

NetBlazer V2 Series

High-speed portable field testers

SMARTER TESTING FOR ALL THINGS 64K TO 100G



NetBlazer 100G

EXFO TFv
Test Function Virtualization

EXFO Connect
Compatible

iSAM

iOptics

OpticalRF™

Feature(s) of this product is/are protected by one or more of patent appl.
US 2012/0307666 A1 and equivalents in other countries.

The NetBlazer V2 Series is the industry's most complete and portable 64K to 100G test solution. Optimize your field technicians' tasks with simultaneous coverage of legacy and high-speed network interfaces.

KEY FEATURES AND BENEFITS

Platform highlights

- Windows 10 IoT (bring your own device, install what you want)
- Custom-designed platform with 128 GB of onboard memory, including a micro SD card interface (massively expand the memory)
- Built-in connectivity—choose between Gigabit interface, WiFi, Bluetooth, and 3G or 4G LTE via USB dongle
- Lightweight and portable solution with an ultra-bright, 8-in multitouch screen

High speed interfaces

- Pluggable CFP4 and QSFP28 optics to facilitate the testing of next-generation 100G networks
- Pluggable QSFP+ interface for 40GE and OTU3
- iOptics—an intelligent pluggable optics test application that quickly validates the sanity of an optical device using minimal configuration

Transport testing

- OTU1, OTU1e/1f, OTU2, OTU2e/2f, OTU3, OTU3e1/e2, OTU4
- SONET and SDH testing STS-1e/3e and STM-0e/1e
- DSn testing DS1, DS3 and dual DS1/DS3 RX
- Plesiochronous digital hierarchy (PDH) testing: E1, E3 and E4
- ISDN PRI for DS1 or E1
- Round-trip delay on all interfaces and payload mappings
- Service disruption measurements on all interfaces and mappings
- Overhead monitoring and modification for all time slots
- Pointer adjustment

Ethernet/Fibre Channel testing

- Dual-port or quad-port testing up to 10G
- Port testing available at 100G
- iSAM: ultra-simple ITU-T Y.1564 and RFC 6349 service activation methodology
- 10M to 100G multisession transmission control protocol (TCP) testing with bidirectional RFC 6349
- Power-over-Ethernet validation within cable test
- EtherSAM (Y.1564), RFC 2544, traffic generation and monitoring, EtherBERT, Through Mode, Smart Loopback and second-port loopback tool
- Packet synchronization, including IEEE 1588v2 PTP and SyncE
- Carrier Ethernet OAM, including ITU-T Y.1731, IEEE 802.1ag, IEEE 802.3ah link OAM
- Packet capture and advanced filtering up to 100G
- Fibre Channel 1x, 2x, 4x, 8x, 10x and 16x support

Fronthaul/FTTA/C-RAN testing

- Dual port and Quad Port CPRI testing up to 9.8G
- CPRI layer-2 link validation for BBU or RRH from 1.2G to 9.8G
- OBSAI layer-2 link validation for BBU or RRH from 1.5G to 6.1G
- CPRI/OBSAI framed and unframed BER with pseudo-random bit sequence (PRBS) patterns and latency measurements
- BBU emulation allowing RF level validation of RRHs, RET status and control and remote SFP identification
- Wander time error testing

RF spectrum analysis

- Real-time high-resolution RF spectrum analysis over CPRI

COMPATIBLE PLATFORM



Platform
FTB-1 Pro

EXFO

CHOOSE THE RIGHT NETBLAZER FOR YOU

					<i>NetBlazer 100G</i>	
NETBLAZER V2 MODULES	FTB-870V2	FTB-880V2	FTB-870Q	FTB-880Q	FTB-890	FTB-890NGE
DSn/PDH (DS1/E1)	•	•	•	•		•
ISDN PRI	•	•	•	•		•
DSn/PDH (DS3, E3 and E4)		•		•		•
OTN (OTU1/OTU2)	•	•	•	•	•	•
OTN (OTU3/OTU4)					•	•
SONET/SDH (up to 10G)	•	•	•	•	•	•
SONET/SDH (electrical)		•		•		•
Fibre Channel (1x, 2x, 4x, 8x and 10x)	•	•	•	•	•	•
Fibre Channel (16x)					•	•
1588 PTP/SyncE	•	•	•	•	•	•
Carrier Ethernet OAM	•	•	•	•	•	•
RFC 6349 (up to 10G TCP)	•	•	•	•	•	•
RFC 6349 (up to 100G TCP)					•	•
CPRI (1.2G up to 9.8G)	•	•	•	•	•	•
Dual-port Ethernet and CPRI testing	•	•	•	•		•
Quad-port Ethernet and CPRI testing			•	•		
OBSAI (1.5G, 3.1G and 6.1G)	•	•	•	•	•	•
OpticalRF™ and BBU Emulation	•	•	•	•		•
Simultaneous transport/Ethernet testing			•	•		
iOptics	•	•	•	•	•	•

TEST SPEEDS UP TO 100G



FTB-890 NetBlazer

The FTB-890 NetBlazer is the entry-level 10M-to-100G tester that covers a wide range of technologies including Ethernet, OTN, SONET/SDH, CPRI and Fibre Channel.



FTB-890NGE NetBlazer

The FTB-890NGE NetBlazer is the most comprehensive all-in-one tester, including testing for legacy networks at 64K all the way up to next-generation networks at speeds of 100G.

TEST SPEEDS UP TO 10G



FTB-880v2 NetBlazer

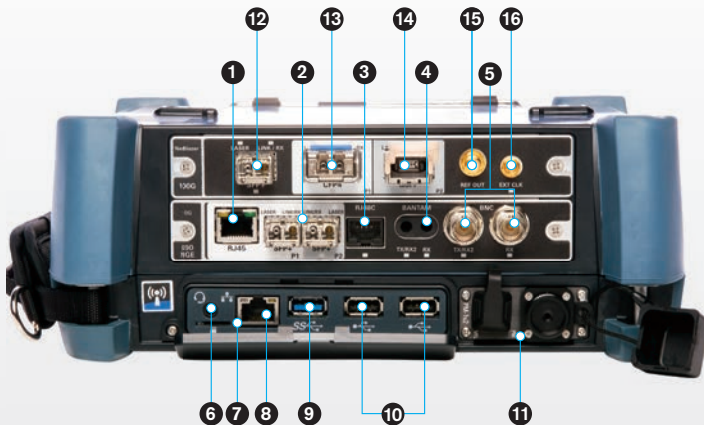
The FTB-880v2 NetBlazer is the field technician's go-to solution covering all things 10G. Fully loaded Ethernet testing includes iSAM and RFC 6349 with GigE and 10 GigE dual ports, OTN, SONET/SDH, DSn/PDH, ISDN PRI, fiber-to-the-antenna (FTTA), Fibre Channel and packet synchronization.



FTB-880Q NetBlazer

Double up everything the FTB-880v2 NetBlazer has to offer, and you get the FTB-880Q NetBlazer. The FTB-880Q is designed for maximum field-technician efficiency through accelerated processes running up to four simultaneous tests, as well as completely independent tests with zero restrictions. The FTB-880Q (and the FTB-870Q) are the only handheld testers offering quad-port GigE and 10 GigE.

STREAMLINED FOR EASE OF USE



- | | | |
|--|--|--|
| <p>1 ETHERNET
10/100/1000 BASE-T</p> <p>2 OPTICAL 10G
CPRI 1.2 to 9.8G
OBSAI 1.5G to 6.1G
OC-192/STM-64,
OC-48/STM-16,
OC-12/STM-4,
OC-3/STM-1,
OC-1/STM-0, OTU1, OTU2,
OTU1e, OTU2e, OTU1f,
OTU2f, 10GE LAN/WAN,
Ethernet 10/100/1000
BASE-T, 100M/1G optical,
FC 1x, 2x, 4x, 8x, 10x,
RF spectrum over CPRI</p> <p>3 DSn/PDH
EXT CLK
Wander</p> <p>4 DSn/PDH
RX2: DS1
EXT CLK</p> <p>5 Electrical
SONET/SDH
DSn/PDH
RX2: DS1/DS3
EXT CLK
Wander</p> | <p>6 Mic/headset jack</p> <p>7 Micro SD card slot</p> <p>8 1 GigE port</p> <p>9 One USB 3.0 port</p> <p>10 Two USB 2.0 ports</p> <p>11 Power meter and VFL</p> <p>12 OPTICAL 10G
Ethernet up to 10 Gbit/s
CPRI 1.2 to 9.8G
OBSAI 1.5G to 6.1G
OC-192/STM-64,
OC-48/STM-16,
OC-12/STM-4,
OC-3/STM-1,
OC-1/STM-0, OTU1, OTU2,
OTU1e, OTU2e, OTU1f,
OTU2f, 10GE LAN/WAN,
Ethernet 10/100/1000
BASE-T, 100M/1G optical,
FC 1x, 2x, 4x, 8x, 10x, 16x</p> | <p>13 HIGH SPEED
CFP4 interface
supporting OTU4, 100GE</p> <p>14 HIGH SPEED
QSFP28/QSFP+ interface
supporting OTU4, OTU3,
OTU3e1/e2, 100GE, 40GE</p> <p>15 REF CLOCK OUT
SMA interface</p> <p>16 EXT CLK
SMB interface</p> |
|--|--|--|

THE ULTRA-PORTABLE CHOICE FOR MULTISERVICE TESTING

The ongoing transition towards a converged network infrastructure for legacy DSn/PDH, ISDN, SONET/SDH, OTN, Fibre Channel, CPRI, OBSAI and packet-based, high-speed Ethernet services requires a test tool that is capable of covering a wide range of interfaces and rates without sacrificing portability, speed or cost. Leveraging the powerful, intelligent FTB-1 Pro handheld platform, the NetBlazer V2 Series streamlines processes and empowers field technicians to test and validate DSn/PDH, ISDN, SONET/SDH, OTN, Fibre Channel, CPRI and Ethernet circuits efficiently.

Powerful and fast

The NetBlazer V2 Series is a fully integrated DSn/PDH, ISDN, SONET/SDH, OTN, Fibre Channel, CPRI, OBSAI and high-speed Ethernet handheld tester. It features an 8-inch multitouch screen and unprecedented configuration simplicity. Multiple platform connectivity options including WiFi, Bluetooth, Gigabit Ethernet and USB ports, make it accessible in any environment.

DSN/PDH, ISDN, SONET/SDH, OTN, FIBRE CHANNEL, CPRI, OBSAI AND CARRIER ETHERNET UP TO 100G

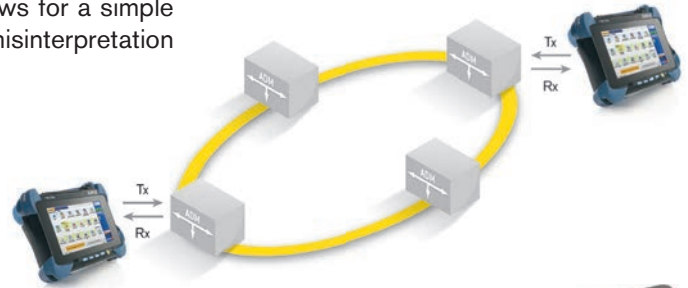
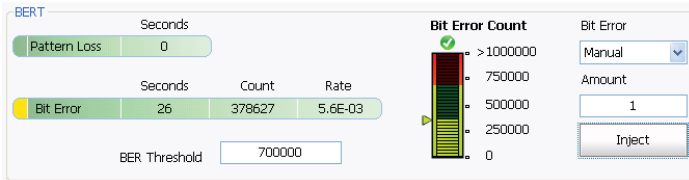
Key Testing Benefits

- › Up to 10G SONET/SDH
- › OTN bit-error-rate (BER) testing with configurable threshold settings
- › GCC 0/1/2 BERT test capability on OTN BERT
- › Coupled, Decoupled and Through mode testing
- › Error and alarm insertion and monitoring
- › Overhead monitoring and manipulation
- › High-order and low-order mappings
- › Tandem connection monitoring (TCM)
- › Pointer manipulation, including pointer sequence testing as per Telcordia GR-253, ANSI T1.105-03 and ITU-T G.783
- › Performance monitoring as per ITU-T G.821, G.826, G.828, G.829, M.2100 and M.2101
- › Frequency analysis and offset generation
- › Automatic protection switching
- › Service-disruption-time measurements
- › Round-trip delay measurements
- › DS1/DS3 and E1/E3/E4 testing
- › Dual DS1/DS3 receiver (Rx) support
- › DS1/DS3 autodetection of line code, framing and pattern
- › DS1 loop codes and NI/CSU emulation
- › DS1 automated multipattern BER
- › DS1/DS0 monitoring, including ABCD signaling bits
- › DS1 FDL and DS3 FEAC
- › Fractional T1/E1 testing
- › ISDN PRI for DS1 or E1 interfaces
- › External clock support
- › 10BASE-T to 100 GigE testing
- › Quad-port testing (8XXQ module only)
- › Dual-port testing
- › 10M-to-100G TCP throughput testing as per RFC 6349
- › SAM: ultra-simple ITU-T Y.1564 combined with RFC 6349
- › EtherSAM, RFC 2544, traffic generation and monitoring, and EtherBERT
- › 1588 PTP supporting G.8265.1 and G.8275.1 profiles and SyncE
- › Through mode and Smart Loopback
- › Cable testing, including power over Ethernet
- › Full line-rate packet capture and advanced filtering from 10M to 100G
- › IPv6 testing
- › VLANs, including E-VLAN, S-VLAN and C-VLAN
- › VLAN scan
- › Multiprotocol label switching (MPLS)
- › Asymmetrical testing with Dual Test Set (EtherSAM, RFC 2544, iSAM and RFC 6349)
- › Carrier Ethernet OAM (MEF, IEEE 802.1ag, ITU-T Y.1731 and ITU-T G.8113.1 MPLS-TP) and link OAM (IEEE 802.3ah)
- › Fibre Channel 1x, 2x, 4x, 8x, 10x, 16x
- › Framed CPRI BBU and RRH layer-2 link validation from 1.2 Gbit/s to 9.8 Gbit/s
- › Unframed and framed CPRI BER from 1.2 Gbit/s to 9.8 Gbit/s with SDT and RTD
- › Framed OBSAI BBU and RRH layer-2 link validation from 1.5 Gbit/s to 6.1 Gbit/s
- › iOptics intelligent pluggable optics test that quickly validates the sanity of an optical device
- › OpticalRF™ real-time high-resolution RF spectrum over CPRI
- › BBU emulation enabling RF level validation of RRHs, RET status and control and remote SFP identification
- › Wander timer error testing

KEY OTN, SONET/SDH AND DS_n/PDH FEATURES

Simplified BER testing

The NetBlazer V2 Series provides the ability to preconfigure bit-error-rate (BER) thresholds that are user-defined prior to running the test. This allows for a simple pass/fail verdict at the conclusion of the test, leaving no room for misinterpretation of the test results.



MULTISERVICE

Decoupled Mode

The Decoupled Mode enables the user to independently configure the Tx and Rx ports of the NetBlazer V2 Series module. This makes it possible to test the mapping and demapping functionality of a network element or at cross-connect points in the network.



Through Mode

This mode is required for in-service monitoring of the network. The NetBlazer V2 Series can be inserted in-line on a specific link to monitor and analyze the errors and alarms in a non-intrusive manner.

Complete overhead monitoring

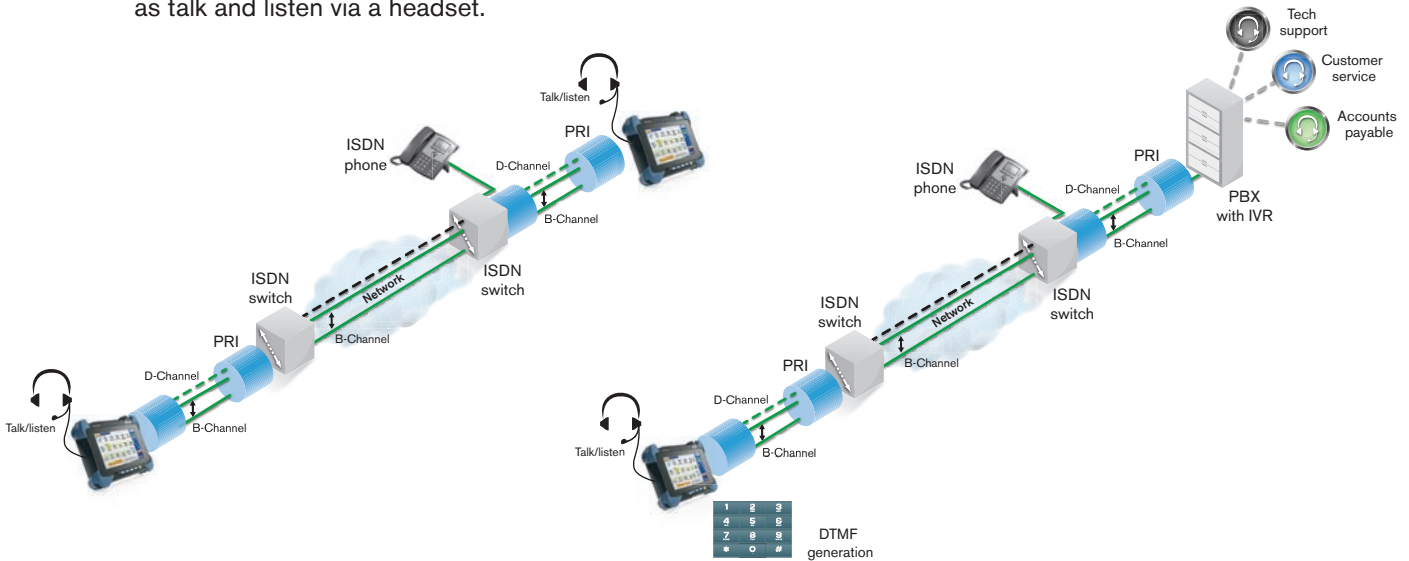
The NetBlazer V2 Series offers access to all SONET/SDH or OTN overhead (OH) bytes. Furthermore, by selecting any given OH byte, the user can retrieve additional detailed information about that byte without having to switch pages.

TX		RX		ODU2										Default OTN OH					
TX	1	F6		OA1		OA2		MFAS		SM		GCC0		RES		RES		JC	
	2	RES		PM & TCM		TCM ACT		TCM6		TCM5		TCM4		FTFL		RES		JC	
	3	TTI		BIP-8		00		TTI		BIP-8		00		TTI		BIP-8		00	00
	4	GCC1		GCC2		APS/PCC		RES		PSI		<<		NJO					
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16		
Legend:																			
TX: OTU FAS ODU OH																			
RX: OTU OH OPU OH																			



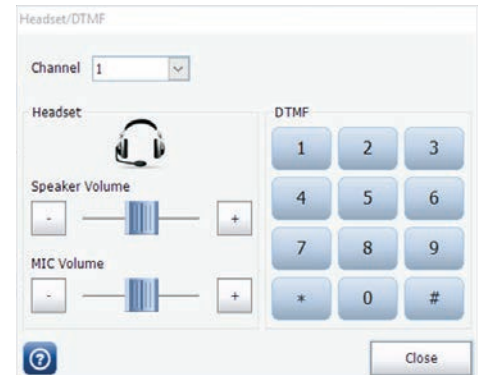
KEY ISDN FEATURES

The NetBlazer V2 Series lets you test and troubleshoot North American or European ISDN PRI configurations, and offers best-in-class ISDN PRI testing by allowing field technicians to call one or all 23 DS1 or 31 E1 PRI channels. Once connected, the user can go channel by channel to perform a BER test on individual or all channels, as well as talk and listen via a headset.



Talk? Listen? Inject DTMF?

With one click, field technicians can talk and listen with simplicity—no need for a clumsy butt set. The FTB-1 Pro platform enables the use of a lightweight talk/listen headset, which can be controlled via software to inject dual-tone multifrequency (DTMF) tones, and control volume and microphone levels.



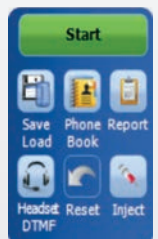
Who's calling? What type of calls?

As calls come in or leave the ISDN primary rate interface, the summary results screen shows a crystal-clear analysis with its own unique call-monitoring grid. In a single glance, users can see all call information: types of calls and statistics such as idle, voice, 3.1 kHz, ringing, alerts, bit error, and pass or fail.

1 Idle	2 Voice	3 Alerting	4 3.1 kHz	5 Idle	6 Voice
7 Idle	8 Ringing	9 Ringing	10 3.1 kHz	11 No Alarm	12 Idle
13 Idle	14 Voice	15 Voice	16 No Alarm	17 Bit Error	18 Voice
19 Idle	20 No Alarm	21 Idle	22 Bit Error	23 No Alarm	24 3.1 kHz
25 Idle	26 Idle	27 Idle	28 No Alarm	29 Pattern	30 Voice

Centralized control

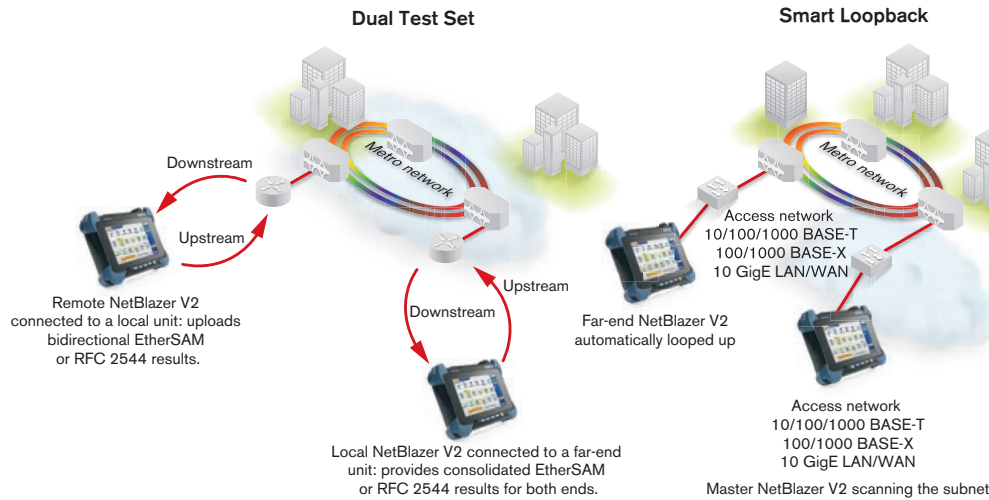
With the NetBlazer V2 Series, field technicians have complete control at their fingertips at all times. Whether that applies to a phone book, headset activation, DTMF injection, error injection, report generation, or save and load configurations, all utilities are just a tap of a finger away from activation.



KEY ETHERNET FEATURES

Intelligent network discovery mode

Using the NetBlazer V2 Series, you can single-handedly scan the network and connect to any available EXFO datacom remote tester. Simply select the unit to be tested and choose whether you want traffic to be looped back via Smart Loopback or Dual Test Set mode for bidirectional EtherSAM, RFC 6349 or RFC 2544 results. As such, you no longer need an additional technician at the far end to relay critical information—the NetBlazer V2 Series takes care of everything.



Smart Loopback flexibility

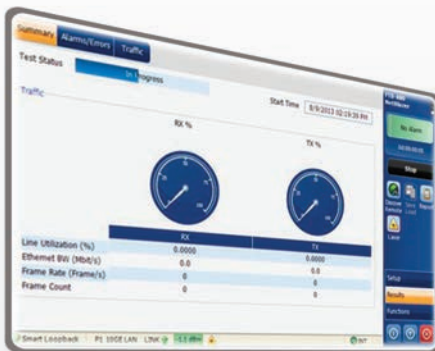
The Smart Loopback functionality has been enhanced to offer five distinct loopback modes. Whether you are looking to pinpoint loopback traffic from a user-datagram-protocol (UDP) or TCP layer, or all the way down to a completely promiscuous mode (Transparent Loopback mode), the NetBlazer V2 Series has the flexibility to adjust to all unique loopback situations.

Dual-Port and Through Mode testing

With dual-port testing, one technician can use a single NetBlazer V2 Series module to launch either EtherSAM or RFC 2544, and obtain bidirectional results using only one module. With traffic generation and monitoring, and EtherBERT tests, the technician can set up two distinct tests, one on port 1 and the other on port 2. Both ports can also be bound to different interfaces (e.g., 10BASE-T electrical on port 1 and 10 GigE on port 2).

VLAN/MPLS

Today's networks are expected to deliver high performance. To meet such high expectations, service providers must rely on various mechanisms, such as Ethernet tagging, encapsulation and labeling. Thanks to these additions, service providers can enhance security, scalability, reliability and performance. The NetBlazer V2 Series supports virtual-local-area-network (VLAN) tags, Q-in-Q VLAN tags and multiprotocol label switching (MPLS).





ETHERSAM: THE NEW STANDARD IN ETHERNET TESTING

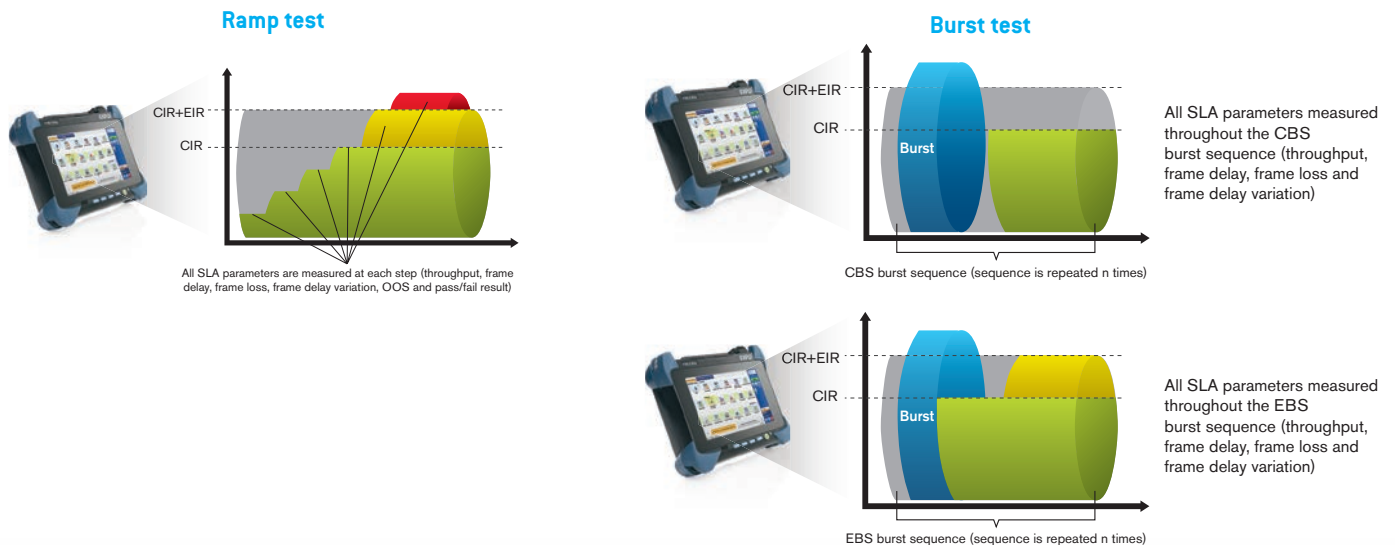
RFC 2544 used to be the most widespread Ethernet testing methodology. However, it was designed for network-device testing in the lab, not service testing in the field. ITU-T Y.1564, the new standard for turning up and troubleshooting Carrier Ethernet services, has a number of advantages over RFC 2544, including validation of critical service-level agreement (SLA) criteria, such as packet jitter and quality-of-service (QoS) measurements. This methodology is also significantly faster, thereby saving time and resources while optimizing QoS.

EXFO's EtherSAM test suite—based on the ITU-T Y.1564 Ethernet service activation methodology—provides comprehensive field testing for mobile backhaul and commercial services.

Contrary to other methodologies, EtherSAM supports new multiservice offerings and can simulate all types of services that will run on the network while simultaneously qualifying all key SLA parameters for each of these services. To prioritize the different service types, EtherSAM validates the QoS mechanisms provisioned in the network, resulting in better troubleshooting, more accurate validation and much faster deployment. EtherSAM consists of two phases, the service configuration test and the service performance test.

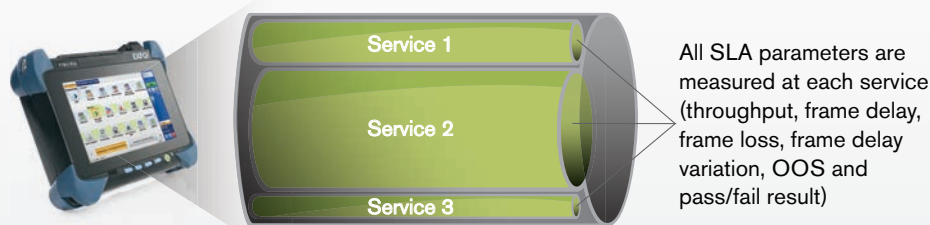
Service configuration test

The service configuration test involves sequentially testing each service to validate that it is properly provisioned and that all specific key performance indicators (KPIs) or SLA parameters have been met. A ramp test and burst test are performed to verify the committed information rate (CIR), excess information rate (EIR), committed burst size (CBS) and excess burst size (EBS).



Service performance test

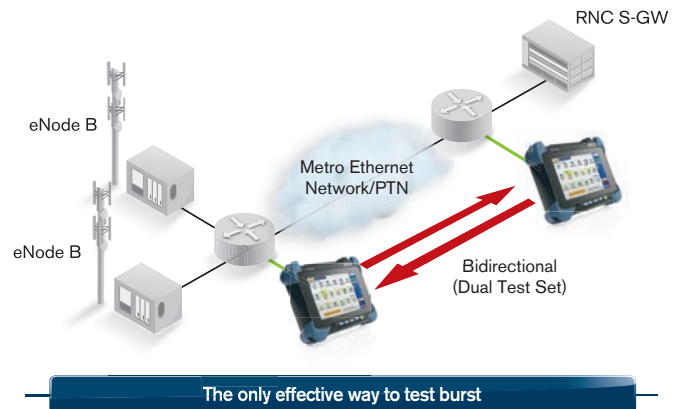
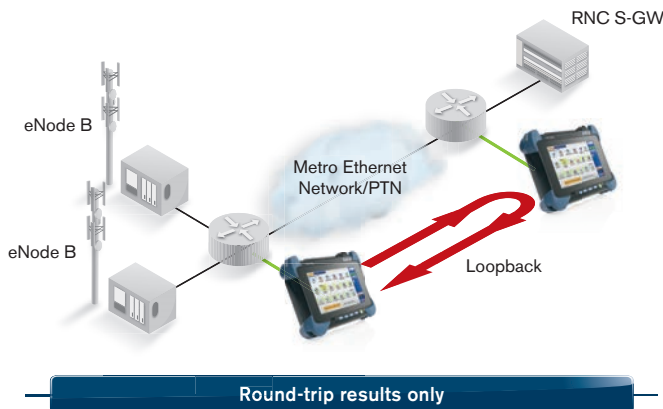
Once the configuration of each individual service has been validated, the service performance test simultaneously validates the quality of all the services over time.





ETHERSAM BIDIRECTIONAL RESULTS

EXFO's EtherSAM approach proves even more powerful as it executes the complete ITU-T Y.1564 test with bidirectional measurements. Key SLA parameters are measured independently in each test direction, thus providing 100% first-time-right service activation—the highest level of confidence in service testing.



iSAM

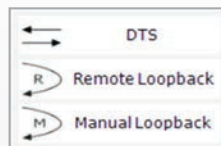
With iSAM, which includes Y.1564 (EtherSAM) and optional RFC 6349, the focus is on minimalism and simplicity, making both tests as simple as possible for all users. This is in sharp contrast with the current situation in the test and measurement market today. One key aspect of iSAM's simplicity lies in its efficiency: it only requires a limited number of steps to set up, run and receive valid test results.

The core objective of iSAM is to remove friction between the user and the testing solution. The end goal is to enable field technicians of any skill level to set up and run an iSAM test, and all of this is done within a one-page setup.

The innovation does not stop there. iSAM also takes the lead in delivering the latest test and measurement standards. iSAM has achieved an industry first by introducing actual Metro Ethernet Forum (MEF) standards and thresholds to guarantee that service providers, mobile network operators and multisystem operators are able to test against the latest MEF 23.1 standard.



One-page setup



Multiple modes of connection

Summary **Logger**

Service Configuration Test Completed, Pass Start Time: 10/15/2015 11:04:42 AM

Service	TX CIR (Mbps)	RX CIR (Mbps)	Delay (ms)	Jitter (ms)	RL Rate (Mbps)
1 Priority	20.0	20.0	0.241	0.116	19.9999
2 Priority	30.0	30.0	0.2	0.116	29.9999
3 Priority	40.0	40.0	0.242	0.116	39.9999

Service Performance Test Completed, Pass

Service	TX CIR (Mbps)	RX CIR (Mbps)
1 Priority	20.0	20.0
2 Priority	30.0	30.0
3 Priority	40.0	40.0

Total RX Rate: L=0 89.9997 Mbps) R=0 89.9997

Buttons: Pass, Start, Stop, Report, Link, Log

One-page results

DUAL PORT

The dual-port testing feature enables technicians to use a single Power Blazer module to launch two simultaneous tests (one on port 1 and the other on port 2), including rates from 10M to 100G. Having a separate set of statistics for alarms and errors provides the capability to inject errors independently. This feature helps technicians reduce testing time during new link implementations.



CABLE TEST WITH POWER OVER ETHERNET (PoE)

The cable test helps field technicians quickly and efficiently detect cable issues. Using this feature with the NetBlazer V2 Series, technicians can troubleshoot any cabling or installation issue by checking the cable's actual pin-out, wire map, cable length, distance-to-fault and propagation delay. With the addition of PoE, technicians can check for the following: presence of power, the power-supply equipment type, power class rating, voltage, current and power in watts. Whether a technician needs to validate a basic component such as a PoE-powered VoIP phone, or an actual PoE-powered small cell, the NetBlazer V2 Series fits the bill for basic to critical devices.



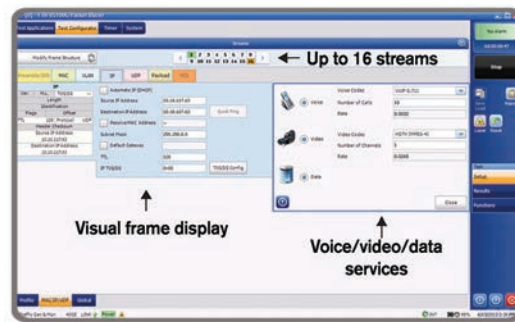


TRAFFIC GENERATION AND MONITORING

The NetBlazer V2 Series surpasses the multistream offerings of typical handheld Ethernet testing devices. Up to 64 streams of traffic (available on 870Q or 880Q modules) can be configured by a technician in order to test just about any frame format: Ethernet II, 802.3 SNAP, IPv4, IPv6, three levels of VLANs, MPLS, UDP and TCP. Each stream has an analog visual gauge and user-definable pass/fail thresholds that instantly show whether the test traffic is in or out of the expected ranges of the SLA.

Layer-2 Transparency Testing

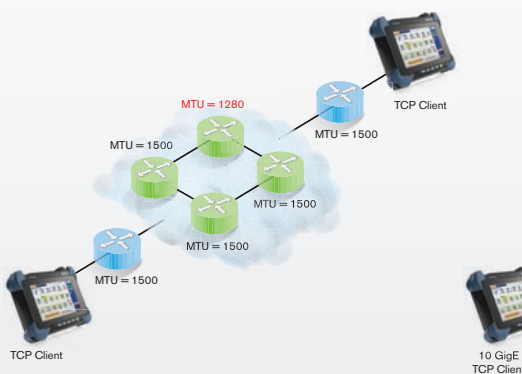
The NetBlazer V2 Series uses a new virtual frame display that allows field technicians to easily configure multiple streams and their parameters, including the ability to modify the source medium-access-control (MAC) address and EtherType. This makes it possible to test layer-2 protocols such as Cisco discovery protocol (CDP), VLAN trunking protocol (VTP) and link layer discovery protocol (LLDP). For added simplification, there are also predefined factory configurations capable of automatically loading up to ten layer-2 protocols simultaneously.



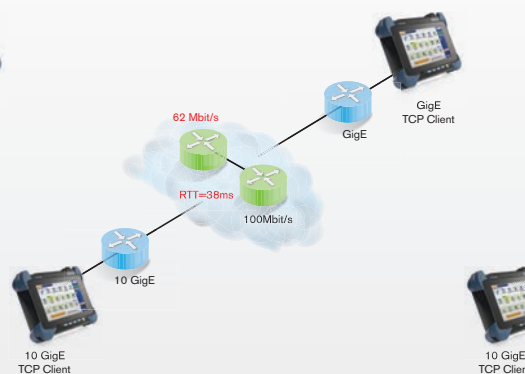
RFC 6349

The Internet Engineering Task Force (IETF) ratified RFC 6349 as a new method for validating an end-to-end TCP service. This new TCP throughput test methodology provides a repeatable standards-based test that validates TCP applications such as web browsing, file transfer, business applications and streaming video. After running the RFC 6349 test, service providers will have all the metrics needed to optimize TCP performance from within their networks or customer premises equipment.

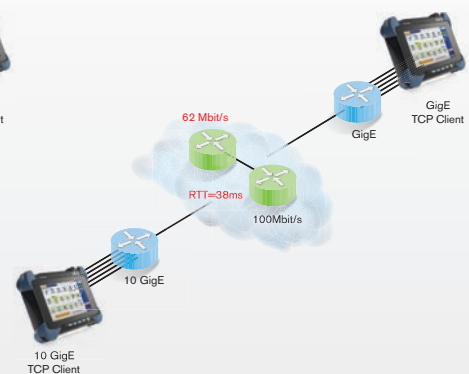
The RFC 6349 test is important, because it includes the following steps that help locate and diagnose TCP issues correctly. The first step consists of finding the maximum transmission unit (MTU) size. This ensures that the network is not fragmenting the traffic. The second step is aimed at determining the baseline round-trip delay, which means letting the technician know that this latency value is the best-case scenario that the network under test can deliver. The third step uses either single or multiple TCP connections to fill the pipe and then report back the actual TCP throughput. Once the test is complete, all TCP metrics are clearly laid out. If changes are required to optimize the TCP performance, the technician will have all the values needed to rectify the situation. In the end, the RFC 6349 test helps to resolve any potential discrepancies occurring between the service provider network and the customer premises equipment.



PATH MTU discovery



Baseline RTT and bandwidth to determine the ideal window size

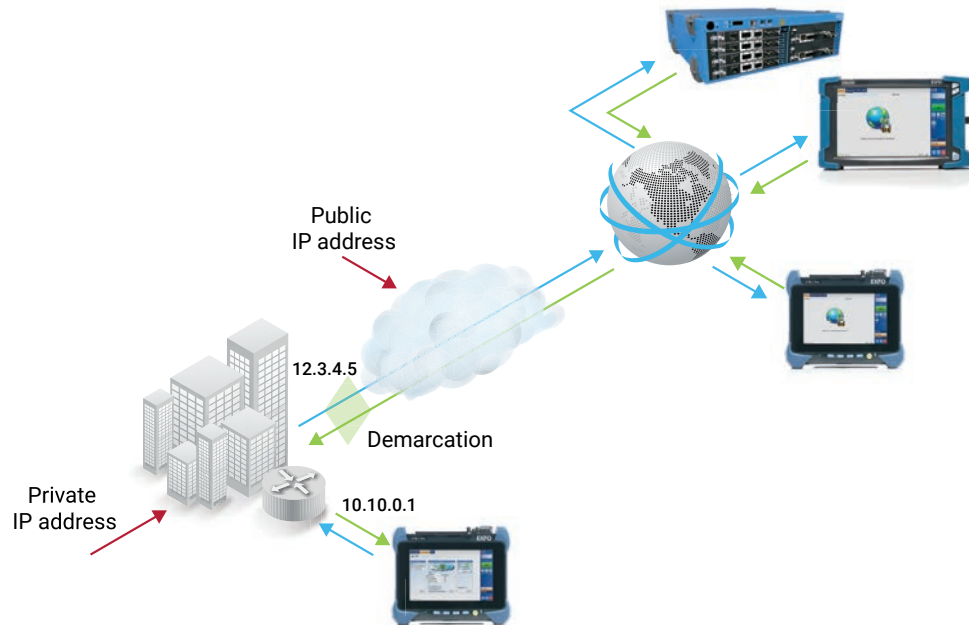


Single or multiple TCP connections to enable full pipe testing



DUAL TEST SET – NETWORK ADDRESS TRANSLATION

Bidirectional testing between a private and public network is a hassle because of extensive network configurations, so service providers are limiting their tests at the demarcation point that is located only in the public network. However, Business Ethernet customers are continually complaining of network problems that are impossible for service providers to pinpoint if they don't or can't look beyond the public/private demarcation point.



Why stop at the demarcation point when you can troubleshoot Business Ethernet service issues directly from inside the customer's network?

Only EXFO offers end-to-end bidirectional testing from within private networks using our patent-pending Dual Test Set Network Address Translation (DTS-NAT) capability. DTS-NAT enables a router to act as an agent between the internet (public network) and a local (private) network. With the easy-to-use dual test set feature, the NetBlazer V2 Series can connect to a remote EXFO test unit located anywhere on the network without any port forwarding or the help of a high-level technician.

EXFO's DTS-NAT feature is truly unique in that it enables service providers to pinpoint issues all the way into customers' networks—when stopping at the demarcation point simply isn't enough to locate difficult network issues. Testing from within the private network will provide you with accurate data to handle serious disputes, meet your customers' service expectations and ultimately reduce churn.

The DTS-NAT feature delivers:

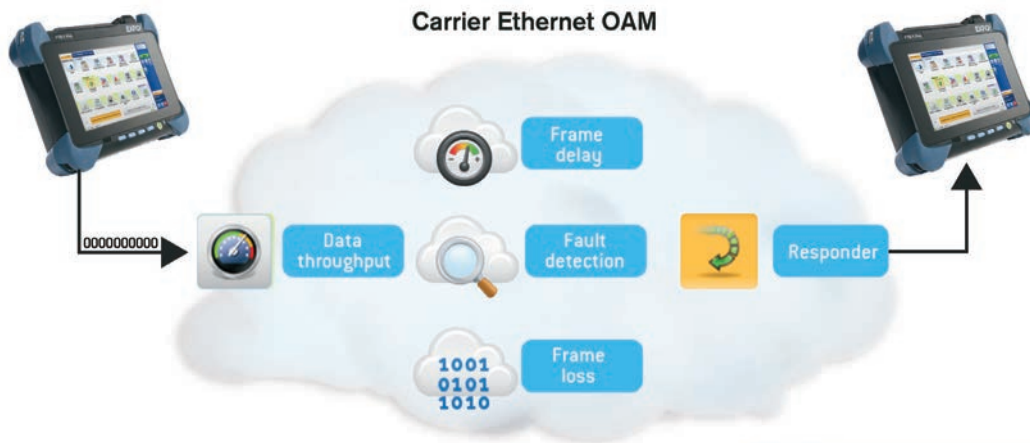
- › One-of-a-kind automated discovery of NAT-enabled networks
- › Fully bidirectional testing through:
 - › EtherSAM—layer 2/layer 3, as per ITU-T Y.1564
 - › Layer 4 TCP, as per RFC 6349
 - › iSAM—intelligent service activation methodology (compliant with both Y.1564 & RFC 6349)
- › Up to eight simultaneous tests using the LTB-8



CARRIER ETHERNET OAM

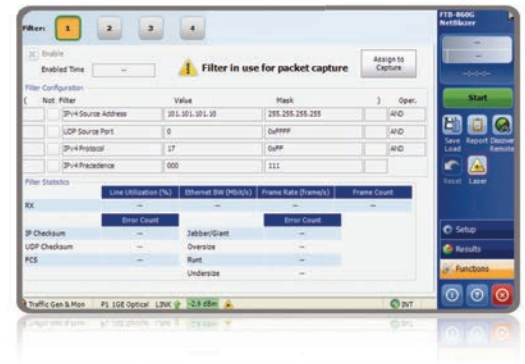
Ever since the introduction of metro Ethernet networks, there has been a need to ensure “five nines” level of availability, and reliability, as well as a 50 millisecond recovery time from failures. As per PDH, time-division multiplexing (TDM) and SONET/SDH, operations, administration and maintenance (OAM) has become a crucial network component that has enabled the same quality for carrier-class Ethernet.

The NetBlazer V2 Series offers a new application that validates the mechanics of the service operation, administration and maintenance (S-OAM) tools, covering ITU-T Y.1731, IEEE 802.1ag, IEEE 802.3ah, ITU-T G.8113.1 (MPLS-TP) and MEF modes. The features of this application include continuity check generation and monitoring, loopback testing, frame loss, synthetic loss and frame delay. There is also an S-OAM link trace and responder.



PACKET CAPTURE

The capturing power of EXFO's NetBlazer V2 Series extends far beyond basic capabilities. The NetBlazer V2 Series adds extra features and functionalities to boost test cycle efficiency and provide more value. Its packet capture tool offers comprehensive filtering, triggering and truncation methods to target specific traffic and quickly pinpoint issues in the lab and in the field.



ADVANCED TRAFFIC FILTERING

In some cases, troubleshooting only concerns a particular traffic flow. The advanced traffic-filtering capability of the NetBlazer V2 Series allows you to restrict traffic by using up to four matching fields and operands (And/Or/Not). A complete set of triggers is available, such as MAC, IP and TCP/UDP fields, as well as VLAN and MPLS fields.

iOptics

The intelligent Pluggable Optics (iOptics) test application is a first-alert test that can be used in field or lab environments to efficiently evaluate the proper operation of an optical device with minimal user configuration required. This test application performs that validation using several sub-tests in addition to monitoring an optical device's power consumption and temperature; it reports a global and individual verdict for each sub-test and monitoring task. The test application also automatically collects the device manufacturing information enabling the user to determine whether or not the desired device has been tested.



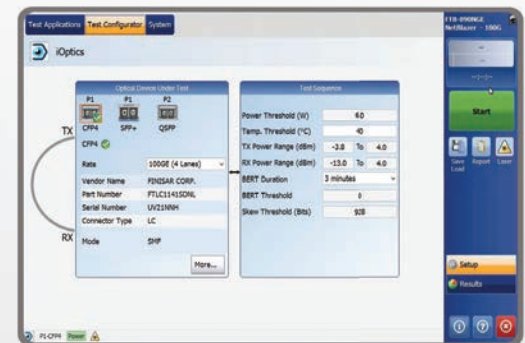
SFP/SFP+



CFP4



QSFP+/
QSFP28





FRONTHAUL/FTTA/C-RAN TESTING

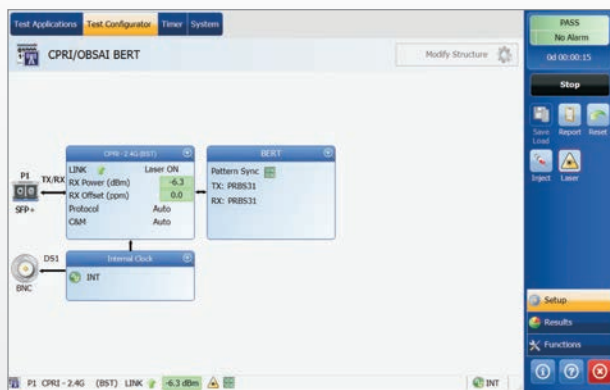
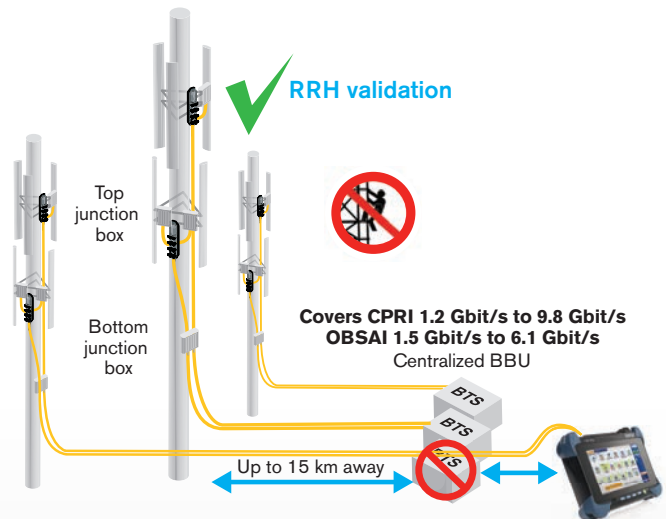
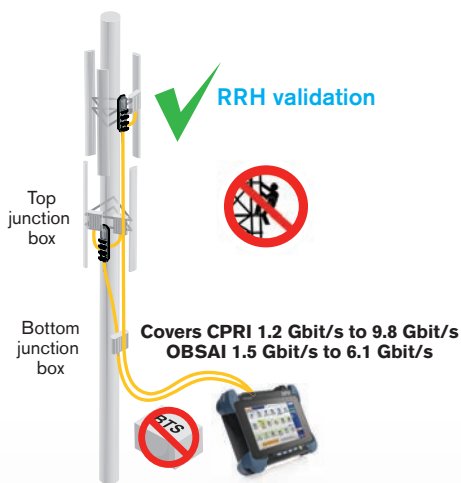
With the NetBlazer V2 modules, field technicians can carry out a variety of FTTA tests. For instance, when installing an RRH, it is critical that all equipment be verified before the riggers have finished the construction phase. The NetBlazer V2 Series CPRI/OBSAI protocol feature verifies that the RRH is fully operational and that the correct small form-factor pluggable (SFP) transceivers are installed and connected correctly.

Using the NetBlazer V2 Series enabled with the layer-2 CPRI/OBSAI protocol, technicians can easily connect to the RRH without having to climb the cell tower. Regardless of whether the cell site's BBU is connected to the RRH, the NetBlazer V2 is always ready to validate a CPRI/OBSAI-enabled BBU. Once connected to the RRH, the NetBlazer V2 is able to supply the field technician with a complete analysis of vital CPRI/OBSAI statistics.

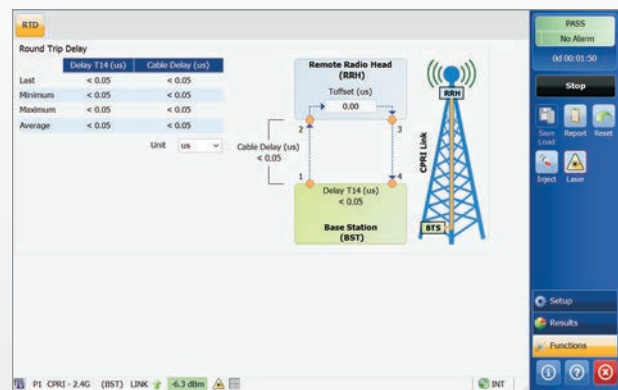
Having this information readily accessible enables field technicians to ensure that the RRH is working at the correct, specified line rate, and that it is timed and fully transmitting continuous frames from the top to the bottom of the tower. In addition, the reverse verification can be made by using the NetBlazer V2 Series to validate the RRH in order to validate the CPRI/OBSAI link with the BBU.

Moving closer toward CPRI/OBSAI-enabled infrastructures, a significant challenge arises as a result of human error occurring between the RRH and the BBU; faulty configurations, bad wiring and incorrect SFPs can lead to problems when trying to initialize the CPRI start-up sequence between the BBU and RRH. The NetBlazer V2 Series test suite better equips field technicians to decipher and solve these basic yet very costly human errors.

Finally, using the NetBlazer V2 Series modules, field technicians can perform an unframed and framed layer-2 CPRI/OBSAI BER test. The NetBlazer V2 Series modules are able to validate that the fiber from the BBU located at the base of the tower or kilometers away in a Cloud-RAN environment is running with the expected latency and is error-free.



Framed CPRI/OBSAI test



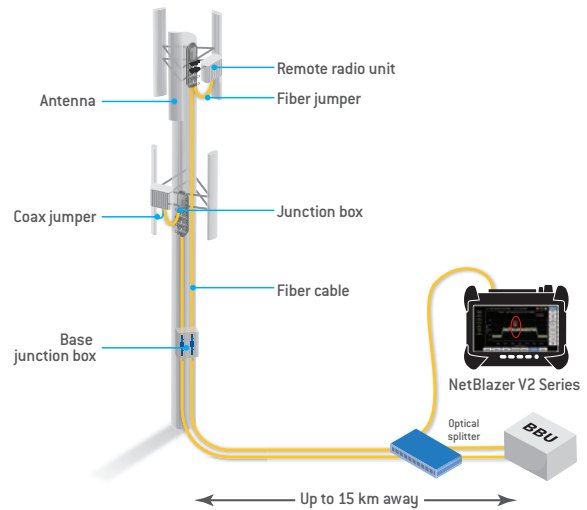
CPRI/OBSAI round-trip delay



RF SPECTRUM ANALYSIS OVER CPRI

Most of today's modern mobile installations interconnect baseband units (BBUs) and far-end remote radio heads (RRHs) with fiber optic cables. This new network configuration, known as fronthaul, provides many advantages. RRHs can now be physically separated from BBUs. However, with this new mobile installation, analog RF signals can only be accessed at RRHs, which are often placed in hard-to-reach locations, such as tower tops or rooftops.

The NetBlazer V2 Series offers a new application that eliminates dangerous and difficult climbs by providing access to RF signals through the digital CPRI link available at the BBU site (at the bottom of the tower or at the BBU hotel located kilometers away). The digital link uses the CPRI protocol to carry RF signals in digital format (IQ data). By accessing the RF signal at the BBU location, costs associated with truck rolls and tower climbs are reduced. In addition, time to resolution of complex RF issues is accelerated by multiple user collaboration via remote access capabilities to EXFO's OpticalRF application from any smart device or laptop.



REAL-TIME HIGH-RESOLUTION RF SPECTRUM ANALYSIS OVER CPRI

OpticalRF on the NetBlazer V2 modules provides the most powerful real-time high-resolution RF spectrum analysis over CPRI. It automatically scans for the correct CPRI rate option and configures it to get an active link.

OpticalRF is an easy-to-use solution that quickly identifies issues, such as external RF interference, internal PIM and external PIM. It detects RF interference even when the BBUs are kilometers away at more convenient locations, such as in a centralized radio access network (C-RAN) architecture.

RF INTERFERENCE ANALYSIS WITH MULTI-ANTENNA DISPLAY

OpticalRF provides the ability to display multiple antenna carriers (AxC) at the same time. Multiple antenna carriers can be displayed either in a side-by-side or overlaid view. PIM detection combined with a pass or fail verdict facilitates the ability to visualize diversity imbalances or passive intermodulation (PIM).



Dual AxC overlay display

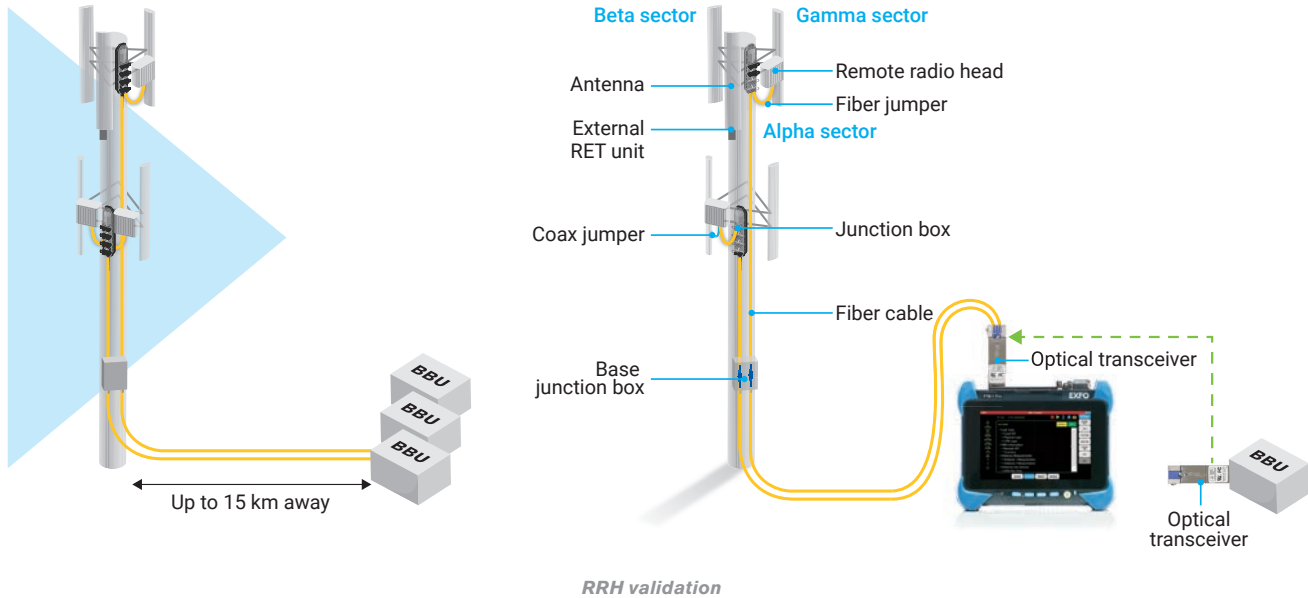


Dual AxC side-by-side display



BASEBAND UNIT (BBU) EMULATION

EXFO's BBU emulation feature enables mobile contractors, technicians and engineers to ensure that cell sites are installed correctly the first time, prior to handing them over to the mobile network operator (MNO) for integration. The solution is designed for simple one-click operation with clear pass/fail verdicts, enabling problems to be isolated quickly and successful test reports to be generated, creating a "birth certificate" for the cell site.



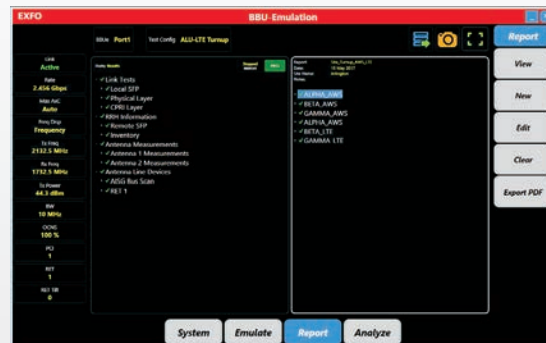
RRH validation

EXFO's BBU emulation solution includes:

- › CPRI layer-2 link tests
- › RRH configuration and information
- › Local and remote SFP identification
- › AISG bus scan
- › Voltage standing wave ratio (VSWR) and receive signal strength indicator (RSSI)
- › PIM testing
- › RRH physical cell identification (PCI)
- › Antenna remote electrical tilt (RET)
- › Orthogonal channel noise simulation (OCNS)
- › Over-the-air (OTA) LTE transmission



BBU emulation turn-up



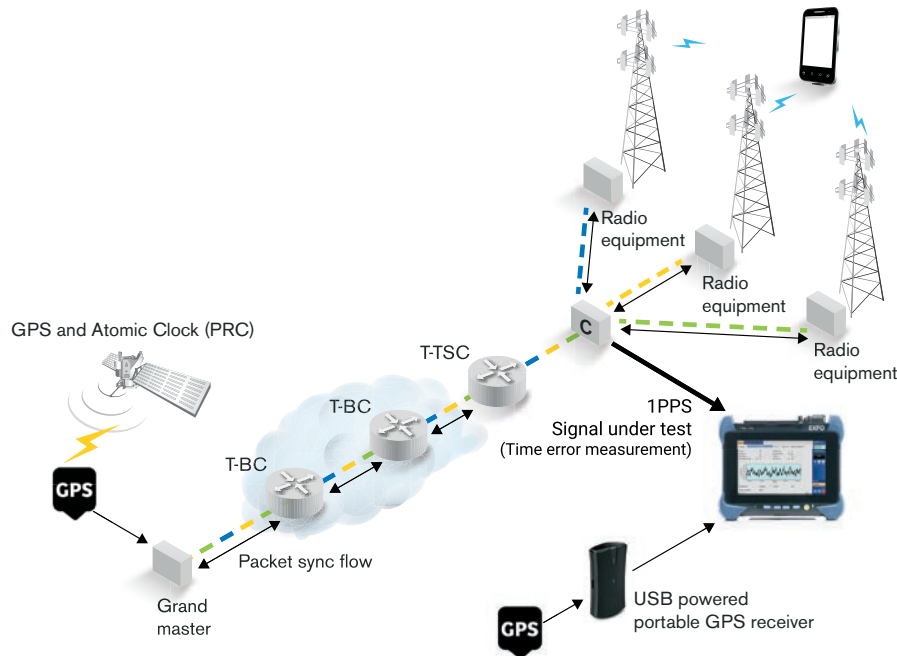
BBU emulation site report



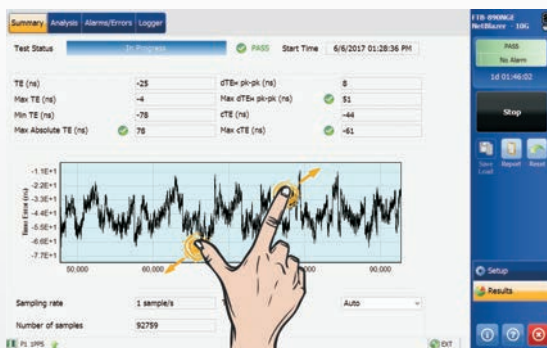
WANDER

MNOs face continuous pressure related to the synchronization of their multiple network elements. Typical deployments involve not only a primary reference time clock and a telecom grand master clock, but also several telecom boundary clocks (T-BC) and telecom time secondary clocks (T-TSC) that feed network elements directly connected to the radio equipment (RE) at the cell towers. A time error budget is defined for different reference points of the network.

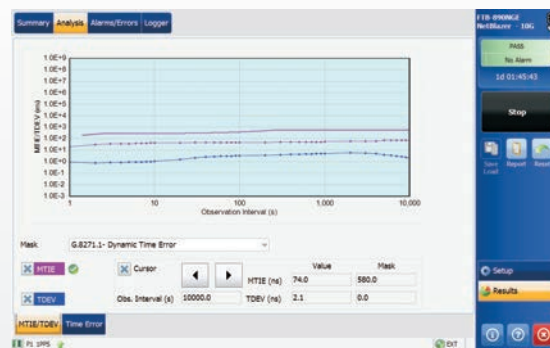
With 5G technology soon to be widely deployed, time constraints are even higher. MNOs must—more than ever—validate that their reference clocks at multiple points of the network are compliant to standardized time error thresholds and expected time error budgets.



EXFO's Wander application delivers all the test results that MNOs require in order to diligently evaluate the reference signal/clock during turn-up or troubleshooting at cell tower locations. The Wander application performs multiple time error measurements such as Maximum Absolute Time Error (Max |TE|), dynamic Time Error (dTE), constant Timer Error (cTE), Maximum Time Interval Error (MTIE), Time Deviation (TDEV), etc. The Wander application automatically evaluates if the signal under test meets different standardized masks such as the MTIE mask defined by ITU G.8271.1, G.8261, G.8282, G.811, G.812, G.813 and others. Signals under evaluation can be 1PPS, Ethernet-SyncE at various rates, such as 2 MHz, etc. Verdicts are presented to the user based on several different criteria. The Wander feature also allows users to zoom into time error graphical results of tests that last up to five days. Synchronization experts can easily identify the most important events during their time error measurements.



Wander results/multitouch pinch-to-zoom



Wander analysis

EFFICIENTLY ASSESSING THE PERFORMANCE OF FIBRE CHANNEL SERVICES

The NetBlazer V2 Series modules provide comprehensive testing capabilities for Fibre Channel (FC) network deployments, supporting multiple FC interfaces.

APPLICATIONS

Since most storage area networks (SANs) cover large distances, and because FC has stringent performance requirements, it is imperative to test at each phase of network deployment to ensure appropriate service levels. EXFO's NetBlazer V2 Series modules provide full wire-speed traffic generation at the FC2 layer, which allows for BER testing for link integrity measurements. The NetBlazer V2 Series also supports latency, buffer-to-buffer credit measurements for optimization, as well as login capabilities.

Latency

Transmission of frames in a network is not instantaneous and is subject to multiple delays caused by the propagation delay in the fiber and the processing time inside each piece of network equipment. Latency is the total accumulation of delays between two endpoints. Some applications, such as VoIP, video and storage area networks, are very sensitive to excess latency.

Therefore, it is critical for service providers to properly characterize network latency when offering FC services. The NetBlazer V2 Series modules estimate buffer-to-buffer credit value requirements from the performed latency measurement.

Buffer-to-buffer credit estimation

In order to regulate traffic flow and congestion, FC ports use *buffers* to temporarily store frames. The number of frames a port can store is referred to as a *buffer credit*. Each time a frame is received by a port, an acknowledgement frame is sent. The buffer-to-buffer credit threshold refers to the amount of frames a port can transmit without receiving a single acknowledgement.

This is a crucial configuration parameter for optimal network performance. Usually, network administrators calculate the value by taking the traveled distance and the data rate into consideration; however, since latency issues are not considered, poor accuracy is to be expected. The NetBlazer V2 Series modules are capable of estimating buffer credit values with respect to latency by calculating the distance according to the round-trip latency time. This value can then be used by network administrators to optimize the network configuration.

Login testing

Most new-generation transport devices (xWDM or SONET/SDH MUX) supporting FC are no longer fully transparent; they also have increased built-in intelligence, acting more as FC switches. With switch fabric login ability, the NetBlazer V2 Series modules support connections to a remote location through a fabric or semitransparent network.

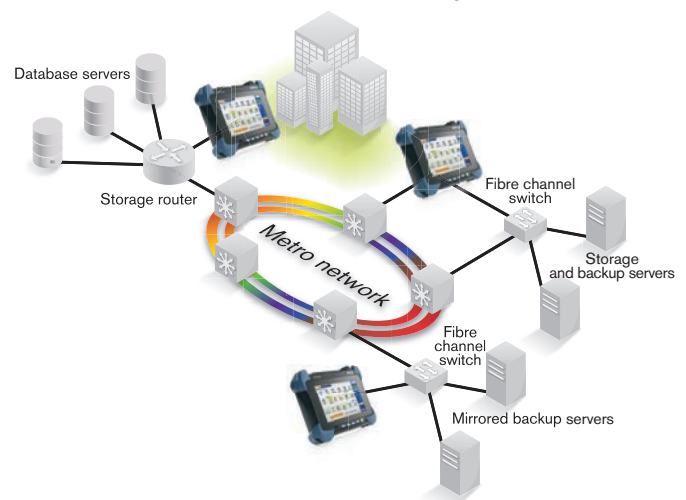
The login process not only permits the unit to connect through a fabric, but it also exchanges some of the basic port characteristics (such as buffer-to-buffer credit and class of service) in order to efficiently transport the traffic through the network.

The login feature allows for automatic detection of port/fabric login, login status (successful login, in progress, failure and logout) and response to remote buffer-to-buffer advertised credit.

COMPLETE SUITE OF FIBRE CHANNEL INTERFACES

Interface	Signal rate (Gbit/s)	Data rate (Mbit/s)
1X	1.0	100
2X	2.1	200
4X	4.2	400
8X	8.5	800
10X	10.5	1200
16X	14.025	1600

End-to-end networking



Thanks to end-to-end network testing capabilities, EXFO's NetBlazer V2 Series enables fast deployment and configuration of FC networks. Communication between the transport network, interconnection devices and end nodes can be validated with features such as BER testing, latency measurement, buffer-to-buffer credit estimation and port login capabilities.



EXFO TFv
Test Function Virtualization

EXFO TFv

EXFO TFv—Test Function Virtualization is a cloud-based suite of defined offerings for service providers who are looking to scale their testing requirements to their specific needs. Under the EXFO TFv umbrella are FTB Anywhere floating licenses, and the newly launched FTB OnDemand time-based software licenses.

FTB Anywhere: Floating Test Licenses

FTB Anywhere is an EXFO Connect-enabled offering that allows FTB platform users to share floating test licenses and get the required functionality—anywhere, anytime. In short, the customer owns the software licenses and can share them between FTB platforms.

FTB OnDemand: Time-Based Software Licenses

FTB OnDemand allows customers to activate time-based software licenses covering a wide range of test functionalities (e.g., 100G testing) to match their exact needs. FTB OnDemand enables users to obtain a license for a specific test for a specific module for a specific period of time. FTB OnDemand is available for a number of best-in-class EXFO test modules. For a complete list of all the available modules, visit our FTB OnDemand web page.

EXFO | Connect

AUTOMATED ASSET MANAGEMENT. PUSH TEST DATA IN THE CLOUD. GET CONNECTED.

EXFO Connect pushes and stores test equipment and test data content automatically in the cloud, allowing you to streamline test operation from build-out to maintenance.

EXPERT TEST TOOLS ON THE FTB-1 PRO PLATFORM

EXpert Test Tools is a series of platform-based software testing tools that enhance the value of the FTB-1 Pro platform, providing additional testing capabilities without the need for additional modules or units.

EXpert TEST TOOLS

EXpert

VoIP TEST TOOLS

The EXpert VoIP Tools generate a voice-over-IP call directly from the test platform to validate performance during service turn-up and troubleshooting.

- Supports a wide range of signaling protocols, including SIP, SCCP, H.248/Megaco and H.323
- Supports mean-opinion-score (MOS) and R-factor quality metrics
- Simplifies testing with configurable pass/fail thresholds and RTP metrics

EXpert

IP TEST TOOLS

The EXpert IP Tools integrate six commonly used datacom test tools into one platform-based application to ensure that field technicians are prepared for a wide range of testing needs.

- Rapidly performs debugging sequences with VLAN scan and LAN discovery
- Validates end-to-end ping and traceroute
- Verifies FTP performance and HTTP availability

EXpert

IPTV TEST TOOLS

This powerful IPTV quality-assessment solution enables set-top box emulation and passive monitoring of IPTV streams, allowing for quick and easy pass/fail verification of IPTV installations.

- Real-time video preview
- Analyzes up to 10 video streams
- Comprehensive QoS and quality-of-experience (QoE) metrics, including MOS score



EXFO

ELECTRICAL ETHERNET INTERFACES

One port: 10/100 BASE-T half/full duplex, 1000BASE-T full duplex Automatic or manual detection of straight/crossover cable			
Electrical interface	10BASE-T	100BASE-TX	1000BASE-T
Tx bit rate	10 Mbit/s	125 Mbit/s	1 Gbit/s
Tx accuracy (uncertainty) (ppm)	±4.6	±4.6	±4.6
Rx bit rate	10 Mbit/s	125 Mbit/s	1 Gbit/s
Rx measurement accuracy (uncertainty) (ppm)		±4.6	±4.6
Duplex mode	Half and full duplex	Half and full duplex	Full duplex
Jitter compliance	IEEE 802.3	IEEE 802.3	IEEE 802.3
Connector	RJ45	RJ45	RJ45
Maximum reach (m)	100	100	100

DSN/PDH AND SONET/SDH ELECTRICAL INTERFACES

Electrical interface	DS1	E1/2M		E3/34M	DS3/45M		STS-1e/STM-0e/52M	E4/140M	STS-3e/STM-1e/155M	
Tx pulse amplitude	2.4 to 3.6 V	3.0 V	2.37 V	1.0 ±0.1 V	0.36 to 0.85 V			1.0 ±0.1 Vpp	0.5 V	
Tx pulse mask	GR-499 Figure 9-5	G.703 Figure 15	G.703 Figure 15	G.703 Figure 17	DS-3 GR-499 Figure 9-8	45M G.703 Figure 14	GR-253 Figure 4-10/4-11	G.703 Figure 18/19	STS-3e GR-253 Figure 4-12, 4-13, 4-14	STM-1e/ 155M G.703 Figure 22 and 23
Tx LBO preamplification	0-133 ft 133-266 ft 266-399 ft 399-533 ft 533-655 ft				0 to 225 ft 225 to 450 ft		0 to 225 ft 225 to 450 ft		0 to 225 ft	
Cable simulation	-22.5 dB -15.0 dB -7.5 dB 0 dB				450 to 900 (927) ft		450 to 900 (927) ft			
Rx level sensitivity	For 772 kHz: TERM: ≤26 dB (cable loss only) at 0 dBdsx Tx DSX-MON: ≤26 dB (20 dB resistive loss + cable loss ≤ 6 dB) Bridge: ≤6 dB (cable loss only)	For 1024 kHz: TERM: ≤6 dB (cable loss only) MON: ≤26 dB (20 dB resistive loss + cable loss ≤ 6 dB) Bridge: ≤6 dB (cable loss only)	For 1024 kHz: TERM: ≤6 dB (cable loss only) MON: ≤26 dB (20 dB resistive loss + cable loss ≤ 6 dB) Bridge: ≤6 dB (cable loss only)	For 17.184 MHz: TERM: ≤12 dB (coaxial cable loss only) MON: ≤26 dB (20 dB resistive loss + cable loss ≤ 6 dB)	For 22.368 MHz: TERM: ≤10 dB (cable loss only) DSX-MON: ≤26.5 dB (21.5 dB resistive loss + cable loss ≤ 5 dB)		For 25.92 MHz: TERM: ≤10 dB (cable loss only) MON: ≤25 dB (20 dB resistive loss + cable loss ≤ 5 dB)	For 70 MHz: TERM: ≤12 dB (coaxial cable loss only) MON: ≤26 dB (20 dB resistive loss + cable loss ≤ 6 dB)	For 78 MHz: TERM: ≤12.7 dB (coaxial cable loss only) MON: ≤26 dB (20 dB resistive loss + cable loss ≤ 6 dB)	
Transmit bit rate	1.544 Mbit/s ±4.6 ppm	2.048 Mbit/s ±4.6 ppm	2.048 Mbit/s ±4.6 ppm	34.368 Mbit/s ±4.6 ppm	44.736 Mbit/s ±4.6 ppm		51.84 Mbit/s ±4.6 ppm	139.264 Mbit/s ±4.6 ppm	155.52 Mbit/s ±4.6 ppm	
Frequency offset generation	1.544 Mbit/s ±140 ppm	2.048 Mbit/s ±70 ppm	2.048 Mbit/s ±70 ppm	34.368 Mbit/s ±50 ppm	44.736 Mbit/s ±50 ppm		51.84 Mbit/s ±50 ppm	139.264 Mbit/s ±50 ppm	155.52 Mbit/s ±50 ppm	
Receive bit rate	1.544 Mbit/s ±140 ppm	2.048 Mbit/s ±100 ppm	2.048 Mbit/s ±100 ppm	34.368 Mbit/s ±100 ppm	44.736 Mbit/s ±100 ppm		51.84 Mbit/s ±100 ppm	139.264 Mbit/s ±100 ppm	155.52 Mbit/s ±100 ppm	
Measurement accuracy (uncertainty) Frequency (ppm) Electrical power (dB)	±4.6 ±1.5	±4.6 ±1.5	±4.6 ±1.5	±4.6 ±1.5	±4.6 ±1.5		±4.6 ±1.5	±4.6 ±1.5	±4.6 ±1.5	
Peak-to-peak voltage	±10 % down to 500 mVpp	±10 % down to 500 mVpp	±10 % down to 500 mVpp	±10 % down to 500 mVpp	±10 % down to 200 mVpp		±10 % down to 200 mVpp	±10 % down to 200 mVpp	±10 % down to 200 mVpp	
Intrinsic jitter (Tx)	ANSI T1.403 section 6.3 GR-499 section 7.3	G.823 section 5.1	G.823 section 5.1	G.823 section 5.1 G.751 section 2.3	GR-499 section 7.3 (categories I and II)		GR-253 section 5.6.2.2 (category II)	G.823 section 5.1 G.751 section 3.3	G.825 section 5.1 GR-253 section 5.6.2.2	
Input jitter tolerance	AT&T PUB 62411 GR-499 section 7.3	G.823 section 7.1	G.823 section 7.1	G.823 section 7.1	GR-499 section 7.3 (categories I and II)		GR-253 section 5.6.2.3 (Category II)	G.823 section 7.1 G.751 section 3.3	G.825 section 5.2 GR-253 section 5.6.2.3	
Line coding	AMI and B8ZS	AMI and HDB3	AMI and HDB3	HDB3	B3ZS		B3ZS	CMI	CMI	
Input impedance (resistive termination)	100 Ω ±5 %, balanced	120 Ω ±5 %, balanced	75 Ω ±5 %, unbalanced	75 Ω ±5 %, unbalanced	75 Ω ±5 %, unbalanced		75 Ω ±5 %, unbalanced	75 Ω ±10 %, unbalanced	75 Ω ±5 %, unbalanced	
Connector type	BANTAM and RJ48C	BANTAM and RJ48C	BNC	BNC	BNC		BNC	BNC	BNC	

SONET AND DS _N FUNCTIONAL SPECIFICATIONS		SDH AND PDH FUNCTIONAL SPECIFICATIONS	
Optical interfaces	OC-1, OC-3, OC-12, OC-48, OC-192	Optical interfaces	STM-0, STM-1, STM-4, STM-16, STM-64
Available wavelengths (nm)	1310, 1550	Available wavelengths (nm)	1310, 1550
Electrical interfaces	DS1, DS3, STS-1e, STS-3e	Electrical interfaces ^a	1.5M (DS1), 2M (E1), 34M (E3), 45M (DS3), 140M (E4), STM-0e, STM-1e
DS1 framing	Unframed, SF, ESF, SLC-96	2M (E1) framing	Unframed, PCM30, PCM31, PCM30 CRC-4, PCM31 CRC-4
DS3 framing	Unframed, M13, C-bit parity	8M (E2), 34M (E3), 140M (E4) framing	Unframed (not applicable to E2), framed
Clocking	Internal, loop-timed, external (BITS)	Clocking	Internal, loop-timed, external (MTS/SETS), 2 MHz
Mappings			
VT1.5	Bulk, DS1	AU-3-TU-11, AU-4-TU-11	Bulk, 1.5M,
VT2	Bulk, E1	AU-3-TU-12, AU-4-TU-12	Bulk, 1.5M, 2M
STS-1 SPE	Bulk, DS3	AU-3-Bulk, 34M, 45M, TU-3-AU-4	Bulk, 34M, 45M
STS-3c	Bulk	AU-4	Bulk, 140M
STS-12c/48c/192c, SPE	Bulk	AU-4-4c/16c/64c	Bulk
SONET overhead analysis and manipulation	A1, A2, J0, E1, F1, D1-D12, K1, K2, S1, M0, M1, E2, J1, C2, G1, F2, H4, Z3, Z4, Z5, N1, N2, Z6, Z7	SDH overhead analysis and manipulation	A1, A2, J0, E1, F1, D1-D12, K1, K2, S1, M0, M1, G1, F2, F3, K3, N1, N2, K4, E2, J1, C2, H4
Error insertion			
DS1	Framing bit, BPV, CRC-6, bit error, EXZ	E1 (2M)	Bit error, FAS, CV, CRC-4, E-bit
DS3	BPV, C-bit, F-bit, P-bit, FEBE, bit error, EXZ	E2 (8M), E3 (34M), E4 (140M)	Bit error, FAS, CV (not applicable to E2)
STS-1e, STS-3e	Section BIP (B1), line BIP (B2), path BIP (B3), BIP-2, REI-L, REI-P, REI-V, BPV, FAS, CV, bit error	STM-0e, STM-1e	RS-BIP (B1), MS-BIP (B2), HP-BIP (B3), MS-REI, HP-REI, LP-BIP-2, LP-REI, CV, FAS, bit error
OC-1, OC-3, OC-12, OC-48, OC-192	Section BIP (B1), line BIP (B2), path BIP (B3), BIP-2, REI-L, REI-P, REI-V, FAS, bit error	STM-0, STM-1, STM-4, STM-16, STM-64	RS-BIP (B1), MS-BIP (B2), HP-BIP (B3), MS-REI, HP-REI, LP-BIP-2, LP-REI, FAS, bit error
Error measurement			
DS1	Framing bit, BPV, CRC-6, EXZ, bit error	E1 (2M)	Bit error, FAS, CV, CRC-4, E-bit
DS3	BPV, C-bit, F-bit, P-bit, FEBE, bit error, EXZ	E2 (8M), E3 (34M), E4 (140M)	Bit error, FAS, CV (not applicable to E2)
STS-1e, STS-3e	Section BIP (B1), line BIP (B2), path BIP (B3), BIP-2, REI-L, REI-P, REI-V, BPV, FAS, CV, bit error	STM-0e, STM-1e	RS-BIP (B1), MS-BIP (B2), HP-BIP (B3), MS-REI, HP-REI, LP-BIP-2, LP-REI, CV, FAS, bit error
OC-1, OC-3, OC-12, OC-48, OC-192	Section BIP (B1), line BIP (B2), path BIP (B3), BIP-2, REI-L, REI-P, REI-V, FAS, bit error	STM-0, STM-1, STM-4, STM-16, STM-64	RS-BIP (B1), MS-BIP (B2), HP-BIP (B3), MS-REI, HP-REI, LP-BIP-2, LP-REI, FAS, bit error
Alarm insertion			
DS1	LOS, RAI, AIS, OOF, pattern loss	E1 (2M)	LOS, LOS Mframe, LOF, AIS, TS16 AIS, RAI, RAI Mframe, pattern loss
DS3	LOS, RDI, AIS, OOF, DS3 idle, pattern loss	E2 (8M), E3 (34M), E4 (140M)	LOS, LOF, RAI, AIS, pattern loss
STS-1e, STS-3e, OC-1, OC-3, OC-12, OC-48, OC-192	LOS, LOF-S, SEF, AIS-L, RDI-L, AIS-P, LOP-P, LOM, PDI-P, RDI-P, ERDI-PCD, ERDI-PPD, ERDI-PSD, UNEQ-P, AIS-V, LOP-V, RDI-V, ERDI-VCD, ERDI-VPD, ERDI-VSD, RFI-V, UNEQ-V, pattern loss	STM-0e, STM-1e, STM-0, STM-1, STM-4, STM-16, STM-64	LOS, LOF, OOF, MS-AIS, MS-RDI, AU-AIS, AU-LOP, H4-LOM, HP-ERDI-CD, HP-ERDI-PD, HP-ERDI-SD, LP-ERDI-CD, LP-ERDI-PD, LP-ERDI-SD, HP-UNEQ, TU-AIS, LP-RFI, LP-RDI, LP-RFI, LP-UNEQ, pattern loss
Alarm detection			
DS1	LOS, LOC, RAI, AIS, OOF, pattern loss	E1 (2M)	LOS, LOS Mframe, LOC, LOF, AIS, TS16 AIS, RAI, RAI Mframe, pattern loss
DS3	LOS, LOC, RDI, AIS, OOF, DS3 idle, pattern loss	E2 (8M), E3 (34M), E4 (140M)	LOS, LOC, LOF, RAI, AIS, pattern loss
STS-1e, STS-3e, OC-1, OC-3, OC-12, OC-48, OC-192	LOS, LOC, LOF-S, SEF, TIM-S, AIS-L, RDI-L, AIS-P, LOP-P, LOM, PDI-P, RDI-P, ERDI-PCD, ERDI-PPD, ERDI-PSD, PLM-P, UNEQ-P, TIM-P, AIS-V, LOP-V, RDI-V, ERDI-VCD, ERDI-VPD, ERDI-VSD, RFI-V, UNEQ-V, TIM-V, PLM-V, pattern loss	STM-0e, STM-1e, STM-0, STM-1, STM-4, STM-16, STM-64	LOS, RS-LOF, LOC, RS-OOF, RS-TIM, MS-AIS, MS-RDI, AU-AIS, AU-LOP, H4-LOM, HP-RDI, HP-ERDI-CD, HP-ERDI-PD, HP-ERDI-SD, LP-ERDI-CD, LP-ERDI-PD, LP-ERDI-SD, HP-PLM, HP-UNEQ, HP-TIM, TU-AIS, LP-RFI, LP-RDI, LP-RFI, LP-UNEQ, LP-TIM, LP-PLM, pattern loss
<i>Frequency alarm on all supported interfaces</i>			
Patterns			
DS0	2E9-1, 2E11-1, 2E20-1, 1100, 1010, 1111, 0000, 1-in-8, 1-in-16, 3-in-24, 32 bit programmable (inverted or non-inverted), bit errors	E0 (64K)	2E9-1, 2E11-1, 2E20-1, 1100, 1010, 1111, 0000 1-in-8, 1-in-16, 3-in-24, 32 bit programmable (inverted or non-inverted), bit errors
DS1	2E9-1, 2E11-1, 2E15-1, 2E20-1, 2E23-1, 2E31-1, 1100, 1010, 1111, 0000, QRSS, 1-in-8, 1-in-16, 3-in-24, 32 bit programmable (inverted or non-inverted), T1-DALY, 55-octet, bit errors, multipattern	E1 (2M)	2E9-1, 2E11-1, 2E15-1, 2E20-1, 2E23-1, 2E31-1, 1100, 1010, 1111, 0000, 1-in-8, 1-in-16, 3-in-24, 32 bit programmable (inverted or non-inverted), bit errors
DS3	2E9-1, 2E11-1, 2E15-1, 2E20-1, 2E23-1, 2E31-1, 1100, 1010, 1111, 0000, 1-in-8, 2-in-8, 1-in-16, 3-in-24, 32 bit programmable (inverted or non-inverted), bit errors	E3 (34M), E4 (140M)	2E9-1, 2E11-1, 2E15-1, 2E20-1, 2E23-1, 2E31-1, 1100, 1010, 1111, 0000, 1-in-8, 1-in-16, 3-in-24, 32 bit programmable (inverted or non-inverted), bit errors
VT1.5/2	2E9-1, 2E11-1, 2E15-1, 2E20-1, 2E23-1, 2E31-1, 1100, 1010, 1111, 0000, 1-in-8, 1-in-16, 32 bit programmable (inverted or non-inverted), bit errors	TU-11/12/3	2E9-1, 2E11-1, 2E15-1, 2E20-1, 2E23-1, 2E31-1, 1100, 1010, 1111, 0000, 1-in-8, 1-in-16, 32 bit programmable (inverted or non-inverted), bit errors
STS-1, STS-3c/12c/48c/192c	2E9-1, 2E11-1, 2E15-1, 2E20-1, 2E23-1, 2E31-1, 1100, 1010, 1111, 0000, 1-in-8, 1-in-16, 32 bit programmable (inverted or non-inverted), bit errors	AU-3/AU-4/AU-4-4c/16c/64c	2E9-1, 2E11-1, 2E15-1, 2E20-1, 2E23-1, 2E31-1, 1100, 1010, 1111, 0000, 1-in-8, 1-in-16, 32 bit programmable (inverted or non-inverted), bit errors
<i>Pattern loss and bit error generation and analysis supported on all patterns</i>			

Notes

- 1.5M (DS1) and 45M (DS3) interfaces described under SONET and DS_N column.
- Not supported for E4 (140M).

FEATURES

HIGH SPEED KEY FEATURES	
Detailed compliance testing	› IEEE 802.3bm standard (2010) › 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 4 x 10G QSFP+ transceivers › Pluggable, MSA-compliant 4 x 25G CFP4 and QSFP28 transceivers › External timing reference (DS1/E1/2 MHz)
Robust physical-layer validation	› 40G/100G XLAUI/CAUI 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/XLAUI lanes in 40G/100G, and on physical lanes in OTU3/OTU4 diagram
Per-wavelength power measurement	Allows users to measure the received optical power per wavelength in the used parallel CFP4 and QSFP+/QSFP28 transceivers
iOptics	› Optical-device I/O interface quick check › Optical Tx power-level range test › Optical Rx signal-presence and power-level range test › BERT (Bit Error Rate Test) at nominal rates and standard offset › Excessive skew test › Temperature and power/current consumption monitoring
100G and 40G MPLS	› Generates and analyzes streams with up to two layers of labels.
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 Mbits › Configurable triggers including errors and header fields › Data capture in packet capture (PCAP) format; read through Wireshark
40G/100G 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 › Performance monitoring: G.821, M.2100 › Frequency analysis and offset generation

OTN TEST FEATURES

OTN	Standards compliance	ITU-T G.709, ITU G.798, ITU G.872
	Interfaces	OTU1 (2.6660 Gbit/s), OTU2 (10.7092 Gbit/s), OTU1e (11.0491 Gbit/s), OTU2e (11.0957 Gbit/s), OTU1f (11.2701 Gbit/s), OTU2f (11.3176 Gbit/s), OTU3 (43.018 Gbit/s), OTU3e1 (44.571 Gbit/s), OTU3e2 (44.583 Gbit/s), OTU4 (111.81 Gbit/s)
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-byte 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-byte 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	Generates 64-byte trail trace identifier (TTI), as defined in ITU-T G.709
	FTFL ^b	As defined in ITU-T G.709
OPU Layer	Alarms	OPU-PLM, OPU-AIS, OPU-CSF
	Payload-type (PT) label	Generates and displays received PT value
Forward Error Correction (FEC)	Errors	FEC-correctable (codeword), FEC-uncorrectable (codeword), FEC-correctable (symbol), FEC-correctable (bit), and FEC-stress (codeword)
Pattern	Patterns	2E-9, 2E-15, 2E-20, 2E-23, 2E-31, NULL, 32-bit programmable (inverted or noninverted)
	Error	Bit error
	Alarm	Pattern loss

ADDITIONAL OTN FUNCTIONS

Frequency measurements	Supports clock frequency measurements (i.e., received frequency and deviation of the input signal clock from nominal frequency), displayed in ppm. Measurements are performed using a local oscillator.							
Frequency offset generation	Supports offsetting the clock of the transmitted signal on a selected interface to exercise clock recovery circuitry on network elements.							
Performance monitoring	The following ITU-T recommendations and corresponding performance monitoring parameters are supported: <table><tr><th>ITU-T recommendation</th><th>Performance monitoring statistics</th></tr><tr><td>G.821</td><td>ES, EFS, EC, SES, UAS, ESR, SESR, DM</td></tr><tr><td>M.2100</td><td>ES, SES, UAS</td></tr></table>		ITU-T recommendation	Performance monitoring statistics	G.821	ES, EFS, EC, SES, UAS, ESR, SESR, DM	M.2100	ES, SES, UAS
ITU-T recommendation	Performance monitoring statistics							
G.821	ES, EFS, EC, SES, UAS, ESR, SESR, DM							
M.2100	ES, SES, UAS							
Service-disruption-time (SDT) measurements	The service disruption time test tool measures the time during which there is a disruption of service due to the network switching from the active channels to the backup channels. Measurements: last disruption, shortest disruption, longest disruption, average disruption, total disruption, and service disruption count.							
Round-trip-delay (RTD) measurements	The round-trip-delay test tool measures the time required for a bit to travel from the transmitter back to its receiver after crossing a far-end loopback. Measurements are supported on all interfaces and mappings. Measurements: last RTD time, minimum, maximum, average, measurement count (number of successful RTD tests) and failed measurement count.							
Through mode	Performs Through mode analysis of any incoming OTN signal transparently.							

ETHERNET TEST FEATURES

EtherSAM (ITU-T Y.1564)	Perform service configuration and service performance tests as per ITU-T Y.1564 including EBS, CBS and EMIX. Tests can be performed using remote loopback or Dual Test Set mode for bidirectional results.
iSAM	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; with the RFC 6349 option enabled, 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.
RFC 2544	Throughput, back-to-back, frame loss and latency measurements according to RFC 2544; frame size: RFC-defined or user-configurable between one to seven sizes
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
RFC 6349 Interop with BV-3100	RFC 6349 can be tested through the network using the Netblazer V2 and the BV3100 verifier. Including the ability to use Interop mode through NAT-enabled networks.
Traffic generation and monitoring	Traffic generation and shaping of up to 16 streams of Ethernet and IP traffic including the simultaneous monitoring of throughput, frame loss, packet jitter, latency and out-of-sequence frames. Also includes the ability to generate fixed, random and frame size sweep, as well as MAC flooding.
Carrier Ethernet OAM	Supports four S-OAM modes, MEF, Y.1731, G.8113.1 (MPLS-TP) and 802.1ag. CCM generation and monitoring, loopback, test, frame loss, synthetic loss and frame delay. Alarm generation: AIS, RDI, LCK, CSF(C-LOS, C-RDI, C-FDI, C-DCI). Alarm monitoring: RDI, AIS, LCK, CSF, loss of continuity, mismerge, unexpected MEP, unexpected MEG/MD level, unexpected period supports S-OAM responder, S-OAM link trace, ping and trace route, filters and packet capture.
Packet capture and filters	Ability to perform 10BASE-T all the way up to 100 GigE full line-rate packet capture and decode. Configuration of capture filters and triggers as well as capture slicing parameters.
Through mode	Sectionalize traffic between a service provider's network and customer premise equipment up to 100G
BER testing	Up to layer 4 supported with or without VLAN Q-in-Q.
Patterns (BERT)	PRBS 2E9-1, PRBS 2E11-1, PRBS 2E15-1, PRBS 2E20-1, PRBS 2E23-1, PRBS 2E31-1 and one user pattern. Capability to invert patterns.
Error measurement (BERT)	Bit error, bit mismatch 0, bit mismatch 1.
Traffic Scan	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
VLAN stacking	Generates up to three layers of VLAN (including IEEE 802.1ad and Q-in-Q tagged VLAN).
VLAN preservation	Validates that CE-VLAN tags classes of service (CoS), and that ID is passed transparently through the network.
MPLS	Generate and analyze streams with up to two layers of MPLS labels.
Cable testing	The cable test application provides test functions to diagnose UTP cables transmitting Ethernet over twisted pair. It verifies connectivity errors and evaluates cabling performance. The cable test can optionally simulate a PoE powered device to verify if a PoE-powered device to verify whether PoE power-sourcing equipment is capable of delivering adequate power prior to connection of a powered device.
PoE	Applicable rates: 10M to 1000M electrical, meets 802.3at (802.3 Section 33) unloaded and loaded testing, identification of cable pairs carrying power and polarity, voltage/current/power measurement on each pair, and user-configurable power class (0 to 4).
Service disruption time (SDT)	Includes statistics such as longest, shortest, last, average, count, total and pass/fail thresholds.
IPv6 testing	Performs the following tests up to 100G over IPv6, EtherSAM, RFC 2544, BERT, traffic generation and monitoring, Through mode, intelligent auto discovery, ping and traceroute.
10 GigE WAN testing	Includes WAN interface sublayer, J0/J1 trace and C2 label generation, J0/J1 trace and C2 label monitoring.
10 GigE WAN alarm monitoring	Includes SEF, LOF, AIS-L, RDI-L, AIS-P, RDI-P, LCD-P, LOP-P, PLM-P, UNEQ-P, ERDI-P, WIS link down, B1, B2, B3, REI-L, REI-P.
TCP throughput	True wire-speed, TCP throughput test for undisputable SLA reinforcement for Ethernet services.
One-way delay	Measurement of the one-way frame delay at up to 10G as part of EtherSAM (Y.1564) and RFC 2544.
Error measurement	Jabber/giant, runt, undersize, oversize, FCS, symbol, alignment, collision, late collision, excessive collision, IP checksum, UDP checksum, TCP checksum and 10G block error.
Alarm detection	LOS, link down, pattern loss, frequency, LOC, 10G local/remote fault.
Flow control	Inject or monitor pause frames, including frame counts of pause, abort frames and total, last, maximum and minimum pause time.
Batch configuration	Ability to automatically set a specific source IP address, subnet mask, default gateway, DHCP, destination MAC address or destination IP address to one or all EtherSAM services or traffic generation streams.
Dual port	Dual-port testing with EtherSAM (ITU-T Y.1564), RFC 2544, EtherBERT and traffic generation and monitoring when using 10/100/1000 BASE-T, 100BASE-X, GigE and 10 GigE.
FEC monitoring	Enable Ethernet FEC capabilities with alarms and error monitoring.
EoE/PBB-TE	Validates EoE and PBB-TE encapsulations.

FIBRE CHANNEL TEST FEATURES

TESTING 1x, 2x, 4x, 8x, 10x, 16x

BERT	Framed FC2
Patterns (BERT)	PRBS 2E31-1, 2E23-1, 2E20-1, 2E15-1, 2E11-1, 2E9-1, one user-defined pattern and capability to invert patterns
Error insertion	Bit error, amount and rate
Error measurement	Bit error, symbol error, oversize error, crc error, undersize error and block error (10x only)
Alarm detection	LOS, pattern loss, link down, local and remote fault (10x only)
Buffer-to-buffer credit testing	Buffer-to-buffer credit estimation based on latency
Latency	Round-trip latency

DSN/PDH AND SONET/SDH TEST FEATURES

Frequency measurements	Supports clock frequency measurements (i.e., received frequency and deviation of the input signal clock from nominal frequency), displayed in ppm, for optical and electrical interfaces. Measurements are performed using a local oscillator.														
Frequency offset generation	Supports offsetting the clock of the transmitted signal on a selected interface to exercise clock recovery circuitry on network elements.														
Dual DSn receivers	Supports two DS1 or DS3 receivers, allowing users to simultaneously monitor two directions of a circuit under test in parallel, resulting in quick isolation of the source of errors.														
Performance monitoring	The following ITU-T recommendations, and corresponding performance monitoring parameters, are supported: <table border="0"> <tr> <td>ITU-T recommendation</td><td>Performance monitoring statistics</td></tr> <tr> <td>G.821</td><td>ES, EFS, EC, SES, UAS, ESR, SESR, DM</td></tr> <tr> <td>G.826</td><td>ES, EFS, EB, SES, BBE, UAS, ESR, SESR, BBER</td></tr> <tr> <td>G.828</td><td>ES, EFS, EB, SES, BBE, SEP, UAS, ESR, SESR, BBER, SEPI</td></tr> <tr> <td>G.829</td><td>ES, EFS, EB, SES, BBE, UAS, ESR, SESR, BBER</td></tr> <tr> <td>M.2100</td><td>ES, SES, UAS</td></tr> <tr> <td>M.2101</td><td>ES, SES, BBE, UAS</td></tr> </table>	ITU-T recommendation	Performance monitoring statistics	G.821	ES, EFS, EC, SES, UAS, ESR, SESR, DM	G.826	ES, EFS, EB, SES, BBE, UAS, ESR, SESR, BBER	G.828	ES, EFS, EB, SES, BBE, SEP, UAS, ESR, SESR, BBER, SEPI	G.829	ES, EFS, EB, SES, BBE, UAS, ESR, SESR, BBER	M.2100	ES, SES, UAS	M.2101	ES, SES, BBE, UAS
ITU-T recommendation	Performance monitoring statistics														
G.821	ES, EFS, EC, SES, UAS, ESR, SESR, DM														
G.826	ES, EFS, EB, SES, BBE, UAS, ESR, SESR, BBER														
G.828	ES, EFS, EB, SES, BBE, SEP, UAS, ESR, SESR, BBER, SEPI														
G.829	ES, EFS, EB, SES, BBE, UAS, ESR, SESR, BBER														
M.2100	ES, SES, UAS														
M.2101	ES, SES, BBE, UAS														
Pointer adjustment and analysis	Generation and analysis of HO/AU and LO/TU pointer adjustments as per GR-253, and ITU-T G.707 <table border="0"> <tr> <td>Generation</td><td>Analysis</td></tr> <tr> <td> - Pointer increment and decrement - Pointer jump with or without NDF - Pointer value </td><td> - Pointer increments - Pointer decrements - Pointer jumps (NDF, no NDF) - Pointer value and cumulative offset </td></tr> </table>	Generation	Analysis	- Pointer increment and decrement - Pointer jump with or without NDF - Pointer value	- Pointer increments - Pointer decrements - Pointer jumps (NDF, no NDF) - Pointer value and cumulative offset										
Generation	Analysis														
- Pointer increment and decrement - Pointer jump with or without NDF - Pointer value	- Pointer increments - Pointer decrements - Pointer jumps (NDF, no NDF) - Pointer value and cumulative offset														
Service-disruption-time (SDT) measurements	The service disruption time test tool measures the time during which there is a disruption of service due to the network switching from the active channels to the backup channels. Measurements: last disruption, shortest disruption, longest disruption, average disruption, total disruption, and service disruption count.														
Round-trip delay (RTD) measurements	The round-trip delay test tool measures the time required for a bit to travel from the NetBlazer transmitter back to its receiver after crossing a far-end loopback. Measurements are provided on all supported NetBlazer interfaces and mappings. Measurements: last, minimum, maximum, average; measurement count: number of successful RTD tests and failed measurement count.														
APS message control and monitoring	Ability to monitor and set up automatic protection switching messages (K1/K2 byte of SONET/SDH overhead).														
Synchronization status	Ability to monitor and set up synchronization status messages (S1 byte of SONET/SDH overhead).														
Signal label control and monitoring	Ability to monitor and set up payload signal labels (C2, V5 byte of SONET overhead).														
Tandem connection monitoring (TCM) ^a	Tandem connection monitoring (TCM) is used to monitor the performance of a subsection of a SONET/SDH path routed via different network providers. The NetBlazer supports transmitting and receiving alarms and errors on a TCM link; also, transmission and monitoring of the tandem connection (TC) trace can be generated to verify the connection between TCM equipment. Error generation: TC-IEC, TC-BIP, TC-REI, TC-OEI Error analysis: TC-IEC, TC-REI, TC-OEI, TC-VIOL (non-standardized alarm) Alarm generation: TC-RDI, TC-UNEQ, TC-ODI, TC-LTC, TC-IAIS Alarm analysis: TC-TIM, TC-RDI, TC-UNEQ, TC-ODI, TC-LTC, TC-IAIS														
Pointer sequence testing	Perform pointer sequence testing as per G.783, GR253 and T1.105-3 standards.														
M13 mux/demux	Ability to multiplex/demultiplex a DS1 signal into/from a DS3 signal. (Note: E1 to DS3 mux/demux available with G.747 software option.)														
DS1 FDL	Support for DS1 Facility Data Link testing.														
DS1 loopcodes	Support for generation of DS1 in-band loopcodes with the availability of up to 10 pairs of user-defined loopcodes.														
NI/CSU loopback emulation	Ability to respond to DS1 in-band/out-of-band loopcodes.														
DS3 FEAC	Support for DS3 far-end alarms and loopback code words.														
DS1/DS3 autodetection	Ability to automatically detect DS1/DS3 line coding, framing and test pattern.														
DS1 multipattern	BER test that includes five automated patterns: all ones, 1-in-8, 2-in-8, 3-in-2, QRSS														
DS1 signaling bits	Ability to monitor the ABCD signaling bits for all 24 DS0 channels														
Through mode	Perform Through mode analysis of any incoming electrical (DSn, PDH, SONET, SDH) and optical line (OC-1/STM-0, OC-3/STM-1, OC-12/STM-4, OC-48/STM-16, OC-192/STM-64) transparently.														

Note

a. HOP and LOP supported as per ITU-T G.707 option 2.

ISDN PRIMARY RATE INTERFACE TEST FEATURES

Supported interfaces	DS1: bantam or RJ48C (SF or ESF) E1: bantam, RJ48C or BNC (PCM31 with or without CRC-4)	Headset support	Talk/listen through a selectable connected voice or 3.1 kHz B-channel
Supported switch types	DS1: national ISDN, Nortel DMS and AT&T 4/5ESS E1: Euro ISDN, Euro VN6 and Q.SIG	D-channel control	D-channel timeslot configuration Rate (64K or 56K) HDLC mode (Normal or Inverted)
Emulation modes	Terminal equipment (TE) Network termination (NT)	Statistics	Call status, CRV, incoming or outgoing calls, call duration BERT (bit error count and rate) with graphical BERT meter on a per B-channel (data) basis Performance monitoring statistics: UAS, EFS, ES and SES Active calls (data, voice, 3.1 kHz) Total call count (connected, cleared, failed/rejected, placed) Frequency (Rx, offset, max +/-max - offset)
Call types/rates	Data (56K or 64K), voice or 3.1 kHz (audio)	Alarms	DS1: LOS, frequency, LOC, AIS, OOF, RAI, D-channel down E1: LOS, frequency, LOC, AIS, LOF, RAI, D-channel down Pattern loss (per B-channel injection)
BER test	Configurable test pattern Provides simultaneous BER testing on multiple B-channels configured with data traffic	Errors	DS1: BPV, EXZ, framing bit, CRC-6, D-channel FCS E1: CV, FAS, CRC-4, E-bit, D-channel FCS Bit error (per B-channel injection)
Call setting	Calling party (numbering type, numbering plan and number up to 30 digits) Called party (number type, numbering plan and number up to 30 digits) Network (network transit selection code of up to four digits, and operator system access: None, Principal or Alternate) > All parameters are configurable on a per-call basis > Highlights missing calls or called party numbers	ISDN logger	Logs layer-2 (Q.921) and layer-3 (Q.931) messages Filter: All, layer 2 or layer 3 Information: ID, time, message type, direction, channel number, called number, call type, cause values/definition, status and progress
Call control	Call origination > Establishment of calls prior to starting the test > Automatically initiate single, multiple or all configured calls upon starting a test Call reception > Auto-Answer mode, Auto-Reject or prompt Call release > Hang up individual or all channels	Pass/fail verdict	BERT, call establishment and termination
DTMF injection	Generate DTMF tones for all standard digits, including 0-9, # and * as per Q.23/G.224 Available for one of the connected voice or 3.1 kHz B-channel	Phone book	Easy access to phone book to manage names and associated numbers. Save/load functions to update the phone book and import/export to exchange the phone book with other NetBlazer

SYNCHRONIZATION INTERFACES

	External Clock DS1/1.5M	External Clock E1/2M	External Clock E1/2M	Trigger 2 MHz
Tx pulse amplitude	2.4 to 3.6 V	3.0 V	2.37 V	0.75 to 1.5 V
Tx pulse mask	GR-499 Figure 9-5	G.703 Figure 15	G.703 Figure 15	G.703 Figure 20
Tx LBO preamplification	Typical power dBdsx +0.6 dBdsx (0 to 133 ft) +1.2 dBdsx (133 to 266 ft) +1.8 dBdsx (266 to 399 ft) +2.4 dBdsx (399 to 533 ft) +3.0 dBdsx (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 (20 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	G.823 section 7.1 G.751 section 3.3
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 ^a	BNC ^a	BNC	BNC

WANDER REFERENCE INTERFACES

	1 PPS	2 MHz	10 MHz
Connector type	BNC, RJ48C	BNC, RJ48C	BNC, RJ48C

EXFO OPTICALRF™: RF SPECTRUM MEASUREMENTS OVER CPRI

Application	Real-time RF spectrum analysis using digitized RF data (IQ data) in the CPRI link
CPRI rate support	• CPRI rate options from 2 to 7 (1.2 Gbit/s to 9.8 Gbit/s) • Automatic CPRI rate scan • Hardware-ready for CPRI rate option 9 (12.1 Gbit/s)
Air technology support	LTE, W-CDMA, CDMA, UMTS
Radio support	Ericsson, Alcatel-Lucent/Nokia, Huawei
Viewer options	• Power spectrum • Waterfall • Power spectrum persistence
RF spectrum settings	• Antenna carrier (AxC) selection • Resolution bandwidth (59 Hz to 30 KHz) • Video bandwidth (170 KHz to 8 MHz) • Persistence delay • Min./max./average hold • Decay adjustments for all traces • Zoom for all views • Center frequency and frequency span adjustments • Reference level adjustment • Up to five markers, with table for power, frequency, delta power and delta frequency • Snapshot and video recording capability • dB, dBm, and dBFS adjustments
Graph settings	• Crosshair or normal cursor • Channel bandwidth barriers • Grid on/off
Interface support	Optical (CWDM, DWDM) SFP interface for both multimode and singlemode fibers
Protocol support	CPRI version 7.0 and lower
Recording	Up to 270 seconds of real-time RF recording available, depending upon channel bandwidth setting. Saved file is playable on any EXFO OpticalRF-enabled test solution.
Remote control and collaboration	The unit can be remotely controlled via a wired or wireless internet connection.
Test solutions supported	FTB-870v2, FTB-880v2, FTB-870Q, FTB-880Q, FTB-720Gv2, FTB-730Gv2 and FTB-890NGE

ADDITIONAL FEATURES

CPRI/OBSAI layer-2 protocol testing	Supports BBU and RRH emulation modes by supporting start-up sequence states, autodetection of protocols, negotiated parameters for control and maintenance.
CPRI BER testing	Includes unframed and framed BER measurement, bit error injection, round-trip delay measurement, and pass/fail verdicts for 1.2 to 9.8 Gbit/s rates.
CPRI/OBSAI SDT	Measurements in ms for the longest, shortest, last, average, total and count of disruptions.
CPRI DUAL PORT	Provides two simultaneous ports of CPRI BBU or RRH layer-2 link validation with rates from 1.2 to 9.8G Gbit/s.
1588 PTP	Validates 1588 PTP packet network synchronization services, supports G.8265.1 and G.8275.1 profiles, emulates PTP clients, generates and analyzes messages between master/clients, clock quality level and IPDV
SyncE	Validates SyncE frequency, ESMC messages and clock quality levels.
Power measurement	Supports power measurement at all times, displayed in dBm (dBdsx for DS1 and DS3), for optical and electrical interfaces.
Power-up and restore	In the event of power failure to the unit, the active test configuration and test logger are saved and restored upon boot-up.
Save and load configuration	Store and load test configurations to/from a non-volatile USB memory stick or internal flash.
Pass/fail analysis	Provides a pass/fail outcome with user-adjustable thresholds, based on bit error rate and/or service disruption time.
Alarm hierarchy	Alarms are displayed according to a hierarchy based on root cause. Secondary effects are not displayed. This hierarchy serves to facilitate alarm analysis.
Report generation	Generate test reports with customizable selections, company logos and clear pass/fail color-coded analysis, in both HTML and PDF formats, and save them directly on the unit, on a USB stick or via EXFO Connect.
Event logger	Log test results with absolute or relative time and date, details and duration of events, color-coded events and pass/fail outcome.
Remote control	Remote control via VNC or Remote Desktop.
Remote loopback	Detects other NetBlazer/PowerBlazer units and sets them to Smart Loopback mode.
Dual test Set	Detects and connects to other NetBlazer/Power Blazer units to perform bidirectional EtherSAM, RFC 6349 and RFC 2544 testing.
Second Port Loopback Tool	Enables any Ethernet test (e.g., EtherSAM, RFC 2544, traffic generation and monitoring, or BERT) to run directly to itself using one self-contained unit with second port loopback.
IP tools	Performs ping and traceroute functions.
Smart loopback	Return Ethernet traffic to the local unit by swapping packet overhead up to layer 4.
Test timer	Select a predefined duration or enter start and stop times.

GENERAL SPECIFICATIONS

MODULE VERSIONS	FTB-880V2	FTB-870V2	FTB-880Q	FTB-870Q
Size (H x W x D)	210 mm x 254 mm x 55 mm (8 ¼ in x 10 in x 2 ⅜ in)		210 mm x 254 mm x 76 mm (8 ¼ in x 10 in x 3 in)	
Weight	0.91 kg (2 lb)	0.85 kg (1.85 lb)	2.1 kg (4.65 lb)	1.84 kg (4.06 lb)
Operating temperature	0 °C to 50 °C (32 °F to 122 °F) up to 2000 m (6561 ft)			
Relative humidity	0 % to 95 %, non-condensing			
Battery duration	Over two hours		Over one hour	
Battery charging time	Two hours			
Languages	English, Spanish, Chinese, Japanese and Korean			

MODULE VERSIONS	FTB-890	FTB-890NGE
Size (H x W x D)	210 mm x 254 mm x 76 mm (8 1/4 in x 10 in x 3 in)	
Weight	1.85 kg (4.08 lb)	2.2 kg (4.85 lb)
Operating temperature	0 °C to 40 °C (32 °F to 104 °F) up to 2000 m (6561 ft)	
Relative humidity	0 % to 95 % non-condensing	
Battery duration	Over one hour	
Battery charging time	Two hours	
Languages	English, Spanish, Chinese, Japanese and Korean	

ORDERING INFORMATION

FTB-890-XX-XX-XX-XX-XX-XX-XX

Test options ■

SONET-SDH = SONET and SDH testing

Transport rate options ■

52M = 52 Mbit/s (OC-1/STM-0)^a

155M = 155 Mbit/s (OC-3/STM-1)^b

622M = 622 Mbit/s (OC-12/STM-4)^b

2488M = 2.5 Gbit/s (OC-48/STM-16)^b

9953M = 10 Gbit/s (OC-192/STM-64)ⁱ

Software options ■

IPv6 = Internet protocol version 6

IPv6_40-100GE = 40GE and 100GE internet protocol version 6

TCM = Tandem connection monitoring

ETH-THRU = Through mode capability

MPLS = Enables MPLS tags

MPLS_40-100GE = Enables 40GE and 100GE MPLS tags

EoE = Ethernet over Ethernet Encapsulation

EoE_40-100GE = 40GE and 100GE Ethernet over Ethernet Encapsulation^j

PBBTE = Provider Backbone Bridge Encapsulation

PBBTE_40-100GE = 40GE and 100GE Provider Backbone Bridge Encapsulation^j

1588PTP = Generates and analyzes 1588 PTP

G82751 = Enables ITU-T G.8275.1 profile

SyncE = Generates and analyzes SyncE protocol

TCP-THPUT = TCP throughput

ETH-OAM = Enables Y.1731, G.8113.1 (MPLS-TP), 802.1ag and MEF

LINK-OAM = Enables 802.3ah link OAM^k

TST-OAM = Enables OAM testing within EtherSAM

ADV-FILTERS = Advanced filtering

ETH-CAPTURE = Full line-rate packet capture

iSAM = Enables simplified Y.1564 test

RFC6349 = Enables TCP testing as per RFC 6349

RFC6349_40-100GE = 40GE and 100GE enables TCP testing as per RFC 6349

RFC6349-EXFOWorx = Interop with BV-3100^g

TRAFFIC-SCAN = Discover and monitor VLAN traffic flows on a live signal

iOptics = Enables intelligent Pluggable Optic Test Application

DP_40-100GE = Enables DUAL PORT at 40G and 100G

CPRI/OBSAI rate options

CPRI-OBSAI = Enables 1.2G to 3.1G CPRI, and 3.1G OBSAI^c

CPRI-4.9G = Enables CPRI 4.9G^d

CPRI-6.1G = Enables CPRI 6.1G^d

CPRI-9.8G = Enables CPRI 9.8G^d

OBSAI-1.5G = Enables OBSAI 1.5G^c

OBSAI-6.1G = Enables OBSAI 6.1G^d

OTN rate options

OTU1 = OTN optical rate 2.666 Gbit/s^e

OTU2 = OTN optical rate 10.709 Gbit/s^d

OTU2-1e-2e = OTN optical rates 11.049/11.096 Gbit/s^d

OTU2-1f-2f = OTN optical rates 11.270/11.318 Gbit/s^d

OTU3 = OTN optical rate of 43.018 Gbit/s^e

OTU3-e1-e2 = OTN optical rates of 44.57 Gbit/s and 44.58 Gbit/s^e

OTU4 = OTN optical rate of 111.81 Gbit/s^f

GCC-BERT = GCC 0/1/2 BERT test^h

Fibre Channel rate options

FC1X = 1x Fibre Channel interface^c

FC2X = 2x Fibre Channel interface^c

FC4X = 4x Fibre Channel interface^c

FC8X = 8x Fibre Channel interface^d

FC10X = 10x Fibre Channel interface^d

FC16X = 16x Fibre Channel interface^d

Ethernet rate options

100optical = 100 Mbit/s optical^c

GigE = 1000 Mbit/s optical and electrical^c

10GigE = 10G LAN and 10G WAN^d

40GE = Ethernet optical rate of 41.25 Gbit/s^e

100GE = Ethernet optical rate of 103.125 Gbit/s^f

Example: FTB-890-SONET-SDH-52M-RFC6349-100GE-OTU3-OTU4

Notes

a. Always included.

b. (155M/622M/2488M) always included with the 2.5G-BUNDLE.

c. Requires purchase of SFP.

d. Requires purchase of SFP+.

e. Requires purchase of QSFP+.

f. Requires purchase of CFP4 or QSFP28.

g. Requires software option RFC6349 or RFC6349_10-100GE.

h. Requires a minimum of one OTN rate.

i. 9953M included with the 10G-BUNDLE.

j. Requires software option 40GE or 100GE.

k. Requires software option ETH-OAM.

ORDERING INFORMATION

FTB-890NGE-XX-XX-XX-XX-XX-XX-XX

Test options

SONET-SDH = SONET and SDH testing

Transport rate options52M = 52 Mbit/s (OC-1/STM-0)^a155M = 155 Mbit/s (OC-3/STM-1)^b622M = 622 Mbit/s (OC-12/STM-4)^b2488M = 2.5 Gbit/s (OC-48/STM-16)^b

9953M = 10 Gbit/s (OC-192/STM-64)

Software optionsDS3-G747 = G.747 test capability^jDS1-FDL = DS1 FDL test capability^jDUAL-RX = DS1/DS3 dual Rx testing^jDS3-FEAC = DS3 FEAC test capability^j

TCM = Tandem connection monitoring

DSn = DSn test capability

PDH = PDH test capability

ISDN-PRI = ISDN primary rate interface^jNI-CSU = NI-CSU loopback emulation^j

Cable_Test = Cable test

IPV6 = Internet protocol version 6

IPV6_40-100GE = 40GE and 100GE IPv6 Internet protocol version 6^k

ETH-THRU = Through mode capability

MPLS = Enables MPLS tags

MPLS_40-100GE = Enables 40GE and 100GE MPLS tags^k

EoE = Ethernet over Ethernet Encapsulation

EoE_40-100GE = 40GE and 100GE Ethernet over Ethernet Encapsulation^k

PBBTE = Provider Backbone Bridge Encapsulation

PBBTE_40-100GE = 40GE and 100GE Provider Backbone Bridge Encapsulation^k

1588PTP = Generates and analyzes 1588 PTP

G82751 = Enables ITU-T G.8275.1 profile

SyncE = Generates and analyzes SyncE protocol

TCP-THPUT = TCP throughput

ETH-OAM = Enables Y.1731, G.8113.1 (MPLS-TP), 802.1ag and MEF

LINK-OAM = Enables 802.3ah link OAM^m

TST-OAM = Enables OAM testing within EtherSAM

ADV-FILTERS = Advanced filtering

ETH-CAPTURE = Full line-rate packet capture

DUAL-PORT = Dual port testing for any enabled Ethernet rate

iSAM = Enables simplified Y.1564 test

RFC6349 = Enables TCP testing as per RFC 6349

RFC6349_40-100GE = 40GE and 100GE enables TCP testing as per RFC 6349

RFC6349-EXFOWorx = Interop with BV-3100^gPoE = Enables Power over Ethernet capability^l

TRAFFIC-SCAN = Discover and monitor VLAN traffic flows on a live signal

DP-CPRI = Enables two CPRI ports

iOptics = Enables Intelligent Pluggable Optic Test Application

CPRI-SPECTRUM = OpticalRF™ RF spectrum over CPRI

PIM = Passive intermodulation (PIM) detection

CPRI-ALU-BBUe = Alcatel-Lucent BBU Emulation over CPRI

WANDER = Enables time error testing for 1PPS^h

DTS-NAT = Enables dual test set over NAT

DP_40-100GE = Enables DUAL PORT at 40G and 100G

CPRI/OBSAI rate optionsCPRI-OBSAI = Enables 1.2G to 3.1G CPRI, and 3.1G OBSAI^cCPRI-4.9G = Enables CPRI 4.9G^dCPRI-6.1G = Enables CPRI 6.1G^dCPRI-9.8G = Enables CPRI 9.8G^dOBSAI-1.5G = Enables OBSAI 1.5G^cOBSAI-6.1G = Enables OBSAI 6.1G^d**OTN rate options**OTU1 = OTN optical rate 2.666 Gbit/s^cOTU2 = OTN optical rate 10.709 Gbit/s^dOTU2-1e-2e = OTN optical rates 11.049/11.096 Gbit/s^dOTU2-1f-2f = OTN optical rates 11.270/11.318 Gbit/s^dOTU3 = OTN optical rate of 43.018 Gbit/s^eOTU3-e1-e2 = OTN optical rates of 44.57 Gbit/s and 44.58 Gbit/s^eOTU4 = OTN optical rate of 111.81 Gbit/s^fGCC-BERT = GCC 0/1/2 BERT testⁱ**Fibre Channel rate options**FC1X = 1x Fibre Channel interface^cFC2X = 2x Fibre Channel interface^cFC4X = 4x Fibre Channel interface^cFC8X = 8x Fibre Channel interface^dFC10X = 10x Fibre Channel interface^dFC16X = 16x Fibre Channel interface^d**Ethernet rate options**100Optical = 100 Mbit/s optical^cGigE = 1000 Mbit/s optical and electrical^c10GigE = 10G LAN and 10G WAN^d40GE = Ethernet optical rate of 41.25 Gbit/s^e100GE = Ethernet optical rate of 103.125 Gbit/s^f

Example: FTB-890NGE-SONET-SDH-52M-DSn-RFC6349-100GE-OTU3-OTU4

Notes

a. Always included.

b. (155M/622M/2488M) always included with the 2.5G-BUNDLE.

c. Requires purchase of SFP.

d. Requires purchase of SFP+.

e. Requires purchase of QSFP+.

f. Requires purchase of CFP4 or QSFP28.

g. Requires software option RFC6349 or RFC6349_10-100GE.

h. Requires a GPS receiver kit for wander measurements such as GP-2263.

i. Requires a minimum of one OTN rate.

j. Requires software option DSn.

k. Requires software option 40GE or 100GE.

l. Requires software option Cable_Test.

m. Requires software option ETH-OAM.

ORDERING INFORMATION

FTB-880v2-XX-XX-XX-XX-XX-XX-XX

Test options ■

SONET-SDH = SONET and SDH testing

Transport rate options ■

52M = 52 Mbit/s (OC-1/STM-0)^a

155M = 155 Mbit/s (OC-3/STM-1)

622M = 622 Mbit/s (OC-12/STM-4)

2488M = 2.5 Gbit/s (OC-48/STM-16)

9953M = 10 Gbit/s (OC-192/STM-64)

Software options ■

DS3-G747 = G.747 test capability^b

DS1-FDL = DS1 FDL test capability^b

DUAL-RX = DS1/DS3 dual Rx testing^b

DS3-FEAC = DS3 FEAC test capability^b

TCM = Tandem connection monitoring

DSn = DSn test capability

PDH = PDH test capability

ISDN-PRI = ISDN primary rate interface^b

NI-CSU = NI-CSU loopback emulation^b

Cable_Test = Cable test

IPv6 = Internet protocol version 6

ETH-THRU = Through mode capability

MPLS = Enables MPLS tags

EoE = Ethernet over Ethernet Encapsulation

PBBTE = Provider Backbone Bridge Encapsulation

G82751 = Enables ITU-T G.8275.1 profile

TST-OAM = Enables OAM testing within EtherSAM

1588PTP = Generates and analyzes 1588 PTP

SyncE = Generates and analyzes SyncE protocol

TCP-THPUT = TCP throughput

ETH-OAM = Enables Y.1731, G.8113.1 (MPLS-TP), 802.1ag and MEF

LINK-OAM = Enables 802.3ah link OAM^h

ADV-FILTERS = Advanced filtering

ETH-CAPTURE = Full line-rate packet capture

DUAL-PORT = Dual port testing for any enabled Ethernet rate

iSAM = Enables simplified Y.1564 test

RFC6349 = Enables TCP testing as per RFC 6349

RFC6349-EXFOWorx = Interop with BV-3100^e

PoE = Enables Power over Ethernet capabilityⁱ

TRAFFIC-SCAN = Discover and monitor VLAN traffic flows on a live signal

DP-CPRI = Enables two CPRI ports

iOptics = Enables intelligent Pluggable Optic Test Application

CPRI-SPECTRUM = OpticalRF™ RF spectrum over CPRI

PIM = Passive intermodulation (PIM) detection

CPRI-ALU-BBUe = Alcatel-Lucent BBU Emulation over CPRI

WANDER = Enables time error testing for 1PPS^f

CPRI/OBSAI rate options

CPRI-OBSAI = Enables 1.2G to 3.1G CPRI, and 3.1G OBSAI^c

CPRI-4.9G = Enables CPRI 4.9G^d

CPRI-6.1G = Enables CPRI 6.1G^d

CPRI-9.8G = Enables CPRI 9.8G^d

OBSAI-1.5G = Enables OBSAI 1.5G^c

OBSAI-6.1G = Enables OBSAI 6.1G^d

OTN rate options

OTU1 = OTN optical rate 2.666 Gbit/s^c

OTU2 = OTN optical rate 10.709 Gbit/s^d

OTU2-1e-2e = OTN optical rates 11.049/11.096 Gbit/s^d

OTU2-1f-2f = OTN optical rates 11.270/11.318 Gbit/s^d

GCC-BERT = GCC 0/1/2 BERT test^g

Fibre Channel rate options

FC1X = 1x Fibre Channel interface^c

FC2X = 2x Fibre Channel interface^c

FC4X = 4x Fibre Channel interface^c

FC8X = 8x Fibre Channel interface^d

FC10X = 10x Fibre Channel interface^d

Ethernet rate options

100optical = 100 Mbit/s optical^c

GigE = 1000 Mbit/s optical and electrical^c

10GigE = 10G LAN and 10G WAN^d

Example: FTB-880v2-SONET-SDH-52M-DSn-GigE

Notes

a. Always included.

b. Requires software option DSn.

c. Requires purchase of SFP.

d. Requires purchase of SFP+.

e. Requires software option RFC6349.

f. Requires a GPS receiver kit for wander measurements such as GP-2263.

g. Requires a minimum of one OTN rate.

h. Requires software option ETH-OAM.

i. Requires software option Cabke_Test.

ORDERING INFORMATION

FTB-870v2-XX-XX-XX-XX-XX-XX

Test options ■

SONET-SDH = SONET and SDH testing

Transport rate options ■

52M = 52 Mbit/s (OC-1/STM-0)^a

155M = 155 Mbit/s (OC-3/STM-1)

622M = 622 Mbit/s (OC-12/STM-4)

2488M = 2.5 Gbit/s (OC-48/STM-16)

9953M = 10 Gbit/s (OC-192/STM-64)

Software options ■

DS1-FDL = DS1 FDL test capability^b

TCM = Tandem connection monitoring

DSn = DSn test capability

PDH = PDH test capability

ISDN-PRI = ISDN primary rate interface^b

NI-CSU = NI-CSU loopback emulation^b

Cable_Test = Cable test

IPV6 = Internet protocol version 6

ETH-THRU = Through mode capability

MPLS = Enables MPLS tags

EoE = Ethernet over Ethernet Encapsulation

PBBTE = Provider Backbone Bridge Encapsulation

G82751 = Enables ITU-T G.8275.1 profile

TST-OAM = Enables OAM testing within EtherSAM

1588PTP = Generates and analyzes 1588 PTP

SyncE = Generates and analyzes SyncE protocol

TCP-THPUT = TCP throughput

ETH-OAM = Enables Y.1731, G.8113.1 (MPLS-TP), 802.1ag and MEF

LINK-OAM = Enables 802.3ah link OAM^b

ADV-FILTERS = Advanced filtering

ETH-CAPTURE = Full line-rate packet capture

DUAL-PORT = Dual port testing for any enabled Ethernet rate

iSAM = Enables simplified Y.1564 test

RFC6349 = Enables TCP testing as per RFC 6349

RFC6349-EXFOWorx = Interop with BV-3100^a

PoE = Enables Power over Ethernet capability^f

TRAFFIC-SCAN = Discover and monitor VLAN traffic flows on a live signal

DP-CPRI = Enables two CPRI ports

iOptics = Enables intelligent Pluggable Optic Test Application

CPRI-SPECTRUM = OpticalRF™ RF spectrum over CPRI

PIM = Passive intermodulation (PIM) detection

CPRI-ALU-BBUe = Alcatel-Lucent BBU Emulation over CPRI

CPRI/OBSAI rate options

CPRI-OBSAI = Enables 1.2G to 3.1G CPRI, and 3.1G OBSAI^c

CPRI-4.9G = Enables CPRI 4.9G^d

CPRI-6.1G = Enables CPRI 6.1G^d

CPRI-9.8G = Enables CPRI 9.8G^d

OBSAI-1.5G = Enables OBSAI 1.5G^c

OBSAI-6.1G = Enables OBSAI 6.1G^d

OTN rate options

OTU1 = OTN optical rate 2.666 Gbit/s^c

OTU2 = OTN optical rate 10.709 Gbit/s^d

OTU2-1e-2e = OTN optical rates 11.049/11.096 Gbit/s^d

OTU2-1f-2f = OTN optical rates 11.270/11.318 Gbit/s^d

GCC-BERT = GCC 0/1/2 BERT test^g

Fibre Channel rate options

FC1X = 1x Fibre Channel interface^c

FC2X = 2x Fibre Channel interface^c

FC4X = 4x Fibre Channel interface^c

FC8X = 8x Fibre Channel interface^d

FC10X = 10x Fibre Channel interface^d

Ethernet rate options

100optical = 100 Mbit/s optical^c

GigE = 1000 Mbit/s optical and electrical^c

10GigE = 10G LAN and 10G WAN^d

Example: FTB-870v2-SONET-52M-IPV6-GigE-FC1X-OTU1

Notes

- Always included.
- Requires software option DSn.
- Requires purchase of SFP.
- Requires purchase of SFP+.
- Requires software option RFC6349.
- Requires software option Cable_Test.
- Requires a minimum of one OTN rate.
- Requires software option ETH-OAM.

ORDERING INFORMATION

FTB-880Q-XX-XX-XX-XX-XX-XX

Test options ■

SONET-SDH = SONET and SDH testing

Transport rate options ■

52M = 52 Mbit/s (OC-1/STM-0)^a
155M = 155 Mbit/s (OC-3/STM-1)
622M = 622 Mbit/s (OC-12/STM-4)
2488M = 2.5 Gbit/s (OC-48/STM-16)
9953M = 10 Gbit/s (OC-192/STM-64)

Software options ■

DS3-G747 = G.747 test capability^b
DS1-FDL = DS1 FDL test capability^b
DUAL-RX = DS1/DS3 dual Rx testing^b
DS3-FEAC = DS3 FEAC test capability^b
TCM = Tandem connection monitoring
DSn = DSn test capability
PDH = PDH test capability
ISDN-PRI = ISDN primary rate interface^b
NI-CSU = NI-CSU loopback emulation^b
Cable_Test = Cable test
IPv6 = Internet protocol version 6
ETH-THRU = Through mode capability
MPLS = Enables MPLS tags
EoE = Ethernet over Ethernet Encapsulation
PBBTE = Provider Backbone Bridge Encapsulation
G82751 = Enables ITU-T G.8275.1 profile
TST-OAM = Enables OAM testing within EtherSAM
1588PTP = Generates and analyzes 1588 PTP
SyncE = Generates and analyzes SyncE protocol
TCP-THPUT = TCP throughput
ETH-OAM = Enables Y.1731, G.8113.1 (MPLS-TP), 802.1ag and MEF
LINK-OAM = Enables 802.3ah link OAMⁱ
ADV-FILTERS = Advanced filtering
ETH-CAPTURE = Full line-rate packet capture
DUAL-PORT = Dual port testing for any enabled Ethernet rate
iSAM = Enables simplified Y.1564 test
RFC6349 = Enables TCP testing as per RFC 6349
RFC6349-EXFOWorx = Interop with BV-3100^e
PoE = Enables Power over Ethernet capability^h
TRAFFIC-SCAN = Discover and monitor VLAN traffic flows on a live signal
DP-CPRI = Enables two CPRI ports
iOptics = Enables intelligent Pluggable Optic Test Application
CPRI-SPECTRUM = OpticalRF™ RF spectrum over CPRI
PIM = Passive intermodulation (PIM) detection
CPRI-ALU-BBUe = Alcatel-Lucent BBU Emulation over CPRI
WANDER = Enables time error testing for 1PPS^f

CPRI/OBSAI rate options

CPRI-OBSAI = Enables 1.2G to 3.1G CPRI, and 3.1G OBSAI^c
CPRI-4.9G = Enables CPRI 4.9G^d
CPRI-6.1G = Enables CPRI 6.1G^d
CPRI-9.8G = Enables CPRI 9.8G^d
OBSAI-1.5G = Enables OBSAI 1.5G^c
OBSAI-6.1G = Enables OBSAI 6.1G^d

OTN rate options

OTU1 = OTN optical rate 2.666 Gbit/s^c
OTU2 = OTN optical rate 10.709 Gbit/s^d
OTU2-1e-2e = OTN optical rates 11.049/11.096 Gbit/s^d
OTU2-1f-2f = OTN optical rates 11.270/11.318 Gbit/s^d
GCC-BERT = GCC 0/1/2 BERT test^g

Fibre Channel rate options

FC1X = 1x Fibre Channel interface^c
FC2X = 2x Fibre Channel interface^c
FC4X = 4x Fibre Channel interface^c
FC8X = 8x Fibre Channel interface^d
FC10X = 10x Fibre Channel interface^d

Ethernet rate options

100Optical = 100 Mbit/s optical^c
GigE = 1000 Mbit/s optical and electrical^c
10GigE = 10G LAN and 10G WAN^d

Example: FTB-880Q-SONET-SDH-52M-DSn-DUAL-PORT-GigE

Notes

- Always included.
- Requires software option DSn.
- Requires purchase of SFP.
- Requires purchase of SFP+.
- Requires software option RFC6349.
- Requires a GPS receiver kit for wander measurements such as GP-2263.
- Requires a minimum of one OTN rate.
- Requires software option Cabke_Test.
- Requires software option ETH-OAM

ORDERING INFORMATION

FTB-870Q-XX-XX-XX-XX-XX-XX

Test options

SONET-SDH = SONET and SDH testing

Transport rate options

52M = 52 Mbit/s (OC-1/STM-0)^a

155M = 155 Mbit/s (OC-3/STM-1)

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Software options

DS1-FDL = DS1 FDL test capability^b

TCM = Tandem connection monitoring

DSn = DSn test capability

PDH = PDH test capability

ISDN-PRI = ISDN primary rate interface^b

NI-CSU = NI-CSU loopback emulation^b

Cable_Test = Cable test

IPv6 = Internet protocol version 6

ETH-THRU = Through mode capability

MPLS = Enables MPLS tags

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PBBTE = Provider Backbone Bridge Encapsulation

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ETH-CAPTURE = Full line-rate packet capture

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RFC6349 = Enables TCP testing as per RFC 6349

RFC6349-EXFOVox = Interop with BV-3100^e

PoE = Enables Power over Ethernet capability^f

TRAFFIC-SCAN = Discover and monitor VLAN traffic flows on a live signal

DP-CPRI = Enables two CPRI ports

iOptics = Enables intelligent Pluggable Optic Test Application

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FC2X = 2x Fibre Channel interface^c

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FC10X = 10x Fibre Channel interface^d

Ethernet rate options

100optical = 100 Mbit/s optical^c

GigE = 1000 Mbit/s optical and electrical^c

10GigE = 10G LAN and 10G WAN^d

Example: FTB-870Q-SONET-SDH-52M-DSn-DUAL-PORT-10GigE

Notes

a. Always included.

b. Requires software option DSn.

c. Requires purchase of SFP.

d. Requires purchase of SFP+.

e. Requires software option RFC6349.

f. Requires software option Cable_Test.

g. Requires a minimum of one OTN rate.

h. Requires software option ETH-OAM

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