

# 5G, fronthaul, Ethernet and transport testing solutions

Smarter testing across all your network up to 400G

Lead the 5G revolution with the most complete testing portfolio in the industry. Discover the powerful and versatile multi-technology Ethernet and transport test solutions bringing ease of use and flexibility to all environments: field, lab, data centers, fronthaul, midhaul, backhaul, etc. Stay ahead with our unique Open Transceiver System (OTS) to support current and future transceiver technologies.

## BUSINESS ETHERNET AND TRANSPORT

### Activate services fast and intelligently

- › Multitechnology, multiport testing from 56K to 100G complete feature set: Ethernet, OTN, SONET, SDH, DS<sub>n</sub>, 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

## DATA CENTER

### Speed up the validation of transceivers

- › iOptics: powerful and easy-to-use transceiver testing tool for AOC cables, QSFP28, SFP28, QSFP+, CFP, CFP2, 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

## 5G, FRONTHAUL, MIDHAUL & 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, OBSAI and up to 100G Ethernet testing
- › Integrated and intelligent fibre testing

## 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**

## CHOOSE THE RIGHT TESTING SOLUTION FOR YOU

FEATURE	FTBx-8870	FTBx-8880	FTBx-88260	FTBx-88200NGE	FTB-88100NGE	FTB-88100G
iOptics	•	•	•	•	•	•
iSAM	•	•	•	•	•	•
iORF	•	•	•			
<b>ETHERNET</b>						
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+	•	•	•	•		
<b>TRANSPORT</b>						
OTN OTU1/2	•	•	•	•	•	
OTN OTU3/4			•	•	•	•
ODU Mux, EoOTN, ODU0, ODUflex	•	•	•	•	•	•
Multichannel OTN and mixed mapping testing				<sup>a</sup>		
OTN GCC BERT	•	•	•	•	•	•
DSn/PDH (DS1/E1)	•	•				
DSn/PDH (DS3, E3 and E4)		•				
ISDN PRI	<sup>b</sup>	<sup>b</sup>				
SONET/SDH	•	•	•	•	•	•
40G OC-768/STM-256					•	•
<b>SYNCHRONIZATION</b>						
1588 PTP/SyncE	•	•	•	•	•	
Wander and time error		•				
<b>FIBRE CHANNEL</b>						
Fibre Channel (1X, 2X, 4X, 8X and 10X)	•	•	•	•	•	
Fibre Channel 16X			•	•		
Fibre Channel 32X			•			
<b>WIRELESS</b>						
eCPRI 10G	•	•	•	•		
eCPRI 25G			•			
Dual-port eCPRI			•			
CPRI 1.2 Gbit/s to 10.1 Gbit/s	•	•	•	•	<sup>c</sup>	
OBSAI 1.5 Gbit/s, 3.1 Gbit/s and 6.1 Gbit/s	•	•	•	•	•	
Dual-port CPRI	•	•	•		•	
OpticalRF	•	•	•			
BBU emulation	•	•				

<sup>a</sup>. On the FTB-2/FTB-4 Pro, LTB-2 and LTB-8 platforms<sup>b</sup>. Available on FTB-1 Pro platforms<sup>c</sup>. CPRI up to 9.8 Gbit/s

## 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)



TEST MODULE SUPPORT	CONFIGURATIONS		
	SINGLE-CARRIER	DUAL-CARRIER	HIGH-POWER DUAL-CARRIER
FTBx-8880 (10G module)	•	• <sup>a</sup>	• <sup>a</sup>
FTBx-8870 (10G module)	•	• <sup>a</sup>	• <sup>a</sup>
FTBx-88200NGE (100G module)		• <sup>b</sup>	• <sup>c</sup>
FTBx-88260 (25G and 100G module)		• <sup>b</sup>	• <sup>c</sup>

<sup>a</sup>: Platform with two modules, it allows for QUAD 10GE testing

<sup>b</sup>: Platform can host one 100G module at a time

<sup>c</sup>: With two modules, it allows for QUAD 100GE testing

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 one 100G module (FTBx-88200NGE or FTBx-88260) at a time and can be combined with any OTDR module or 10G T&D module. It enables concurrent dual-module operation with OTDRs and 10G T&D modules. When equipped with a 100G module, the platform supports the operation of one module at a time and 2 x 100G 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).





## 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. Besides the T&D FTBx modules (FTBx-8880, FTBx-8870, FTBx-88200NGE and FTBx-88260), the FTB-4 Pro also supports FTB-88100NGE and FTB-88100G for users testing CFP and CFP2 transceivers. 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. Like the FTB-4 Pro, it also supports the FTB-88100NGE and FTB-88100G for users testing CFP and CFP2 transceivers.

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



### 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.



## CHOOSE THE TRANSPORT AND DATACOM MODULE THAT MEETS YOUR TESTING REQUIREMENTS

### FTBx-88260: 10G, 25G, 40G 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), 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
 <b>SFP28</b>	SFP, SFP+, tunable SFP+, SFP28, copper SFP and SFP+	<ul style="list-style-type: none"> <li>› 10M to 25G data rates</li> <li>› FC 1X to FC 32X data rates</li> <li>› Dual-port capability</li> </ul>	2
 <b>QSFP28</b>	QSFP+, QSFP28	<ul style="list-style-type: none"> <li>› 40G / 50G<sup>(1)</sup> / 100G data rates</li> <li>› Dual-port capability</li> <li>› AOC cables</li> </ul>	2
 <b>CFP4</b>	CFP4, SMA (REF OUT)	<ul style="list-style-type: none"> <li>› 100G data rate</li> <li>› Ref out for eye diagram analysis</li> <li>› Dual-port offered with extra OTS</li> </ul>	1
 <b>SYNC</b>	SMA <sup>(1)</sup> , SMB (EXT CLK and 1PPS)	<ul style="list-style-type: none"> <li>› Built-in GNSS/GPS<sup>(1)</sup></li> <li>› Ideal solution for one-way delay</li> <li>› Ready for next-gen timing applications<sup>(1)</sup></li> </ul>	Not applicable

(1) For more information, please contact EXFO.



## CHOOSE THE TRANSPORT AND DATACOM MODULE THAT MEETS YOUR TESTING REQUIREMENTS

### 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.

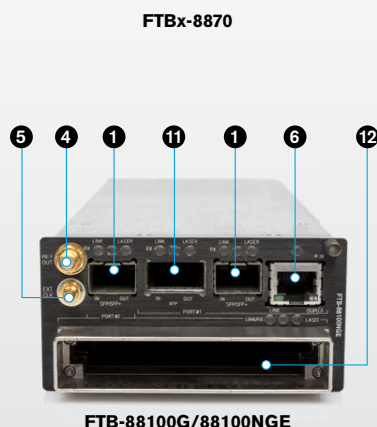
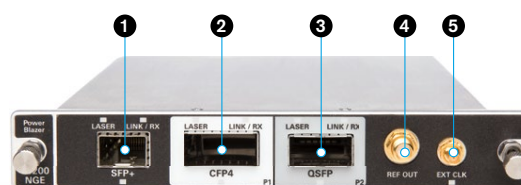
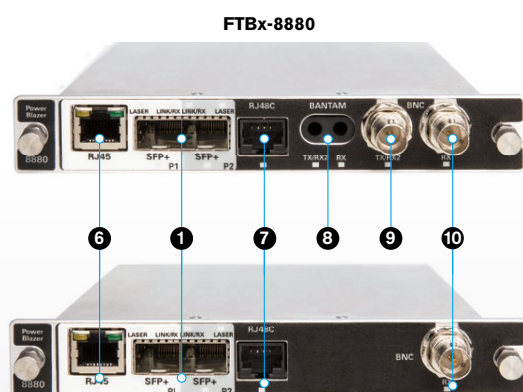
### FTBx-88200NGE: the test solution for next-generation 40G-100G networks

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.

## CHOOSE THE RIGHT MODULE FOR YOU

PHYSICAL INTERFACES	FTBx-8870	FTBx-8880	FTBx-88200NGE	FTB-88100NGE	FTB-88100G
RJ45	•	•	• <sup>a</sup>	•	
RJ48C	•	•			
BNC	• <sup>b</sup>	•		•	
Bantam		•			
SFP/SFP+	• <sup>c</sup>	• <sup>c</sup>	• <sup>c</sup>	•	
QSFP+/QSFP28			•		
CFP4			•		
CFP/CFP2 (requires adapter)				•	•

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



- SFP+**  
CPRI 1.2G to 10.1G (9.8G for the FTB-88100NGE)  
OBSAI 1.5G to 6.1G  
10G eCPRI (on FTBx-8880/70 and FTBx-88200NGE)  
SONET/SDH up to OC-192/STM-64  
OTN up to OTU2 including overlock  
Ethernet up to 10G  
FC up to 10X  
FC 16X (only on FTBx-88200NGE)  
RF spectrum over CPRI (only on FTBx-8870/8880)
- CFP4**  
OTN OTU4  
Ethernet 100GE
- QSFP**  
OTN OTU3/4 including overlock  
Ethernet 40GE/ 100GE.
- REF OUT**  
SMA interface
- EXT CLK**  
SMB interface
- RJ45**  
Ethernet 10/100/1000 BASE-T
- RJ48C**  
DSn/PDH  
EXT CLK  
Wander
- BANTAM**  
DSn/PDH  
RX2: DS1  
EXT CLK
- BNC**  
Electrical  
SONET/SDH  
DSn/PDH  
RX2: DS1/DS3  
EXT CLK  
Wander
- BNC**  
DSn/PDH  
RX: DS1  
EXT CLK
- XFP**  
SONET/SDH OC-192/STM-64  
Ethernet 10G  
FC 10x
- CFP (CFP2 with adapter)**  
OTN OTU3/4 including overlock  
Ethernet 40GE/100GE

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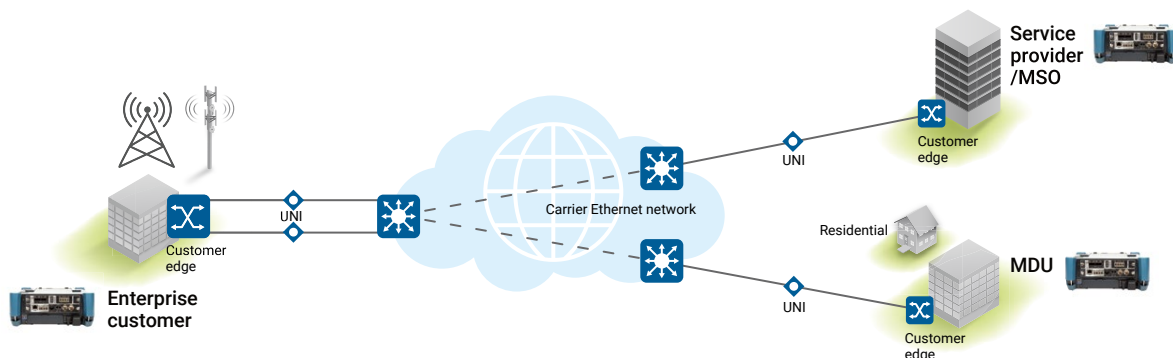
## BUSINESS ETHERNET AND TRANSPORT AND MODULES

### Key benefits

EXFO's market leading products make service turn-up and troubleshooting from a business Ethernet service perspective to a complete transport system a go-to solution for service providers, multiple system operators and their contractors. 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.



### 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 & 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



## 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 10.1 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

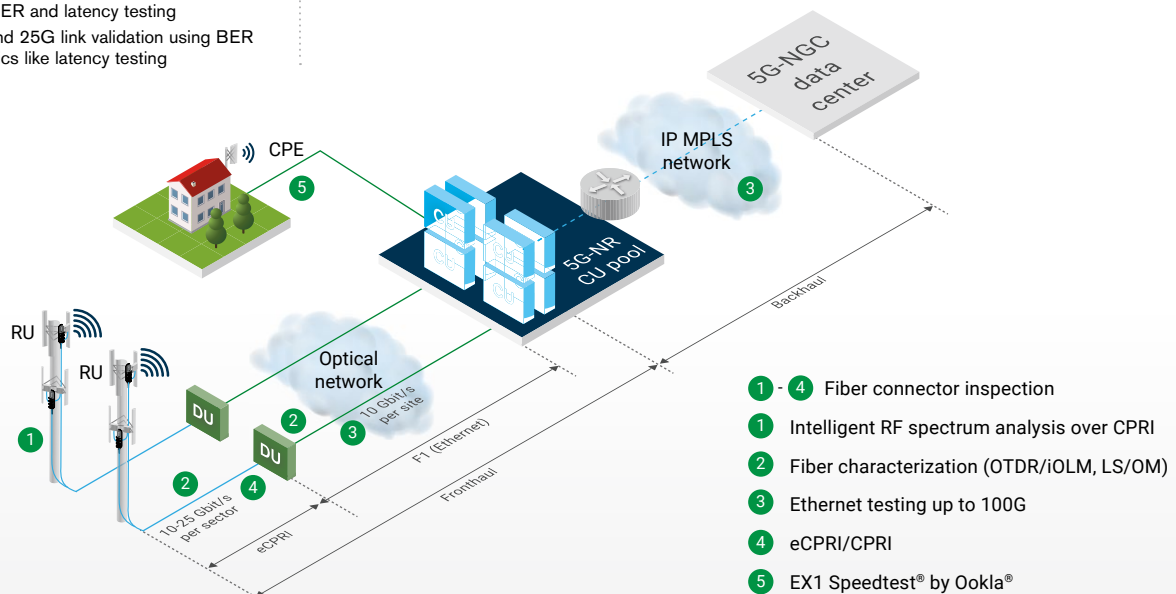
##### 5G CPE commissioning

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

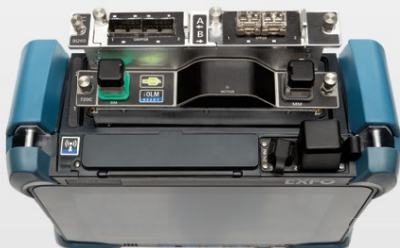
#### MAINTENANCE & TROUBLESHOOTING

##### 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



### 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 & interface support

#### FTBx-88260



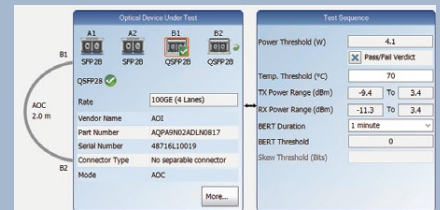
CFP4  
QSFP+  
AOC cables  
SFP/SFP+/SFP28  
QSFP28 (CWDM4, LR4, SR4, PSM4, etc.)

### Before deployment



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

### iOptics



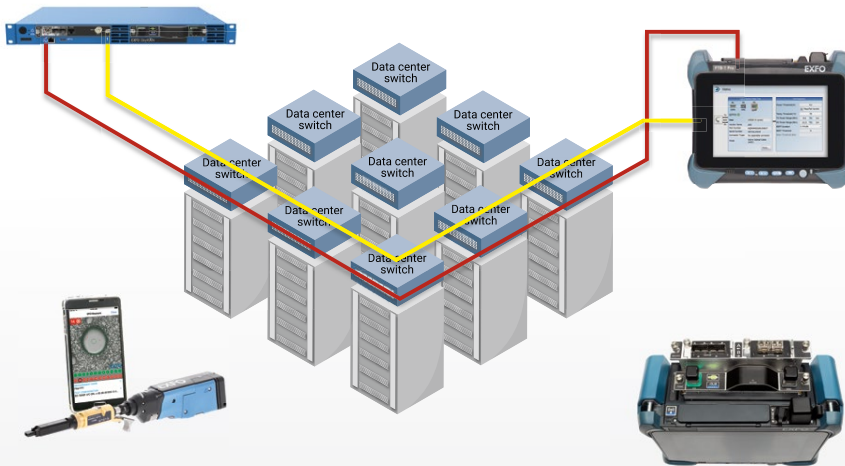
The iOptics intelligent pluggable optics test application offers a complete, powerful and easy-to-use tool for validating any type of 100M to 100G transceiver or AOC cable. It is a first-alert test that can be used in your data center to efficiently evaluate the proper operation of an optical transceiver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

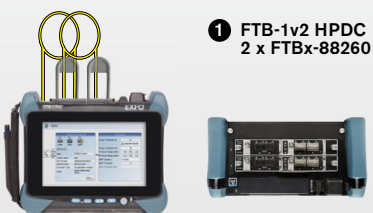
In the event of a fail verdict during the execution of any of the previous tests, the faulty area is highlighted, and the associated errors/alarms are saved on a test report.

### After deployment

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



### Recommended test kits



1 FTB-1v2 HPDC  
2 x FTBx-88260



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



3 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.



	<b>Network system design and validation/verification</b>	<ul style="list-style-type: none"> <li>Standard-based testing</li> <li>Multirate testing from 10M to 400G</li> <li>Client testing: Ethernet, FC, OTN, SONET &amp; SDH</li> </ul>
	<b>Transceiver validation: optical and electrical test</b>	<ul style="list-style-type: none"> <li>iOptics</li> <li>Transceiver stress test</li> <li>Power and temperature monitoring</li> </ul>
	<b>Transceiver validation spectral analysis</b>	<ul style="list-style-type: none"> <li>Optical spectrum analyzer for SMSR testing in transceiver production floor</li> </ul>
	<b>5G wireless and core validation</b>	<ul style="list-style-type: none"> <li>eCPRI validation up to 25G</li> <li>eCPRI QoS measurement and dual-port</li> <li>CPRI/OBSAI link validation and BERT</li> </ul>
	<b>Ethernet testing</b>	<ul style="list-style-type: none"> <li>BERT</li> <li>Unframed BERT per lane</li> <li>Traffic generation</li> <li>Service validation</li> <li>Synchronization tools</li> <li>Service disruption time evaluation</li> </ul>
	<b>OTN advanced tools</b>	<ul style="list-style-type: none"> <li>OTN, multistage mapping</li> <li>Ethernet over OTN, ODU0 and ODUflex</li> <li>Multichannel OTN and mix mapping</li> </ul>
	<b>Remote access and automation</b>	<ul style="list-style-type: none"> <li>Remote access</li> <li>Automation tools</li> <li>Inventory management</li> </ul>

### Recommended test kit



FTB-4 Pro



FTBx-88260



TS-CFP4

TS-SFP28

TS-QSFP28

TS-SYNC



FTBx-5243-HWA



## SUMMARY OF KEY FEATURES

KEY FEATURES	
Detailed compliance testing	<ul style="list-style-type: none"> <li>› IEEE 802.3 - 2018 standard</li> <li>› CFP MSA CFP4 Hardware Specification Revision 1.1 18 Mar 2015</li> <li>› CFP MSA Management Interface Specification Version 2.4 (R06b)</li> <li>› ITU-T G.709, G.798 and G.872</li> </ul>
Multi-interface support	<ul style="list-style-type: none"> <li>› Pluggable, MSA-compliant 4 x 10G QSFP+ transceivers</li> <li>› Pluggable, MSA-compliant 4 x 25G CFP4 and QSFP28 transceivers</li> <li>› Pluggable, MSA-compliant SFP28 optical transceiver</li> <li>› Pluggable, MSA-compliant SFP/SFP+ electrical and optical transceivers</li> <li>› Pluggable, MSA-compliant 10 x10G CFP/CFP2 transceivers</li> <li>› External timing reference (DS1/E1/2 MHz)</li> <li>› Low-speed and high-speed reference clock output for eye diagram measurements</li> <li>› Active optical cable support</li> <li>› Tunable SFP+ and complete ITU-T grid</li> </ul>
Robust physical-layer validation	<ul style="list-style-type: none"> <li>› CAUI-4/XLAUI lane error generation and monitoring</li> <li>› PCS lane mapping and monitoring capability</li> <li>› Per-lane skew generation and measurement</li> <li>› PCS error generation and monitoring per lane</li> <li>› Full MDIO/I2C read/write access</li> </ul>
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 CFP/CFP2/CFP4 and QSFP+/QSFP28 transceivers
iOptics	<ul style="list-style-type: none"> <li>› Optical-device I/O interface quick check</li> <li>› Optical TX power-level test</li> <li>› Optical RX signal-presence and level test</li> <li>› BERT and frequency offset standard</li> <li>› Framed excessive skew test</li> <li>› Temperature and power consumption monitoring</li> </ul>
Layer 2/3/4 Ethernet testing	<ul style="list-style-type: none"> <li>› Unframed BERT up to 100G</li> <li>› EtherBERT from 10M, 1G, 10G, 25G up to 100G</li> <li>› Dual-port Ethernet testing capabilities from 10M, 1G, 10G, 25G up to 100G</li> <li>› 100 GigE through mode testing</li> <li>› RFC 2544, including throughput, back-to-back, latency and frame loss with dual test set for bidirectional measurements</li> <li>› EtherSAM (ITU-T Y.1564) with dual test set for bidirectional measurements</li> <li>› 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</li> <li>› 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</li> <li>› Dual test set mode</li> <li>› 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.</li> <li>› Intelligent autodiscovery</li> <li>› 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</li> <li>› Q-in-Q capability with the ability to go up to three layers of stacked VLANs</li> <li>› VLAN CoS and ID preservation</li> <li>› 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</li> <li>› Ping and traceroute</li> <li>› Advanced filtering capability for in-depth network troubleshooting</li> <li>› Smart Loopback</li> <li>› Flow control injects or monitors pause frames, including frame counts of pause, abort frames and total, last, maximum and minimum pause time</li> <li>› IPv6 protocol generation and analysis</li> <li>› Service disruption time (SDT)</li> <li>› Ethernet MAC flooding</li> <li>› Frame size sweep</li> </ul>
Synchronization	<ul style="list-style-type: none"> <li>› Validates 1588 PTP packet network synchronization services, emulates PTP clients, and generates and analyzes messages between master/clients, clock quality level and IPDV</li> <li>› Validates SyncE frequency, ESMC messages and clock quality levels</li> <li>› Ability to perform time error analysis and wander measurement; evaluation if the signal under test meets multiple standardized masks (MTIE, TDEV)</li> </ul>
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	<ul style="list-style-type: none"> <li>› Ethernet packet capture up to 4 Mbit</li> <li>› Configurable triggers including errors and header fields</li> <li>› Data capture in packet capture (PCAP) format; read through Wireshark</li> </ul>



## KEY FEATURES (CONT'D)

OTN testing	<ul style="list-style-type: none"> <li>› OTU4 (112 Gbit/s), OTU3 (43 Gbit/s), OTU3e1 (44.57 Gbit/s) and OTU3e2 (44.58 Gbit/s) unframed and framed BER tests</li> <li>› FEC testing: error insertion and monitoring</li> <li>› OTL 3.4 and 4.4: alarm and error generation and monitoring</li> <li>› OTL lane mapping, and skew generation and measurement</li> <li>› OTU, ODU, OPU overhead manipulation and monitoring</li> <li>› OTU, ODU (including ODU TCM), OPU layer alarm/error generation and analysis</li> <li>› OTU, ODU (including ODU TCM) trace messages</li> <li>› Round-trip delay (RTD) measurement</li> <li>› OTN SDT measurement</li> <li>› OTN through and OTN intrusive through mode testing</li> <li>› 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</li> <li>› Performance monitoring: G.821, M.2100</li> <li>› Frequency analysis and offset generation</li> </ul>
Multichannel OTN and mixed mapping testing	<ul style="list-style-type: none"> <li>› 100G OTN validation of individual channel connectivity</li> <li>› Support for mixing and mapping of ODU0, ODU1, ODU2, or ODU3 data containers into an ODU4 container</li> <li>› Alarm/error monitoring</li> <li>› Single alarm/error injection on one single channel or on all channels at one time</li> <li>› Concurrent OTN BERT analysis</li> <li>› Simultaneous channelized SDT measurement</li> <li>› Flexible channel/tributary slot selection</li> </ul>
Ethernet mapping over OTN	<ul style="list-style-type: none"> <li>› Ethernet mapping over OTN respectively, with GMP support</li> <li>› 40G transcoding capability with alarms, errors and statistics</li> <li>› GMP alarms, errors and statistics</li> <li>› 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</li> <li>› Flexibility to map up to a 10G Ethernet client signal into ODUflex</li> </ul>
SONET/SDH mapping over OTN	<ul style="list-style-type: none"> <li>› OC-768/STM-256 mapping in ODU3</li> <li>› OC-192/STM-64 mapping in ODU2</li> <li>› OC-48/STM-16 mapping in ODU1</li> <li>› OC-12/STM-4 and OC-3/STM1 mapping in ODU0</li> </ul>
SONET/SDH testing	<ul style="list-style-type: none"> <li>› PRBS pattern payload generation and analysis down to STS-1/AU-3 granularity</li> <li>› High-order mappings: STS-1/3c/12c/48c/192c/STS-768c and AU-3/AU-4/AU-4-4c/16c/64c/AU-4-256c</li> <li>› Section/RS, Line/MS and high-order (STS/AU) path overhead manipulation and monitoring</li> <li>› Section/RS, Line/MS and high-order (STS/AU) path alarm/error generation and monitoring</li> <li>› Single, rate and burst error insertion modes</li> <li>› High-order (STS/AU) pointer generation and monitoring</li> <li>› Performance monitoring: G.821, G.828, G.829, M.2100, M.2101</li> <li>› Frequency analysis and offset generation</li> <li>› Automatic protection switching (APS) and SDT measurements</li> <li>› Round-trip delay (RTD) measurements</li> <li>› Tandem connection monitoring</li> </ul>
Fronthaul	<ul style="list-style-type: none"> <li>› CPRI layer-2 link validation for BBU or RRH from 1.2G to 9.8G</li> <li>› OBSAI layer-2 link validation for BBU or RRH from 1.5G to 6.1G</li> <li>› BBU emulation allowing RF level validation of RRHs, RET status and control and remote SFP identification</li> <li>› eCPRI BER testing: unframed/framed BER measurement, bit error injection, one-way/round-trip delay measurement, QoS metrics and Pass/Fail verdict for 10G/25G rates</li> <li>› iORF: intelligent spectrum analysis over CPRI. Automated analysis and detection of interference and PIM issues at the push of one button</li> </ul>
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



## ELECTRICAL INTERFACES

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

SYNCHRONIZATION INTERFACES			
	External Clock DS1/1.5M	External Clock E1/2M	External 2 MHz
Tx pulse amplitude (V)	2.4 to 3.6	2.37	0.75 to 1.5
Tx pulse mask	GR-499 figure 9.5	G.703 figure 15	G.703 figure 20
Tx LBO pre-amplification (typical) (dBdsx)	0.6 for 0 to 40.5 m (0 to 133 ft) 1.2 for 40.5 to 81.1 m (133 to 266 ft) 1.8 for 81.1 to 121.6 m (266 to 399 ft) 2.4 for 121.6 to 162.5 m (399 to 533 ft) 3 for 162.5 to 200 m (533 to 655 ft)		
Rx-level sensitivity	TERM: $\leq 6$ dB (cable loss only) at 772 kHz for T1 DSX-MON: $\leq 26$ dB (20 dB resistive loss + cable loss $\leq 6$ dB)	TERM: $\leq 6$ dB (cable loss only) MON: $\leq 26$ dB (resistive loss + cable loss $\leq 6$ dB)	$\leq 6$ dB (cable loss only)
Transmission bit rate	1.544 Mbit/s $\pm 4.6$ ppm	2.048 Mbit/s $\pm 4.6$ ppm	
Reception bit rate	1.544 Mbit/s $\pm 50$ ppm	2.048 Mbit/s $\pm 50$ ppm	
Intrinsic jitter (Tx)	ANSI T1.403 section 6.3 GR-499 section 7.3	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	
Line coding	AMI and B8ZS	AMI and HDB3	
Input impedance (resistive termination)	75 $\Omega \pm 5$ %, unbalanced	75 $\Omega \pm 5$ %, unbalanced	75 $\Omega \pm 5$ %, unbalanced
Connector type <sup>a</sup>	SMB or BNC	SMB or BNC	SMB or BNC

WANDER REFERENCE INTERFACES			
	1 PPS	2 MHz	10 MHz
Connector type	BNC, RJ48C	BNC, RJ48C	BNC, RJ48C

REF-OUT INTERFACE	
Tx pulse amplitude	Min: 200 mVpp Max: 1300 mVpp
Transmission frequency	155 MHz to 3.5 GHz
Output configuration	AC-coupled
Load impedance	50 $\Omega$
Connector type	SMA
External cable	Maximum 1 meter cable length (RG178 cable with 3.1 dB/m attenuation at 3.5 GHz)

### Note

An SMB-to-BNC adapter is available.



## MECHANICAL AND ENVIRONMENTAL SPECIFICATIONS

	FTBx-8870	FTBx-8880	FTBx-88260	FTB-88100G	FTB-88100NGE	FTBx-88200NGE
Size (H x W x D)	25 mm x 160 mm x 118 mm (1 in x 6 <sup>5</sup> / <sub>16</sub> in x 4 <sup>5</sup> / <sub>8</sub> in)		25 mm x 160 mm x 118 mm (1 in x 6 <sup>5</sup> / <sub>16</sub> in x 4 <sup>5</sup> / <sub>8</sub> in)	51 mm x 96 mm x 288 mm (2 in x 3 <sup>3</sup> / <sub>4</sub> in x 11 <sup>5</sup> / <sub>16</sub> in)		25 mm x 160 mm x 118 mm (1 in x 6 <sup>5</sup> / <sub>16</sub> in x 4 <sup>5</sup> / <sub>8</sub> in)
Weight	0.35 kg (0.75 lb)	0.41 kg (0.9 lb)	0.9 kg (1.9 lb)	1.1 kg (2.4 lb)		0.5 kg (1.1 lb)
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)
	storage	-40 °C to 70 °C (-40 °F to 158 °F)		-40 °C to 60 °C (-40 °F to 140 °F)		-40 °C to 70 °C (-40 °F to 158 °F)

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