

8100

NETWORK TESTING

NEXT-GENERATION SONET/SDH ANALYZER

FTB-8100



Fully integrated test solution supporting DS_n/PDH, SONET/SDH and Next-Generation SONET/SDH test functions

- DS1/E1 to OC-48/STM-16 interfaces in a single module (upgradable to OC-192/STM-64)
- Supports SONET, SDH, DS_n, PDH and Next-Generation SONET/SDH
- Ethernet-over-SONET/SDH (EoS) test capabilities via support for GFP, VCAT and LCAS
- Ethernet add/drop interface enabling advanced EoS service generation, analysis and troubleshooting
- Full interworking with EXFO's world-class FTB-8510 Packet Blazer™ Ethernet Test Module, for simultaneous Ethernet and SONET/SDH testing
- Intuitive, feature-rich smart user interface (SUI) with built-in automated test scripting capabilities
- Multiple-module, multiple-technology platform supporting optical, datacom (Ethernet/Fibre Channel) and SONET/SDH test modules



The Next Step in SONET/SDH Testing

The proliferation of packet-based services at the enterprise level is expanding the possibilities for SONET/SDH networks. With the advent of Next-Generation SONET/SDH technologies, such as generic framing procedure (GFP) and virtual concatenation (VCAT), service providers now have a cost-effective means of introducing new revenue-generating, data-aware transport services on existing SONET/SDH infrastructures. This opportunity in turn creates the need for test solutions that can help ensure proper deployment, operation and maintenance of these new services—and stay within budget.

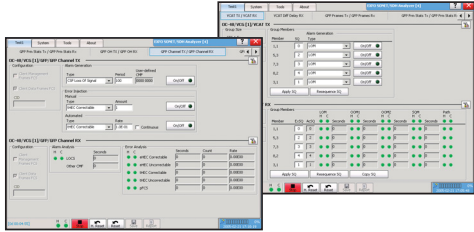
EXFO's FTB-8100 Next-Generation SONET/SDH Analyzer combines advanced DSn/PDH, SONET/SDH and Next-Gen SONET/SDH test functions in a single unit, eliminating the need for multiple, purpose-built test platforms when commissioning or troubleshooting SONET/SDH services and new data-aware SONET/SDH circuits. Housed in the portable FTB-400 Universal Test System, and fully compatible with the FTB-8510 Packet Blazer™ Ethernet Test Module, the FTB-8100 is ideally suited for lab, central office and field applications.



FTB-8100 modules are housed in the FTB-400 portable platform's new eight-slot receptacle (GP-408). This configuration supports multiple FTB-8100 modules, delivering simultaneous multipoint testing capabilities.

Next-Gen SONET/SDH Testing

The FTB-8100 Next-Generation SONET/SDH Analyzer provides support for generic framing procedure (GFP), virtual concatenation (VCAT) and link capacity adjustment scheme (LCAS) test functions:



GFP-F

- Generation and analysis of frame types (client management/client data)
- Alarm/error generation and monitoring
- Overhead manipulation and monitoring
- Transmission and reception stats monitoring

VCAT

- Simultaneous manipulation of every member of a VCAT group
- Alarm/error generation and monitoring
- Sequence-indicator manipulation and processing
- Group-summary monitoring
- Differential delay analysis and insertion

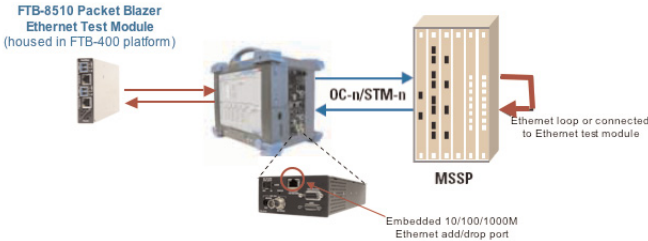
LCAS

- Emulation and analysis of LCAS protocol (Automatic and Manual modes)
- Source and sink state machines control and monitoring
- Real-time generation and monitoring of LCAS control fields
- Real-time insertion and monitoring of LCAS alarms/errors

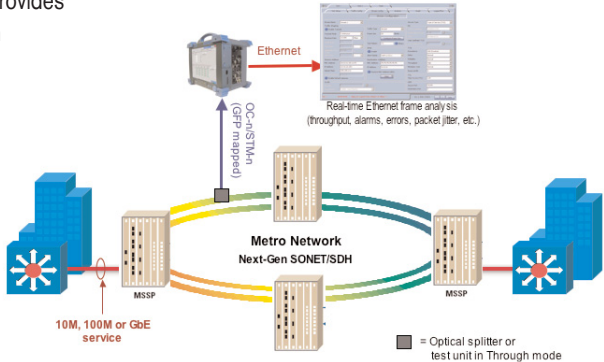
Ethernet Add/Drop Interface

In addition to its internal PRBS generator, each FTB-8100 module includes an embedded 10/100/1000M Ethernet interface that can be used to interconnect with an FTB-8510 Packet Blazer module or an external Ethernet device (e.g., switch or router), delivering the industry's first data-integrated Next-Generation SONET/SDH test solution for advanced Ethernet-over-SONET service emulation and analysis. This flexible configuration is ideal for Ethernet-over-SONET/SDH test and maintenance applications—both in the lab and in the field.

What's more, the FTB-8100's compatibility with the FTB-8510 Packet Blazer™ provides you with the added benefit of simultaneous Ethernet and SONET/SDH testing in a single platform.



The FTB-8100 module's embedded 10/100/1000M Ethernet interface allows users to extract and insert Ethernet payload to/from a GFP-mapped OC-n/STM-n line, providing a powerful test solution for Ethernet-over-SONET/SDH service validation.

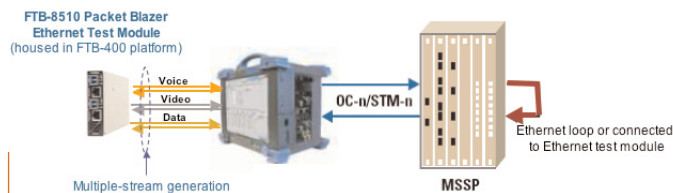


The FTB-8100's embedded 10/100/1000M Ethernet interface is also an ideal Ethernet-over-SONET/SDH circuit troubleshooting and monitoring tool.

Scalable, High-Performance SONET/SDH Testing

Multiservice QoS Testing

Next-Generation SONET/SDH networks are being deployed to transport a mix of services, such as voice, video and data access services. EXFO's FTB-8100, in conjunction with the FTB-8510 Packet Blazer Ethernet Test Module, allows for the generation and analysis of multiple Ethernet test streams over a GFP enabled Ethernet-over-SONET/SDH link. Each stream's quality-of-service setting is user-configurable (via IP TOS, Diffserv, Ethernet 802.1 priority bits), providing a means of prequalifying delivery of multiple services over their multiservice provisioning platforms (MSPPs) and corresponding Next-Generation SONET/SDH networks.



Combining the FTB-8510's Ethernet multiple-streaming capabilities and the FTB-8100's embedded 10/100-100M Ethernet interface creates a powerful solution for testing multiple services over SONET/SDH.

Simultaneous Multichannel Testing

The FTB-8100's virtual concatenation functionality supports real-time multichannel testing, allowing for each low-order (e.g., VT1.5, VC-11, VC-12) or high-order (e.g., STS-1/3, VC-3/4) path of a configured virtual concatenation group (VCG) to be controlled and monitored independently. This gives users full visibility of all path errors and alarms per VCG member, critical for VCAT circuit troubleshooting and maintenance applications. In addition, this multichannel visibility provides a means of generating simultaneous alarms and errors per member, ideal for lab validation applications.

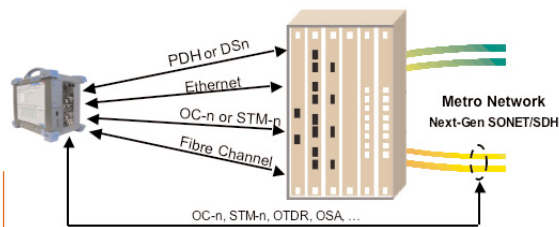
SONET/SDH Service Assurance and Troubleshooting

In addition to its Next-Generation SONET/SDH features, the FTB-8100 also offers advanced SONET/SDH test functions, including:

- High-order (HO) mappings: STS-1/3c/6c/9c/12c/24c/48c and AU-3/AU-4/AU-4-2c/3c/4c/8c/16c
- Low-order (LO) mappings: VT1.5/2/6, VC-11/12/2/3
- Section, line, HO and LO path overhead manipulation and monitoring
- Section, line, HO and LO path alarm generation and monitoring
- Section, line, HO and LO path error injection and measurement
- Pointer processing and generation
- Electrical and optical signal frequency analysis and power measurement
- Error performance monitoring
- Through-mode testing
- Service disruption time measurements
- APS (K1/K2), SS bits, SSM and signal label encoders/decoders
- Dual DS1/DS3 receiver testing

Multiple-Protocol Platform: First-Class Versatility

The FTB-8100 is housed in the FTB-400 portable platform's new eight-slot module receptacle (GP-408). This high-performance, multiple-protocol configuration provides users with an all-in-one solution capable of supporting of FTB-81x0, FTB-8510 Packet Blazer, FTB-8520 Packet Blazer SAN and EXFO optical-layer test modules, making it the industry's first network-testing platform combining Next-Generation SONET/SDH functions with Ethernet, Fibre Channel and optical-layer testing capabilities. The resulting modularity enables users to upgrade their systems in the field according to their testing needs, optimizing capital expenditures.



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.

Electrical Interfaces

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

	DS1	E1/2M		E3/34M	DS3/45M	STS-1/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	GR-499 figure 9-8	GR-253 figure 4-10/4-11	G.703 figure 18/19, figure 4-12/4-13/4-14	GR-253	
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 255 to 450 ft	0 to 225 ft 255 to 450 ft	0 to 225 ft	
Tx LBO - 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: 26 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 17.184 MHz: TERM: = 12 dB (coaxial cable loss only) MON: 20 dB (resistive loss + cable loss ≤ 6 dB) Note: measurement units = dBm	For 22.368 MHz: TERM: = 10 dB (cable loss only) DSX-MON: 21.5 dB (resistive loss + cable loss ≤ 5 dB) Note: measurement units = dBm	For 25.92 MHz: TERM: = 10 dB (cable loss only) MON: 20 dB (resistive loss + cable loss ≤ 5 dB) Note: measurement units = dBm	For 70 MHz: TERM: = 12 dB (coaxial cable loss only) MON: 20 dB (resistive loss + cable loss ≤ 6 dB) Note: measurement units = dBm	For 78 MHz: TERM: = 10 dB (coaxial cable loss only) MON: 20 dB (resistive loss + cable loss ≤ 6 dB) Note: measurement units = dBm	
Transmission Bit Rate	1.544 Mb/s ± 4.6 ppm	2.048 Mb/s ± 4.6 ppm	2.048 Mb/s ± 4.6 ppm	34.368 Mb/s ± 4.6 ppm	44.736 Mb/s ± 4.6 ppm	51.84 Mb/s ± 4.6 ppm	139.264 Mb/s ± 4.6 ppm	155.52 Mb/s ± 4.6 ppm	
Reception Bit Rate	1.544 Mb/s ± 140 ppm	2.048 Mb/s ± 100 ppm	2.048 Mb/s ± 100 ppm	34.368 Mb/s ± 100 ppm	44.736 Mb/s ± 100 ppm	51.84 Mb/s ± 100 ppm	139.264 Mb/s ± 100 ppm	155.52 Mb/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	
	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	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 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 (category II)	
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 (category II)	
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 ± 10%, unbalanced	
Connector Type	BANTAM	BANTAM	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 Mb/s ± 4.6 ppm	2.048 Mb/s ± 4.6 ppm	2.048 Mb/s ± 4.6 ppm	
Reception Bit Rate	1.544 Mb/s ± 140 ppm	2.048 Mb/s ± 100 ppm	2.048 Mb/s ± 100 ppm	
Tx Frequency	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
Rx Frequency	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)	100 ohms ± 5%, balanced	120 ohms ± 5%, balanced	75 ohms ± 5%, unbalanced	75 ohms ± 5%, unbalanced
Connector Type	BANTAM	BANTAM	BNC	BNC

Ethernet Add/Drop Interface

10/100/1000BaseT (Add/Drop)	
Compliance	10 Mb/s: IEEE 802.3 section 14. 100 Mb/s: IEEE 802.3 section 25. 1000 Mb/s: IEEE 802.3 section 40.
Connector	RJ-45 Ethernet

Optical Interfaces

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

		OC-3/STM-1c			OC-12/STM-4c			OC-48/STM-16c		
		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	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	-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	-28 to -9 dBm
Transmission Bit Rate		155.52 Mb/s ± 4.6 ppm	155.52 Mb/s ± 4.6 ppm	155.52 Mb/s ± 4.6 ppm	622.08 Mb/s ± 4.6 ppm	622.08 Mb/s ± 4.6 ppm	622.08 Mb/s ± 4.6 ppm	2.48832 Gb/s ± 4.6 ppm	2.48832 Gb/s ± 4.6 ppm	2.48832 Gb/s ± 4.6 ppm
Reception Bit Rate		155.52 Mb/s ± 100 ppm	155.52 Mb/s ± 100 ppm	155.52 Mb/s ± 100 ppm	622.08 Mb/s ± 100 ppm	622.08 Mb/s ± 100 ppm	622.08 Mb/s ± 100 ppm	2.48832 Gb/s ± 100 ppm	2.48832 Gb/s ± 100 ppm	2.48832 Gb/s ± 100 ppm
Operational Wavelength Range		1260 to 1360 nm	1263 to 1360 nm	1480 to 1580 nm	1274 to 1356 nm	1280 to 1335 nm	1480 to 1580 nm	1260 to 1360 nm	1280 to 1335 nm	1500 to 1580 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)	1 nm (20 dB from center)	< 1 nm (20 dB from center)
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
	Optical Power	± 2 dB	± 2 dB	± 2 dB	± 2 dB	± 2 dB	± 2 dB	± 2 dB	± 2 dB	± 2 dB
Maximum RX before damage¹		+ 3 dBm	+ 3 dBm	+ 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)	GR-253 (SONET) G.958 (SDH)	GR-253 (SONET) G.958 (SDH)
SONET Classification		GR-253 IR-1	GR-253 LR-1	GR-253 LR-2	GR-253 IR-1	GR-253 LR-1	GR-253 LR-2	GR-253 IR-1	GR-253 LR-1	GR-253 LR-2
SDH Classification		ITU G.957 S-1.1	ITU G.957 S-1.1	ITU G.957 S-1.2	ITU G.957 S-4.1	ITU G.957 L-4.1	ITU G.957 L-4.2	ITU G.957 S-16.1	ITU G.957 L-16.1	ITU G.957 L-16.2
Laser Type		MLM	SLM	SLM	MLM	SLM	SLM	SLM	SLM	SLM
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	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	Dual LC	Dual LC
Transceiver Type²		SFP	SFP	SFP	SFP	SFP	SFP	SFP	SFP	SFP

Note 1: In order not to exceed the maximum receiver power level before damage, an attenuator must be used.

Note 2: SFP Compliance:

- The FTB-8100 selected SFP shall meet the requirements stated in the "Small Form-Factor Pluggable (SFP) Transceiver Multisource Agreement (MSA)".
- The FTB-8100 selected SFP shall meet the requirements stated in the "Specification for Diagnostic Monitoring Interface for Optical Xcvrs".

Functional Specifications

SONET/DSn

Optical interfaces	OC-3, OC-12, OC-48
Available wavelengths (nm)	1310, 1550
Electrical interfaces	DS1, DS3, STS-1, STS-3
Standards compliance	Optical and STS-1 interfaces: Telcordia GR-253 DSn electrical interfaces: Telcordia GR-499
DSn testing	integrated M13 mux, G.747, Through mode, service disruption time, dual DS-1 receiver, dual DS-3 receiver
DS1 line coding	AMI, B8ZS
DS1 framing	Unframed, SF, ESF
DS3 line coding	B3ZS
DS3 framing	Unframed, M13, C-bit parity
Clocking	Internal, loop-timed, external (BITS)
SONET testing	STS-1e, STS-3e, OC-3, OC-12, OC-48, overhead processing, Through mode, pointer processing Tx/Rx, SS bits/sync status/messaging/signal label/APS (K1/K2)/trace enoders and decoders, service disruption time measurements

SDH/PDH

Optical interfaces	STM-1, STM-4, STM-16
Available wavelengths (nm)	1310, 1550
Electrical interfaces	1.5M, 34M, 45M, 140M, STM-0e, STM-1e
Standards compliance	Optical interfaces: ITU-T G.707, G.841, G.957, G.958, G.691 Electrical interfaces: ITU-T G.703
PDH testing	Integrated E13 mux and E34 mux, Through mode, PDH spare bits Tx/Rx, service disruption time
2M line coding	AMI, HDB3
2M framing	Unframed, PCM30, PCM31, PCM30 CRC-4, PCM31 CRC-4
34M line coding	HDB3
34M framing	Unframed, framed
140M line coding	CMI
140M framing	Unframed, framed
Clocking	Internal, loop-timed, external (MTS/SETS), 2 MHz
SDH testing	STM-e, STM-1e, STM-1, STM-4, STM-16, overhead processing, Through mode, pointer processing Tx/Rx, SS bits/sync status/messaging/ signal label/APS (K1/K2)/trace encoders and decoders, service disruption time measurements

Mappings

VT1.5	DS1 async	TU-11-AU-3, TU-11-AU-4	1.5M async
VT2	E1 async	TU-12-AU-3, TU-12-AU-4	2M async
VT6	Bulk filled	TU-3-AU-3, TU-3-AU-4	45M, 34M async, bulk filled, GFP
STS-1 SPE	DS3, bulk filled, GFP	TU-2	Bulk filled
STS-3c SPE	Bulk filled, GFP	AU-4	140M async, bulk filled, GFP
STS-6c SPE	Bulk filled, GFP	AU-4-2c	Bulk filled, GFP
STS-9c SPE	Bulk filled, GFP	AU-4-3c	Bulk filled, GFP
STS-12c SPE	Bulk filled, GFP	AU-4-4c	Bulk filled, GFP
STS-24c SPE	Bulk filled, GFP	AU-4-8c	Bulk filled, GFP
STS-48c SPE	Bulk filled, GFP	AU-4-16c	Bulk filled, GFP

VCAT mappings are also available. Please refer to the VCAT section of this document for details.

Patterns

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), 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)	2E9-1, 2E11-1, 2E15-1, 2E20-1, 2E23-1, 2E31-1, 1100, 1010, 1010, 1111, 0000, 1-in-8, 1-in-16, 3-in-24, 32 bit programmable (inverted or non-inverted), bit errors
		E3 (34M)	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
		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, 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, 3-in-24, 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, 3-in-24, 32 bit programmable (inverted or non-inverted), bit errors
STS-1SPE, STS-3c SPE, STS-6c SPE, STS-9c SPE, STS-12c SPE, STS-24c SPE, STS-48c SPE	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	AU-3/AU-4/AU-4-2c/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, 3-in-24, 32 bit programmable (inverted or non-inverted), bit errors

Functional Specifications (cont'd)

SONET/DSn

SDH/PDH

Error Insertion

DS1	Framing bit, BPV, CRC-6		
DS3	BPV, C-bit, F-bit, P-bit, framing bit, FEBE	E1 (2M)	Bit error, FAS, CV, CRC-4, E-bit
SONET (STS-1, STS-3, OC-3, OC-12, OC-48)	Section BIP (B1), line BIP (B2), path BIP (B3), BIP-2, REI-L, REI-P, REI-V, BPV	E2 (8M)	Bit error, FAS, CV
		E3 (34M)	Bit-error, FAS, CV
		E4 (140M)	Bit-error, FAS, CV
		SDH (STM-0 e, STM-1 e, 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, CV

Error Measurement

DS1	Framing bit, BPV, CRC-6, excess zeros	E1 (2M)	Bit error, FAS, CV, CRC-4, E-bit
DS3	BPV, C-bit, F-bit, P-bit, framing bit, FEBE	E2 (8M)	Bit error, FAS, CV
SONET (STS-1, STS-3, OC-3, OC-12, OC-48)	Section BIP (B1), line BIP (B2), path BIP (B3), BIP-2, REI-L, REI-P, REI-V, BPV	E3 (34M)	Bit error, FAS, CV
		E4 (140M)	Bit error, FAS, CV
		SDH (STM-0 e, STM-1 e, 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, CV

Alarm Insertion

DS1	LOS, RAI, AIS, OOF	E1 (2M)	LOS, LOS Mframe, LOS CRC Mframe, LOF, AIS, TS16 AIS, RAI, RAI Mframe, pattern loss
DS3	LOS, RDI, AIS, OOF, DS3 idle	E2 (8M)	LOS, LOF, RAI, AIS, pattern loss
		E3 (34M)	LOS, LOF, RAI, AIS, pattern loss
		E4 (140M)	LOS, LOF, RAI, AIS, pattern loss
SONET (STS-1, STS-3, 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	SDH (STM-0 e, STM-1 e, STM-1 STM-4, STM-16)	LOS, LOF, LOF, OOF, MS-AIS, MS-RDI, AU-AIS, AU-LOP, H4-LOM, HP-PDI, HP-RDI, ERDI-PSD, ERDI-PCD, ERDI-PPD, HP-UNEQ, TU-AIS, LP-RFI, LP-RDI, ERDI-VCD, ERDI-VPD, ERDI-VSD, LP-RFI, LP-UNEQ

Alarm Detection

DS1	LOS, loss of clock (LOC), RAI, AIS, OOF	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	E2 (8M)	LOS, LOC, LOF, RAI, AIS, pattern loss
		E3 (34M)	LOS, LOC, LOF, RAI, AIS, pattern loss
		E4 (140M)	LOS, LOC, LOF, RAI, AIS, pattern loss
SONET (STS-1, STS-3, 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-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	SDH (STM-0 e, STM-1 e, STM-1 STM-4, STM-16)	LOS, LOF, LOC, LOF, OOF, RS-TIM, MS-AIS, MS-RDI, AU-AIS, AU-LOP, H4-LOM, HP-PDI, HP-RDI, ERDI-PSD, ERDI-PCD, ERDI-PPD, HP-PLM, HP-UNEQ, HP-TIM, TU-AIS, LP-RFI, LP-RDI, ERDI-VCD, ERDI-VPD, ERDI-VSD, LP-RFI, LP-UNEQ, LP-TIM, LP-PLM

Frequency alarm on all supported interfaces

Frequency alarm on all supported interfaces

Overhead Testing

SONET overhead manipulation and monitoring (STS-1, STS-3, OC-3/12/48/192)	A1, A2, J0/Z0, E1, F1, D1-D12, K1, K2, S1, M0/M1, E2, Z2, J1, C2, G1, F2, H4, Z3, Z4, Z5	SDH overhead manipulation and monitoring (STM-0e/1e/1o/4o/16o/64o)	A1, A2, J0/Z0, E1, F1, D1-D12, K1, K2, S1, M0/M1, E2, J1, C2, G1, F2, F3, K3, N1
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Performance Monitoring

The following ITU-T recommendations, and corresponding performance monitoring parameters, are supported on the FTB-8100 product line.

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

Functional Specifications (cont'd)

SONET/DSn

Pointer Analysis and Generation

SONET

- Generation and analysis of HO and LO pointer adjustment as per GR-253
- Trigger:
 - Pointer increment and decrement
 - Pointer jump with or without NDF
- Analysis:
 - Pointer increments
 - Pointer decrements
 - Pointer jumps (NDF, no NDF)
 - Pointer value and cumulative offset

SDH/PDH

SDH

- Generation and analysis of AU and TU pointer adjustment as per ITU-T G.703
- Trigger:
 - Pointer increment and decrement
 - Pointer jump with or without NDF
- Analysis:
 - Pointer increments
 - Pointer decrements
 - Pointer jumps (NDF, no NDF)
 - Pointer value and cumulative offset

Next-Gen SONET

Generic Framing Procedure (GFP)

Standards compliance	As per ITU-T G.7041, G.783 and G.806	Standards compliance	As per ITU-T G.7041, G.783 and G.806
Payload	PRBS pattern; Ethernet	Payload	PRBS pattern; Ethernet
Ethernet add/drop	Ability to add/drop Ethernet payload to/from GFP mapped OC-n signal	Ethernet add/drop	Ability to add/drop Ethernet payload to/from GFP mapped OC-n signal
Error insertion	Correctable core HEC, uncorrectable core HEC, correctable type HEC, uncorrectable type HEC, correctable extension HEC, uncorrectable extension HEC, payload FCS	Error insertion	Correctable core HEC, uncorrectable core HEC, correctable type HEC, uncorrectable type HEC, correctable extension HEC, uncorrectable extension HEC, payload FCS
Error monitoring	Correctable core HEC, uncorrectable core HEC, correctable type HEC, uncorrectable type HEC, correctable extension HEC, uncorrectable extension HEC, payload FCS	Error monitoring	Correctable core HEC, uncorrectable core HEC, correctable type HEC, uncorrectable type HEC, correctable extension HEC, uncorrectable extension HEC, payload FCS
Alarm insertion	Loss of client signal (LOCS), loss of client character synchronization (LOCCS) and loss of frame delineation (LFD)	Alarm insertion	Loss of client signal (LOCS), loss of client character synchronization (LOCCS) and loss of frame delineation (LFD)
Alarm monitoring	Loss of client signal (LOCS), loss of client character synchronization (LOCCS) and loss of frame delineation (LFD)	Alarm monitoring	Loss of client signal (LOCS), loss of client character synchronization (LOCCS) and loss of frame delineation (LFD)
Statistics	Transmit: client data frames (including payload bytes), client management frames, total frames, idle frames, GFP bandwidth usage (%), GFP mapping efficiency (%) Receive: client data frames (including payload bytes), client management frames, total frames, idle (control) frames, reserved (control) frames, invalid frames, discarded frames, EXI mismatches, UPI mismatches, CID mismatches, GFP bandwidth usage (%), GFP mapping efficiency (%)	Statistics	Transmit: client data frames (including payload bytes), client management frames, total frames, idle frames, GFP bandwidth usage (%), GFP mapping efficiency (%) Receive: client data frames (including payload bytes), client management frames, total frames, idle (control) frames, reserved (control) frames, invalid frames, discarded frames, EXI mismatches, UPI mismatches, CID mismatches, GFP bandwidth usage (%), GFP mapping efficiency (%)
Header manipulation	PTI, PFI, EXI, UPI, CID and spare (extension header) fields	Header manipulation	PTI, PFI, EXI, UPI, CID and spare (extension header) fields
Header monitoring	PLI, PTI, PFI, EXI, UPI, CID, spare (extension header) fields, cHEC, tHEC, eHEC	Header monitoring	PLI, PTI, PFI, EXI, UPI, CID, spare (extension header) fields, cHEC, tHEC, eHEC

Functional Specifications (cont'd)

Next-Gen SONET

Virtual Concatenation (VCAT)

Standards compliance	Supports high-order and low-order virtual concatenation as per ANSI T1.105, G.783 and G.806	Standards compliance	Supports high-order and low-order virtual concatenation as per ITU G.707, G.783 and G.806
Mappings	High-order STS-1-xv (x = 1 to 21) STS-3-xv (x = 1 to 7) Low-order VT1.5-xv (x = 1 to 64) VT-2-xv (x = 1 to 64)	Mappings	High-order VC-3-xv (x = 1 to 21) VC-4-xv (x = 1 to 7) Low-order VC-12-xv (x = 1 to 64) VC-11-xv (x = 1 to 64)
Error insertion	REI-P, AIS-P, LOP-P, B3	Error insertion	REI-P, AIS-P, LOP-P, B3
Error monitoring	REI-P, AIS-P, LOP-P, B3	Error monitoring	REI-P, AIS-P, LOP-P, B3
Alarm insertion	LOM, OOM1, OOM2, SQM	Alarm insertion	LOM, OOM1, OOM2, SQM
	VCAT alarms can be generated independently on any member of a VCG		VCAT alarms can be generated independently on any member of a VCG
Alarm monitoring	LOM, OOM1, OOM2, SQM, LOA	Alarm monitoring	LOM, OOM1, OOM2, SQM, LOA
Differential delay	Analysis Range: 0 to 256 ms Display: numerical and graphical Insertion Range: 0 to 256 ms	Differential delay	Analysis Range: 0 to 256 ms Display: numerical and graphical Insertion Range: 0 to 256 ms
Sequence number manipulation and processing	Sequence range: 0 to 63 Sequence number monitoring: current AcSQ (accepted SQ) monitored against the ExSQ (expected SQ); SQM alarm raised on mismatch	Sequence number manipulation and processing	Sequence range: 0 to 63 Sequence number monitoring: current AcSQ (accepted SQ) monitored against the ExSQ (expected SQ); SQM alarm raised on mismatch

Link Capacity Adjustment Scheme (LCAS)

Standards compliance	As per ANSI T1.105, ITU G.7042, G.783 and G.806; supported for both low-order and high-order VCAT groups	Standards compliance	As per ITU G.7042, G.707, G.783 and G.806; supported for both low-order and high-order VCAT groups
Test functions	<ul style="list-style-type: none"> Emulation of source and sink state machines Automatic and manual control of source and sink state machines Independent overwrite capability at the source and sink for each member Automatic SQ management 	Test functions	<ul style="list-style-type: none"> Emulation of source and sink state machines Automatic and manual control of source and sink state machines Independent overwrite capability at the source and sink for each member Automatic SQ management
Source state machine control	<ul style="list-style-type: none"> Add/remove member(s) Configure: RS-ACK timeout Statistics count: received RS-ACK Error/alarm generation: CRC errors, group ID (GID) mismatch Error/alarm monitoring: loss of transport capacity, loss of partial transport capacity, loss of total transport capacity, failure of protocol, unexpected member status 	Source state machine control	<ul style="list-style-type: none"> Add/remove member(s) Configure: RS-ACK timeout Statistics count: received RS-ACK Error/alarm generation: CRC errors, group ID (GID) mismatch Error/alarm monitoring: loss of transport capacity, loss of partial transport capacity, loss of total transport capacity, failure of protocol, unexpected member status
Sink state machine control	<ul style="list-style-type: none"> Add/remove member(s) Configure Hold-Off and Wait-to-Restore timers Toggle RS-ACK Statistics count: transmitted RS-ACK Error/alarm generation: unexpected member status Error/alarm monitoring: loss of transport capacity, loss of partial transport capacity, loss of total transport capacity, failure of protocol, CRC errors 	Sink state machine control	<ul style="list-style-type: none"> Add/remove member(s) Configure Hold-Off and Wait-to-Restore timers Toggle RS-ACK Statistics count: transmitted RS-ACK Error/alarm generation: unexpected member status Error/alarm monitoring: loss of transport capacity, loss of partial transport capacity, loss of total transport capacity, failure of protocol, CRC errors

Next-Gen SDH

Functional Specifications (cont'd)

Additional Test and Measurement Functions

Power measurements	Supports power measurements, displayed in dBm, 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.
Service disruption time	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. Available choices depend on the test case mounted, and include alarms and errors listed in this document, bit errors and pattern loss. Measurements: last disruption, shortest disruption, longest disruption, average disruption, service disruption count. Units: μ s, ms, seconds, minutes.
APS message control and monitoring	Ability to monitor and set up automatic protection switching messages (K1/K2 byte of SONET/SDH overhead).
Synchronization status control and monitoring	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 overhead).
Dual DS _n receiver	This functionality enables the simultaneous, bidirectional monitoring of a DS1/DS3 circuit under test, allowing users to quickly determine the source of errors. It is particularly useful when encountering but errors on a DS1/DS3 circuit, where unidirectional monitoring results in suboptimal problem isolation.
Through mode	Ability to perform Through mode analysis of an incoming optical line (OC-3/STM-1, OC-12/STM-4 and OC-48/STM-16) and electrical DS _n /PD interface.
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.)

Additional Features

Scripting	The built-in scripting engine and embedded macrorecorder provide a simple means of automating test cases and routines. Embedded scripting routines provide a powerful means of creating advanced test scripts.
Event logger	Supports logging of test results, and the ability to print, export (to a file), or export the information contained in the logging tool.
Power-up and restore	In the event of a power failure to the unit, the active test configuration and results are saved and restored upon bootup.
Save 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.
Report generation	Ability to generate test reports in the following user-selectable formats: .pdf, .html, .txt and .csv.

Specifications

FTB-8100	FTB-8110	FTB-8100-NG	FTB-8110-NG
SONET/SDH 2.5 Gb/s Analyzer module with one small form pluggable (SFP) transceiver receptacle supporting up to OC-48/STM-16 optical rates	SONET/SDH 2.5 Gb/s Analyzer module with one small form pluggable (SFP) transceiver receptacle supporting up to OC-48/STM-16 optical rates, as well as electrical DSn/PDH interfaces	Next-Gen SONET/SDH 2.5 Gb/s Analyzer module with one small form pluggable (SFP) transceiver receptacle supporting up to OC-48/STM-16 optical rates	Next-Gen SONET/SDH 2.5 Gb/s Analyzer module with one small form pluggable (SFP) transceiver receptacle supporting up to OC-48/STM-16 optical rates, as well as electrical DSn/PDH interfaces
Test Interfaces			
SONET: OC-3, OC-12, OC-48 SDH: STM-1, STM-4, STM-16	SONET: OC-3, OC-12, OC-48, STS-1e, STS-3e SDH: STM-1, STM-4, STM-16, STM-0e, STM-1e DSn: DS-1, DS-3, Dual DS1 Rx, Dual DS3 Rx PDH: E1, E3, E4	SONET: OC-3, OC-12, OC-48 SDH: STM-1, STM-4, STM-16	SONET: OC-3, OC-12, OC-48, STS-1e, STS-3e SDH: STM-1, STM-4, STM-16, STM-0e, STM-1e DSn: DS-1, DS-3, Dual DS1 Rx, Dual DS3 Rx PDH: E1, E3, E4

GENERAL SPECIFICATIONS

	FTB-8100	FTB-8110	FTB-8100-NG	FTB-8110-NG
Weight (without transceiver)	0.9 kg (2.0 lb)	1.4 kg (3.0 lb)	0.9 kg (2.0 lb)	1.4 kg (3.0 lb)
Size (H x W x D)	51 mm x 76 mm x 254 mm (2 in x 3 in x 10 in)	76 mm x 76 mm x 254 mm (3 in x 3 in x 10 in)	51 mm x 76 mm x 254 mm (2 in x 3 in x 10 in)	76 mm x 76 mm x 254 mm (3 in x 3 in x 10 in)
Temperature				
operating	0 °C to 40 °C (32 °F to 104 °F)	0 °C to 40 °C (32 °F to 104 °F)	0 °C to 40 °C (32 °F to 104 °F)	0 °C to 40 °C (32 °F to 104 °F)
storage	-40 °C to 60 °C (-40 °F to 140 °F)	-40 °C to 60 °C (-40 °F to 140 °F)	-40 °C to 60 °C (-40 °F to 140 °F)	-40 °C to 60 °C (-40 °F to 140 °F)

ORDERING INFORMATION

MODULE

FTB-81XX-XX-XX-XX-XX

Model

See models listed above.

Test options

SONET = SONET-BASE-SW

SDH = SDH-BASE-SW

SONET-SDH = Software option for combined SONET/SDH functionality

Rate options

155 = 155 Mb/s (OC-3/STM-1)

622 = 622 Mb/s (OC-12/STM-4)

2488 = 2.488 Gb/s (OC-48/STM-16)

Software options

DSn

PDH

G.747¹

Next-Gen SONET/SDH²

EEoS³

Transceivers:

FTB-8190: Multirate (155/622/2488 Mb/s) optical SFP transceiver module with LC connector; 1310 nm; short reach

FTB-8191: Multirate (155/622/2488 Mb/s) optical SFP transceiver module with LC connector; 1310 nm; intermediate reach

FTB-8192: Multirate (155/622/2488 Mb/s) optical SFP transceiver module with LC connector; 1550 nm; long reach

Notes

- Enables E1/2M in DS3/45M analysis, as per ITU-T G.747 recommendation.
- Next-Gen SONET/SDH options include GFP, HO-VCAT, LO-VCAT and LCAS. These options are only applicable for FTB-8100-NG and FTB-8110-NG modules.
- Enables Ethernet add/drop interface. This option is only applicable for FTB-8100-NG and FTB-8110-NG modules.

TEST KIT

TK-400-D4-NXX-XX-FTB-81XX-XX-XX-XX-XX

TFT active color touchscreen

Memory

N12 = Additional 256 MB
(Total of 512 MB)

Module receptacle

MP = Eight-slot protocol module receptacle

See model and software info left

Complementary Product

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-80x0 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-8510 Packet Blazer Ethernet Test Module

The FTB-8510 Packet Blazer™ brings performance assurance to Ethernet-based frame services. It offers all the test and measurement functionalities required to meet service-level agreements (SLAs) between service providers and their customers. This FTB-400-housed module tests transparent connectivity in its native format: 10/100/1000Base-T, 1000Base-SX, 1000Base-LX and 1000Base-ZX for LAN-to-LAN services delivered via ATM, frame relay, Next-Generation SONET/SDH, SONET/SDH hybrid multiplexers, switched Ethernet, VLANs, dark fiber, WDM, FTTx systems or other means.

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



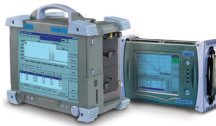
For more information on the FTB-8510, please refer to its detailed product specification sheet at <http://documents.exfo.com/specsheets/FTB-8510-ang.pdf>

Find out more about EXFO's extensive line of high-performance portable instruments by visiting our website at www.exfo.com.



Rugged Handheld Solutions

- OLTS
- Power meter
- Light source
- Talk set



Optical Fiber

- OTDR
- OLTS
- ORL meter
- Switch

DWDM Test Systems

- OSA
- PMD analyzer
- Chromatic dispersion analyzer
- Multiwavelength meter

Transport/Datacom

- 10/100 and Gigabit Ethernet
- SONET/DSn (DS0 to OC-192c)
- SDH/PDH (64 kb/s to STM-64c)
- SAN

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