Multi-protocol transport and datacom solutions

Smarter testing across all your network up to 400G

SPEC SHEET

EXFO leads the 5G revolution with the most complete testing portfolio in the industry featuring automated, versatile and future-proof solutions. With support for multiple technologies—including Ethernet, Fiber Channel, Transport, CPRI, eCPRI, and more—EXFO solutions validate network performance from the lab to the field quickly, easily and with first-time-right results.

BUSINESS ETHERNET AND TRANSPORT

Activate services fast and intelligently

- Multitechnology, multiport testing from 56K to 400G complete feature set: Ethernet, OTN, SONET, SDH, DSn, PDH, ISDN, synchronization
- Service activation using EXFO's unique iOptics and iSAM, making testing intelligent, simpler and faster
- Portable 4 x 100GE test set unique in the industry
- Full suite of Fibre Channel testing from 1X to 32X

5G, FRONTHAUL, MIDHAUL AND BACKHAUL

Install, validate and troubleshoot your 5G and 4G networks

- iORF: the only intelligent application for RF spectrum analysis over CPRI in the industry
- iOptics: intelligent pluggable optics test application
- eCPRI, CPRI up to option 10 (24.3G), OBSAI and up to 100G Ethernet testing
- Integrated and intelligent fibre testing

DATA CENTER

Speed up the validation of transceivers

- iOptics: powerful and easy-to-use transceiver testing tool for AOC cables, QSFP28, SFP28, QSFP+, CFP4, SFP+, SFP
- Portable QUAD PORT solution to test multiple circuits simultaneously: 4 x 100G, 4 x 25G, 4 x 10G
- Intelligent applications: provide a complete test suite in a single-page configuration for quick test results
- Industry leader in high-accuracy latency measurements

NEMS AND LABS

Validate the design and the features of network elements

- Optical transport system validation up to 100G: Ethernet, OTN, SONET/SDH, FC, CPRI/OBSAI, eCPRI
- Advanced OTN testing: single and multistage mappings, ODUflex multichannel with mixed mappings
- Full transceiver validation
- Wireless 5G transport validation

EXFO

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CHOOSE THE RIGHT TESTING SOLUTION FOR YOU

FEATURES	FTBx-8870	FTBx-8880	FTBx-88260	FTBx-88200NGE
iOptics	•	•	•	•
iSAM	•	•	•	•
iORF	•	•	•	
Ethernet				
Dual-port Ethernet testing	•	•	•	•
BERT	•	•	•	•
Unframed BERT	•	•	•	•
RFC 2544	•	•	•	•
Smart Loopback	•	•	•	•
ITU-T Y.1564 testing (EtherSAM)	•	•	•	•
Traffic generation and monitoring	•	•	•	•
RFC 6349 (up to 10G)	•	•	•	•
RFC 6349 (40G and 100G)			•	•
Carrier Ethernet OAM (up to 10G)	•	•	•	•
Link OAM (up to 10G)	•	•	•	•
Dual test set (asymmetrical tests)	•	•	•	•
Layer 2 transparency	•	•	•	•
Tunable SFP+	•	•	•	•
Transport				
OTN OTU1/2	•	•	•	•
OTN OTU3/4			•	•
ODU Mux, EoOTN, ODU0, ODUflex	•	•	•	•
Multichannel OTN and mixed mapping testing				• [a]
OTN GCC BERT (Power OTN OH analysis)	•	•	•	•
DSn/PDH (DS1/E1)	•	•		
DSn/PDH (DS3, E3 and E4)		•		
ISDN PRI	• [b]	• [b]		
SONET/SDH	•	•	•	•
Synchronization				
1588 PTP/SyncE	•	•	•	•
Wander and time error		•		
Fibre Channel				
Fibre Channel (1X, 2X, 4X, 8X and 10X)	•	•	•	•
Fibre Channel 16X			•	•
Fibre Channel 32X			•	
Wireless				
eCPRI 10G	•	•	•	•
eCPRI 25G			•	
Dual-port eCPRI			•	
CPRI 1.2 Gbit/s to 10.1 Gbit/s	•	•	•	•
CPRI 24.3 Gbit/s			•	
OBSAI 1.5 Gbit/s, 3.1 Gbit/s and 6.1 Gbit/s	•	•	•	•
Dual-port CPRI	•	•	•	
OpticalRF	•	•	•	
BBU emulation	•	•	•	

a. Available on the FTB-2, FTB-4 Pro, LTB-2 and LTB-8 platforms
b. Available on FTB-1 Pro platforms

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FIELD TESTING: FTB-1 PRO

Choose the portable platform that meets your field testing needs

The FTB-1 Pro modular platforms are the most flexible solution because they allow users to build a test set that includes the tools they really need. The unique advantage of this design is twofold. First, it allows engineers and field technicians to easily change the test module in the field so that the right test is performed either at the deployment of the infrastructure, during service activation or during troubleshooting. Second, it protects the investment allocated to test instruments. This is particularly valuable in light of all the new testing needs that 5G will bring. 5G standards are currently being developed. Only flexible, future-proof solutions will help MSOs, data centers, service providers and NEMs make the optimal investment in their fleet of test instruments, reducing their cost of acquisition. The modular FTB-1 Pro platform is available in three configurations.

FTB-1 Pro single-carrier (SC)

This configuration offers engineers and field technicians the most compact and flexible one-slot test solution. The platform can host either an OTDR module or a 10G module for transport and Ethernet testing. It provides optical and electrical interfaces from 56K to 10G to easily turn-up, validate and troubleshoot OTN, SONET/SDH, DSn/PDH, ISDN/PRI, CPRI/OBSAI, Fibre Channel and Ethernet services, including dual port 10G multiservice testing.

FTB-1 Pro dual-carrier (DC)

The dual-carrier configuration offers engineers and field technicians multiple configurations by hosting two modules allowing simultaneous optical, Ethernet and transport testing, depending on the modules equipping the platform. It provides optical and electrical interfaces from 56K to 100G to easily turn-up, validate and troubleshoot transport technologies (OTN, SONET/SDH, DSn/PDH, ISDN), 5G and fronthaul (eCPRI, CPRI, OBSAI, Optical RF), Fibre Channel and Ethernet services, including QUAD-port 10G multiservice testing. The dual-carrier platform can host an OTDR and a transport & datacom (T&D) module and, as a result, offers the most compact and flexible all-in-one solution in the market. Combined with EXFO's intelligent test applications such as iOLM, iSAM, iOptics and iORF, the FTB-1 Pro dual-carrier not only protects the investment on field test equipment, but has a direct impact on reducing the operational costs of MSOs, service providers, wireless network operators and webscale companies.

The dual-carrier configuration supports concurrent dual-module operation when using OTDRs and 10G T&D modules. When equipped with a 100G module (FTBx-88260 or FTBx-88200NGE), the platform supports the operation of one module at a time and 2 x 100G testing.

	CONFIGURATIONS		
Test module support	**Single-carrier**	**Dual-carrier**	**High-power dual-carrier**
FTBx-8880 (10G module)	•	•[a]	•[a]
FTBx-8870 (10G module)	•	•[a]	•[a]
FTBx-88200NGE (100G module)		•[b]	•[c]
FTBx-88260 (25G & 100G module)		•[b]	•[c]

a. Platform with two modules, it allows for QUAD 10GE testing
b. Platform can host one 100G module at a time
c. With two modules, it allows for QUAD 100GE testing

FTB-1 Pro high-power dual-carrier (HPDC)

The high-power dual-carrier configuration features the FTB-1 Pro platform's most flexible solution allowing simultaneous dual-module operation of all modules supported by the platform. The high-power version of the dual-carrier configuration offers simultaneous QUAD 100GE testing, which makes it the most compact 4 x 100GE field tester in the marketplace when housing 2 x 100G test modules (FTBx-88200NGE or FTBx-88260).

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LAB TESTING

Select the most suitable platform for your lab or benchtop operation

LTB-8 rackmount

The LTB-8 is 3U high platform that offers rackmount or benchtop operation for both lab and production environments and offers eight slots that can be accessed individually. It can host optical and T&D FTBx modules such as FTBx-8880, FTBx-8870, FTBx-88200NGE and FTBx-88260.

When equipped with 8 x FTBx-88260 or 8 x FTBx-88200NGE, this multiservice, multitechnology solution can test up to 16 x 100GE simultaneously.

LTB-2 rackmount

The LTB-2 rackmount solution is a more compact version of the LTB-8 platform and occupies one rack unit. It can host two single-slot modules that run concurrently and independently. When equipped with 2 x FTBx-88260 or 2 x FTBx-88200NGE, this solution can test up to 4 x 100 GE simultaneously.

FTB-4 Pro modular platform

The FTB-4 Pro offers four slots to house different optical and T&D modules: FTBx-8880, FTBx-8870, FTBx-88200NGE and FTBx-88260. This platform is the most suitable portable lab solution in a test scenario that requires optical spectrum analysis, OTDR validation and multiservice multitechnology service verification.

When equipped with 4 x FTBx-88260 or 4 x FTBx-88200NGE, the FTB-4 Pro can test up to 8 x 100GE circuits running simultaneously.

FTB-2 Pro modular platform

The most compact modular lab-focused portable platform, it features two slots that can house optical and T&D modules.

When equipped with 2 x FTBx-88200NGE or 2 x FTBx-88260, the tester allows for 4 x 100GE testing.

EXFO | MULTILINK

EXFO Multilink test environment

EXFO Multilink is a multi-user, multimodule and multiplatform software application that enables remote control access of each platform and module through a centralized dashboard featuring an easy-to-use, web-based graphical user interface (GUI). The multilink environment is controlled by a virtual server available on LTB-8 platforms and the environment can manage LTB-8, FTB-4 Pro and FTB-2 Pro platforms.

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CHOOSE THE TRANSPORT AND DATACOM MODULE THAT MEETS YOUR TESTING REQUIREMENTS

FTBx-88260: 10G, 25G, 40G, 50G and 100G testing with swappable transceiver interfaces

A shared challenge in the telecom industry today is the large number of various pluggable transceivers available and the rapid rate at which new types of transceivers are being launched. Whether we consider SFP and SFP+ (for rates up to 10G), look at QSFP28 and CFP4 (for 100G rates) or start adding SFP28 (for 25G rates) and PAM4 QSFP28 for 50GE transmissions, it becomes clear that integrating all these into the network is a challenge. With the imminent arrival of even more transceiver types (e.g., SFP56, SFP-DD, QSFP-56), the challenge to keep up (for NEMs) as well as struggle to integrate all these into a network (for data centers and network operators) will be daunting.

With those challenges in mind, EXFO has introduced the FTBx-88260 T&D test module. Customizable, it's built with EXFO's Open Transceiver System (OTS), an innovative evolutionary design concept that enables users to match the type of interfaces on the module with their specific testing needs. It's future-proof, so as new transceivers are developed and launched, testing them will be as simple as changing an OTS insert in the test module rather than having to purchase an entirely new test unit.

The FTBx-88260 offers two OTS slots (A and B) that can each house any of these options:

FTBx-88260

OPEN TRANSCEIVER SYSTEM	SUPPORTED INTERFACES	FEATURES	NUMBER OF TEST PORTS
SFP28	SFP, SFP+, tunable SFP+, SFP28, copper SFP and SFP+	› 10M to 25G data rates › FC 1X to FC 32X data rates › Dual-port capability	2
QSFP28	QSFP+, QSFP28	› 40G / 50G / 100G data rates › Dual-port capability › AOC cables	2
CFP4	CFP4, SMA (REF OUT)	› 100G data rate › Ref out for eye diagram analysis › Dual-port offered with extra OTS	1
SYNC	SMA[a], SMB (EXT CLK and 1PPS)	› Built-in GNSS/GPS[a] › Ideal solution for one-way delay › Ready for next-gen timing applications[a]	Not applicable

a. For more information, please contact EXFO.

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CHOOSE THE TRANSPORT AND DATACOM MODULE THAT MEETS YOUR TESTING REQUIREMENTS (CONT'D)

FTBx-8880/8870: comprehensive 10G testing

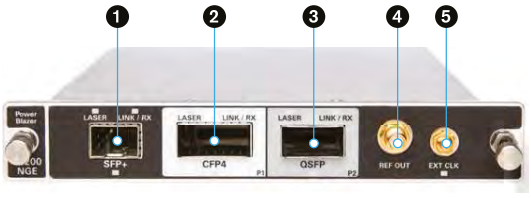
This series of modules offers a full suite of testing capabilities for multiple technologies from 56K to 10G, addressing different test applications both in field and lab scenarios: legacy testing (DSn/PDH), metro and longhaul Ethernet network, transport technology (OTN), fronthaul/backhaul, data centers, 5G deployment, etc.

FTBx-88200NGE: the test solution for next-generation 40G-100G networks

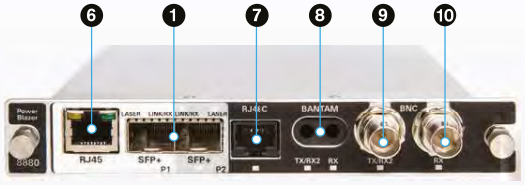
Multiple 100G interfaces enable both data centers and carriers to deploy 100G circuits more cost effectively. It offers integrated CFP4 and QSFP28/QSFP+ interfaces, ready for 100G network diversity.

PHYSICAL INTERFACES	FTBx-8870	FTBx-8880	FTBx-88200NGE
RJ45	•	•	•[a]
RJ48C	•	•	
BNC	•[b]	•	
Bantam		•	
SFP/SFP+	•[c]	•[c]	•[c]
QSFP+/QSFP28			•
CFP4			•

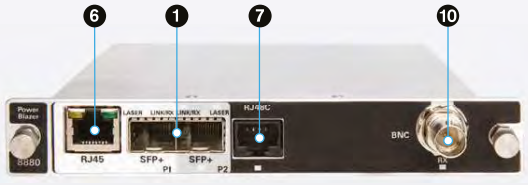
a. With the use of a copper SFP.
b. BNC connector for input clock only.
c. Supports tunable SFP+ and copper SFP+



FTBx-88200NGE



FTBx-8880



FTBx-8870

1 SFP+
CPRI 1.2G to 10.1G
OBSAI 1.5G to 6.1G
10G eCPRI
SONET/SDH up to OC-192/STM-64
OTN up to OTU2 including overclock
Ethernet up to 10G
10/100/1000BASE-T with copper SFP
FC up to 10X
FC 16X (only on FTBx-88200NGE)
RF spectrum over CPRI
(only on FTBx-8870/8880)

2 CFP4
OTN OTU4
Ethernet 100GE

3 QSFP
OTN OTU3/4 including overclock
Ethernet 40GE/ 100GE.

4 REF OUT
SMA interface

5 EXT CLK
SMB interface

6 RJ45
Ethernet 10/100/1000 BASE-T

7 RJ48C
DSn/PDH
EXT CLK
Wander

8 BANTAM
DSn/PDH
RX2: DS1
EXT CLK

9 BNC
Electrical
SONET/SDH
DSn/PDH
RX2: DS1/DS3
EXT CLK
Wander

10 BNC
DSn/PDH
RX: DS1
EXT CLK

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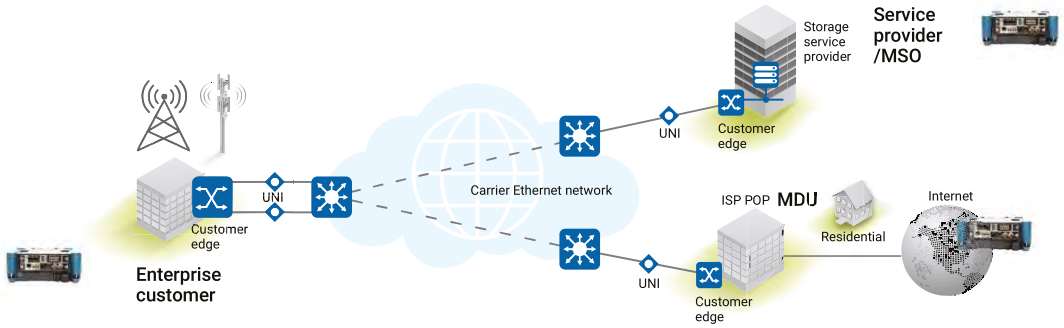
BUSINESS ETHERNET AND TRANSPORT

Key benefits

EXFO's market leading products are designed to make service turn-up and troubleshooting activities easy and fast. Service providers, multiple system operators and their contractors rank EXFO solutions number one in the market for both business Ethernet service and transport testing. EXFO's solutions once again lead the pack with our latest introduction of the FTBx-88260 module. EXFO's customers are no longer handcuffed by having to yet again purchase a new system to work with the latest optical transceiver. EXFO's OTS system guarantees the ability to interchange transceivers as tests become fully standardized.

EXFO's applications are also market leading. EXFO'S transport and datacom test sets and modules cover all the typical Ethernet standard testing applications from BERT, RFC 2544, EtherSAM (ITU-T Y.1564) to RFC 6349 L4 TCP testing. However, EXFO leads by applications like iSAM. iSAM combines all the cutting-edge standards tests into one extremely simple turn-up and troubleshooting tool that no one else on the market has. From a transport perspective, EXFO's solutions cover legacy TDM DSn/PDH and ISDN PRI all the way to SONET/SDH and full-blown OTN testing up to OTU4.

Service providers and MSOs can expedite the activation of services by taking advantage of EXFO's unique QUAD port 100GE solution. Technicians can simultaneously validate 4 x 100G services using one portable tester: the QUAD port 100G kit. It allows for faster deployment of multiple 100GE services, more productive use of test set fleets, ultimately lowering OPEX and CAPEX. The LTB-2 rackmount platform also features up to 4 x 100GE simultaneous testing and allows MSOs to have a universal test device located in central offices, promoting the execution of standardized test procedures.



ETHERNET BUSINESS SERVICES APPLICATIONS Physical interfaces	RFC 2544	EtherSAM (Y.1564)	RFC 6349	iSAM (Y.1564 & RFC 6349)
Single service: layer 2/3/4 SLA issues Metrics: throughput, latency, frame loss	•	•		•
Multiple services: layer 2/3 SLA issues Metrics: throughput, latency, jitter, frame loss		•		•
Stateful layer 4 TCP troubleshooting Metrics: BDP, window size, buffer delay, TCP efficiency			•	•
Layer 2, 3, 4 (Stateful) turn-up and troubleshooting Metrics: all of the above including MEF pass/fail benchmarking				•

Recommended test kits

Service provider/MSO/Managed services kit

FTB-1 Pro DC
FTBx-88260
FTBx-8880

Benefits:

- EXFO's OTS system guaranteeing investment protection
- Complete Ethernet and transport feature set
  - Dual-port Ethernet up to 100G
  - DSn/PDH/ISDN/SONET/SDH
  - OTU1 to OTU4 and Fibre Channel 1X to 32X
  - Synchronization: 1588 PTP, SyncE, wander and time error

Simultaneous QUAD port 100G kit

FTB-1 Pro HPDC
2 x FTBx-88260

Benefits:

- Unlimited dual-port capability
  - 2 x OTU4 multistage mapping and FEC
- 4 x 100G BERT tests
  - Maximum time saving test set for reduced OPEX and increased technician efficiency
- ZERO overheating issues

1G turn-up kit

EX1

Benefits:

- Turn-up via Ookla Speedtest™
- Business/Residential turn-up via
  - GPON emulation
  - LAN
  - Optical SFP
  - WiFi

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5G, FRONTHAUL, MIDHAUL AND BACKHAUL

Laying the foundation for 5G while strengthening your existing 4G network

As the industry migrates to LTE-Advanced Pro and 5G, latency, power loss and bit-error rate performance will become major concerns due to the increasingly demanding fronthaul, midhaul and backhaul requirements. Fronthaul networks will be required to support speeds of up to 25 Gbit/s, 50 Gbit/s, even 100 Gbit/s with higher traffic loads and more demanding services. Deploying a rock-solid network that's massively scalable and able to support any new service demanded by customers can be challenging–unless you have the right test tools and procedures in place.

Test smarter with the FTB 5GPro test solution: Following standardized, field-proven procedures and using intelligent, flexible test solutions take the guesswork out of setup, execution and analysis–leading to high-quality networks, delivered on time and able to address any foreseeable service requirements.

INSTALLATION

Fiber connector inspection
- Detect dirty or damaged connectors (at each connection point)
- Clean or replace damaged connectors, as required

Fiber link characterization
- Detect issues on the fiber span potentially impacting total budget loss (dB), such as macrobends, splices, bad connectors and fibre breaks

Transport validation
- CPRI link validation from 1.2 Gbit/s to 24.3 Gbit/s using BER and latency testing
- eCPRI 10G and 25G link validation using BER and QoS metrics like latency testing

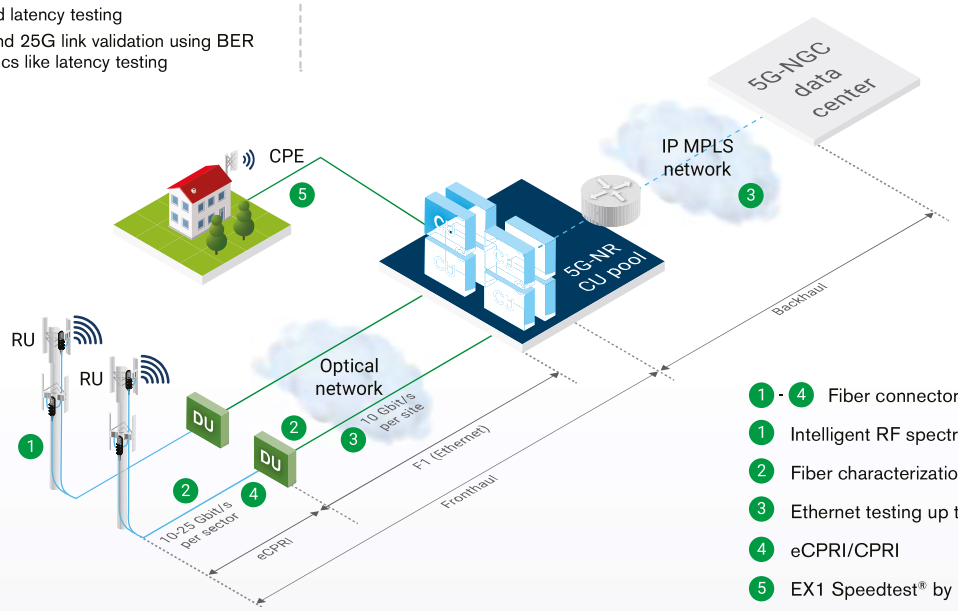
ACTIVATION

Site commissioning
- Test RRH/RU functionality from the bottom of the tower or at the C-RAN hub by emulating the base station
- Verify if the 5G equipment located at the top of the tower is operational via eCPRI 10/25G link validation.
- Validate proper installation of mobile network equipment before handover to MNO

5G CPE commissioning
- Verify 4G LTE and 5G coverage in residential areas
- Test 5G CPE speeds up to gigabit rates

MAINTENANCE & TROUBLESHOOTING

Find and mitigate RF interference
- Access the RF signal at the BBU location either at the bottom of the tower or at the C-RAN hub via CPRI link
- Track down and mitigate interference sources



1 - 4 Fiber connector inspection
1 Intelligent RF spectrum analysis over CPRI
2 Fiber characterization (OTDR/iOLM, LS/OM)
3 Ethernet testing up to 100G
4 eCPRI/CPRI
5 EX1 Speedtest® by Ookla®

Recommended test kit: FTB 5GPro

FTB-1v2 DC
FTBx-88260
FTBx-720C

FIP-435B

EX1

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DATA CENTER

The ever-increasing growth in bandwidth-hungry applications flooding data centers and the fight to provide enhanced levels of performance inside cloud networks are driving the migrations to higher rates. Deploying fiber and network infrastructure inside data centers as fast and as efficiently as possible is the challenge. At the same time, new technologies are emerging, and data centers are struggling to keep pace. Hard choices must be made.

EXFO's unique data center portfolio helps data center managers and technicians keep up with both the explosion of data and the pace of technology changes with its unique flexibility and powerful easy-to-use applications, allowing them to optimize their deployment and troubleshooting times. For 400G test solutions, please consult the 400G Power Blazer Series data sheet.

Ultimate flexibility and interface support

FTBx-88260

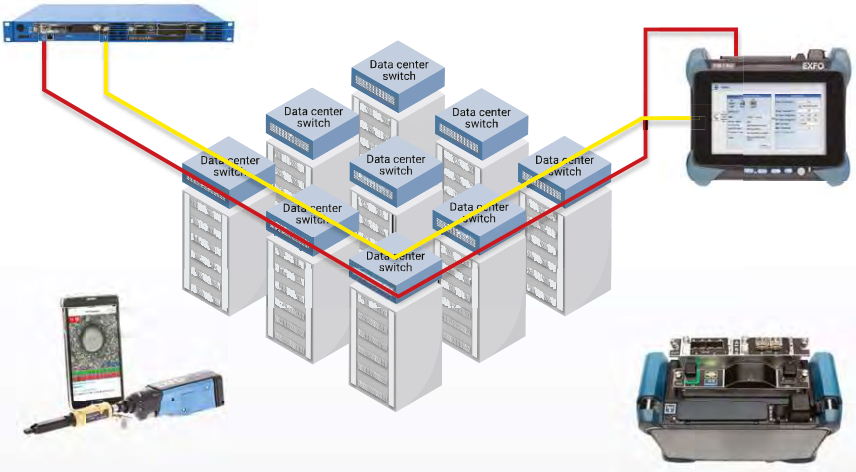
CFP4
QSFP+
AOC cables
SFP/SFP+/SFP28
QSFP28 (CWDM4, LR4, SR4, PSM4, etc.)

Before deployment

Optimize transceiver validation time up to 4 x QSFP28, 4 x SFP28 and 2 AOC cables

After deployment

Optimize deployment and troubleshooting times inside data centers with EXFO's all-in-one solutions



iOptics

The iOptics intelligent pluggable optics test application offers a complete, powerful and easy-to-use tool for validating any type of 100M to 100G transceiver or AOC cable. It is a first-alert test that can be used in your data center to efficiently evaluate the proper operation of an optical transceiver device using minimal user configuration. The automated testing sequence includes:

- Monitoring the pluggable internal temperature
- Monitoring the transceiver power consumption and current
- Validating the MDIO/I2C and hardware-pin operation from the transceiver or AOC cable tested
- Validating communication per channel
- Stress test: automated solution that validates the bit-error performance of the optical interface
- Skew test: measures the skew associated to each physical coding sublayer (PCS) lane

In the event of a fail verdict during the execution of any of the previous tests, the faulty area is highlighted, and the associated errors/alarms are saved on a test report.

Recommended test kits

❶ FTB-1v2 HPDC
2 x FTBx-88260

❷ FTB-1v2 DC
1 x FTBx-88260
1 x FTBx-720C
FIPT-400-MF

❸ LTB-2
1 x FTBx-88260
1 x FTBx-720C
FIPT-400-MF

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NETWORK EQUIPMENT MANUFACTURERS (NEMs) AND LABS

Network equipment manufacturers (NEMs) and high-speed labs are currently facing increasing pressure to ramp up and optimize their production lines to launch high quality-products as fast and efficiently as possible. Remote and simultaneous access for different developing teams around the world has recently become a must. Today's challenge requires acquiring the right equipment while ensuring long-term technology investment.

EXFO's NEMs portfolio is a powerful, versatile and scalable test and measurement solution that incorporates rackmounts (LTB-8/LTB-2) and portable (FTB-4 Pro/FTB-2 Pro) platforms with a wide variety of modules, providing unique flexibility. In addition, the Open Transceiver System (OTS) enhances the portfolio by enabling the mix-and-match of interfaces, which allows users to maximize the life of the tester and, at the same time, be ready for future standards.

Moreover, EXFO's Multilink provides easy-to-use remote access and automation tools for EXFO's rackmount and portable solutions, becoming a key asset for NEMs to not only boost their productivity and agility, but also to accelerate their time to market while keeping their CAPEX in check. For 400G test solutions, please consult the 400G Power Blazer Series data sheet.

Network system design and validation/verification	› Standard-based testing › Multirate testing from 10M to 400G › Client testing: Ethernet, FC, OTN, SONET and SDH
Transceiver validation: optical and electrical test	› iOptics › Transceiver stress test › Power and temperature monitoring
Transceiver validation spectral analysis	› Optical spectrum analyzer for SMSR testing in transceiver production floor
5G wireless and core validation	› eCPRI validation up to 25G › eCPRI QoS measurement and dual-port › CPRI/OBSAI link validation and BERT
Ethernet testing	› BERT › Unframed BERT per lane › Traffic generation › Service validation › Synchronization tools › Service disruption time evaluation
OTN advanced tools	› OTN, multistage mapping › Ethernet over OTN, ODU0 and ODUflex › Multichannel OTN and mix mapping
Remote access and automation	› Remote access › Automation tools › Inventory management

EXFO | MULTILINK

Recommended test kit

FTB-4 Pro

FTBx-5243-HWA

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SUMMARY OF KEY FEATURES

KEY FEATURES	
Detailed compliance testing	› IEEE 802.3 - 2018 standard › CFP MSA CFP4 Hardware Specification Revision 1.1 18 Mar 2015 › CFP MSA Management Interface Specification Version 2.4 (R06b) › ITU-T G.709, G.798 and G.872
Multi-interface support	› Pluggable, MSA-compliant QSFP+ transceivers › Pluggable, MSA-compliant CFP4 and QSFP28 transceivers › Pluggable, MSA-compliant SFP28 optical transceiver › Pluggable, MSA-compliant SFP/SFP+ electrical and optical transceivers › External timing reference (DS1/E1/2 MHz) › Low-speed and high-speed reference clock output for eye diagram measurements › Active optical cable support › Tunable SFP+ and complete ITU-T grid
Robust physical-layer validation	› CAUI-4/XLAUI lane 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/I2C read/write access
PRBS patterns per lane	Allows users to configure different PRBS patterns on different CAUI-4/XLAUI lanes in 40G/100G, and on physical lanes in OTU3/OTU4 unframed configurations; typically used to identify crosstalk issues when looking at the eye diagram
Per-wavelength power measurement	Allows users to measure the received optical power per wavelength CFP4 and QSFP+/QSFP28 transceivers
iOptics	› Optical-device I/O interface quick check › Optical TX power-level test › Optical RX signal-presence and level test › BERT and frequency offset standard › Framed excessive skew test › Temperature and power consumption monitoring
Layer 2/3/4 Ethernet testing	› Unframed BERT up to 100G › EtherBERT at 10M, 1G, 10G, 25G, 40G, 50G and 100G using fixed frames (up to 16000 bytes) or EMIX › Round-trip latency measurements with pass/fail verdict up to 100G › Dual-port Ethernet testing capabilities from 10M to 100G, including 25G, 40G and 50G › 100 GigE through mode testing › RFC 2544, including throughput, back-to-back, latency and frame loss with dual test set for bidirectional measurements › EtherSAM (ITU-T Y.1564) with dual test set for bidirectional measurements › RFC 6349: Performs TCP testing with single or multiple TCP connections from 10BASE-T up to 100G; discovers the MTU, RTT, actual and ideal TCP throughput; user can apply suggested window size boost factor to optimize test results › Simplified ITU-T Y.1564 test that performs service configuration and service performance tests using remote loopback or dual test set mode for bidirectional results; an additional, completely automated RFC 6349 test can be run in conjunction with the EtherSAM (Y.1564) tests, or on its own to perform layer-4 TCP testing, with the inclusion of discovering the maximum transmission unit (MTU) and round-trip time (RTT), as well as the actual and ideal TCP throughput of the circuit under test › Dual test set mode › Layer-2 control protocol testing offers the most complete set of predefined L2 protocols in the industry (38 different protocols including all MEF 45 and CISCO L2CP frames) in addition to 8 user-defined protocols › Intelligent autodiscovery of EXFO modules or third-party devices allowing single user to perform end-to-end testing by looping up and looping down remote devices (EXFO and 3rd party units) up to layer 4. › Traffic generation and shaping of up to 16 streams of Ethernet and IP traffic, and monitoring of throughput, latency, packet jitter, frame loss and out-of-sequence › Q-in-Q capability with the ability to go up to three layers of stacked VLANs › VLAN CoS and ID preservation › Discover up to three levels of VLAN tagged traffic (C-/S-/E-VLAN) including their ID and priority, as well as the total VLAN tagged frame count and associated bandwidth › Ping and traceroute functions; user can configure up to 1000 ping messages › Advanced filtering capability for in-depth network troubleshooting › Smart Loopback › Flow control injects or monitors pause frames, including frame counts of pause, abort frames and total, last, maximum and minimum pause time › IPv6 protocol generation and analysis › Service disruption time (SDT) › Ethernet MAC flooding › Frame size sweep
Synchronization	› Validates 1588 PTP packet network synchronization services, emulates PTP clients, and generates and analyzes messages between master/clients, clock quality level and IPDV › Validates SyncE frequency, ESMC messages and clock quality levels › Ability to perform time error analysis and wander measurement; evaluation if the signal under test meets multiple standardized masks (MTIE, TDEV)
MPLS	Generates and analyzes streams with up to two layers of labels
Carrier Ethernet OAM	Fault-management and performance-monitoring Ethernet and MPLS-TP OAM protocols, including Y.1731, 802.1ag, MEF, Link OAM (802.3ah) and G.8113.1 OAMs
Advanced filtering	Ability to configure up to 10 filters, each with four fields that can be combined with AND/OR/NOT operations; a mask is also provided for each field value with IPv4 and IPv6 capabilities
Packet capture	› Ethernet packet capture up to 4 Mbit, depending on the rate › Configurable triggers including errors and header fields › Data capture in packet capture (PCAP) format; read through Wireshark

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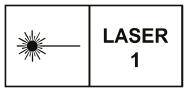
KEY FEATURES (CONT'D)

OTN testing	› OTU4 (112 Gbit/s), OTU3 (43 Gbit/s), OTU3e1 (44.57 Gbit/s) and OTU3e2 (44.58 Gbit/s) unframed and framed BER tests › FEC testing: error insertion and monitoring › OTL 3.4 and 4.4: 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 alarm/error generation and analysis › OTU, ODU (including ODU TCM) trace messages › Round-trip delay (RTD) measurement › OTN SDT measurement › OTN through and OTN intrusive through mode testing › Multiplexing/demultiplexing of ODU13, ODU23, ODU123, ODU03, ODU013, ODU0123, ODU04, ODU014, ODU134, ODU24, ODU234, ODU34, ODU14, ODU01234, ODU0124, ODU12, ODU024, ODU034, ODU1e4, ODUflex24, ODU2e4 and ODU124, ODU1234 with PRBS pattern and GigE and 10 GigE client mappings into OPU payloads. ODUflex at ODU2, ODU3 and ODU4 rates with full flexibility to configure the required bandwidth based on n x 1.25 Gbit/s tributary time slots with a PRBS pattern into the ODUflex payload; 40 GigE client mapping into ODU3 into ODU4 › Performance monitoring: G.821, M.2100 › Frequency analysis and offset generation including frequency sweep › Power OTN OH analysis for BERT and synchronization testing of multiple fields in the OTN OH, including GCC0/1/2
Multichannel OTN and mixed mapping testing	› 100G OTN validation of individual channel connectivity › Support for mixing and mapping of ODU0, ODU1, ODU2, or ODU3 data containers into an ODU4 container › Alarm/error monitoring › Single alarm/error injection on one single channel or on all channels at one time › Concurrent OTN BERT analysis › Simultaneous channelized SDT measurement › Flexible channel/tributary slot selection
Ethernet mapping over OTN	› Ethernet mapping over OTN respectively, with GMP support › 40G transcoding capability with alarms, errors and statistics › GMP alarms, errors and statistics › GigE mapping into ODU0 using GFP-T, 10 GigE mapping into ODU2 using GFP-F, direct 10 GigE mappings into ODU1e/2e in different ODU multiplexing structures, and 40 GigE client mapped into ODU3/ODU4 › Flexibility to map up to a 10G Ethernet client signal into ODUflex
SONET/SDH mapping over OTN	› OC-768/STM-256 mapping in ODU3 › OC-192/STM-64 mapping in ODU2 › OC-48/STM-16 mapping in ODU1 › OC-12/STM-4 and OC-3/STM1 mapping in ODU0
SONET/SDH testing	› PRBS pattern payload generation and analysis down to STS-1/AU-3 granularity › High-order mappings: STS-1/3c/12c/48c/192c and AU-3/AU-4/AU-4-4c/16c/64c › Section/RS, Line/MS and high-order (STS/AU) path overhead manipulation and monitoring › Section/RS, Line/MS and high-order (STS/AU) path alarm/error generation and monitoring › Single, rate and burst error insertion modes › High-order (STS/AU) pointer generation and monitoring › Performance monitoring: G.821, G.828, G.829, M.2100, M.2101 › Frequency analysis and offset generation › Automatic protection switching (APS) and SDT measurements › Round-trip delay (RTD) measurements › Tandem connection monitoring
Fronthaul	› CPRI layer-2 link validation for BBU or RRH from 1.2G to 24.3G. CPRI option 10 (24.3G) can be tested with either SFP28 or QSFP28 on the FTBx-88260. › OBSAI layer-2 link validation for BBU or RRH from 1.5G to 6.1G › BBU emulation allowing RF level validation of RRHs, RET status and control and remote SFP identification › eCPRI BER testing: unframed and framed L2/3/4 BER measurement, bit error injection, one-way/round-trip delay measurement, QoS metrics and Pass/Fail verdict for 10G/25G rates. eCPRI 25G can be tested with either SFP28 or QSFP28 on the FTBx-88260. › iORF: intelligent spectrum analysis over CPRI. Automated analysis and detection of interference and PIM issues at the push of one button
OpticalRF™	The most powerful real-time high-resolution RF spectrum analysis over CPRI. Quickly identify issues such as RF interference and passive intermodulation (PIM) from the BBU site
Remote access	Remote access: supported via EXFO Remote ToolBox, EXFO Multilink, VNC or Web VNC
Report generation	Test reports generated in PDF and HTML formats. Reports are easily customizable and can be automatically generated at the conclusion of each test.

LASER SAFETY



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