

FTB-810 NetBlazer Series Transport Tester

COMPLETE, FAST, INTUITIVE TRANSPORT TESTING



Comprehensive, yet simple test suites for field technicians to easily turn up, validate and troubleshoot transport circuits covering all DSn/PDH and SONET/SDH interfaces up to 10 Gbit/s.

KEY FEATURES AND BENEFITS

Complete test suite for DSn/PDH and SONET/SDH interfaces up to 10 Gbit/s

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

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

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

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

PLATFORM COMPATIBILITY



Platform
FTB-1

THE ULTRA-PORTABLE CHOICE FOR DS_N/PDH AND SONET/SDH TESTING

With a large installed base, testing DS_N/PDH and SONET/SDH circuits, both in access and metro networks, continues to be a daily need that requires a test unit that is comprehensive, without sacrificing portability, speed or cost. Leveraging the powerful, intelligent FTB-1 handheld platform, the FTB-810 NetBlazer series streamlines processes and empowers field technicians to test and validate DS_N/PDH and SONET/SDH circuits efficiently.

Powerful and Fast

Available in two hardware models (FTB-810 and FTB-810G), the FTB-810 NetBlazer series delivers fully integrated DS_N/PDH and SONET/SDH testing and offers the industry's largest touch screen 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.

The Testing You Need for Any DS_N/PDH or SONET/SDH Application

- › Installation, commissioning and maintenance of access and metro networks
- › Turn-up of DS_N/PDH or SONET/SDH circuits
- › Performance assessment and troubleshooting
- › Performance monitoring of DS_N/PDH and SONET/SDH circuits
- › Round-trip delay assessment of transport circuits
- › BER testing up to OC-192/STM-64

FTB-810G: DS_N/PDH AND SONET/SDH UP TO 10 G_{BIT}/S

If the need is for transport testing at all rates up to 10 Gbit/s, then the FTB-810G is the perfect solution.

- › SFP port for OC-3/12/48 or STM-1/4/16
- › SFP+ port for OC-192 or STM-64
- › RJ-48C and bantam ports for DS1 or E1
- › BNC port for DS3, E1/E3/E4, 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

FTB-810: DS_N/PDH AND SONET/SDH UP TO 2.5 G_{BIT}/S

If the need is only for transport testing at all rates up to 2.5 Gbit/s, then the FTB-810 is the answer.

- › SFP port for OC-3/12/48 or STM-1/4/16
- › RJ-48C and bantam ports for DS1 or E1
- › BNC port for DS3, E1/E3/E4, STS-1e/STS-3e or STM-0e/STM-1e

- › DS1/DS3 and E1/E3/E4 testing
- › OC-3/12/48 and STM-1/4/16 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

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

The FTB-810 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.

Dedicated Quick-Action Buttons

- › 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

- › Optical power status available at all times
- › Pass/fail indication at all times
- › Pattern and clock synchronization
- › Electrical/optical power monitoring with valid-range color indicator (optical interface)
- › Frequency offset with valid-range color indicator
- › Overhead overwrite indicator
- › Error/alarm injection
- › Alarm hierarchy pinpointing the root-cause (when possible)

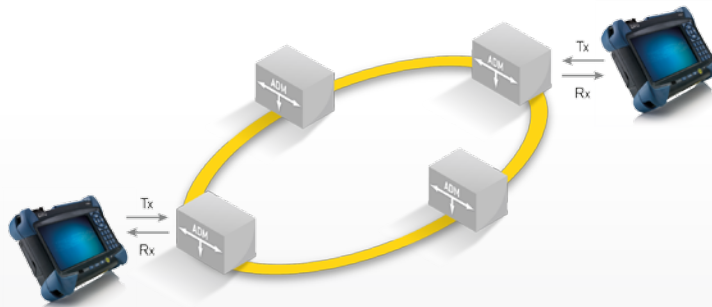
Streamlined Navigation

- › 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 easily be determined with a simple glance at the display screen
- › 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 Features

Simplified BER Testing

The FTB-810 NetBlazer series 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.



BERT

	Seconds	Count	Rate
Pattern Loss	0		
Bit Error	26	378627	5.6E-03

BER Threshold:

Bit Error Count

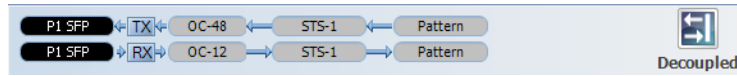
Bit Error

Manual

Amount

Decoupled Mode

The Decoupled mode enables the user to independently configure the Tx and Rx ports of the FTB-810 NetBlazer module. This is required for testing the mapping and demapping functionality of a network element or at cross-connect points in the network.



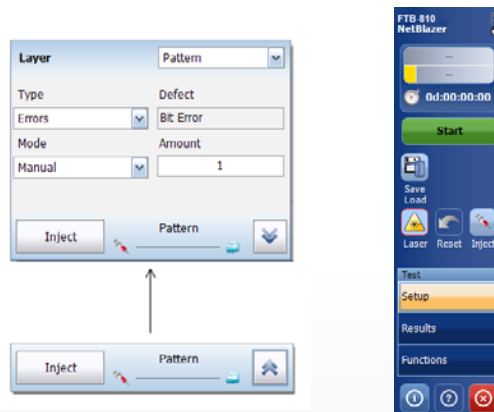
Through Mode

This mode is required for in-service monitoring of the network. The FTB-810 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-810 feature enables the user to inject errors with a single click, from any screen. This allows 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-810 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		RX	
STS-1 Timeslot		STS-1 Timeslot	
Transport OH	STS	Transport OH	STS
A1	A1	30	J1
E9	28	01	00
B1	E1	F1	B3
09	09	09	J2
D1	D3	D3	C3
00	00	00	02
H1	H2	H3	G1
00	00	00	Z7
			01
B2	K1	K2	F2
00	00	00	00
D4	D5	D6	H4
00	00	00	00
D7	D8	D9	Z3
00	00	00	00
D10	D11	D12	Z4
00	00	00	00
S1	Z2	E2	N1
00	00	00	00

VS	
Bits 1-2	SRP-2 00
Bit 3	REI 0
Bit 4	RFI 0
Bits 5-7	Label 110
Test signal, ITU-T O.181 specific mapping	
Bit 8	RDI 0

SPECIFICATIONS

SFP 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) ^a	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 ^b	Dual LC				Dual LC				Dual LC				
Transceiver type ^c	SFP				SFP				SFP				

SFP+ 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)	±4.6	±4.6	±4.6
Optical power (dB)	±2	±2	±2
Maximum Rx before damage (dBm) ^a	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 ^b	LC	LC	LC
Transceiver type ^d	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-810 selected SFP shall meet the requirements stated in the "Small Form-Factor Pluggable (SFP) Transceiver Multisource Agreement (MSA)". The FTB-810 selected SFP shall meet the requirements stated in the "Specification for Diagnostic Monitoring Interface for Optical Xcvrs".
- SFP+ compliance: The FTB-810 selected SFP+ shall meet the requirements stated in the SFP-8431 "Enhanced Small Form-Factor Pluggable Module SFP+" Transceiver Multisource Agreement (MSA)". The FTB-810 selected SFP+ shall meet the requirements stated in the "Specification for Diagnostic Monitoring Interface for Optical Xcvrs".

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	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 dBdsx 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 ≤ 8 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	
Electrical power (dB)	±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	
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	CMI	CMI		
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	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: ≤ 6 dB (cable loss only) (at 772 kHz for T1) DSX-MON: ≤ 26 dB (20 dB resistive loss + cable loss ≤ 6 dB) Bridge: ≤ 6 dB (cable loss only)	TERM: ≤ 6 dB (cable loss only) MON: ≤ 26 dB (20 dB resistive loss + cable loss ≤ 6 dB) Bridge: ≤ 6 dB (cable loss only)	TERM: ≤ 6 dB (cable loss only) MON: ≤ 26 dB (resistive loss + cable loss ≤ 6 dB) Bridge: ≤ 6 dB (cable loss only)	≤ 6 dB (cable loss only)
Transmission bit rate	1.544 Mbit/s ± 4.6 ppm	2.048 Mbit/s ± 4.6 ppm	2.048 Mbit/s ± 4.6 ppm	
Reception bit rate	1.544 Mbit/s ± 50 ppm	2.048 Mbit/s ± 50 ppm	2.048 Mbit/s ± 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	
Line coding	AMI and B8ZS	AMI and HDB3	AMI and HDB3	G.823 section 7.1 G.751 section 3.3
Input impedance (resistive termination)	75 ohms ± 5 %, unbalanced	75 ohms ± 5 %, unbalanced	75 ohms ± 5 %, unbalanced	75 ohms ± 5 %, unbalanced
Connector type	BNC ^a	BNC ^a	BNC	BNC

Note

a. Adaptation cable required for BANTAM.

FUNCTIONAL SONET AND DS _N 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 ^a	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
Mappings			
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
Error insertion			
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
Error measurement			
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
Alarm insertion			
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
Alarm detection			
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>			
Patterns			
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 ^b , 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
<i>Pattern loss and bit error generation and analysis supported on all patterns</i>			

Notes

- 1.5M (DS1) and 45M (DS3) interfaces described under SONET and DS_N 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-810. ITU-T Recommendation G.821 G.826 G.828 G.829 M.2100 M.2101 Performance monitoring statistics ES, EFS, EC, SES, UAS, ESR, SESR, DM ES, EFS, EB, SES, BBE, UAS, ERS, SESR, BBER ES, EFS, EB, SES, BBE, SEP, UAS, ESR, SESR, BBER, SEPI ES, EFS, EB, SES, BBE, UAS, ESR, SESR, BBER ES, SES, UAS, ESR, SESR 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 Generation > Pointer increment and decrement > Pointer jump with or without NDF > Pointer value Analysis > Pointer increments > Pointer decrements > 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-810 transmitter back to its receiver after crossing a far-end loopback. Measurements are provided on all supported FTB-810 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-810 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 auto detection	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.

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.
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.

UPGRADES		
SFP upgrades	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
	FTB-8194	SFP module; rates: 155/622 Mbit/s; 1310 nm, LC connector, 15 km reach
	FTB-8195	SFP module; rates: 155/622 Mbit/s; 1310 nm, LC connector, 40 km reach
	FTB-8196	SFP module; rates: 155/622 Mbit/s; 1550 nm, LC connector, 80 km reach
SFP+ upgrades	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

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	
<p>FTB-810-XX-XX-XX</p> <p>Test options ■ SONET = SONET testing SDH = SDH testing SONET-SDH = SONET and SDH testing</p> <p>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)</p> <p>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</p> <p>Example: FTB-810-SONET-155M-Dual-Rx</p>	<p>FTB-810G-XX-XX-XX</p> <p>Test options ■ SONET = SONET testing SDH = SDH testing SONET-SDH = SONET and SDH testing</p> <p>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)</p> <p>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</p>

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