SONET/SDH TEST MODULE

FTB-8115
Transport Blazer

NETWORK TESTING—TRANSPORT AND DATACOM

Platform Compatibility

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

Fully integrated test solution supporting SONET/SDH test functions

- DS0/E0 to OC-48/STM-16 testing in a single module
- Supports SONET, SDH, DSn and PDH
- SmartMode automatic signal structure discovery with real-time alarm/error/pointer movement monitoring
- Intuitive, feature-rich user interface with available automated test scripting and multi-user remote management capabilities
- Supported on FTB-200 and FTB-400 platforms, optimizing capital expenditures

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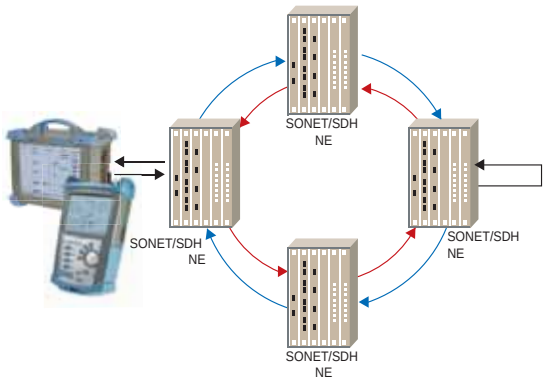
EXPERTISE REACHING OUT

Advanced SONET/SDH Access and Metro Testing

EXFO's FTB-8115 Transport Blazer test module combines advanced DSn/PDH and SONET/SDH test functions in a single unit, eliminating the need for multiple, purpose-built test platforms for the commissioning or troubleshooting of T1/E1 to OC-48/STM-16 circuits. The extensive list of DSn, SONET, PDH and SDH features available on the FTB-8115 Transport Blazer allows users to perform a wide range of tests from simple bit-error-rate (BER) analysis to more advanced network characterization and troubleshooting. These functions include:

- Mixed and bulk payload generation and analysis from 64 Kbit/s to 2.5 Gbit/s
- High-order mappings: STS-1/3c/6c/9c/12c/24c/48c and AU-3/AU-4/AU-4-2c/3c/4c/8c/16c
- Low-order mappings: VT1.5/2/6, TU-11/12/2/3
- Section, line, high-order (HO) and low-order (LO) path overhead manipulation and monitoring
- Section, line, high-order and low-order path alarm/error generation and monitoring
- High-order and low-order pointer generation and monitoring
- Performance monitoring: G.821, G.826, G.828, G.829, M.2100, M.2101
- Frequency analysis and power measurement
- Frequency offset generation
- Automatic protection switching and service disruption time measurements
- Round-trip delay measurements
- Dual DS1/DS3 receiver testing
- Independent transmitter and receiver testing
- Through mode analysis
- DS1 FDL and loopcodes
- Fractional T1/E1 testing
- Tandem connection monitoring



Housed in either the FTB-400 or FTB-200 platform, the FTB-8115 module enables field circuit turn-up and troubleshooting.

SMARTMODE: REAL-TIME SIGNAL STRUCTURE DISCOVERY AND MONITORING

EXFO's FTB-8115 Transport Blazer supports a unique feature called SmartMode. This provides users with full visibility of all high-order (STS/AU) and low-order (VT/TU) mixed mappings within the incoming SONET/SDH test signal.

SmartMode automatically discovers the signal structure of the OC-n/STM-n line, including mixed mappings. In addition to this in-depth multichannel visibility, SmartMode performs real-time monitoring of all discovered high-order paths and user selected low-order paths simultaneously, providing users with the industry's most powerful SONET/SDH multichannel monitoring and troubleshooting solution. Real-time monitoring allows users to easily isolate network faults, saving valuable time and minimizing service disruption. SmartMode also provides one-touch test case start, allowing users to quickly configure a desired test path.

FTB-8115 SmartMode: multichannel signal discovery with real-time alarm scan (shown in the FTB-400 user interface).

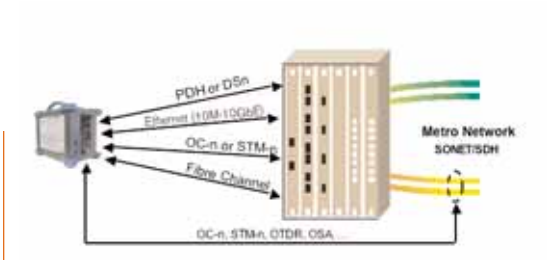
Unsurpassed Configuration and Operational Flexibility

MULTIPLATFORM SUPPORT AND VERSATILITY

The FTB-8115 Transport Blazer module is supported and interchangeable on both the FTB-400 Universal Test System and the FTB-200 Compact Platform. This cross-platform support provides users with added flexibility by enabling them to select the appropriate platform that suits their testing needs. EXFO is the first and only test solution provider to offer this versatility, delivering single to multi-application test solutions with the same hardware module, which in turn dramatically reduces capital expenditures.

Inserted in the FTB-200 Compact Platform, the FTB-8115 Transport Blazer module delivers SONET/SDH test functions in a small, lightweight platform, ideal for field technicians' installation and commissioning needs. When combined with the FTB-200's optional integrated high-precision power meter, visual fault locator and fiber scope, this solution provides all the critical test tools required for day-to-day activities, eliminating the need to carry and manage multiple test sets.

The FTB-8115 module is supported on both the FTB-200 and the FTB-400 platforms.



With its modular, multislot design, the FTB-400 platform enables users to configure and upgrade their systems in the field according to their testing needs, minimizing capital expenditures.

The FTB-400 platform configuration–used with either the four-slot (GP-404) or eight-slot (GP-408) receptacle–provides users with an all-in-one solution supporting a mix of Transport Blazer modules, Packet Blazer modules (FTB-8510G 10 Gigabit Ethernet, FTB-8510 Ethernet, FTB-8520 SAN) and optical-layer test modules, making it the industry's first truly integrated network testing platform. The resulting modularity enables users to upgrade their systems in the field according to their testing needs. This multiservice test platform is the ideal solution for field, central office and lab applications.

HARDWARE UPGRADABILITY

Part of the Transport Blazer family of products, the FTB-8115 module can be factory upgraded to support 10 Gbit/s operation. In addition, the upgrades can include Next-Generation Ethernet-over-SONET/SDH test functions, such as generic framing procedure (GFP), virtual concatenation (VCAT) and link capacity adjustment scheme (LCAS).

AUTOMATED TEST SCRIPTING

When configured for the FTB-400 platform, the FTB-8115 Transport Blazer comes with a built-in macrorecorder, allowing users to easily record their test actions and automatically create test scripts. This also allows them to build standard test routines that can be easily accessed and run by field technicians with little or no manual intervention.

REMOTE MANAGEMENT

The FTB-8115 Transport Blazer module allows users to perform remote testing and data analysis, as well as remote monitoring via standard Ethernet or remote dial-up connections.

TEST LOGGER AND REPORTING

EXFO's FTB-8115 Transport Blazer module supports a detailed test logger and test reporting tools, enabling users to view any errors/alarms that occurred during the test interval, which can then be used for post-processing of results or SLA conformance validation.

Total Events: 17 — View Details

ID	Date/Time	Data Path	Event	Duration
1	00:00:00	TEST 1	StartEvent	
2	00:00:01	Optical	AlarmLos	00:01:31
3	00:00:01	STS-1	AlarmLop	00:00:01
4	00:01:32	OC-12	AlarmLof	00:00:01
5	00:01:53	Optical	AlarmFrequency	00:00:08
6	00:02:13	STS-1	AlarmLop	00:00:01
7	00:02:13	OC-12	AlarmLof	00:00:05
8	00:03:34	STS-1	Error03	00:00:05
9	00:03:49	STS-1	AlarmAis	00:00:09
10	00:06:46	STS-1	Error03	00:00:01
11	00:07:36	OC-12	Error81	00:00:06
12	00:07:42	STS-1	AlarmLop	00:00:01
13	00:07:42	OC-12	AlarmLof	00:00:03
14	00:07:54	STS-1	AlarmLop	00:00:01
15	00:07:54	OC-12	AlarmLof	00:00:02
16	00:08:02	STS-1	AlarmLop	00:00:01
17	00:08:02	OC-12	AlarmLof	Pending...

Test logger: a detailed, time-stamped list of all events occurring during test execution.

Electrical Interfaces

The following section provides detailed information on all supported electrical interfaces.

		DS1	E1/2M		E2/8M	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	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 16	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 4-14/22, 23
Tx LBO Preamplification		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)					0 to 225 ft 225 to 450 ft	0 to 225 ft 225 to 450 ft		0 to 225 ft
Cable Simulation		Power dBdsx –22.5 dBdsx –15.0 dBdsx –7.5 dBdsx 0 dBdsx					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) Note: measurement units = dBdsx	For 1024 kHz: TERM: ≤ 6 dB (cable loss only) MON: ≤ 25 dB (20 dB resistive loss + cable loss ≤ 6 dB) Bridge: ≤ 6 dB (cable loss only) Note: measurement units = dBm	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) Note: measurement units = dBm	For 4224 kHz: TERM: ≤ 6 dB (cable loss only) MON: ≤ 26 dB (20 dB resistive loss + cable loss ≤ 6 dB) Note: measurement units = dBm	For 17.184 MHz: TERM: ≤ 12 dB (coaxial cable loss only) MON: ≤ 26 dB (20 dB resistive loss + cable loss ≤ 6 dB) Note: measurement units = dBm	For 22.368 MHz: TERM: ≤ 10 dB (cable loss only) DSX-MON: ≤ 26.5 dB (21.5 dB resistive loss + cable loss ≤ 5 dB) Note: measurement units = dBm	For 25.92 MHz: TERM: ≤ 10 dB (cable loss only) MON: ≤ 25 dB (20 dB resistive loss + cable loss ≤ 5 dB) Note: measurement units = dBm	For 70 MHz: TERM: ≤ 12 dB (coaxial cable loss only) MON: ≤ 26 dB (20 dB resistive loss + cable loss ≤ 6 dB) Note: measurement units = dBm	For 78 MHz: TERM: ≤ 12.7 dB (coaxial cable loss only) MON: ≤ 26 dB (20 dB resistive loss + cable loss ≤ 6 dB) Note: measurement units = dBm
Transmit Bit Rate		1.544 Mbit/s ± 4.6 ppm	2.048 Mbit/s ± 4.6 ppm	2.048 Mbit/s ± 4.6 ppm	8.448 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
Receive Bit Rate		1.544 Mbit/s ± 140 ppm	2.048 Mbit/s ± 100ppm	2.048 Mbit/s ± 100ppm	8.448 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	Frequency	± 4.6 ppm	±4.6 ppm	±4.6 ppm	± 4.6 ppm	± 4.6 ppm	±4.6 ppm	±4.6 ppm	±4.6 ppm	±4.6 ppm
	Electrical Power	DSX range: ± 1.0 dB DSX-MON range: ± 2.0 dB	NORMAL: ± 1.0 dB MONITOR: ± 2.0 dB	NORMAL: ± 1.0 dB MONITOR: ± 2.0 dB	NORMAL: ± 1.0 dB MONITOR: ± 2.0 dB	NORMAL: ±1.0 dB MONITOR: ±2.0 dB	DSX range: ± 1.0 dB DSX-MON range: ±2.0 dB	DSX range: ± 1.0 dB DSX-MON range: ±2.0 dB	NORMAL: ±1.0 dB MONITOR: ±2.0 dB	NORMAL: ± 1.0 dB MONITOR: ±2.0 dB
Peak-to-Peak Voltage		±10 % down to 500 mVpp	±10% down to 500 mVpp	±10% down to 500 mVpp	±10% down to 400 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
Frequency Offset Generation		1.544 Mbit/s ± 140 ppm	2.048 Mbit/s ± 70 ppm	2.048 Mbit/s ± 70 ppm	8.448 Mbit/s ± 50 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
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.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	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	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 ±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	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 Sensivity	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 ± 140 ppm	2.048 Mbit/s ± 100 ppm	2.048 Mbit/s ± 100 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	
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.

Optical Interfaces

The following section provides detailed information on all supported optical interfaces.

		OC-3/STM-1o			OC-12/STM-4o			OC-48/STM-16o			
		15 km; 1310 nm	40 km; 1310 nm	80 km; 1550 nm	15 km; 1310 nm	40 km; 1310 nm	80 km; 1550 nm	15 km; 1310 nm	40 km; 1310 nm	40 km; 1550 nm	80 km; 1550 nm
Tx Level		–15 to –8 dBm	–5 to 0 dBm	–5 to 0 dBm	–15 to –8 dBm	–3 to +2 dBm	–3 to +2 dBm	–5 to 0 dBm	–2 to +3 dBm	–5 to 0 dBm	–2 to +3 dBm
Rx Level Sensitivity		–28 to –8 dBm	–34 to –10 dBm	–34 to –10 dBm	–28 to –8 dBm	–28 to –8 dBm	–28 to –8 dBm	–18 to 0 dBm	–27 to –9 dBm	–18 to 0 dBm	–28 to –9 dBm
Transmission Bit Rate		155.52 Mbit/s ± 4.6 ppm	155.52 Mbit/s ± 4.6 ppm	155.52 Mbit/s ± 4.6 ppm	622.08 Mbit/s ± 4.6 ppm	622.08 Mbit/s ± 4.6 ppm	622.08 Mbit/s ± 4.6 ppm	2.48832 Gbit/s ± 4.6 ppm			
Reception Bit Rate		155.52 Mbit/s ± 100 ppm	155.52 Mbit/s ± 100 ppm	155.52 Mbit/s ± 100 ppm	622.08 Mbit/s ± 100 ppm	622.08 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	1480 to 1580 nm	1274 to 1356 nm	1280 to 1335 nm	1480 to 1580 nm	1260 to1360 nm	1280 to1335 nm	1430 to1580 nm	1500 to1580 nm
Spectral Width		7.7 nm RMS	1 nm (20 dB from center)	1 nm (20 dB from center)	4 nm RMS	1 nm (20 dB from center)	< 1 nm (20 dB from center)	< 1 nm (–20 dB from center)			
Frequency Offset Generation		155.52 Mbit/s ± 50 ppm	155.52 Mbit/s ± 50 ppm	155.52 Mbit/s ± 50 ppm	622.08 Mbit/s ± 50 ppm	622.08 Mbit/s ± 50 ppm	622.08 Mbit/s ± 50 ppm	2.48832 Gbit/s ± 50 ppm			
Measurement Accuracy	Frequency	±4.6 ppm	±4.6 ppm	±4.6 ppm	±4.6 ppm	±4.6 ppm	±4.6 ppm	±4.6 ppm			
	Optical Power	±2 dB	±2 dB	±2 dB	±2 dB	±2 dB	±2 dB	±2 dB			
Maximum Rx before Damage [a]		+3 dBm	+3 dBm	+3 dBm	+3 dBm	+3 dBm	+3 dBm	+3 dBm			
Jitter Compliance		GR-253 (SONET) G.958 (SDH)	GR-253 (SONET) G.958 (SDH)	GR-253 (SONET) G.958 (SDH)	GR-253 (SONET) G.958 (SDH)	GR-253 (SONET) G.958 (SDH)	GR-253 (SONET) G.958 (SDH)	GR-253 (SONET) G.958 (SDH)			
Line Coding		NRZ	NRZ	NRZ	NRZ	NRZ	NRZ	NRZ			
Eye Safety		Class 1 laser complies with 21 CFR 1040.10 and 1040.11	Class 1 laser complies with 21 CFR 1040.10 and 1040.11	Class 1 laser complies with 21 CFR 1040.10 and 1040.11	Class 1 laser complies with 21 CFR 1040.10 and 1040.11	Class 1 laser complies with 21 CFR 1040.10 and 1040.11	Class 1 laser complies with 21 CFR 1040.10 and 1040.11	Class 1 laser complies with 21 CFR 1040.10 and 1040.11			
Connector		Dual LC	Dual LC	Dual LC	Dual LC	Dual LC	Dual LC	Dual LC			
Tranceiver Type [b]		SFP	SFP	SFP	SFP	SFP	SFP	SFP			

NOTES

a. In order not to exceed the maximum receiver power level before damage, an attenuator must be used.

b. SFP compliance: The FTB-8115 selected SFP shall meet the requirements stated in the "Small Form-Factor Pluggable (SFP) Transceiver Multisource Agreement (MSA)". The FTB-8115 selected SFP shall meet the requirements stated in the "Specification for Diagnostic Monitoring Interface for Optical Xcvrs".

FUNCTIONAL SPECIFICATIONS

SONET and DSn		SDH and PDH	
Optical interfaces	OC-3, OC-12, OC-48	**Optical interfaces**	STM-1, STM-4, STM-16
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), 8M (E2), 34M (E3), 45M (DS3), 140M (E4), STM-0e, STM-1e
DS1 framing	Unframed, SF, ESF	2M framing	Unframed, PCM30, PCM31, PCM30 CRC-4, PCM31 CRC-4
DS3 framing	Unframed, M13, C-bit parity	8M, 34M, 140M framing	Unframed, framed
Clocking	Internal, loop-timed, external (BITS), inter-module	Clocking	Internal, loop-timed, external (MTS/SETS), 2 MHz, inter-module
Mappings		**Mappings**	
VT1.5	Bulk, DS1	TU-11-AU-3, TU-11-AU-4	Bulk, 1.5M
VT2	Bulk, E1	TU-12-AU-3, TU-12-AU-4	Bulk, 2M
VT6	Bulk	TU-3-AU-4	Bulk, 34M, 45M
STS-1 SPE	Bulk, DS3	TU-2-AU-3, TU-2-AU-4	Bulk
STS-3c/6c/9c/12c/24c/48c, SPE	Bulk	AU-4 AU-4-2c/3c/4c/8c/16c	Bulk, 140M Bulk
SONET overhead analysis and manipulation	A1, A2, J0, E1, F1, D1-D12, K1, K2, S1, M0, E2, J1, C2, G1, F2, H4, Z3, Z4, Z5, N1, N2	**SDH overhead analysis and manipulation**	A1, A2, J0, E1, F1, D1-D12, K1, K2, S1, M0, E2, J1, C2, G1, F2, F3, K3, N1, N2
Error insertion		**Error insertion**	
DS1	Framing bit, BPV, CRC-6, bit error	E1 (2M)	Bit error, FAS, CV, CRC-4, E-bit
DS3	BPV, C-bit, F-bit, P-bit, FEBE, bit error	E2 (8M), E3 (34M), E4 (140M)	Bit error, FAS, CV
STS-1e, STS-3e	Section BIP (B1), line BIP (B2), path BIP (B3), BIP-2, REI-L, REI-P, REI-V, BPV, bit error	STM-0e, STM-1e	RS-BIP (B1), MS-BIP (B2), HP-BIP (B3), MS-REI, HP-REI, LP-BIP-2, LP-REI, bit error, CV
OC-3, OC-12, OC-48	Section BIP (B1), line BIP (B2), path BIP (B3), BIP-2, REI-L, REI-P, REI-V, bit error	STM-1, STM-4, STM-16	RS-BIP (B1), MS-BIP (B2), HP-BIP (B3), MS-REI, HP-REI, LP-BIP-2, LP-REI, bit error
Error measurement		**Error measurement**	
DS1	Framing bit, BPV, CRC-6, excess zeros, bit error	E1 (2M)	Bit error, FAS, CV, CRC-4, E-bit
DS3	BPV, C-bit, F-bit, P-bit, FEBE, bit error	E2 (8M), E3 (34M), E4 (140M)	Bit error, FAS, CV
STS-1e, STS-3e	Section BIP (B1), line BIP (B2), path BIP (B3), BIP-2, REI-L, REI-P, REI-V, BPV, bit error	STM-0e, STM-1e	RS-BIP (B1), MS-BIP (B2), HP-BIP (B3), MS-REI, HP-REI, LP-BIP-2, LP-REI, bit error, CV
OC-3, OC-12, OC-48	Section BIP (B1), line BIP (B2), path BIP (B3), BIP-2, REI-L, REI-P, REI-V, bit error	STM-1, STM-4, STM-16	RS-BIP (B1), MS-BIP (B2), HP-BIP (B3), MS-REI, HP-REI, LP-BIP-2, LP-REI, bit error
Alarm insertion		**Alarm insertion**	
DS1	LOS, RAI, AIS, OOF, pattern loss	E1 (2M)	LOS, LOS Mframe, LOS CRC 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	LOS, LOF, 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	LOS, LOF, OOF, MS-AIS, MS-RDI, AU-AIS, AU-LOP, H4-LOM, HP-PDI, ERDI-PSD, ERDI-PCD, ERDI-PPD, HP-UNEQ, TU-AIS, LP-RFI, LP-RDI, ERDI-VCD, ERDI-VPD, ERDI-VSD, LP-RFI, LP-UNEQ, pattern loss
Alarm detection		**Alarm detection**	
DS1	LOS, loss of clock (LOC), RAI, AIS, OOF, pattern loss	E1 (2M)	LOS, LOS Mframe, LOS CRC 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	LOS, LOC, LOF, SEF, TIM-S, AIS-L, RDI-L, AIS-P, LOP-P, LOM, PDI-P, RDI-P, ERDI-PCD, ERDI-PPD, ERDI-PSD, PLM/SLM-P, UNEQ-P, TIM-P, AIS-V, LOP-V, RDI-V, ERDI-VCD, ERDI-VPD, ERDI-VSD, RFI-V, UNEQ-V, TIM-V, PLM/SLM-V, pattern loss	STM-0e, STM-1e, STM-1, STM-4, STM-16	LOS, LOF, LOC, OOF, RS-TIM, MS-AIS, MS-RDI, AU-AIS, AU-LOP, H4-LOM, HP-RDI, ERDI-PSD, ERDI-PCD, ERDI-PPD, HP-PLM/SLM, HP-UNEQ, HP-TIM, TU-AIS, LP-RFI, LP-RDI, ERDI-VCD, ERDI-VPD, ERDI-VSD, LP-RFI, LP-UNEQ, LP-TIM, LP-PLM/SLM, pattern loss
Frequency alarm on all supported interfaces.			
Patterns		**Patterns**	
DS0	2E9-1, 2E11-1, 2E20-1, User defined	E0 (64K)	2E9-1, 2E11-1, 2E20-1, User defined
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, QRSS, 1-in-8, 1-in-16, 3-in-24, 32 bit programmable (inverted or non-inverted), bit errors	E2 (8M), 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
VT1.5/2/6	2E9-1, 2E11-1, 2E15-1, 2E20-1, 2E23-1, 2E31-1, 1100, 1010, 1111, 0000, QRSS, 1-in-8, 1-in-16, 32 bit programmable (inverted or non-inverted), bit errors	TU-11/12/2/3	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/6c/9c/12c/24c/48c, SPE	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/AU4-2c/3c/4c/8c/16c	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

LSS (loss of pattern) and bit error generation and analysis supported on all patterns.

NOTES

a. 1.5M (DS1) and 45M (DS3) interfaces discribed under SONET and DSn column.

b. Not supported for E4 (140M).

ADDITIONAL TEST AND MEASUREMENT FUNCTIONS

Power measurements	Supports power measurements, displayed in dBm (dBdsx for DS1), for optical and electrical interfaces.
Frequency measurements	Supports clock frequency measurements (i.e., received frequency and deviation of the input signal clock from nominal frequency), displayed in ppm and b/s (bps), for optical and electrical interfaces.
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-8115.

ITU-T recommendation	Performance monitoring statistics
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.703

Generation	Analysis
• 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 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. User-selectable triggers: All supported alarms and errors. Measurements: last disruption, shortest disruption, longest disruption, average disruption, total disruption, and service disruption count.
Round-trip delay measurements	The round-trip delay test tool measures the time required for a bit to travel from the FTB-8115 transmitter back to its receiver after crossing a far-end loopback. Measurements are supported on all supported FTB-8115 interfaces and mappings. Measurements: last RTD time, minimum, maximum, average, measurement count (no. of successful RTD tests), 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 bytes of SONET/SDH overhead).
Through mode	Ability to perform Through mode analysis of any incoming electrical (DSn, PDH) and optical line (OC-3/12/48, STM-1/4/16).
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.
Tandem connection monitoring (TCM)[a]	Tandem connection monitoring (TCM), option 2[b], is used to monitor the performance of a subsection of a SONET/SDH path routed via different network providers. The FTB-8115 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, OEI Error analysis: TC-IEC, TC-REI, OEI, TC-VIOL Alarm generation: TC-RDI, TC-UNEQ, ODI, TC-LTC, TC-IAIS Alarm analysis: TC-TIM, TC-RDI, TC-UNEQ, ODI, TC-LTC, TC-IAIS

ADDITIONAL FEATURES

Scripting	The built-in scripting engine and embedded macro-recorder provide a simple means of automating test cases and routines. Embedded scripting routines provide a powerful means of creating advanced test scripts. Available for the FTB-400 platform.
Reports	Supports generation of test reports in .html, .csv, .txt, .pdf formats. Contents or reports are customizable by the user.
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 bootup.
Store and load configurations	Ability to store and load test configurations to/from non-volatile memory.
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.
Configurable test views	This allows users to customize their test views, i.e., to dynamically insert or remove test tabs/windows, in addition to creating new test windows, so as to accurately match their testing needs.
Configurable test timer	Provides the ability for a user to set pre-defined test start and stop times.
Remote control	Remote management software. This allows users to remotely monitor and control the FTB-8115 module via standard Ethernet connection.

NOTES

a. HOP and LOP supported.

b. G.707 option 2.

SPECIFICATIONS

FTB-8115

SONET/SDH 155 Mbit/s, 622 Mbit/s and 2.5 Gbit/s Analyzer module supporting up to OC-48/STM-16 optical rates, as well as electrical DSn/PDH interfaces

Test Interfaces

SONET: STS-1e, STS-3e, OC-3, OC-12, OC-48
SDH: STM-0e, STM-1e, STM-1, STM-4, STM-16
DSn: DS1, DS3, Dual DS1 Rx, Dual DS3 Rx
PDH: E1, E2, E3, E4

GENERAL SPECIFICATIONS

	FTB-8115
Weight (without transceiver)	0.9 kg (2.0 lb)
Size (H x W x D)	51 mm x 76 mm x 254 mm (2 in x 3 in x 10 in)
Temperature	
operating	0 °C to 40 °C (32 °F to 104 °F)
storage	–40 °C to 60 °C (–40 °F to 140 °F)

ORDERING INFORMATION

FTB-8115-XX-XX-XX-XX

Model

Test options
SONET = SONET-BASE-SW
SDH = SDH-BASE-SW
SONET-SDH = Option for combined SONET/SDH functionality

Rate options
155 = 155 Mbit/s (OC-3/STM-1)
622 = 622 Mbit/s (OC-12/STM-4)

Example
FTB-8115-SONET-155-8194-DUAL RX

Options[a]
G.747[b]
DS1-FDL
DUAL RX
TCM = Tandem connection monitoring
Smart mode

Test options
8194 = SFP modules 155/622 Mbit/s at 1310 nm, 15 km
8195 = SFP modules 155/622 Mbit/s at 1310 nm, 40 km
8196 = SFP modules 155/622 Mbit/s at 1550 nm, 80 km

NOTES

a. Multiple options can be purchased to suit the required test application.
b. Enables E1/2M in DS3/45M analysis and generation, as per ITU-T G.747 recommendation.

Complementary Products

FTB-8080 SYNC ANALYZER

The FTB-8080 Synch Analyzer is a comprehensive test solution for telecom network synchronization assurance, monitoring and troubleshooting applications. It offers a full range of wander and sync testing functionalities, including graphical display of TIE, MTIE and TDEV parameters, as well as comparison to ITU/ANSI/TS standards and user-definable masks. The companion Sync View software suite allows remote data retrieval and test case setup, eliminating the need to visit test sites during prolonged monitoring periods. The FTB-8080 can be used in conjunction with an FTB-8120/8130 module to provide wander measurements up to OC-192/STM-64 rates.

For more information on the FTB-8080, please refer to its detailed product specification sheet at http://documents.exfo.com/specsheets/FTB-8080-ang.pdf

FTB-8120/8130 TRANSPORT BLAZER NEXT-GENERATION SONET/SDH TEST MODULES

The FTB-8120 (2.5/2.7 Gb/s) and FTB-8130 (10/10.7 Gbit/s) Transport Blazer test modules combine advanced DSn/PDH, SONET/SDH, next-generation SONET/SDH and optical transport network (OTN) test functions, eliminating the need for multiple purpose-built test platforms when commissioning or troubleshooting SONET/SDH, OTN and new data-aware SONET/SDH circuits. These modules offer DS0/E0 to OC-192/STM-64 testing in a single unit, and they perform Ethernet-over-SONET/SDH (EoS) testing via optional support for GFP, VCAT and LCAS. Thanks to the SmartMode functionality, they also enable signal structure discovery for rates of up to 10 Gbit/s, with simultaneous monitoring of all discovered STS/AU and user selected VT/TU channels.

For details on the FTB-8120/8130 modules, please refer to the detailed product specification sheet at http://documents.exfo.com/specsheets/FTB-8120-8130-ang.pdf

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