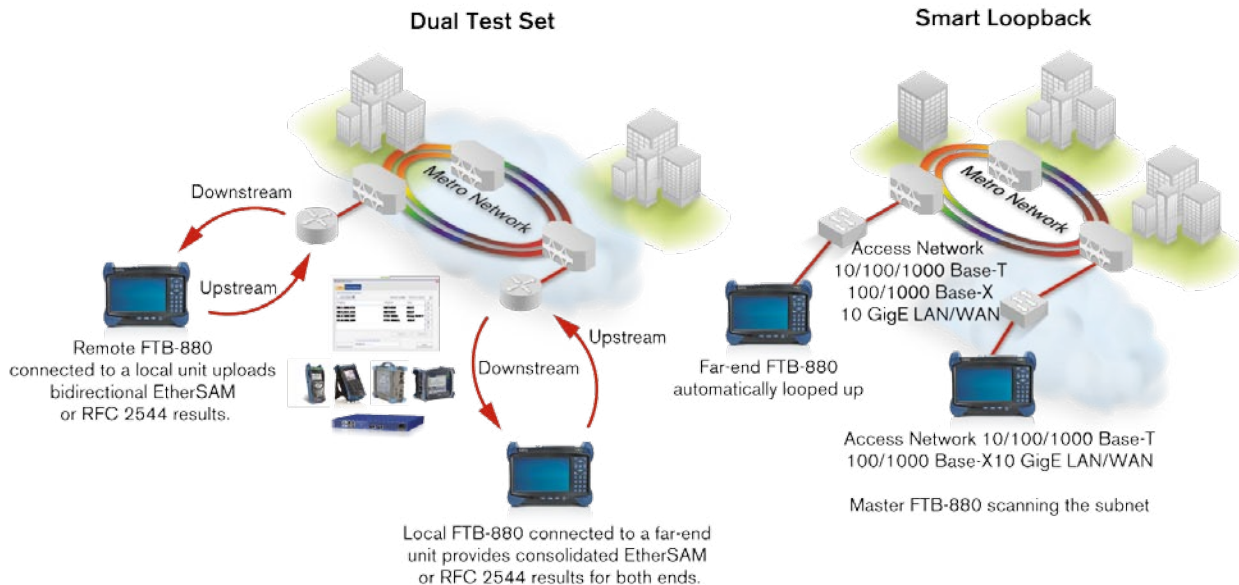
The FTB-880 NetBlazer offers access to the entire SONET/SDH overhead (OH) bytes from a single page. Furthermore, by selecting any given OH byte, the user can retrieve additional detailed information about that byte without having to switch pages.

TX STS-1 Timeslot												RX STS-1 Timeslot											
Transport OH						STS						Transport OH						STS					
A1	F6	28	01	J1	V5	B1	E1	F1	B3	J2	V5	A1	F6	28	01	J1	V5	B1	E1	F1	B3	J2	V5
00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
D1	D3	D3	C2	Z6		D1	D3	D3	C2	Z6		D1	D3	D3	C2	Z6		D1	D3	D3	C2	Z6	
00	00	00	00	02	00	00	00	00	00	02	00	00	00	00	00	02	00	00	00	00	00	02	00
H1	H2	H3	G1	Z7	G1	H1	H2	H3	G1	Z7	G1	H1	H2	H3	G1	Z7	G1	H1	H2	H3	G1	Z7	G1
00	00	00	00	02	00	00	00	00	00	02	00	00	00	00	00	02	00	00	00	00	00	02	00
B2	K1	K2	F2			B2	K1	K2	F2			B2	K1	K2	F2			B2	K1	K2	F2		
00	00	00	00			00	00	00	00			00	00	00	00			00	00	00	00		
D4	D5	D6	144			D4	D5	D6	144			D4	D5	D6	144			D4	D5	D6	144		
00	00	00	00			00	00	00	00			00	00	00	00			00	00	00	00		
D7	D8	D9	Z3			D7	D8	D9	Z3			D7	D8	D9	Z3			D7	D8	D9	Z3		
00	00	00	00			00	00	00	00			00	00	00	00			00	00	00	00		
D10	D11	D12	Z4			D10	D11	D12	Z4			D10	D11	D12	Z4			D10	D11	D12	Z4		
00	00	00	00			00	00	00	00			00	00	00	00			00	00	00	00		
S1	Z2	E2	N1			S1	Z2	E2	N1			S1	Z2	E2	N1			S1	Z2	E2	N1		
00	00	00	00			00	00	00	00			00	00	00	00			00	00	00	00		

## Key Ethernet Features

### Intelligent Network Discovery Mode

Using the FTB-880 or the FTB-860x test set, you can single-handedly scan the network and connect to any available EXFO datacom remote tester. Simply select the unit to be tested and choose whether you want traffic to be looped back via Smart Loopback or Dual Test Set for simultaneous bidirectional EtherSAM and RFC 2544 results. No more need for an additional technician at the far end to relay critical information—these NetBlazer products take care of it all.



### Smart Loopback Flexibility

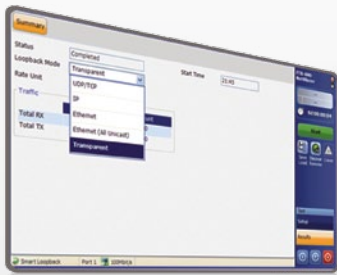
The Smart Loopback functionality has been enhanced to offer five distinct loopback modes. Whether you are looking to pinpoint loopback traffic from a UDP or TCP layer, or all the way down to a completely promiscuous mode (Transparent Loopback mode), the FTB-880 or the FTB-860x has the flexibility to adjust for all unique loopback situations.

### Global Pass/Fail Analysis

The NetBlazer series provides 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 the unit is in the technician's hands or across the room.

### Remembering the Last IP or MAC Addresses

Field technicians have enough things to worry about and don't always have the luxury of time to enter the same IP or MAC address test after test. The NetBlazer series remembers the last ten MAC, IPv4 and IPv6 addresses as well as J0/J1/J2 traces for SONET/SDH layer for 10G WAN, even after the unit has been rebooted.



### Traffic Generation

Unparalleled analog visual gauges combined with user-defined thresholds show instantaneously whether or not the test traffic is in or out of expected ranges.

Additionally, bandwidth and frame size can be modified on-the-fly without navigating away to a different page, giving technicians instantaneous reaction on the gauges. Traffic generation brings together over 10 critical stats in a very visual and organized fashion, ensuring that technicians can quickly and easily interpret the outcome of the test.

Throughput, jitter and latency with visual pass/fail thresholds, analog gauges and digital readouts.

Frame loss and out-of-sequence notification.

Overall pass/fail assessment.

Real-time bandwidth and frame-size adjustment.

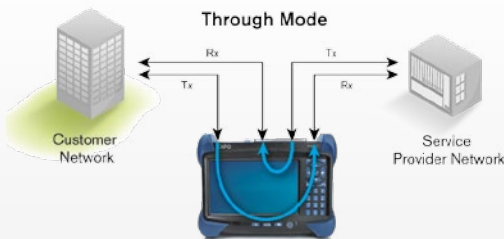
The analog gauges are lined with Green and Red layers to represent the expected thresholds.

### Multistream Configuration

Configuring multiple streams with proper COS and QOS bits can be a complex task. The FTB-880 or the FTB-860x makes it simpler, with all streams easily selectable and configurable from one location. With large icons located throughout the stream pages, configuration becomes as simple as a touch of a finger. Technicians can define one configuration profile and apply it to all the background streams simultaneously. From there, it is just a matter of making slight tweaks as needed rather than complete configuration profiles per stream.

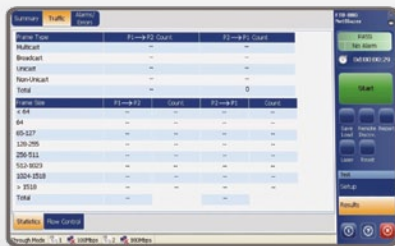
### Through Mode

Through mode testing consists of passing traffic through either of the NetBlazer's two 100/1000 Base-X ports or the two 10/100/1000 Base-T ports for in-service troubleshooting of live traffic between the carrier/service provider network and the customer network. Through mode allows technicians to access circuits under test without the need for a splitter.



### Supporting 10 Gigabit Ethernet

The 10 Gigabit Ethernet interface is available in both 10 GigE LAN and 10 GigE WAN modes via a single SFP+ transceiver. All Ethernet testing applications—from BER testing to the full EtherSAM suite—are available for both IPv4 and IPv6. Unique to the 10 GigE WAN interface is the ability to send and monitor SONET/SDH J0/J1 traces and the path signal label (C2). The WAN interface can also monitor SONET and SDH alarms and errors.



## ETHERSAM: THE NEW STANDARD IN ETHERNET TESTING

RFC 2544 has been the most widely used Ethernet testing methodology; however, it was designed for network device testing in the lab, not for service testing in the field. ITU-T Y.1564 is the new standard for turning up and troubleshooting Carrier Ethernet services. It has a number of advantages over RFC 2544, including validation of critical SLA criteria such as packet jitter and QoS measurements. This methodology is also significantly faster, therefore saving time and resources while optimizing QoS.

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

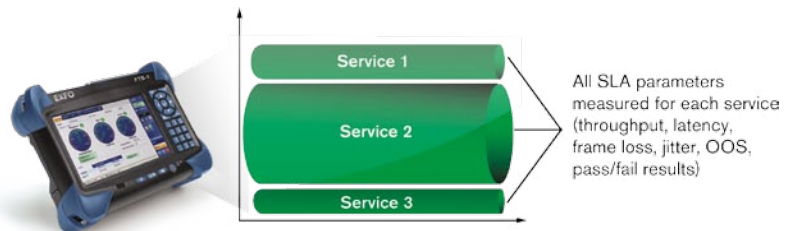
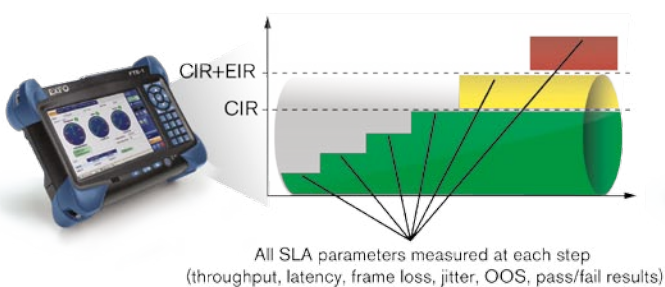
Contrary to other methodologies, EtherSAM supports new multiservice offerings. It can simulate all types of services that will run on the network and simultaneously qualify all key SLA parameters for each of these services. Moreover, it validates the QoS mechanisms provisioned in the network to prioritize 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 of sequentially testing each service. It validates that the service is properly provisioned and that all specific KPIs or SLA parameters are met.

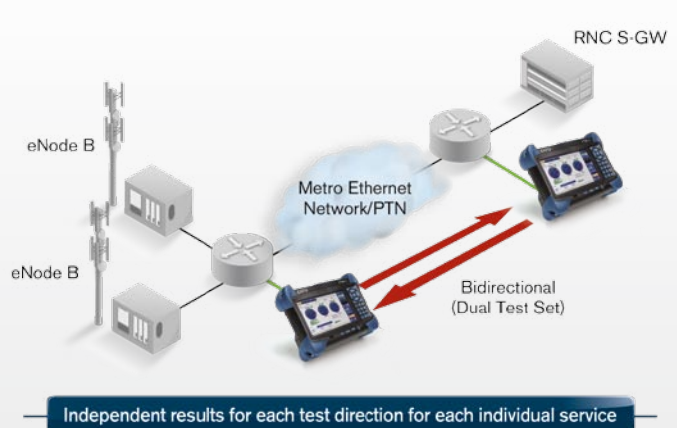
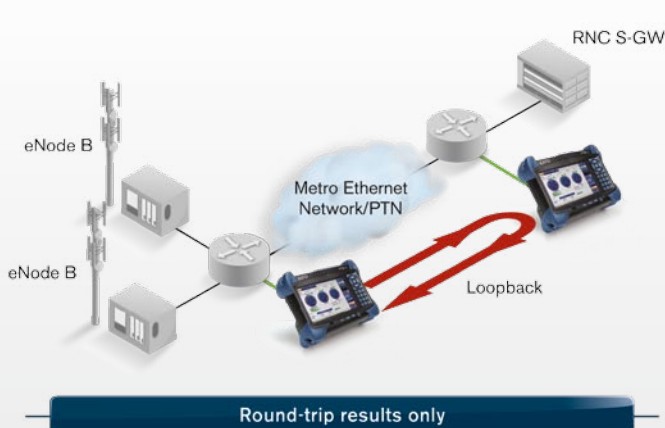
### Service Performance Test

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



### EtherSAM Bidirectional Results

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



## EXPERT TEST TOOLS ON THE FTB-1 PLATFORM

EXpert Test Tools is a series of platform-based software testing tools that enhance the value of the FTB-1 platform, providing additional testing capabilities without the need for additional modules or units.

### EXpert TEST TOOLS

#### EXpert VoIP TEST TOOLS

EXpert VoIP generates a voice-over-IP call directly from the test platform to validate performance during service turn-up and troubleshooting.

- Supports a wide range of signaling protocols, including SIP, SCCP, H.248/Megaco and H.323
- Supports MOS and R-factor quality metrics
- Simplifies testing with configurable pass/fail thresholds and RTP metrics

#### EXpert IP TEST TOOLS

EXpert IP integrates six commonly used datacom test tools into one platform-based application to ensure that field technicians are prepared for a wide range of testing needs.

- Rapidly performs debugging sequences with VLAN scan and LAN discovery
- Validates end-to-end ping and traceroute
- Verifies FTP performance and HTTP availability

#### EXpert IPTV TEST TOOLS

This powerful IPTV quality assessment solution enables set-top-box emulation and passive monitoring of IPTV streams, allowing quick and easy pass/fail verification of IPTV installations.

- Real-time video preview
- Analyzes up to 10 video streams
- Comprehensive QoS and QoE metrics including MOS score





## SPECIFICATIONS

ETHERNET OPTICAL INTERFACES							
	Two ports: 100M and GigE						
Available wavelengths (nm)	850, 1310 and 1550						
	100 Base-FX	100 Base-LX	1000 Base-SX	1000 Base-LX	1000 Base-ZX	1000 Base-BX10-D	1000 Base-BX10-U
Wavelength (nm)	1310	1310	850	1310	1550	Tx: 1490 Rx: 1310	Tx: 1310 Rx: 1490
Tx level (dBm)	-20 to -15	-15 to -8	-9 to -3	-9.5 to -3	0 to 5	-9.5 to -3	-9.5 to -3
Rx level sensitivity (dBm)	-31	-28	-20	-22	-22	-20	-20
Maximum reach	2 km	15 km	550 m	10 km	80 km	10 km	10 km
Transmission bit rate (Gbit/s)	0.125	0.125	1.25	1.25	1.25	1.25	1.25
Reception bit rate (Gbit/s)	0.125	0.125	1.25	1.25	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	1480 to 1500	1260 to 1360
Measurement accuracy (uncertainty)							
Frequency (ppm)	±4.6	±4.6	±4.6	±4.6	±4.6	±4.6	±4.6
Optical power (dB)	±2	±2	±2	±2	±2	±2	±2
Maximum Rx before damage (dBm) <sup>a</sup>	3	3	6	6	6	6	6
Jitter compliance	ANSI X3.166	IEEE 802.3	IEEE 802.3	IEEE 802.3		IEEE 802.3ah	IEEE 802.3ah
Ethernet classification	ANSI X3.166	IEEE 802.3	IEEE 802.3	IEEE 802.3		IEEE 802.3ah	IEEE 802.3ah
Laser type	LED	FP	VCSSEL	FP	DFB	DFB	FP
Eye safety	Class 1	Class 1	Class 1	Class 1	Class 1	Class 1	Class 1
Connector <sup>b</sup>	LC	LC	LC	LC	LC	LC	LC
Transceiver type <sup>c</sup>	SFP	SFP	SFP	SFP	SFP	SFP	SFP

SONET/SDH OPTICAL INTERFACES												
	OC-3/STM-1				OC-12/STM-4				OC-48/STM-16			
Reach and wavelength	15 km; 1310 nm	40 km; 1310 nm	40 km; 1550 nm	80 km; 1550 nm	15 km; 1310 nm	40 km; 1310 nm	40 km; 1550 nm	80 km; 1550 nm	15 km; 1310 nm	40 km; 1310 nm	40 km; 1550 nm	80 km; 1550 nm
Tx level (dBm)	-5 to 0	-2 to 3	-5 to 0	-2 to 3	-5 to 0	-2 to 3	-5 to 0	-2 to 3	-5 to 0	-2 to 3	-5 to 0	-2 to 3
Rx operating range (dBm)	-23 to -10	-30 to -15	-23 to -10	-30 to -15	-22 to 0	-27 to -9	-22 to 0	-29 to -9	-18 to 0	-27 to -9	-18 to 0	-28 to -9
Transmit bit rate	155.52 Mbit/s ±4.6 ppm				622.08 Mbit/s ±4.6 ppm				2.48832 Gbit/s ±4.6 ppm			
Frequency offset generation (ppm)	±50				±50				±50			
Receive bit rate	155.52 Mbit/s ±100 ppm				622.08 Mbit/s ±100 ppm				2.48832 Gbit/s ±100 ppm			
Operational wavelength range	1261 to 1360 nm	1263 to 1360 nm	1430 to 1580 nm	1480 to 1580 nm	1270 to 1360 nm	1280 to 1335 nm	1430 to 1580 nm	1480 to 1580 nm	1260 to 1360 nm	1280 to 1335 nm	1430 to 1580 nm	1500 to 1580 nm
Spectral width	1 nm (-20 dB)				1 nm (-20 dB)				1 nm (-20 dB)			
Measurement accuracy (uncertainty)												
Frequency (ppm)		±4.6				±4.6				±4.6		
Optical power (dB)		±2				±2				±2		
Maximum Rx before damage (dBm) <sup>a</sup>		3				3				3		
Jitter compliance		GR-253 (SONET) G.958 (SDH)				GR-253 (SONET) G.958 (SDH)				GR-253 (SONET) G.958 (SDH)		
Line coding		NRZ				NRZ				NRZ		
Eye safety		Class 1				Class 1				Class 1		
Connector <sup>b</sup>		Dual LC				Dual LC				Dual LC		
Transceiver type <sup>c</sup>		SFP				SFP				SFP		

## Notes

- In order not to exceed the maximum receiver power level before damage, an attenuator must be used.
- External adaptors can be used for other types of connectors.
- SFP compliance: The FTB-880 selected SFP shall meet the requirements stated in the "Small Form-Factor Pluggable (SFP) Transceiver Multiservice Agreement (MSA)". The FTB-880 selected SFP shall meet the requirements stated in the "Specification for Diagnostic Monitoring Interface for Optical Xcvrs".

## 10G ETHERNET OPTICAL INTERFACES

	10G Base-SR/SW	10G Base-LR/LW	10G Base-ER/EW
Wavelength (nm)	850	1310	1550
Tx level (dBm)	-5 to -1	-8 to 0.5	-4.7 to 4.0
Rx level sensitivity (dBm)	-11.1	-12.6	-14.1
Maximum reach	300 m	10 km	40 km
Tx bit rate (Gbit/s)	9.95 to 10.3	9.95 to 10.3	9.95 to 10.3
Rx bit rate (Gbit/s)	9.95 to 10.3	9.95 to 10.3	9.95 to 10.3
Tx operational wavelength range (nm)	840 to 860	1260 to 1355	1530 to 1565
Measurement accuracy (uncertainty) Frequency (ppm)	±4.6	±4.6	±4.6
Maximum Rx before damage (dBm) <sup>a</sup>	6	5	5
Jitter compliance	IEEE 802.3ae	IEEE 802.3ae	IEEE 802.3ae
Fibre Channel classification		ANSI FC-PI-3	
Laser type	VCSEL	DFB	CML
Eye safety	Class 1	Class 1	Class 1
Connector <sup>b</sup>	LC	LC	LC
Transceiver type <sup>c</sup>	SFP+	SFP+	SFP+

## 10G SONET/SDH OPTICAL INTERFACES

	OC-192/STM-64	OC-192/STM-64	OC-192/STM-64
Wavelength (nm)	1310	1550	1550
Tx level (dBm)	-6 to -1	-1 to 2	0 to 4
Rx level sensitivity (dBm)	-11 to 0.5	-14 to -1	-24 to -7
Maximum reach	10 km	40 km	80 km
Transmission bit rate (Gbit/s)	9.95328 ±4.6 ppm	9.95328 ±4.6 ppm	9.95328 ±4.6 ppm
Frequency offset generation (ppm)	±50	±50	±50
Reception bit rate (Gbit/s)	9.95328 ±100 ppm	9.95328 ±100 ppm	9.95328 ±100 ppm
Tx operational wavelength range (nm)	1260 to 1355	1530 to 1565	1530 to 1565
Measurement accuracy (uncertainty) Frequency (ppm) Optical power (dB)	±4.6 ±2	±4.6 ±2	±4.6 ±2
Maximum Rx before damage (dBm) <sup>a</sup>	5	5	3
Jitter compliance	GR-253 (SONET) G.825 (SDH)	GR-253 (SONET) G.825 (SDH)	GR-253 (SONET) G.825 (SDH)
Eye safety	Class 1	Class 1	Class 1
Connector <sup>b</sup>	LC	LC	LC
Transceiver type <sup>c</sup>	SFP+	SFP+	SFP+

## Notes

- In order not to exceed the maximum receiver power level before damage, an attenuator must be used.
- External adaptors can be used for other types of connectors.
- SFP+ compliance: The FTB-880 selected SFP+ shall meet the requirements stated in the SFP-8431 "Enhanced Small Form-Factor Pluggable Module SFP+" Transceiver Multisource Agreement (MSA)". The FTB-880 selected SFP+ shall meet the requirements stated in the "Specification for Diagnostic Monitoring Interface for Optical Xcvrs".

## ELECTRICAL ETHERNET INTERFACES

	Two ports: 10/100 Base-T half/full duplex, 1000 Base-T full duplex Automatic or manual detection of straight/crossover cable		
	10 Base-T	100 Base-T	1000 Base-T
Tx bit rate	10 Mbit/s	125 Mbit/s	1 Gbit/s
Tx accuracy (uncertainty) (ppm)	±4.6	±4.6	±4.6
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

## DSN/PDH AND SONET/SDH ELECTRICAL INTERFACES

	DS1	E1/2M		E3/34M	DS3/45M		STS-1e/STM-0e/52M	E4/140M	STS-3e/STM-1e/155M	
Tx pulse amplitude	2.4 to 3.6 V	3.0 V	2.37 V	1.0 ±0.1 V	0.36 to 0.85 V			1.0 ±0.1 Vpp	0.5 V	
Tx pulse mask	GR-499 Figure 9.5	G.703 Figure 15	G.703 Figure 15	G.703 Figure 17	DS-3 GR-499 Figure 9-8	45M G.703 Figure 14	GR-253 Figure 4-10/4-11	G.703 Figure 18/19	STS-3e GR-253 Figure 4-12, 4-13, 4-14	STM-1e/155M G.703 Figure 22 and 23
Tx LBO preamplification	0-133 ft 133-266 ft 266-399 ft 399-533 ft 533-655 ft				0 to 225 ft 225 to 450 ft		0 to 225 ft 225 to 450 ft		0 to 225 ft	
Cable simulation	-22.5 dB -15.0 dB -7.5 dB 0 dB				450 to 900 (927) ft		450 to 900 (927) ft			
Rx level sensitivity	For 772 kHz: TERM: ≤ 26 dB (cable loss only) at 0 dBd <sub>sx</sub> Tx DSX-MON: ≤ 26 dB (20 dB resistive loss + cable loss ≤ 6 dB) Bridge: ≤ 6 dB (cable loss only)	For 1024 kHz: TERM: ≤ 6 dB (cable loss only) MON: ≤ 26 dB (20 dB resistive loss + cable loss ≤ 6 dB) Bridge: ≤ 6 dB (cable loss only)	For 1024 kHz: TERM: ≤ 6 dB (cable loss only) MON: ≤ 26 dB (20 dB resistive loss + cable loss ≤ 6 dB) Bridge: ≤ 6 dB (cable loss only)	For 17.184 MHz: TERM: ≤ 12 dB (coaxial cable loss only) MON: ≤ 26 dB (20 dB resistive loss + cable loss ≤ 6 dB)	For 22.368 MHz: TERM: ≤ 10 dB (cable loss only) DSX-MON: ≤ 26.5 dB (21.5 dB resistive loss + cable loss ≤ 5 dB)	For 25.92 MHz: TERM: ≤ 10 dB (cable loss only) MON: ≤ 25 dB (20 dB resistive loss + cable loss ≤ 5 dB)	For 70 MHz: TERM: ≤ 12 dB (coaxial cable loss only) MON: ≤ 26 dB (20 dB resistive loss + cable loss ≤ 6 dB)	For 78 MHz: TERM: ≤ 12.7 dB (coaxial cable loss only) MON: ≤ 26 dB (20 dB resistive loss + cable loss ≤ 6 dB)		
Transmit bit rate	1.544 Mbit/s ±4.6 ppm	2.048 Mbit/s ±4.6 ppm	2.048 Mbit/s ±4.6 ppm	34.368 Mbit/s ±4.6 ppm	44.736 Mbit/s ±4.6 ppm	51.84 Mbit/s ±4.6 ppm	139.264 Mbit/s ±4.6 ppm	155.52 Mbit/s ±4.6 ppm		
Frequency offset generation	1.544 Mbit/s ±140 ppm	2.048 Mbit/s ±70 ppm	2.048 Mbit/s ±70 ppm	34.368 Mbit/s ±50 ppm	44.736 Mbit/s ±50 ppm	51.84 Mbit/s ±50 ppm	139.264 Mbit/s ±50 ppm	155.52 Mbit/s ±50 ppm		
Receive bit rate	1.544 Mbit/s ±140 ppm	2.048 Mbit/s ±100 ppm	2.048 Mbit/s ±100 ppm	34.368 Mbit/s ±100 ppm	44.736 Mbit/s ±100 ppm	51.84 Mbit/s ±100 ppm	139.264 Mbit/s ±100 ppm	155.52 Mbit/s ±100 ppm		
Measurement accuracy (uncertainty)										
Frequency (ppm)	±4.6	±4.6	±4.6	±4.6	±4.6	±4.6	±4.6	±4.6	±4.6	±4.6
Electrical power (dB)	±1.5	±1.5	±1.5	±1.5	±1.5	±1.5	±1.5	±1.5	±1.5	±1.5
Peak-to-peak voltage	±10 % down to 500 mVpp	±10 % down to 500 mVpp	±10 % down to 500 mVpp	±10 % down to 500 mVpp	±10 % down to 200 mVpp	±10 % down to 200 mVpp	±10 % down to 200 mVpp	±10 % down to 200 mVpp	±10 % down to 200 mVpp	±10 % down to 200 mVpp
Intrinsic jitter (Tx)	ANSI T1.403 section 6.3 GR-499 section 7.3	G.823 section 5.1	G.823 section 5.1	G.823 section 5.1 G.751 section 2.3	GR-449 section 7.3 (categories I and II)	GR-253 section 5.6.2.2 (category II)	G.823 section 5.1	G.825 section 5.1 GR-253 section 5.6.2.2		
Input jitter tolerance	AT&T PUB 62411 GR-499 section 7.3	G.823 section 7.1	G.823 section 7.1	G.823 section 7.1	GR-449 section 7.3 (categories I and II)	GR-253 section 5.6.2.2 (category II)	G.823 section 7.1 G.751 section 3.3	G.825 section 5.2 GR-253 section 5.6.2.3		
Line coding	AMI and B8ZS	AMI and HDB3	AMI and HDB3	HDB3	B3ZS	B3ZS	CM1	CM1		
Input impedance (resistive termination)	100 ohms ±5 %, balanced	120 ohms ±5 %, balanced	75 ohms ±5 %, unbalanced	75 ohms ±5 %, unbalanced	75 ohms ±5 %, unbalanced	75 ohms ±5 %, unbalanced	75 ohms ±10 %, unbalanced	75 ohms ±5 %, unbalanced		
Connector type	BANTAM and RJ-48C	BANTAM and RJ-48C	BNC	BNC	BNC	BNC	BNC	BNC		

SYNCHRONIZATION INTERFACES				
	External Clock DS1/1.5M	External Clock E1/2M	External Clock E1/2M	Trigger 2 MHz
Tx pulse amplitude	2.4 to 3.6 V	3.0 V	2.37 V	0.75 to 1.5 V
Tx pulse mask	GR-499 figure 9.5	G.703 figure 15	G.703 figure 15	G.703 figure 20
Tx lbo preamplification	Typical power dBdsx +0.6 dBdsx (0-133 ft) +1.2 dBdsx (133-266 ft) +1.8 dBdsx (266-399 ft) +2.4 dBdsx (399-533 ft) +3.0 dBdsx (533-655 ft)			
Rx level sensitivity	TERM: $\leq 6$ dB (cable loss only) (at 772 kHz for T1) DSX-MON: $\leq 26$ dB (20 dB resistive loss + cable loss $\leq 6$ dB) Bridge: $\leq 6$ dB (cable loss only)	TERM: $\leq 6$ dB (cable loss only) MON: $\leq 26$ dB (20 dB resistive loss + cable loss $\leq 6$ dB) Bridge: $\leq 6$ dB (cable loss only)	TERM: $\leq 6$ dB (cable loss only) MON: $\leq 26$ dB (resistive loss + cable loss $\leq 6$ dB) Bridge: $\leq 6$ dB (cable loss only)	$\leq 6$ dB (cable loss only)
Transmission bit rate	1.544 Mbit/s $\pm$ 4.6 ppm	2.048 Mbit/s $\pm$ 4.6 ppm	2.048 Mbit/s $\pm$ 4.6 ppm	
Reception bit rate	1.544 Mbit/s $\pm$ 50 ppm	2.048 Mbit/s $\pm$ 50 ppm	2.048 Mbit/s $\pm$ 50 ppm	
Intrinsic jitter (Tx)	ANSI T1.403 section 6.3 GR-499 section 7.3	G.823 section 6.1	G.823 section 6.1	G.703 table 11
Input jitter tolerance	AT&T PUB 62411 GR-499 section 7.3	G.823 section 7.2 G.813	G.823 section 7.2 G.813	G.823 section 7.1 G.751 section 3.3
Line coding	AMI and B8ZS	AMI and HDB3	AMI and HDB3	
Input impedance (resistive termination)	75 ohms $\pm$ 5 %, unbalanced	75 ohms $\pm$ 5 %, unbalanced	75 ohms $\pm$ 5 %, unbalanced	75 ohms $\pm$ 5 %, unbalanced
Connector type	BNC <sup>a</sup>	BNC <sup>a</sup>	BNC	BNC

**Note**

a. Adaptation cable required for BANTAM.

FUNCTIONAL SONET AND DS <sub>N</sub> SPECIFICATIONS		FUNCTIONAL SDH AND PDH SPECIFICATIONS	
Optical interfaces	OC-3, OC-12, OC-48, OC-192	Optical interfaces	STM-1, STM-4, STM-16, STM-64
Available wavelengths (nm)	1310, 1550	Available wavelengths (nm)	1310, 1550
Electrical interfaces	DS1, DS3, STS-1e, STS-3e	Electrical interfaces <sup>a</sup>	1.5M (DS1), 2M (E1), 34M (E3), 45M (DS3), 140M (E4), STM-0e, STM-1e
DS1 framing	Unframed, SF, ESF, SLC-96	2M (E1) framing	Unframed, PCM30, PCM31, PCM30 CRC-4, PCM31 CRC-4
DS3 framing	Unframed, M13, C-bit parity	8M (E2), 34M (E3), 140M (E4) framing	Unframed (not applicable to E2), framed
Clocking	Internal, loop-timed, external (BITS)	Clocking	Internal, loop-timed, external (MTS/SETS), 2 MHz
<b>Mappings</b>			
VT1.5	Bulk, DS1	AU-3-TU-11, AU-4-TU-11	Bulk, 1.5M,
VT2	Bulk, E1	AU-3-TU-12, AU-4-TU-12	Bulk, 1.5M, 2M
STS-1 SPE	Bulk, DS3	AU-3-Bulk, 34M, 45M, TU-3-AU-4	Bulk, 34M, 45M
STS-3c	Bulk	AU-4	Bulk, 140M
STS-12c/48c/192c, SPE	Bulk	AU-4-4c/16c/64c	Bulk
SONET overhead analysis and manipulation	A1, A2, J0, E1, F1, D1-D12, K1, K2, S1, M0, M1, E2, J1, C2, G1, F2, H4, Z3, Z4, Z5, N1, N2, Z6, Z7	SDH overhead analysis and manipulation	A1, A2, J0, E1, F1, D1-D12, K1, K2, S1, M0, M1, G1, F2, F3, K3, N1, N2, K4, E2, J1, C2, H4
<b>Error insertion</b>			
DS1	Framing bit, BPV, CRC-6, bit error, EXZ	E1 (2M)	Bit error, FAS, CV, CRC-4, E-bit
DS3	BPV, C-bit, F-bit, P-bit, FEBE, bit error, EXZ	E2 (8M), E3 (34M), E4 (140M)	Bit error, FAS, CV (not applicable to E2)
STS-1e, STS-3e	Section BIP (B1), line BIP (B2), path BIP (B3), BIP-2, REI-L, REI-P, REI-V, BPV, FAS, CV, bit error	STM-0e, STM-1e	RS-BIP (B1), MS-BIP (B2), HP-BIP (B3), MS-REI, HP-REI, LP-BIP-2, LP-REI, CV, FAS, bit error
OC-3, OC-12, OC-48, OC-192	Section BIP (B1), line BIP (B2), path BIP (B3), BIP-2, REI-L, REI-P, REI-V, FAS, bit error	STM-1, STM-4, STM-16, STM-64	RS-BIP (B1), MS-BIP (B2), HP-BIP (B3), MS-REI, HP-REI, LP-BIP-2, LP-REI, FAS, bit error
<b>Error measurement</b>			
DS1	Framing bit, BPV, CRC-6, EXZ, bit error	E1 (2M)	Bit error, FAS, CV, CRC-4, E-bit
DS3	BPV, C-bit, F-bit, P-bit, FEBE, bit error, EXZ	E2 (8M), E3 (34M), E4 (140M)	Bit error, FAS, CV (not applicable to E2)
STS-1e, STS-3e	Section BIP (B1), line BIP (B2), path BIP (B3), BIP-2, REI-L, REI-P, REI-V, BPV, FAS, CV, bit error	STM-0e, STM-1e	RS-BIP (B1), MS-BIP (B2), HP-BIP (B3), MS-REI, HP-REI, LP-BIP-2, LP-REI, CV, FAS, bit error
OC-3, OC-12, OC-48, OC-192	Section BIP (B1), line BIP (B2), path BIP (B3), BIP-2, REI-L, REI-P, REI-V, FAS, bit error	STM-1, STM-4, STM-16, STM-64	RS-BIP (B1), MS-BIP (B2), HP-BIP (B3), MS-REI, HP-REI, LP-BIP-2, LP-REI, FAS, bit error
<b>Alarm insertion</b>			
DS1	LOS, RAI, AIS, OOF, pattern loss	E1 (2M)	LOS, LOS Mframe, LOF, AIS, TS16 AIS, RAI, RAI Mframe, pattern loss
DS3	LOS, RDI, AIS, OOF, DS3 idle, pattern loss	E2 (8M), E3 (34M), E4 (140M)	LOS, LOF, RAI, AIS, pattern loss
STS-1e, STS-3e, OC-3, OC-12, OC-48, OC-192	LOS, LOF-S, SEF, AIS-L, RDI-L, AIS-P, LOP-P, LOM, PDI-P, RDI-P, ERDI-PCD, ERDI-PPD, ERDI-PSD, UNEQ-P, AIS-V, LOP-V, RDI-V, ERDI-VCD, ERDI-VPD, ERDI-VSD, RFI-V, UNEQ-V, pattern loss	STM-0e, STM-1e, STM-1, STM-4, STM-16, STM-64	LOS, LOF, OOF, MS-AIS, MS-RDI, AU-AIS, AU-LOP, H4-LOM, HP-ERDI-CD, HP-ERDI-PD, HP-ERDI-SD, LP-ERDI-CD, LP-ERDI-PD, LP-ERDI-SD, HP-UNEQ, TU-AIS, LP-RFI, LP-RDI, LP-RFI, LP-UNEQ, pattern loss
<b>Alarm detection</b>			
DS1	LOS, LOC, RAI, AIS, OOF, pattern loss	E1 (2M)	LOS, LOS Mframe, LOC, LOF, AIS, TS16 AIS, RAI, RAI Mframe, pattern loss
DS3	LOS, LOC, RDI, AIS, OOF, DS3 idle, pattern loss	E2 (8M), E3 (34M), E4 (140M)	LOS, LOC, LOF, RAI, AIS, pattern loss
STS-1e, STS-3e, OC-3, OC-12, OC-48, OC-192	LOS, LOC, LOF-S, SEF, TIM-S, AIS-L, RDI-L, AIS-P, LOP-P, LOM, PDI-P, RDI-P, ERDI-PCD, ERDI-PPD, ERDI-PSD, PLM-P, UNEQ-P, TIM-P, AIS-V, LOP-V, RDI-V, ERDI-VCD, ERDI-VPD, ERDI-VSD, RFI-V, UNEQ-V, TIM-V, PLM-V, pattern loss	STM-0e, STM-1e, STM-1, STM-4, STM-16, STM-64	LOS, RS-LOF, LOC, RS-OOF, RS-TIM, MS-AIS, MS-RDI, AU-AIS, AU-LOP, H4-LOM, HP-RDI, HP-ERDI-CD, HP-ERDI-PD, HP-ERDI-SD, LP-ERDI-CD, LP-ERDI-PD, LP-ERDI-SD, HP-PLM, HP-UNEQ, HP-TIM, TU-AIS, LP-RFI, LP-RDI, LP-RFI, LP-UNEQ, LP-TIM, LP-PLM, pattern loss
<i>Frequency alarm on all supported interfaces</i>			
<b>Patterns</b>			
DS0	2E9-1, 2E11-1, 2E20-1, 1100, 1010, 1111, 0000, 1-in-8, 1-in-16, 3-in-24, 32 bit programmable (inverted or non-inverted), bit errors	E0 (64K)	2E9-1, 2E11-1, 2E20-1, 1100, 1010, 1111, 0000 1-in-8, 1-in-16, 3-in-24, 32 bit programmable (inverted or non-inverted), bit errors
DS1	2E9-1, 2E11-1, 2E15-1, 2E20-1, 2E23-1, 2E31-1, 1100, 1010, 1111, 0000, QRSS, 1-in-8, 1-in-16, 3-in-24, 32 bit programmable (inverted or non-inverted), T1-DALY, 55-octet, bit errors	E1 (2M)	2E9-1, 2E11-1, 2E15-1, 2E20-1, 2E23-1, 2E31-1, 1100, 1010, 1111, 0000, 1-in-8, 1-in-16, 3-in-24, 32 bit programmable (inverted or non-inverted), bit errors
DS3	2E9-1, 2E11-1, 2E15-1, 2E20-1, 2E23-1, 2E31-1, 1100, 1010, 1111, 0000, 1-in-8, 1-in-16, 3-in-24, 32 bit programmable (inverted or non-inverted), bit errors	E3 (34M), E4 (140M)	2E9-1, 2E11-1, 2E15-1, 2E20-1, 2E23-1, 2E31-1, 1100, 1010, 1111, 0000, 1-in-8, 1-in-16, 3-in-24 <sup>b</sup> , 32 bit programmable (inverted or non-inverted), bit errors
VT1.5/2	2E9-1, 2E11-1, 2E15-1, 2E20-1, 2E23-1, 2E31-1, 1100, 1010, 1111, 0000, 1-in-8, 1-in-16, 32 bit programmable (inverted or non-inverted), bit errors	TU-11/12/3	2E9-1, 2E11-1, 2E15-1, 2E20-1, 2E23-1, 2E31-1, 1100, 1010, 1111, 0000, 1-in-8, 1-in-16, 32 bit programmable (inverted or non-inverted), bit errors
STS-1, STS-3c/12c/48c/192c	2E9-1, 2E11-1, 2E15-1, 2E20-1, 2E23-1, 2E31-1, 1100, 1010, 1111, 0000, 1-in-8, 1-in-16, 32 bit programmable (inverted or non-inverted), bit errors	AU-3/AU-4/AU-4-4c/16c/64c	2E9-1, 2E11-1, 2E15-1, 2E20-1, 2E23-1, 2E31-1, 1100, 1010, 1111, 0000, 1-in-8, 1-in-16, 32 bit programmable (inverted or non-inverted), bit errors

*Pattern loss and bit error generation and analysis supported on all patterns*

**Notes**

- 1.5M (DS1) and 45M (DS3) interfaces described under SONET and DS<sub>N</sub> column.
- Not supported for E4 (140M).

## DSN/PDH AND SONET/SDH TEST FEATURES

Frequency measurements	Supports clock frequency measurements (i.e., received frequency and deviation of the input signal clock from nominal frequency), displayed in ppm, for optical and electrical interfaces. Measurements are performed using a local oscillator.														
Frequency offset generation	Supports offsetting the clock of the transmitted signal on a selected interface to exercise clock recovery circuitry on network elements.														
Dual DSN receivers	Supports two DS1 or DS3 receivers, allowing users to simultaneously monitor two directions of a circuit under test in parallel, resulting in quick isolation of the source of errors.														
Performance monitoring	The following ITU-T recommendations, and corresponding performance monitoring parameters, are supported on the FTB-880. <table border="0"> <tr> <td><b>ITU-T recommendation</b></td> <td><b>Performance monitoring statistics</b></td> </tr> <tr> <td>G.821</td> <td>ES, EFS, EC, SES, UAS, ESR, SESR, DM</td> </tr> <tr> <td>G.826</td> <td>ES, EFS, EB, SES, BBE, UAS, ERS, SESR, BBER</td> </tr> <tr> <td>G.828</td> <td>ES, EFS, EB, SES, BBE, SEP, UAS, ESR, SESR, BBER, SEPI</td> </tr> <tr> <td>G.829</td> <td>ES, EFS, EB, SES, BBE, UAS, ESR, SESR, BBER</td> </tr> <tr> <td>M.2100</td> <td>ES, SES, UAS, ESR, SESR</td> </tr> <tr> <td>M.2101</td> <td>ES, SES, BBE, UAS, ESR, SESR, BBER</td> </tr> </table>	<b>ITU-T recommendation</b>	<b>Performance monitoring statistics</b>	G.821	ES, EFS, EC, SES, UAS, ESR, SESR, DM	G.826	ES, EFS, EB, SES, BBE, UAS, ERS, SESR, BBER	G.828	ES, EFS, EB, SES, BBE, SEP, UAS, ESR, SESR, BBER, SEPI	G.829	ES, EFS, EB, SES, BBE, UAS, ESR, SESR, BBER	M.2100	ES, SES, UAS, ESR, SESR	M.2101	ES, SES, BBE, UAS, ESR, SESR, BBER
<b>ITU-T recommendation</b>	<b>Performance monitoring statistics</b>														
G.821	ES, EFS, EC, SES, UAS, ESR, SESR, DM														
G.826	ES, EFS, EB, SES, BBE, UAS, ERS, SESR, BBER														
G.828	ES, EFS, EB, SES, BBE, SEP, UAS, ESR, SESR, BBER, SEPI														
G.829	ES, EFS, EB, SES, BBE, UAS, ESR, SESR, BBER														
M.2100	ES, SES, UAS, ESR, SESR														
M.2101	ES, SES, BBE, UAS, ESR, SESR, BBER														
Pointer adjustment and analysis	Generation and analysis of HO/AU and LO/TU pointer adjustments as per GR-253, and ITU-T G.707 <table border="0"> <tr> <td><b>Generation</b></td> <td><b>Analysis</b></td> </tr> <tr> <td>› Pointer increment and decrement</td> <td>› Pointer increments</td> </tr> <tr> <td>› Pointer jump with or without NDF</td> <td>› Pointer decrements</td> </tr> <tr> <td>› Pointer value</td> <td>› Pointer jumps (NDF, no NDF)</td> </tr> <tr> <td></td> <td>› Pointer value and cumulative offset</td> </tr> </table>	<b>Generation</b>	<b>Analysis</b>	› Pointer increment and decrement	› Pointer increments	› Pointer jump with or without NDF	› Pointer decrements	› Pointer value	› Pointer jumps (NDF, no NDF)		› Pointer value and cumulative offset				
<b>Generation</b>	<b>Analysis</b>														
› Pointer increment and decrement	› Pointer increments														
› Pointer jump with or without NDF	› Pointer decrements														
› Pointer value	› Pointer jumps (NDF, no NDF)														
	› Pointer value and cumulative offset														
Service disruption time (SDT) measurements	The service disruption time test tool measures the time during which there is a disruption of service due to the network switching from the active channels to the backup channels. Measurements: last disruption, shortest disruption, longest disruption, average disruption, total disruption, and service disruption count.														
Round-trip delay (RTD) measurements	The round-trip delay test tool measures the time required for a bit to travel from the FTB-880 transmitter back to its receiver after crossing a far-end loopback. Measurements are provided on all supported FTB-880 interfaces and mappings. Measurements: last, minimum, maximum, average; measurement count: no. of successful RTD tests and failed measurement count.														
APS message control and monitoring	Ability to monitor and set up automatic protection switching messages (K1/K2 byte of SONET/SDH overhead).														
Synchronization status	Ability to monitor and set up synchronization status messages (S1 byte of SONET/SDH overhead).														
Signal label control and monitoring	Ability to monitor and set up payload signal labels (C2, V5 byte of SONET overhead).														
Tandem connection monitoring (TCM) *	Tandem connection monitoring (TCM) is used to monitor the performance of a subsection of a SONET/SDH path routed via different network providers. The FTB-880 supports transmitting and receiving alarms and errors on a TCM link; also, transmission and monitoring of the tandem connection (TC) trace can be generated to verify the connection between TCM equipment. Error generation: TC-IEC, TC-BIP, TC-REI, TC-OEI Error analysis: TC-IEC, TC-REI, TC-OEI, TC-VIOL (non-standardized alarm) Alarm generation: TC-RDI, TC-UNEQ, TC-ODI, TC-LTC, TC-IAIS Alarm analysis: TC-TIM, TC-RDI, TC-UNEQ, TC-ODI, TC-LTC, TC-IAIS														
Pointer sequence testing	Perform pointer sequence testing as per G.783, GR253 and T1.105-3 standards.														
M13 mux/demux	Ability to multiplex/demultiplex a DS1 signal into/from a DS3 signal. (Note: E1 to DS3 mux/demux available with G.747 software option.)														
DS1 FDL	Support for DS1 Facility Data Link testing.														
DS1 loopcodes	Support for generation of DS1 in-band loopcodes with the availability of up to 10 pairs of user-defined loopcodes.														
NI/CSU loopback emulation	Ability to respond to DS1 in-band/out-of-band loopcodes.														
DS3 FEAC	Support for DS3 far-end alarms and loopback code words.														
DS1/DS3 autodetection	Ability to automatically detect DS1/DS3 line coding, framing and test pattern.														
Through mode	Perform Through mode analysis of any incoming electrical (DSn, PDH, SONET, SDH) and optical line (OC-3/STM-1, OC-12/STM-4, OC-48/STM-16, OC-192/STM-64) transparently.														

### Notes

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

## ETHERNET TEST FEATURES

EtherSAM (ITU-T Y.1564)	Capability to perform the service configuration test and the service performance test as per ITU-T Y.1564. Tests can be performed using 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 sizes, user-configurable between 1-7 sizes.
Traffic generation and monitoring	Generate, shape and monitor Ethernet and IP traffic with throughput, frame loss, sequencing, packet jitter, latency, frame size, traffic type and flow control.
Multistream background traffic	Transmit and monitor up to nine additional streams over Ethernet and IP networks. Configurable per-stream analysis and capability to set packet size, MAC source/destination address, VLAN ID, VLAN priority, IP source/destination address, ToS field, DSCP field, TTL, UDP source/destination port and payload.
Through mode	Sectionalize traffic between a service provider's network and customer premises equipment.
BER testing	Up to layer 4 supported with or without VLAN Q-in-Q.
Patterns (BERT)	PRBS 2E9-1, PRBS 2E11-1, PRBS 2E15-1, PRBS 2E20-1, PRBS 2E23-1, PRBS 2E31-1 and one user pattern. Capability to invert patterns.
Error measurement (BERT)	Bit error, bit mismatch 0, bit mismatch 1.
Error measurements	Jabber/giant, runt, undersize, oversize, FCS, symbol, alignment, collision, late collision, excessive collision, 10G block error.
Alarm detection	LOS, link down, pattern loss, frequency, 10G local/remote fault.
VLAN stacking	Generate streams with up to two layers of VLAN (including IEEE 802.1ad Q-in-Q tagged VLAN) traffic by VLAN ID or VLAN priority at any of the stacked VLAN layers.
Cable testing	Category 5 cable (or better), 100 UTP/STP cable, ≤120 meters.
Service disruption time (SDT)	Includes statistics such as longest, shortest, last, average, count, total and pass/fail thresholds.
IPv6 testing	Includes BERT, RFC 2544, traffic generation and monitoring, background streams, Smart Loopback, Remote Loopback, ping and traceroute.
10 GigE WAN testing	Includes WAN interface sublayer, J0/J1 trace and C2 label generation, J0/J1 trace and C2 label monitoring.
10 GigE WAN alarm monitoring	Includes SEF, LOF, AIS-L, RDI-L, AIS-P, RDI-P, LCD-P, LOP-P, PLM-P, UNEQ-P, ERDI-P, WIS link down, B1, B2, B3, REI-L, REI-P.

## ADDITIONAL FEATURES

Power measurement	Supports power measurement at all times, displayed in dBm (dBdsx for DS1 and DS3), for optical and electrical interfaces.
Power-up and restore	In the event of a power failure to the unit, the active test configuration and test logger are saved and restored upon boot-up. Applicable to transport test applications only.
Save and load configuration	Store and load test configurations to/from a non-volatile USB memory stick or internal flash.
Pass/fail analysis	Provides a pass/fail outcome with user-adjustable thresholds, based on bit error rate and/or service disruption time.
Alarm hierarchy	Alarms are displayed according to a hierarchy based on root cause. Secondary effects are not displayed. This hierarchy serves to facilitate alarm analysis.
Report generation	Generate test reports on the unit or exported via USB.
Event logger	Log test results with absolute or relative time and date, details and duration of events, color-coded events and pass/fail outcome.
Remote control	Remote control through VNC.
Remote loopback	Detects other AXS-200/850, FTB-860 and FTB-880 units and sets them into Smart Loopback mode.
Dual test set	Detects and connects to any of EXFO's Ethernet testers to perform bidirectional RFC 2544 and EtherSAM testing.
IP tools	Perform ping and traceroute functions.
Smart loopback	Return Ethernet traffic to the local unit by swapping packet overhead up to layer 4.

## UPGRADES

<b>SFP upgrades</b>	FTB-8590	SFP modules GigE/FC/2FC at 850 nm, MM, <500 m
	FTB-85910	SFP modules 100 Base-FX, 1340 nm, MM, 2 km
	FTB-85911	SFP modules 100 Base-LX10, 1310 nm, SM, 15 km
	FTB-8190	SFP module; rates: 155/622 Mbit/s, 2.5/2.7 Gbit/s, GigE/FC/2FC; 1310 nm, LC connector, 15 km reach
	FTB-8191	SFP module; rates: 155/622 Mbit/s, 2.5/2.7 Gbit/s, GigE/FC/2FC; 1310 nm, LC connector, 40 km reach
	FTB-8192	SFP module; rates: 155/622 Mbit/s, 2.5/2.7 Gbit/s, GigE/FC/2FC; 1550 nm, LC connector, 80 km reach
	FTB-8193	SFP module; rates: 155/622 Mbit/s, 2.5/2.7 Gbit/s, GigE/FC/2FC; 1550 nm, LC connector, 40 km reach
<b>SFP+ upgrades</b>	FTB-8690	SFP+ modules, 10 GigE, 850 nm, MM, 300 m
	FTB-8693	SFP+ modules, 9.953-10.709/11.3, 1310 nm, SMF, 10 km
	FTB-8694	SFP+ modules, 8.5, 9.953-10.709/11.1, 1550 nm, SMF, 40 km
	FTB-8695	SFP+ modules, 8.5, 9.953-10.709/11.1, 1550 nm, SMF, 80 km
<b>Bidirectional SFP upgrades</b>	FTB-8596	SFP modules bidirectional 1490 Tx 1310 Rx 1000 BASE-BX10
	FTB-8597	SFP modules bidirectional 1310 Tx 1490 Rx 1000 BASE-BX10
	FTB-8598	SFP modules bidirectional 1310 Tx 1490/1550 Rx 1000 BASE-BX
	FTB-8599	SFP modules bidirectional 1550 Tx 1310 Rx 1000 BASE-BX

## GENERAL SPECIFICATIONS

Size (H x W x D)	130 mm x 252 mm x 56 mm (5 1/8 in x 9 15/16 in x 2 3/16 in)
Weight (without battery)	0.97 kg (2.1 lb)
Temperature	
Operating	0 °C to 50 °C (32 °F to 122 °F)
Storage	-40 °C to 70 °C (-40 °F to 158 °F)
Relative humidity	0 % to 93 %, non-condensing
Battery life (typical usage)	Over 4 hours
Battery charging time	2 hours from full discharge to full charge
Languages	English, Chinese

**ORDERING INFORMATION**

**FTB-880-FLEX-XX-XX-XX-XX**

**Test options**

- SONET = SONET testing
- SDH = SDH testing
- SONET-SDH = SONET and SDH testing

**Rate options**

- 155M = 155 Mbit/s (OC-3/STM-1)
- 622M = 622 Mbit/s (OC-12/STM-4)
- 2488M = 2.5 Gbit/s (OC-48/STM-16)
- 9953M = 10 Gbit/s (OC-192/STM-64)

**Ethernet software options**

- 100 OPTICAL = 100 Mbit/s optical
- GigE = 1000 Mbit/s optical and electrical
- 10G LAN = 10 GigE LAN interface
- 10G WAN = 10 GigE WAN interface

**Software options**

- 00 = Without software options
- DS3-G747 = G.747 test capability
- DS1-FDL = DS1 FDL test capability
- DUAL-RX = DS1/DS3 dual Rx testing
- DS3-FEAC = DS3 FEAC test capability
- TCM = Tandem connection monitoring
- DSn = DSn test capability
- PDH = PDH test capability
- NI-CSU = NI-CSU loopback emulation
- Cable\_test = Cable test
- MULTIPLE\_STREAMS = Multiple streams
- IPV6 = Internet protocol version 6
- ETH-THRU = Through mode capability
- TRAFFIC\_GEN = Traffic generation capability

Example: FTB-880-SONET-155M-DSN-GIGE

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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). Contact EXFO for prices and availability or to obtain the phone number of your local EXFO distributor.

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

In case of discrepancy, the Web version takes precedence over any printed literature.