

# FTB-85100G Packet Blazer

100G/40G ETHERNET AND OTN TEST MODULE



SPEC SHEET

The industry's first compact, portable 100G/40G Ethernet and OTN testing solution

## KEY FEATURES

40G/100G Ethernet fully compliant with IEEE 802.3ba standard and OTU3/OTU4 as per ITU-T G.709—all in single module

OTU3/OTU4 with forward error correction (FEC) and optical transport layer (OTL) testing capabilities as a software option

40G/100G Ethernet over OTU3/OTU4 with complete mapping capabilities using GMP

40G/100G IP traffic at 100% transmission with full Ethernet statistics and packet capture

Fully integrated testing capabilities for assessing CFP MSA optical modules with full MDIO access

Physical-layer performance assessment: PCS and CAUI lanes mappings, skew measurement and signal conditioning

Remote management and complete automation testing capabilities using SCPI

Single instrument for lab testing, field trials and early deployments

## COMPLEMENTARY PRODUCTS



Platform  
FTB-500



Transport Blazer  
FTB-8140



Packet Blazer  
FTB-85100G



Assessing  
Next-Gen Networks

überreicht durch:



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Opternus GmbH  
April 2011

## 40G/100G ETHERNET—A RAPIDLY EMERGING MARKET

The ongoing growth of enterprise, residential and mobile multimedia services (such as peer-to-peer, IPTV and video-over-Internet) is producing unprecedented levels of traffic, stressing the bandwidth capabilities of metro and core transport networks. Consequently, carriers worldwide are actively seeking strategies to efficiently and cost-effectively scale IP packet transmission. Specifically intended to facilitate this transition, 40G/100G Ethernet technologies offer carriers the flexibility to phase in the implementation of these higher-speed rates to better align capacity increases with their specific growth and budget strategies.

These new data rates are based on the IEEE 802.3ba standard. The most significant concept introduced in this new working standard is the use of parallel optics (including CWDM, LAN WDM and parallel ribbon fiber), which strongly influence the physical coding sublayer (PCS) implementation—one of the new building blocks for 40G/100G Ethernet. The key difference between the IEEE 802.3ba standard and its predecessor is the introduction of PCS lanes (formerly known as virtual lanes). PCS lanes provide an effective method of handling various parallel optical configurations and, therefore, demand a comprehensive solution that can easily test from 10 x 10 Gbit/s to 4 x 25 Gbit/s and, in the future, 1 x 100 Gbit/s configurations. Thorough PCS testing is among the critical layer 1/2/3 tests needed to ensure that 40G/100G Ethernet equipment and network services can be deployed rapidly and with confidence.

## THE INDUSTRY'S FIRST RUGGED AND PORTABLE 100G/40G ETHERNET AND OTN COMPLIANT TESTER

The first rugged and portable 100G/40G Ethernet and OTN analyzer on the market, the FTB-85100G Packet Blazer enables teams to efficiently share the equipment in the lab, perform field trials and carry out early deployments, all with a single tester. Purpose-built for applications where thorough testing, portability, true ruggedness and ease of use are required, it offers powerful layer 1/2/3 traffic generation and analysis features to stress and validate network elements and services against demanding corner cases.

The FTB-85100G supports multiple transceiver interfaces and offers unprecedented full-line-rate testing of the physical coding sublayer (PCS). Users can also generate and analyze 100 Gbit/s and 40 Gbit/s line rate Ethernet and IP packets, as well as perform comprehensive EtherBERT™ tests, all via an intuitive graphical user interface (GUI).

With its complete range of test features and automation capabilities, the FTB-85100G can execute multilayer testing to rapidly validate physical-layer characteristics and accurately benchmark Ethernet/IP performance of equipment and services. Its flexible and scalable FPGA-based architecture ensures rapid and seamless incorporation of updates as the standard is ratified and refined moving forward, protecting your testing investment without sacrificing timely support of features and functions.

## OPTICAL TRANSPORT NETWORK (OTN) TESTING

Optical transport network (OTN) as per ITU-T G.709 is the transport technology of choice for transporting 40G/100G Ethernet traffic over the core network due to its operation, administration, maintenance and provisioning (OAM&P) supported capability for troubleshooting and maintenance as well as FEC for performance enhancement. The FTB-85100G Packet Blazer supports numerous OTN testing capabilities, including OTU4 (112 Gbit/s) and OTU3 (43 Gbit/s) full-line-rate testing with OTN framing and FEC testing as per ITU-T G.709, enabling breakthrough-level qualification of 100G and 40G Ethernet transmission over OTN. These capabilities are offered as a software option on existing 40G/100G modules.



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## 40G/100G ETHERNET OVER OTU3/OTU4 TESTING

ITU-T G.709 defines two approaches for mapping constant bit rate (CBR) and packet-based client signals over OTNs. The client signal can either be mapped using ODUflex—an aggregate of  $n \times 1.25$  Gbit/s tributaries—with a bit rate suitable for the client signal or mapping the client signal directly into ODUk, using GMP if the bit rate of the client signal is close to a conventional ODUk ( $k = 0, 1, 2, 3, 4$ ) rate. Using EXFO's FTB-85100G Packet Blazer, service providers can map 40G/100G Ethernet services over OTN with different traffic characteristics, run bit error-rate (BER) tests end-to-end across the optical transport network and measure the ratio of the error bits compared to the number of sent bits. In this testing configuration, the FTB-85100G Blazer module provides complete analysis of the OTU3/OTU4 transport layer, as well as complete GMP statistics to ensure proper recovery of the client signal at the receive end. EXFO's 40G/100G Ethernet-over-OTN testing capability includes also validating the 40G/100G Ethernet IP traffic transmission with 100% throughput and ensuring that latency does not impact service providers' service level agreements (SLAs) with their customers.

## CAUI/XLAUI SIGNAL CONDITIONING

EXFO's FTB-85100G Packet Blazer module offers a signal-conditioning tool to characterize the electrical CAUI/XLAUI lanes and troubleshooting electrical-level issues on standard optical interfaces used within 40G/100G systems. This capability provides direct access to amplitude and pre-/post-emphasis control of the 10G electrical CAUI/XLAUI lane transmitters, as well as equalization correction at the receivers. The signal-conditioning interface provides access to the electrical parameters, enabling users to better compensate for signal integrity issues or modify specific electrical parameters to observe the effects of stressing the pluggable optical device. Having the ability to modify signal parameters with a wide dynamic range of amplitude, pre-emphasis and equalization controls, CFP manufacturers can evaluate and optimize the performance of their modules.

## EXFO'S CFP-TO-CXP ADAPTER

The newly introduced CFP-to-CXP adapter kit includes two CFP/CXP adapters and an optical cable supporting 40G/100G Ethernet and OTN rates. The CFP/CXP kit addresses end-to-end system level testing where 40G/100G Ethernet and OTN traffic is carried over the extended CAUI (electrical) lanes between the two CFP/CXP adapters. The CFP/CXP adapter can also be used to connect directly to CXP interfaces on customers' network elements.



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## KEY FEATURES

Detailed compliance testing	IEEE 802.3ba draft 3.2 CFP MSA draft 1.0 and CFP MSA management interface (MDIO) draft 1.2 ITU-T G.709, G.798 and G.872
Multi-interface support	MSA-compliant pluggable 4x10G, 4x25G and 10x10G CFPs and CXP transceivers 100GBASE-SR10/LR4/ER4, 40GBASE-SR4/LR4 and 10 x 10G SMF optical interfaces External timing reference (DS1/E1/2MHz) Low- and high-speed reference clock output
Robust physical-layer validation	40G/100G XLAUI lanes error generation and monitoring PCS lane mapping and monitoring capability Per-lane skew generation and measurement PCS error generation and monitoring per lane Full MDIO read/write access Signal conditioning—CAUI/XLAUI pre-emphasis and gain equalization capability
Layer-2/3 Ethernet testing	40G and 100G unframed BER test and EtherBERT 40G/100G Ethernet traffic generation and reception at 105% wire speed Configurable transmission rate MAC and IP header configuration Random and fixed packet size generation Throughput measurement Ethernet latency measurement FCS, IP checksum and payload error generation and monitoring Complete Ethernet statistics including total and valid frame counts as well as Rx frame sizes Flow control analysis
OTN testing	OTU3 (43 Gbit/s) and OTU4 (112 Gbit/s) unframed and framed BER tests FEC testing—error insertion and monitoring OTL3.4, 4.4 and 4.10 alarm and error generation and monitoring OTL lane mapping and skew generation and measurement OTU, ODU, OPU overhead manipulation and monitoring OTU, ODU (including ODU TCM), OPU layer alarms/errors generation and analysis OTU, ODU (including ODU TCM) trace messages OTN round-trip delay (RTD) measurement
Ethernet mapping over OTN	40G and 100G Ethernet mapping over OTU3 and OTU4, respectively using GMP 40G transcoding capability with alarms, errors and statistics Complete GMP alarms, errors and statistics Payload type 21 mapping support
Packet capture	Ethernet packet capture up to 4 Mbit/s Advanced filtering; capability to configure up to 10 filters of four fields each that can be combined with AND/OR/NOT operations; a mask is also provided for each field value Configurable triggers including errors and header fields Data capture in packet-capture (PCAP) format; read through Wireshark
Different PRBS patterns per lane	Allows users to configure different PRBS patterns on different CAUI lanes in a 40G/100G and OTU3/OTU4 unframed configurations; typically used when looking at the eye diagram of the CAUI lanes to identify crosstalk issues
Per-wavelength power measurement	Allows users to measure the received optical power per wavelength in the used parallel optics CFPs
Remote control	Remote access using VNC or WebVNC Remote control for automated testing

## TECHNICAL SPECIFICATIONS

EXFO's 40G/100G Ethernet test solution is comprised of the FTB-85100G Packet Blazer module (housed in the FTB-500 portable platform) or the IQS-85100G Packet Blazer module (housed in the IQS-600 rackmount platform). For complete technical specifications on the FTB-500 or IQS-600 platforms, refer to their respective product page on EXFO's website.

FTB-85100G PACKET BLAZER MODULE	
<b>CFP Interface</b>	
Mechanical	Compliant with CFP MSA draft 1.0
Electrical	Compliant with CFP MSA draft 1.0
High-speed interface	Compliant with IEEE 802.3ba draft 3.2
Management	Compliant with CFP MSA management interface (MDIO) draft 1.2
<b>CFP/CXP Adapter</b>	
Mechanical	Compatible with CFP MSA HW specification rev 1.4
Electrical	Compatible with CFP MSA HW specification rev 1.4
Signaling	Compatible with IEEE802.3ba draft 3.2
Management	Compatible with CFP MSA management interface specification rev 1.4
HDMI Port	EXFO proprietary
<b>Additional features on high-speed electrical interface (CAUI/XLAUI)</b>	
Frequency measurement accuracy (uncertainty)	±4.6 ppm using internal clock
Frequency offset generation	±150 ppm

SYNCHRONISATION INTERFACES				
	External Clock DS1/1.5M	External Clock E1/2M	External Clock E1/2M	2 MHz (Trigger)
Tx pulse amplitude (V)	2.4 to 3.6	3.0	2.37	0.75 to 1.5
Tx pulse mask Tx LBO	GR-499 figure 9.5	G.703 figure 15	G.703 figure 15	G.703 figure 20
Pre-amplification (typical) (dBdsx)	0.6 (0 to 133 ft) 1.2 (133 to 266 ft) 1.8 (266 to 399 ft) 2.4 (399 to 533 ft) 3.0 (533 to 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	
Input impedance (resistive termination)	75 Ω ± 5 %, unbalanced	75 Ω ± 5 %, unbalanced	75 Ω ± 5 %, unbalanced	75 Ω ± 5 %, unbalanced
Connector type	BNC <sup>a</sup>	BNC <sup>a</sup>	BNC	BNC

**Note**

a. Adaptation cable required for Bantam connector (EXFO part number: TJ-ELEC-BALUN).

## FUNCTIONAL SPECIFICATIONS

### 40G/100G UNFRAMED BER TEST

Line rates	40G and 100G
Pattern configuration	Square wave training pattern, unframed PRBS in nAUI lanes and unframed interleaved PRBS
Patterns	PRBS 2E9-1, PRBS 2E11-1, PRBS 2E15-1, PRBS 2E20-1, PRBS 2E23-1, PRBS 2E31-1 Error measurement: invalid 0, invalid 1, bit error total and bit error rate
Error injection configuration	Single, rate and continuous

### 40G/100G ETHERNET BER TEST

Line rates	40G/100G Ethernet
Layer-2/3 header configuration	IP and MAC source/destination addresses
Stream configuration	Transmit mode, Tx rate, frame size, IFG and sequence tag
Transmit mode	Continuous and n-Frames
Tx rate (%)	Utilization and actual
Frame Size	Fixed and random (from 64 to 16 383 bytes)
Patterns	PRBS 2E9-1, PRBS 2E11-1, PRBS 2E15-1, PRBS 2E20-1, PRBS 2E23-1, PRBS 2E31-1 and user-configurable pattern
Error insertion	IP checksum, FCS, pattern
Error injection type	Manual, rate and continuous
Ethernet statistics	Rx alarms, Rx errors, Rx valid frame count, IP errors analysis, Rx frame size analysis, total frame count, Rx throughput and flow control analysis
Ethernet latency statistics	Current, minimum, maximum, average, successful and failed counts
Rx alarms	FCS, IP, Ethernet frame and sequence tag
Rx error analysis	Jabber/giant, runt, undersize, oversize, bad FCS and total error count
Rx valid frame count	Multicast, broadcast, unicast, non-unicast and total valid count
IP error analysis	Bad IP checksum
Rx frame size analysis	<64, 64, 65-127, 128-255, 256-511, 512-1023, 1024-1518 and >1518
Total frame count	Rx count and Tx count
Rx throughput	Bandwidth (bit/s), utilization (%) and frame rate (frame/s)
Flow control analysis	Pause frames, abort frames and total pause time



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## FUNCTIONAL SPECIFICATIONS (CONT'D)

## OTU3/OTU4 UNFRAMED BER TEST

Line rates	OTU3 (43.018 Gbit/s) and OTU4 (111.81 Gbit/s) BER test
Pattern configuration	Square wave training pattern, unframed PRBS in nAUI lanes and unframed interleaved PRBS
Patterns	PRBS 2E9-1, PRBS 2E11-1, PRBS 2E15-1, PRBS 2E20-1, PRBS 2E23-1, PRBS 2E31-1
Error monitoring	Invalid 0, invalid 1, bit error total and bit error rate
Error injection configuration	Single, rate and continuous

## OTU3/OTU4 FRAMED BER TEST

Line rates	OTU3 (43.018 Gbit/s) and OTU4 (111.81 Gbit/s) BER test
Standards compliance	ITU-T G.709, ITU G.798, ITU G.872

## OTL Layer

Errors	LLM, FAS
Alarms	OOF, LOF, OOR, AIS, OLA (configurable) <sup>a</sup> , LOL <sup>a</sup>

## OTU Layer

Errors	OTU-FAS, OTU-MFAS, OTU-BEI, OTU-BIP-8
Alarms	LOF, OOF, LOM, OOM, OTU-AIS, OTU-TIM, OTU-BDI, OTU-IAE, OTU-BIAE
Traces	64-bytes trail trace identifier (TTI) as defined in ITU-T G.709

## ODU TCM Layer

Errors	TCMi-BIP-8, TCMi-BEI (i = 1 to 6)
Alarms	TCMi-LTC, TCMi-TIM, TCMi-BDI, TCMi-IAE, TCMi-BIAE
Traces	64-bytes trail trace identifier (TTI) as defined in ITU-T G.709

## ODU Layer

Errors	ODU-BIP-8, ODU-BEI
Alarms	ODU-AIS, ODU-OCI, ODU-LCK, ODU-TIM, ODU-BDI, ODU-FSF, ODU-BSF, ODU-FSD, ODU-BSD
Traces	64-bytes trail trace identifier (TTI) as defined in ITU-T G.709
FTFL	As defined in ITU-T G.709

## OPU Layer

Alarm	OPU-PLM
Payload type	Generates and displays received PT value

## GMP

Alarms	GMP OOS
Errors	Cm CRC-8, CnD CRC-5
Statistics	Cm min, Cm max, CnD min, CnD max

## Forward Error Correction (FEC)

Errors	Forward-correctable (codeword), FE-uncorrectable (codeword), FEC-correctable (symbol), FEC-correctable (bit) and FEC-stress (codeword)
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## OTN Round-Trip Delay (RTD)

OTN RTD	Current, minimum, maximum, average, successful and failed counts
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## 40GE Transcoding

Alarms	1027B block lock, 1027B HI BER
Errors	1027B invalid flag, 513B MSEQ violation, 66B PCS-BIP-8 per lane, 66B OTN-BIP-8 per lane, seq violation, POS violation

## Note

a. Alarm analysis only



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## MECHANICAL AND ENVIRONMENTAL SPECIFICATIONS

## FTB-85100G Module

Size (H x W x D)	96 mm x 152 mm x 292 mm	(3 ¾ in x 6 in x 11 ½ in)
Weight	2.5 kg	(5.5 lb)
Temperature operating storage	0 °C to 40 °C -40 °C to 60 °C	(32 °F to 104 °F) (-40 °F to 140 °F)

## CFP/CXP Adapter

Size (H x W x D)	15 mm x 82 mm x 156 mm	(9/16 in x 3 ¼ in x 6 ⅛ in)
Weight	0.2 kg	(0.44 lb)
Temperature operating storage	0 °C to 70 °C -40 °C to 70 °C	(32 °F to 158 °F) (-40 °F to 158 °F)

## ORDERING INFORMATION

## TK-500-85100G-XX-XX-XX-XX

## Display

S1 = TFT active screen  
S2 = Outdoor-enhanced screen

Module capacity <sup>a</sup>

OCT = Eight-slot module capacity

Battery <sup>a</sup>

BTY = With batteries

## Options

00 = Without software option  
OTU3 = 43.018 Gbit/s OTN <sup>b</sup>  
OTU4 = 111.81 Gbit/s OTN <sup>c</sup>  
EoOTN = Ethernet over OTN <sup>d</sup>

## Rates

40 GigE = 41.25 Gbit/s Ethernet  
100 GigE = 103.125 Gbit/s Ethernet

Example: TK-500-85100G-S1-OCT-BTY-40GigE-OTU3

## Notes

- Always included.
- Requires 40 GigE rate.
- Requires 100 GigE rate.
- Requires OTU3 and/or OTU4 option(s).

## TRANSCEIVERS AND ACCESSORIES

FTB-85951 = 100 Gbit/s Ethernet and OTN CFP transceiver (10 x 10G WDM)

FTB-85940 = CFP to CXP adapter module

TK-CXP-CABLE-5M = CFP to CXP adapter kit

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EXFO is certified ISO 9001 and attests to the quality of these products. This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation. EXFO has made every effort to ensure that the information contained in this specification sheet is accurate. However, we accept no responsibility for any errors or omissions, and we reserve the right to modify design, characteristics and products at any time without obligation. Units of measurement in this document conform to SI standards and practices. In addition, all of EXFO's manufactured products are compliant with the European Union's WEEE directive. For more information, please visit [www.EXFO.com/recycle](http://www.EXFO.com/recycle). Contact EXFO for prices and availability or to obtain the phone number of your local EXFO distributor.

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