FTB-700G V2 Series

OPTICAL, ETHERNET AND MULTISERVICE TESTER

EXFO TFv
Test Function Virtualization

EXFO Connect
Compatible

iSAM

iOLM
READY

iOptics

OpticalRF™

ConnectorMax2

TECHNICAL SHEET

An all-in-one Ethernet/optical solution for field technicians who install, test and troubleshoot wired, wireless, C-RAN, FTTx, fronthaul, backhaul, small cell, DAS, CWDM and data center networks

PLATFORM HIGHLIGHTS

- Windows 10 IoT (bring your own device, install what you want)
- Ultra-bright 8-inch multitouch screen
- Built-in connectivity—choose between Gigabit interface, WiFi, Bluetooth and 3G or 4G LTE via USB dongle
- Lightweight and portable solution designed for field engineers or cell technicians who install, troubleshoot and maintain wired and wireless networks

MULTISERVICE TESTING

- Dual-port testing up to 10G
- iSAM ultra-simple multiservice activation
- 10G multisession transmission-control-protocol (TCP) testing with bidirectional RFC 6349
- Power-over-Ethernet validation within cable test
- EtherSAM, RFC 2544, traffic generation and monitoring, EtherBERT, Through Mode, TCP throughput and Smart Loopback
- Packet synchronization including IEEE 1588 V2 precision time protocol (PTP) and SyncE
- Packet capture and advanced filtering up to 10G
- Fibre Channel 1x, 2x, 4x, 8x, 10x support
- OTN testing OTU-1/2, OTU-1e/2e
- Optical SONET and SDH testing up to 10G
- Electrical SONET and SDH testing
- DSn and PDH testing including ISDN PRI
- iOptics—intelligent pluggable optics test application for fast validation of an optical device, with minimal configuration

OPTICAL TESTING

- Integrated tool combining an OTDR, inspection probe, visual fault locator, broadband power meter and a CW source mode
- iOLM-ready: intelligent multiple acquisitions at multiple wavelengths with clear go/no-go results presented in a straightforward visual format
- iOLM minimizes training and avoids misconfiguration thanks to automatic parameter settings
- 100% automated, one-step connector inspection process
- Completely wireless, self-powered inspection probe for connector endface inspection
- 18 CWDM channels or C-Band ITU DWDM grid channels 17-62 from single OTDR port for single-ended construction, in-service testing and troubleshooting through MUX/DEMUX/OADM

FRONTHAUL/FTTA/C-RAN TESTING

- 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
- CPRI/OBSAI service disruption time (SDT) measurements
- BBU emulation allowing RF level validation of RRHs , RET status and control and remote SFP identification
- Wander time error testing

RF SPECTRUM ANALYSIS

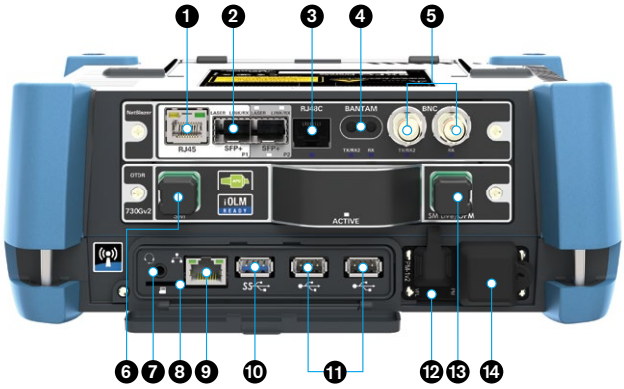
- Real-time high-resolution RF spectrum analysis over CPRI

EXFO

THE ULTRA-PORTABLE CHOICE FOR MULTISERVICE TESTING

The ongoing transition towards a converged network infrastructure for optical, SONET/SDH, OTN, Fibre Channel and packet-based Ethernet services requires a test tool that can cover a wide range of interfaces and rates without sacrificing portability, speed or cost. Leveraging the powerful FTB-1 handheld platform, the FTB-700G V2 Series streamlines processes and empowers field technicians to efficiently test and validate optical networks, SONET/SDH, OTN, Fibre Channel, CPRI and Ethernet circuits.

THE BEST FROM OPTICAL, ETHERNET AND MULTITEST FEATURES



1. **ETHERNET**
   10 to 1000 BASE-T
2. **OPTICAL ETHERNET**
   Up to 10 Gbit/s
   1000BASE-T
   CPRI 1.2 to 9.8G
   OBSAI 1.5G to 6.1G
   Fibre Channel 1x, 2x, 4x, 8x, 10x
   SONET/SDH up to 10G
   OTN OTU1/2
   RF spectrum analysis over CPRI
3. DSn/PDH
   EXT CLK
   Wander
4. DSn/PDH
   RX2: DS1
   EXT CLK
5. Electrical
   SONET/SDH
   DSn/PDH
   RX2: DS1/DS3
   EXT CLK
   Wander
6. Singlemode OTDR port
7. Mic/headset jack
8. Micro SD card slot
9. 1 GigE port
10. One USB 3.0 port
11. Two USB 2.0 ports
12. VFL
13. Multimode or singlemode live or singlemode CWDM or singlemode DWDM
14. Power meter

FIBER INSPECTION REACHES NEW HEIGHTS

During fiber-to-the-antenna (FTTA) installation, operators and infrastructure owners have to hire climbing specialists to mount towers and install the fibers and connect the remote radio heads (RRH). This is a costly endeavor. Crews usually familiar with copper or RF technology don't always have the required fiber-testing background and it is difficult to carry bulky equipment up the towers. In addition, studies have shown that about 80% of network problems are related to dirty or bad connectors, stressing the need for proper connector inspection.

Thanks to a fully automated test process, the FIP-435B inspection probe helps close the technology gap, reduces the number of climbs required and streamlines the work needed at the top of the tower. The device's automatic focus adjustment feature delivers optimal image capture resolution while its focus protection feature prevents any risk of false positive results, ensuring technicians won't have to climb the same mountain twice.

Moreover, tower climbers can rely only on the LED pass/fail indicator to get an immediate analysis result based on industry standards. The probe can be operated with just one hand, allowing them to concentrate on the task at hand and reach hard-to-access locations more easily.

OPTICAL

FIVE MODELS TO FIT YOUR BUDGET

The FIP-430B: complete and fully automated feature set that includes the powerful fiber image-centering system, focus adjustment and optimization, and onboard pass/fail analysis.

The FIP-435B: go one step further with the wireless probe. Includes all FIP-430B features.

The semi-automated FIP-420B: has the same features as the FIP-430B, without the automated focus adjustment.

The semi-automated FIP-425B: the wireless version of the semi-automated FIP-420B.

The FIP-410B: offers all the basic inspection features needed for manual inspection only.

100% Automated [a]

1-step Process [a]

57% Shorter Test Time [b]

FEATURES	USB WIRED			WIRELESS	
	Basic **FIP-410B**	Semi-Automated **FIP-420B**	Fully Automated **FIP-430B**	Semi-Automated **FIP-425B**	Fully Automated **FIP-435B**
Three magnification levels	√	√	√	√	√
Image capture	√	√	√	√	√
Five-megapixel CMOS capturing device	√	√	√	√	√
Automatic fiber image-centering function	X	√	√	√	√
Automatic focus adjustment	X	X	√	X	√
Onboard pass/fail analysis	X	√	√	√	√
Pass/fail LED indicator	X	√	√	√	√
WiFi connectivity	X	X	X	√	√

Notes

a. Models FIP-430B and FIP-435B.

b. Data sourced from EXFO's case study, with calculation based on typical analysis time.

REMOVING COMPLEXITY FROM THE OTDR

OTDR TESTING COMES WITH ITS LOAD OF CHALLENGES...

- WRONG OTDR TRACES
- COUNTLESS TRACES TO ANALYZE
- REPEATING THE SAME JOB TWICE
- COMPLEX INSTRUMENT TRAINING/SUPPORT

iOLM | intelligent Optical Link Mapper

In response to these challenges, EXFO developed a better way to test fiber optics: The iOLM is an OTDR-based application designed to simplify OTDR testing by eliminating the need to configure parameters, and/or analyze and interpret multiple complex OTDR traces. Its advanced algorithms dynamically define the testing parameters, as well as the number of acquisitions that best fit the network under test. By correlating multipulse widths on multiple wavelengths, the iOLM locates and identifies faults with maximum resolution–all at the push of a single button.

HOW DOES IT WORK?

Dynamic multipulse acquisition → Intelligent trace analysis → Combines all results into a single link view → Comprehensive diagnosis →

Turning traditional OTDR testing into clear, automated, first-time-right results for technicians of any skill level.

THREE WAYS TO BENEFIT FROM THE iOLM

COMBO

Run both iOLM and OTDR applications (Oi code)

UPGRADE

Add the iOLM software option to your iOLM-ready unit, even while in the field

iOLM ONLY

Order a unit with the iOLM application only

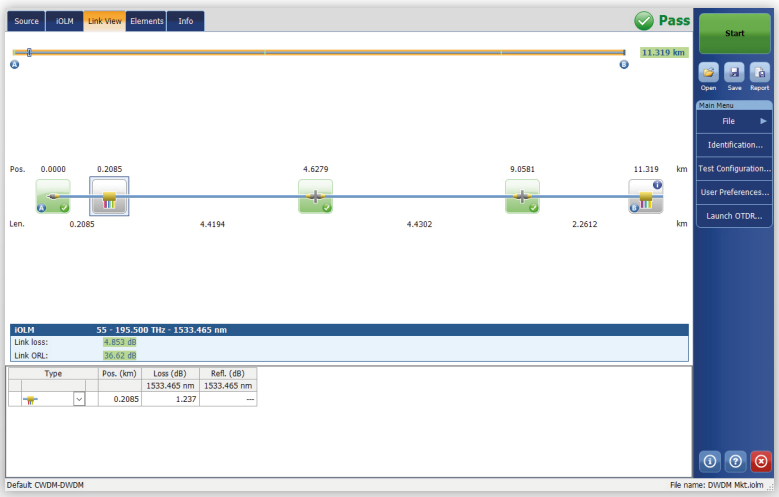
iOLM FEATURES VALUE PACK

In addition to the standard iOLM feature set, you can select added-value features as part of the **Advanced** or **Pro** packages. Please refer to the intelligent Optical Link Mapper (iOLM) specification sheet for the complete and most recent description of these value packs.

iOLM FOR CWDM AND DWDM NETWORKS

All iOLM benefits tailored to CWDM and DWDM network topologies and challenges: optimized CWDM/DWDM algorithm, new icon to represent MUX, DEMUX and OADM.

Typical CWDM/DWDM passive networks will exhibit a series of high loss MUX/DEMUX or OADM, which would lead the technician to use longer pulse widths to reach the end of the link at the expense of front-end resolution, in a very similar way to what has been seen in PON networks. iOLM's dynamic multipulse acquisition accurately characterizes the complete link with all necessary pulses, for best resolution along the link and generating a single iOLM file per link to facilitate reporting.



Many CWDM/DWDM passive networks rely on duplex fibers for TX/RX on the same wavelength, iLoop will greatly increase efficiency in those cases, by characterizing TX and RX link in a single acquisition. iLoop will guide the user in the test sequence and will automate all the process of generating single files and reports per link.

LOOPBACK TESTING MODE (iLOOP) [a]

The iLOOP feature allows your iOLM unit to double its testing efficiency by reducing testing time by 50% compared to a traditional unidirectional test method. This intelligent application relies on the loopback single-ended measurement method to characterize two fibers at once. The application splits the results into two individual links, thus eliminating the need for post-processing. iLOOP automatically generates individual iOLM and OTDR (.sor) files, in addition to PDF reports, for all your fibers directly from the field, enabling you to close your job immediately and move on to the next fiber pair faster.

This option is particularly efficient for applications such as fiber-to-the-antenna (FTTA), distributed antenna systems (DAS) and data centers, where iLOOP enables you to simultaneously test Rx/Tx fibers with a simple loop jumper between the two fibers. Once the measurement is completed, iLOOP applies pass/fail assessments and generates a report for each single fiber.

SPECIALIZE YOUR iOLM WITH THE OPTIMODE FOR FTTA/C-RAN [a]

Optimodes are test configurations tailored to optimize specific use cases and go a step beyond recognized iOLM performances.

The optimode *short-link close events* was specifically designed for FTTA and C-RAN applications. Tailored to short links with close connectors, this optimode offers the highest resolution achieved so far, and enables technicians to pinpoint problem connectors with greater accuracy and therefore fix issues while still on-site. This in turn reduces both installation and repair time.

SPECIFICATIONS	FTB-720G V2	FTB-730G V2
Maximum link length [b] (m)	2500	2500
Maximum link loss (dB)	8	10
Detection of 5 m patchcord [c, d]	Up to 2.5 dB loss	Up to 3.5 dB loss

Notes

a. Available for FTB-720G V2 and FTB-730G V2.

b. Total length, unidirectional or total loopback, including launch, loop and receive fibers.

c. At 1550 nm, fiber length after reflection ≤ –55 dB, fiber section before event must be detectable.

d. Typical.

TROUBLESHOOTING HIGH-SPEED MULTIMODE NETWORKS WITH ENCIRCLED FLUX

SPSB-EF-C30

Whether for an expanding enterprise-class business or a large-volume data center, new high-speed data networks built with multimode fibers are running under tighter tolerances than ever before. In the event of failure, intelligent and accurate test tools are needed to quickly find and fix the fault.

Multimode fibers are the trickiest links to test, because the test results are highly dependent on each device's output conditions. Troubleshooting with a different unit than the construction unit may mislead the technician or result in the inability to find the fault, thereby creating longer network downtimes.

For multimode fibers, EXFO recommends using an external launch mode conditioner that is Encircled Flux (EF)-compliant. The EF standard (as recommended in TIA-568 via TIA-526-14-B and IEC 61280-4-1 Ed. 2.0) is a way of controlling the source launch conditions so that tier-2 troubleshooting can be performed with maximum accuracy and consistency.

Use of an external EF-compliant device* such as the SPSB-EF-C30 is a fast and easy way to fix faulty networks.

*For more detailed information about EF compliance, please read the Encircled Flux Test Solutions specification sheet.

MULTISERVICE

Powerful and Fast

The FTB-700G V2 Series offers a fully integrated DSn/PDH, ISDN, SONET/SDH, OTN, Fibre Channel, CPRI, OBSAI and Ethernet handheld tester, and an 8-inch multitouch screen with unprecedented configuration simplicity. Platform connectivity is abundant via WiFi, Bluetooth, Gigabit Ethernet and USB ports, making it accessible in any environment.

What you need for any DSN/PDH, ISDN, SONET/SDH, OTN, Fibre Channel, CPRI, OBSAI or Ethernet application

- Installation, commissioning and maintenance of access and metro networks
- Turn-up of SONET/SDH circuits
- Performance assessment of Carrier Ethernet services
- Validation of OTN networks and services
- Installation, activation and maintenance of metro Ethernet networks
- Deployment of active Ethernet (point-to-point) access services
- Installation and activation of Fibre Channel networks
- Testing and troubleshooting
- In-service troubleshooting of live traffic
- Performance monitoring of SONET/SDH and OTN circuits
- Simplified DSn and PDH testing including ISDN PRI
- Round-trip delay assessment of transport circuits
- BER testing up to 11.3 Gbit/s
- FTTA validation from 1.2 Gbit/s to 9.8 Gbit/s via layer-2 CPRI protocol and unframed BER testing
- OpticalRF™ real-time, high-resolution RF spectrum analysis over CPRI

SONET/SDH, OTN, FIBRE CHANNEL, CPRI, OBSAI AND ETHERNET AT UP TO 11.3 GBIT/S

The FTB-700G V2 Series is the all-in-one solution for wired or wireless testing up to 11.3 Gbit/s.

- RJ45 port for Electrical 10/100/1000M Ethernet
- SFP+ port 1 for OTU1, OTU2, OTU1e, OTU2e, OTU1f, OTU2f, OC-1, 3, 12, 48 and 192 or STM-0, 1, 4, 16 and 64 or Fibre Channel 1x, 2x, 4x, 8x and 10x or CPRI 1.2, 2.4, 3.1, 4.9, 6.1 and 9.8 Gbit/s or OBSAI 1.5 Gbit/s and 3.1Gbit/s, and 100/1000M, 10G Ethernet and 1000BASE-T (using RJ45 copper SFP)
- SFP+ port 2 for Fibre Channel 1x, 2x, 4x, 8x, 10x or CPRI 1.2, 2.4, 3.1, 4.9, 6.1 and 9.8 Gbit/s or OBSAI 1.5 Gbit/s and 3.1Gbit/s, and 100/1000M, 10G Ethernet and 1000BASE-T (using RJ45 copper SFP)
- RJ48C port for DS1/1.5M, E1/2M and clock in/out: DS1/1.5M/E1/2M/2 MHz
- Bantam port for TX: DS1/1.5M, E1/2M, RX2: DS1/1.5M and clock in/out: DS1/1.5M/E1/2 MHz
- BNC TX: E1/2M, E3/34M, DS3/45M, STS-1e/STM-0e/52M, E4/140M, STS-3e/STM-1e/155M RX2: DS1/1.5M, DS3 and clock out: DS1/1.5M/E1/2M/2 MHz
- BNC RX: E1/2M, E3/34M, DS3/45M, STS-1e/STM-0e/52M, E4/140M, STS-3e/STM-1e/155Ms

Key Testing Benefits

- Up to 10G SONET/SDH
- OTN 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
- 10 BASE-T to 10 GigE testing
- Dual-port testing
- 10G TCP throughput testing as per RFC 6349
- TCP throughput testing up to 1 GigE
- EtherSAM, RFC 2544, traffic generation and monitoring, EtherBERT and iSAM ultra-simple ITU-T Y.1564
- 1588 PTP and SyncE
- Through Mode and Smart Loopback
- Cable testing including power-over-Ethernet
- Full line-rate packet capture and advanced filtering from 10M to 10G
- IPv6 testing
- VLANs including E-VLAN, S-VLAN and C-VLAN
- MPLS
- Asymetrical testing with Dual Test Set (EtherSAM, RFC 2544, RFC 6349 and iSAM)
- Carrier Ethernet OAM (MEF, IEEE 802.1ag, ITU-T Y.1731 and ITU-T G.8113.1 MPLS-TP)
- Fibre Channel 1x, 2x, 4x, 8x and 10x
- 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 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 for fast validation of optical devices
- OpticalRF™ real-time high-resolution RF spectrum analysis over CPRI
- BBU emulation enabling RF level validation of RRHs, RET status and control and remote SFP identification
- Wander timer error testing

Fronthaul/FTTA/C-Ran Testing

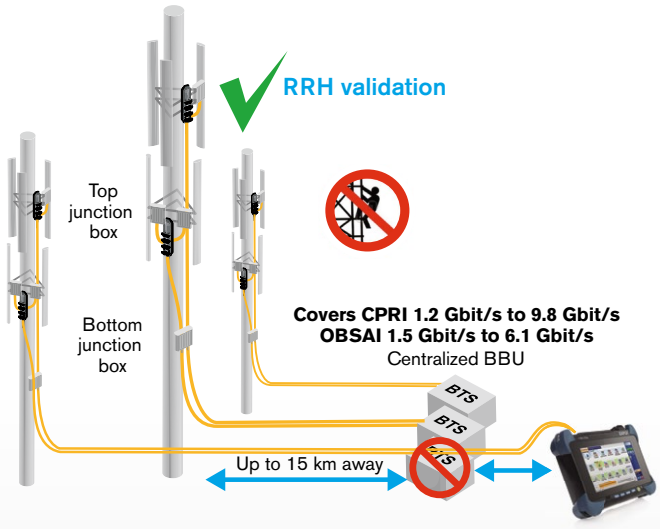
With the FTB-700G V2 modules, field technicians can carry out a variety of FTTA tests. For instance, when installing an RRH, it is critical that all equipment be verified before the riggers have finished the construction phase. The FTB-700G V2 Series CPRI/OBSAI protocol feature verifies that the RRH is fully operational and that the correct small form-factor pluggable (SFP) transceivers are installed and connected correctly.

Using the FTB-700G 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 FTB-700G V2 is always ready to validate a CPRI/OBSAI-enabled BBU. Once connected to the RRH, the FTB-700G 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 FTB-700G 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 FTB-700G V2 Series test suite better equips field technicians to decipher and solve these basic, yet very costly, human errors.

Finally, using the FTB-700G V2 Series modules, field technicians can perform an unframed and framed layer-2 CPRI/OBSAI BER test. The FTB-700G 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.



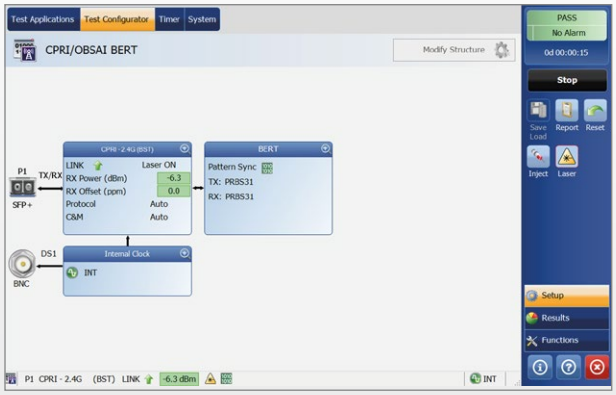


Figure 1. Framed CPRI/OBSAI test

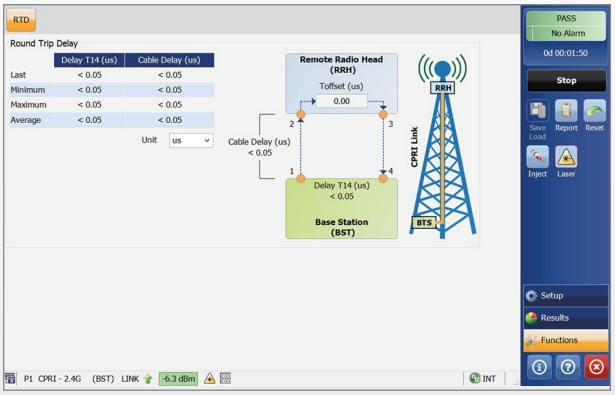


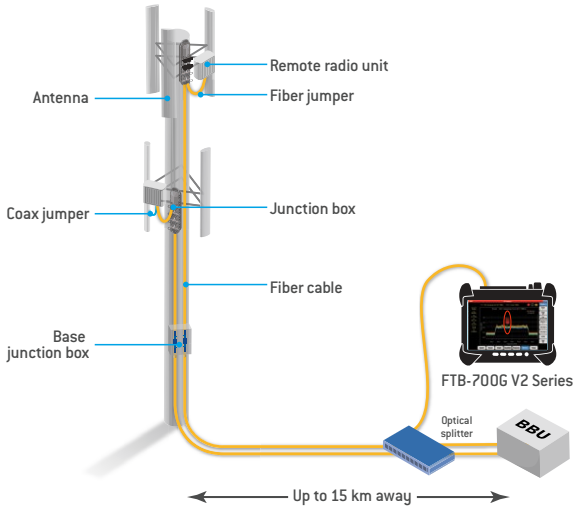
Figure 2. CPRI/OBSAI round-trip delay

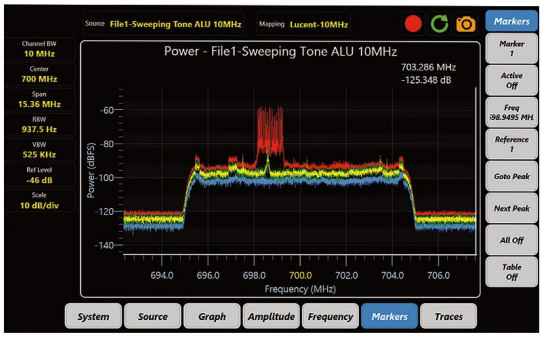
OpticalRF™

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 FTB-700G 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 FTB-700G 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).

Figure 3. Dual AxC overlay display

Figure 4. Dual AxC side-by-side display

EXFO

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.

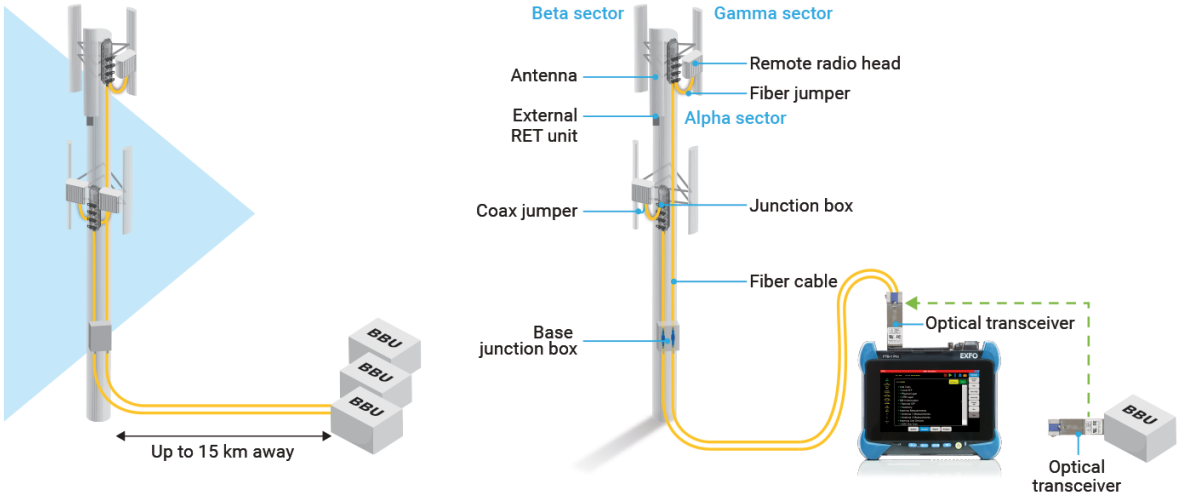


Figure 5. RRH validation

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

Figure 6. BBU emulation turn-up

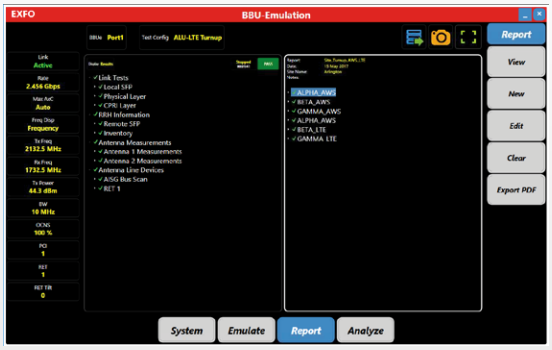
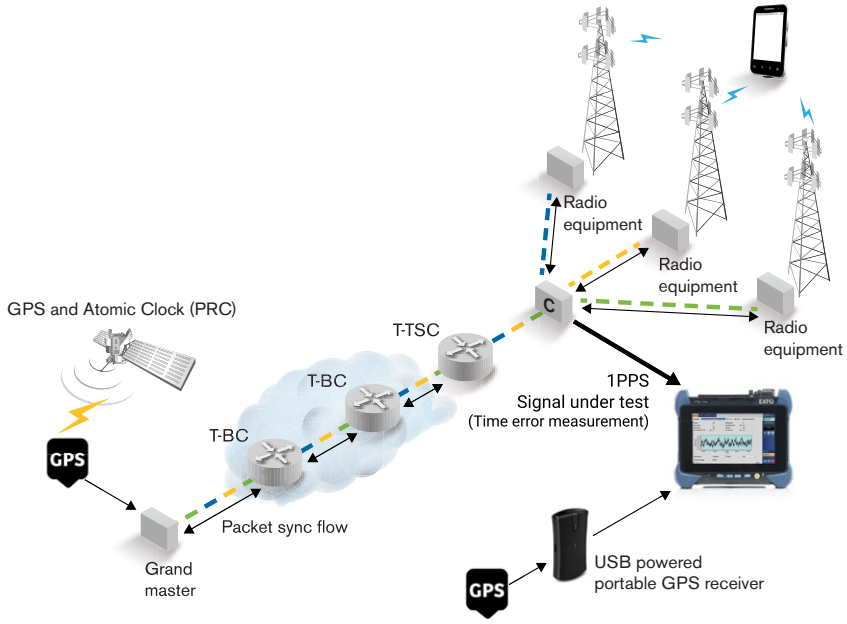


Figure 7. BBU emulation site report

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. Wander 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 or TDEV mask defined by ITU G.8271.1, G8261, 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. Wander also allows users to zoom into time error graphical results of tests that last up to thirty days. Synchronization experts can easily identify the most important events during their time error measurements.

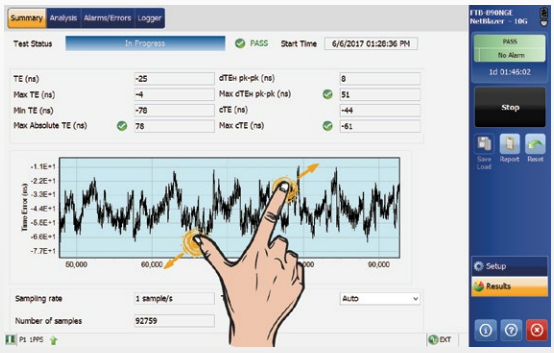


Figure 8. Wander results/multitouch pinch-to-zoom

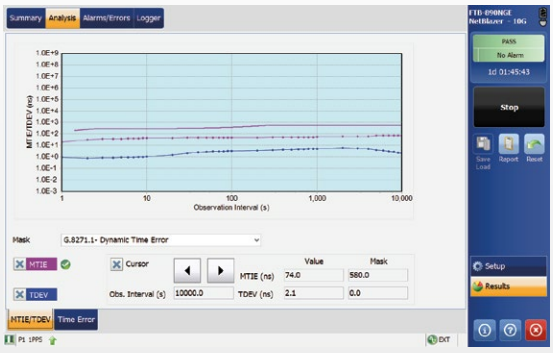
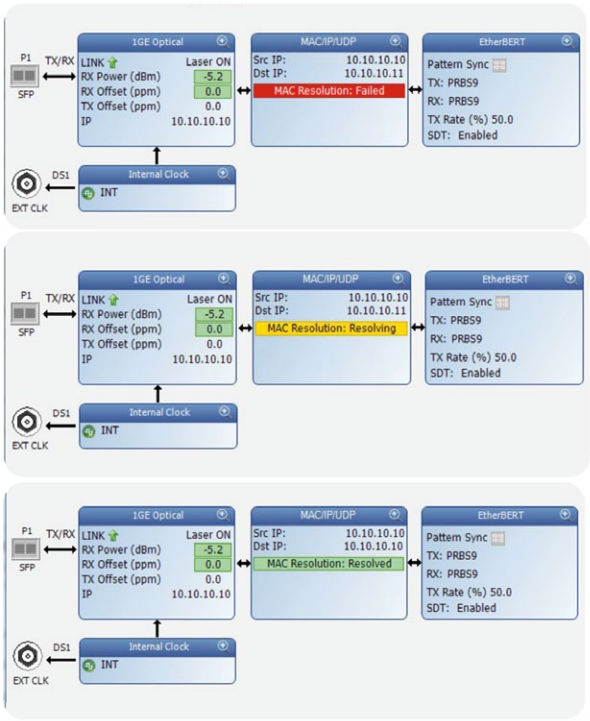


Figure 9. Wander analysis

REVAMPED SETUP PROCEDURES

The new Test Configurator enables tests to be easily set up and provides critical test information immediately after the actual setup stage. In the screenshot to the right, the RFC 2544 test was selected with Throughput and back-to-back tests enabled (frame loss and latency are disabled). The green arrow pointing upwards confirms that the link is up. The destination IP address is resolved and the test is ready to be executed. The Test Configurator covers all stages of testing: setup, review and execution.

The control panel has icons that provide access to the most important testing elements, buttons for the Setup, Results and Functions screens, as well as a clear pass/fail indicator. This gives field technicians the assurance that their testing time will be optimized.



MULTISERVICE

Setting a new GUI standard: unprecedented simplicity in configuration setup and navigation

The FTB-700G V2 Series intelligent situational configuration setup feature guides technicians through complete and accurate testing processes (e.g., suggestion prompts and help guides). This feature reduces navigation by combining associated testing functions on a single screen and offers intelligent autodiscovery that enables a single technician to perform end-to-end testing.

Dedicated quick action buttons

- Remote discovery to find all other EXFO units
- Laser on/off
- Test reset to clear results and statistics while running a test
- Report generation
- Save or load test configurations
- Quick error injection
- Enable second Ethernet loopback port

Assorted notifications

- Clear indication of link status for single or dual ports
- Negotiated speed display for single or dual ports
- Power status available at all times for single or dual ports
- Pass/fail indication at all times
- Pattern and clock synchronization
- Frequency offset with valid-range color indicator
- Overhead overwrite indicator
- Error/alarm injection
- Alarm hierarchy pinpointing root cause (when possible)

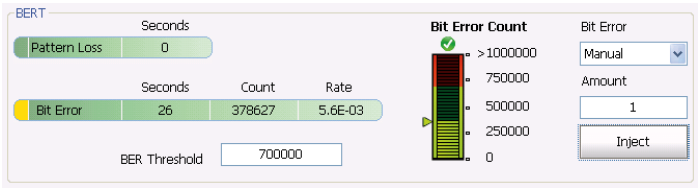
Streamlined navigation

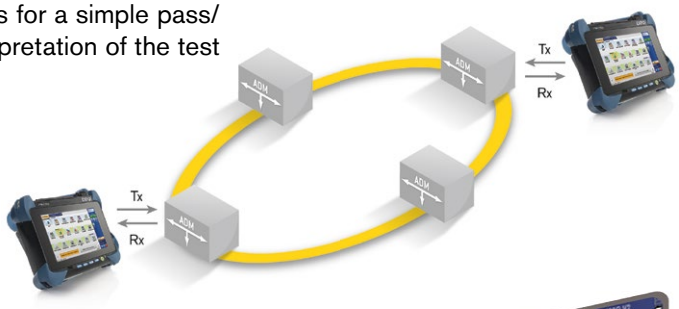
- Remote discovery button available at all times; no need to leave your current location to scan for a remote unit
- Testing status can be enlarged to fill the entire screen by simply clicking on the alarm status button; whether the unit is in your hand or on the other side of the room, test results can be easily determined with a simple glance at the display screen
- RFC 2544 results and graphs are also displayed in a single page; no need to navigate through multiple screens to view individual RFC subtest results
- Simplified test structure definition using task-based test-application selection, signal configuration, front-end and smart timeslot selection
- Centralized functions: error/alarm management, performance monitoring and overhead manipulation/monitoring

KEY OTN, SONET/SDH AND DSN/PDH FEATURES

Simplified BER testing

The FTB-700G 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

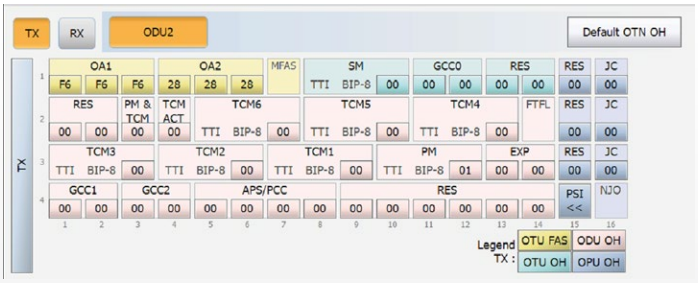
The Decoupled Mode enables the user to independently configure the Tx and Rx ports of the FTB-700G V2 Series module. This makes it possible to test the mapping and demapping functionality of a network element or at cross-connect points in the network.

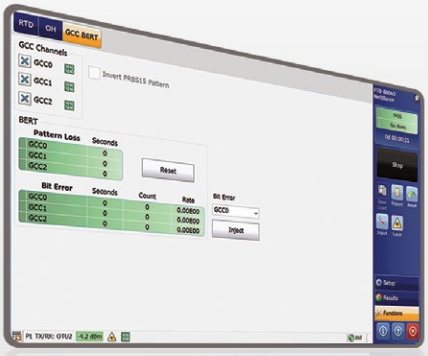
Through Mode

This mode is required for in-service monitoring of the network. The FTB-700G 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 FTB-700G 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.



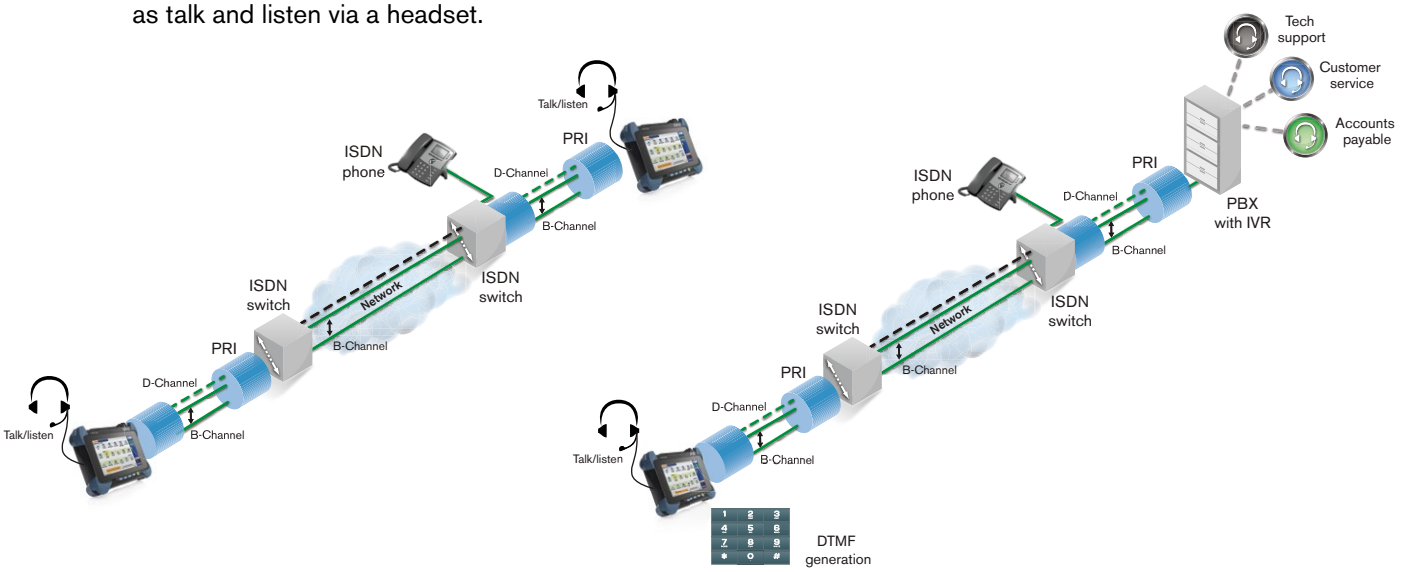


OTN GCC Bert

This FTB-700G V2 Series feature enables the user to run a BERT test on GCC channels. The test set supports BERT on GCC0/1/2 channels individually, two channels simultaneously or all channels simultaneously.

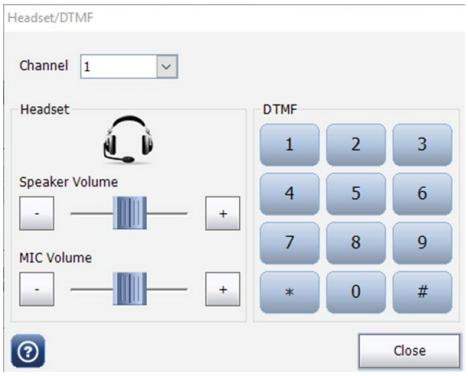
KEY ISDN FEATURES

The FTB-700G 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.

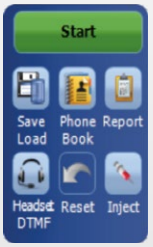


Who's calling? What type of calls?

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.

Centralized control

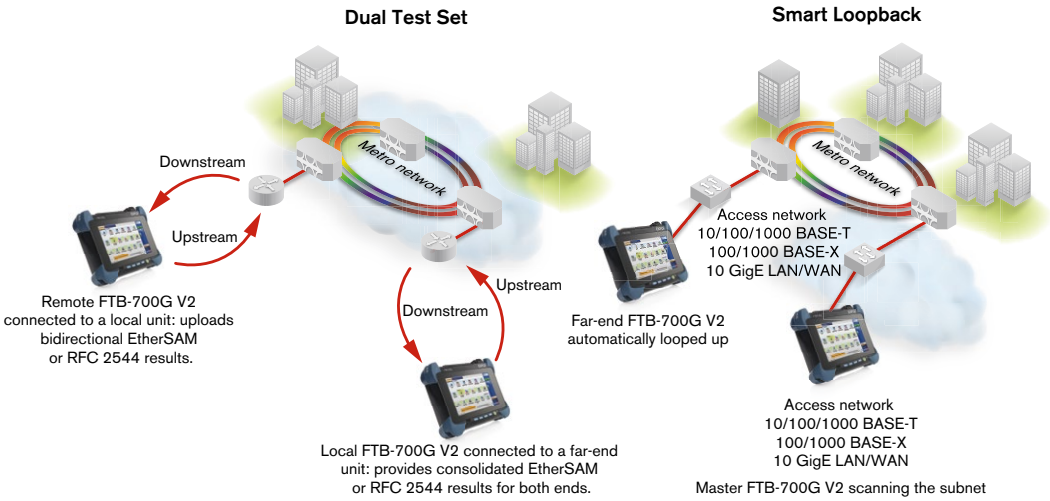
With the FTB-700G V2 Series, field technicians have complete control at their fingertips at all times. Whether that applies to a phone book, headset activation, DTMF injection, error injection, report generation, or save and load configurations, all utilities are just a tap of a finger away from activation.



KEY ETHERNET FEATURES

Intelligent network discovery mode

Using the FTB-700G 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–these modules take 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 FTB-700G V2 Series has the flexibility to adjust to all unique loopback situations.

Dual-Port and Through Mode Resting

With dual-port testing, one technician can use a single FTB-700G 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 FTB-700G 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.

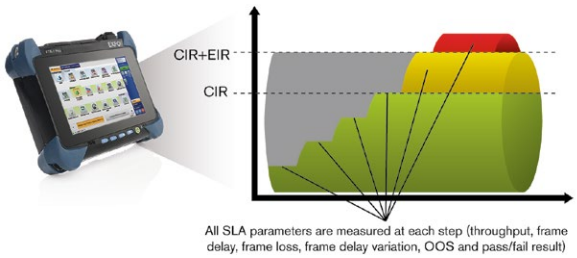
EXFO's EtherSAM test suite–based on the ITU-T Y.1564 Ethernet service activation methodology–provides comprehensive field testing for mobile backhaul and commercial services.

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.

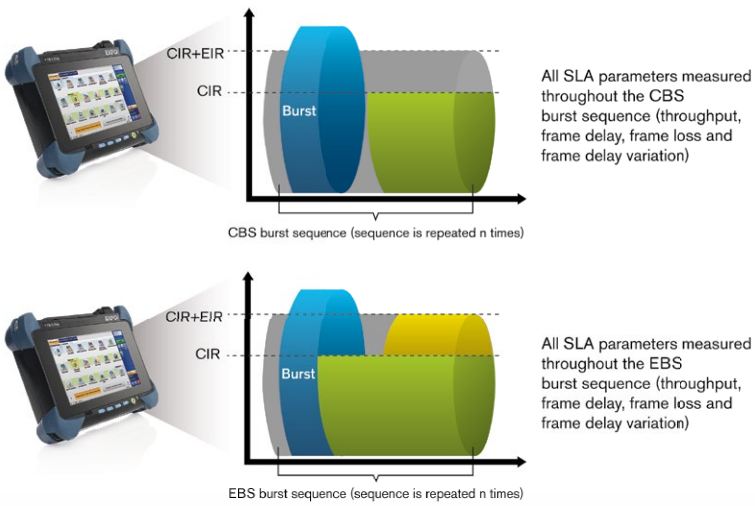
Service configuration test

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).

Ramp test

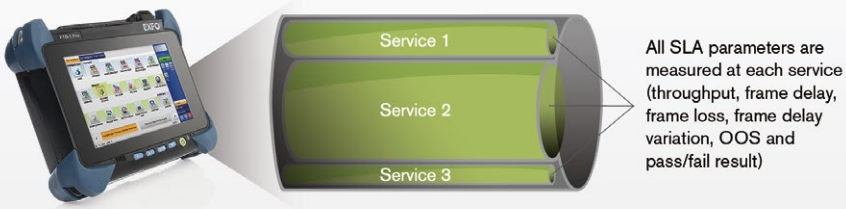


Burst test



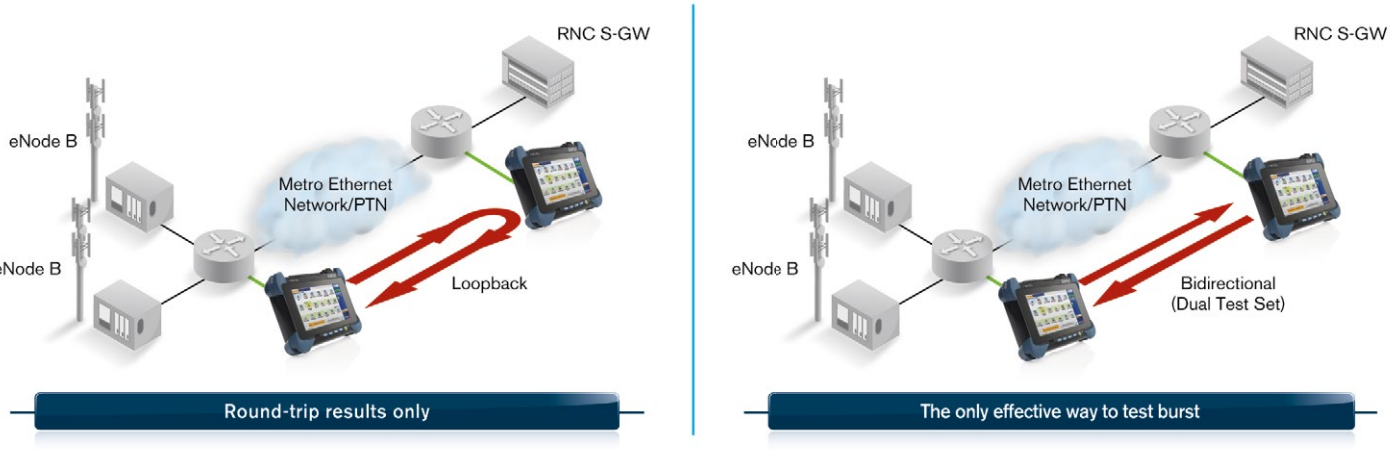
Service performance test

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.



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.

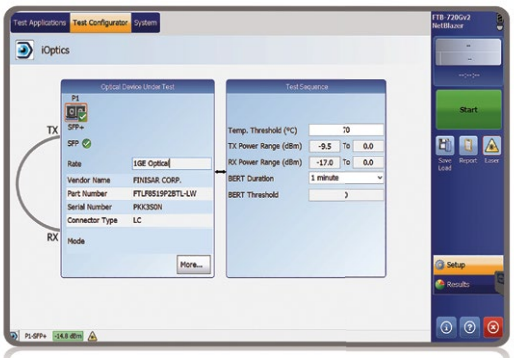


Figure 10. SFP

Figure 11. SFP+

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.

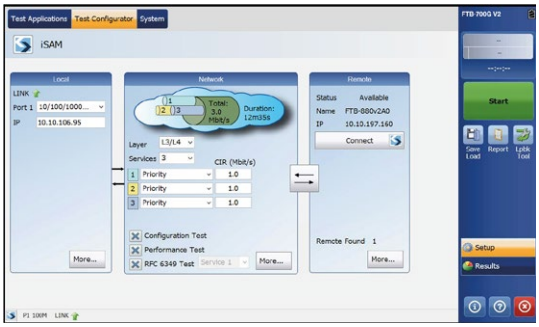


Figure 12. One-page setup

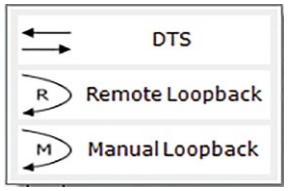
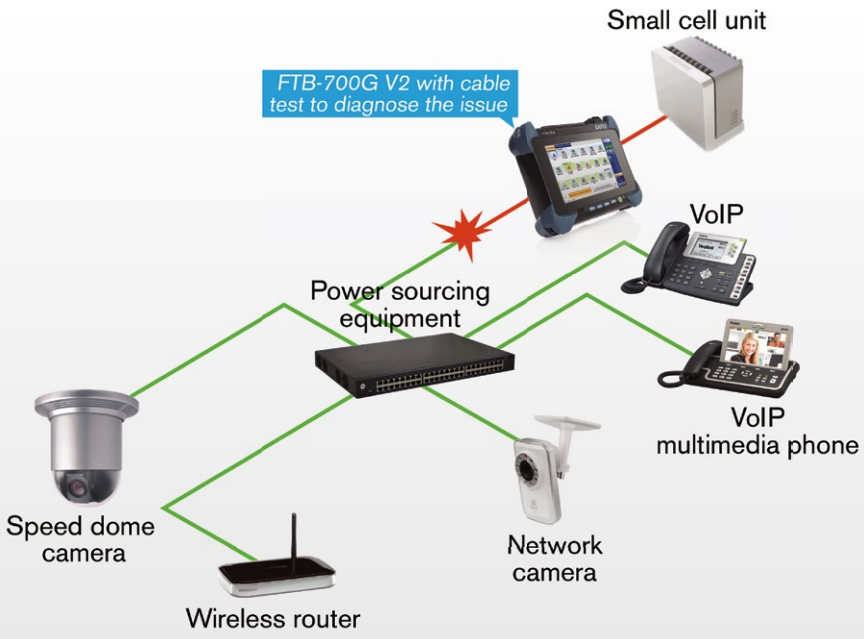


Figure 13. Multiple modes of connection

Figure 14. One-page results

CABLE TEST WITH POWER OVER ETHERNET (PoE)

The cable test helps field technicians quickly and efficiently detect cable issues. Using this feature in conjunction with the FTB-700G V2 Series, technicians can troubleshoot any cabling or installation issue by checking the cable's actual pinout, 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 FTB-700G V2 Series fits the bill for basic to critical devices.

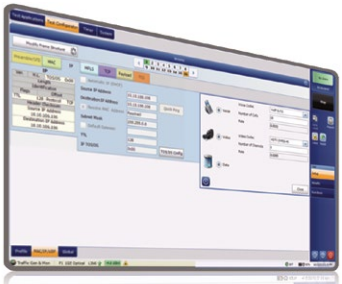


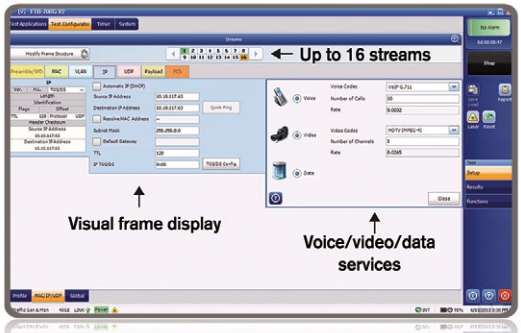
TRAFFIC GENERATION AND MONITORING

The FTB-700G V2 Series surpasses the multistream offerings of typical handheld Ethernet testing devices. Up to 32 streams of traffic 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 FTB-700G 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.

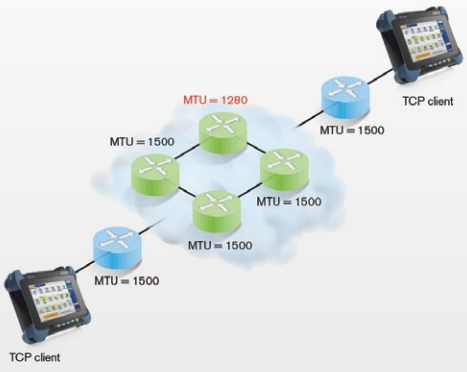


Figure 15. Path MTU discovery

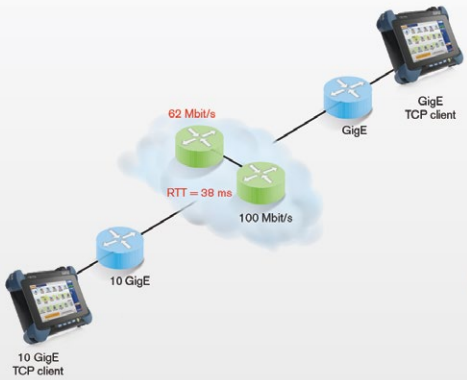


Figure 16. Baseline RTT and bandwidth to determine the ideal window size

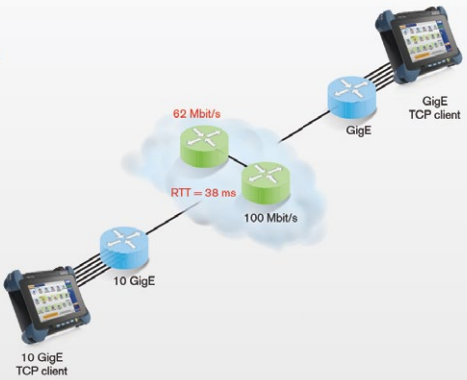
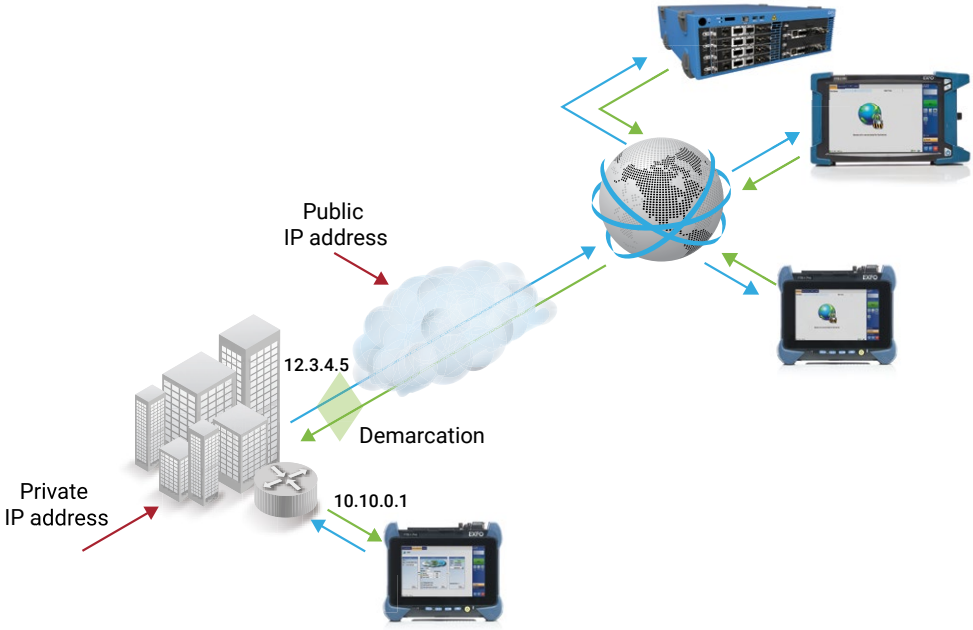


Figure 17. Single or multiple TCP connections to enable full pipe testing

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 FTB-700G 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.

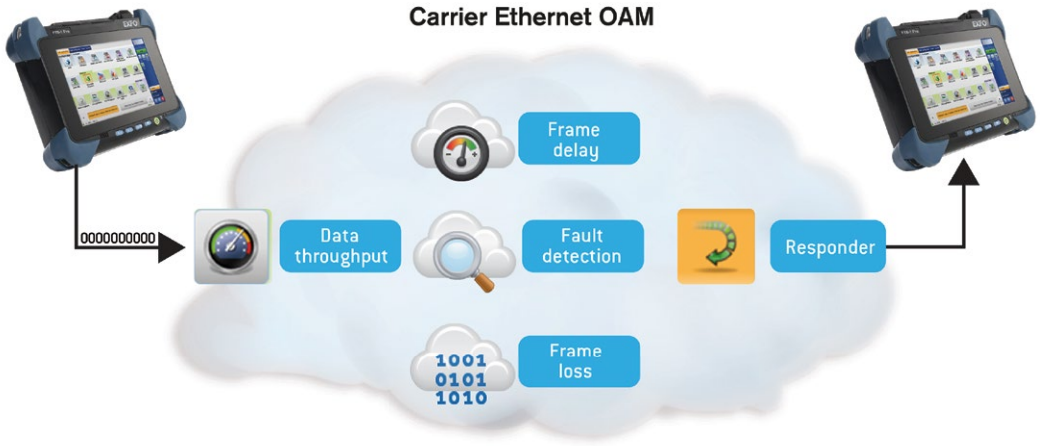
The DTS-NAT feature delivers:

- 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

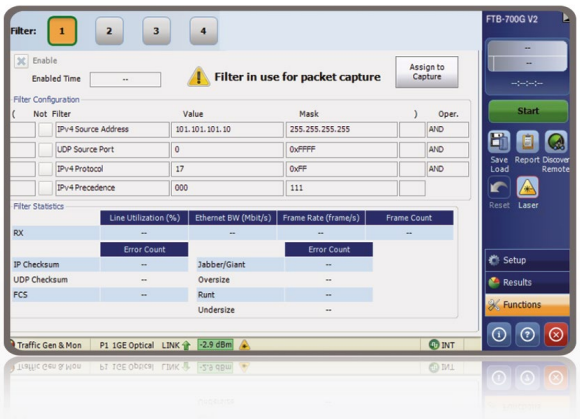
Ever since the introduction of metro Ethernet networks, there has been a need to ensure *five nines* level of availability, and reliability, as well as a 50 millisecond recovery time from failures. As per PDH, time-division multiplexing (TDM) and SONET/SDH, operations, administration and maintenance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

The FTB-700G 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 FTB-700G V2 Series extends far beyond basic capabilities. The FTB-700G 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 FTB-700G 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.

EFFICIENTLY ASSESSING THE PERFORMANCE OF FIBRE CHANNEL SERVICES

The FTB-700G V2 Series modules provide comprehensive testing capabilities for Fibre Channel (FC) network deployments, supporting multiple FC interfaces.

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

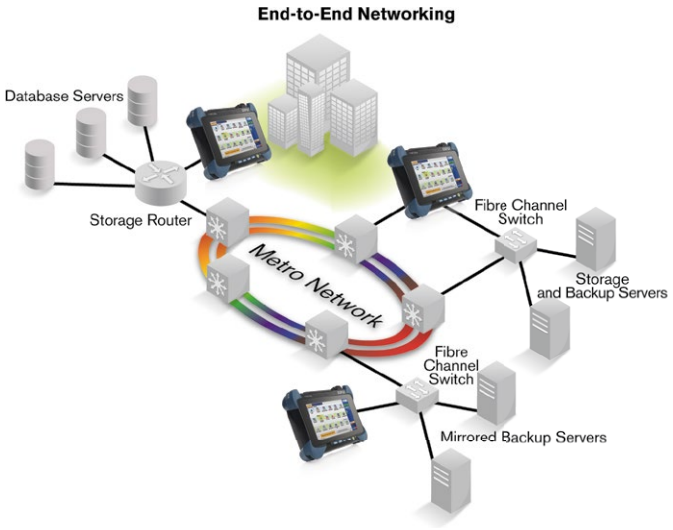
APPLICATIONS

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 FTB-700G V2 Series modules provide full wire-speed traffic generation at the FC2 layer, which enables for BER testing for link integrity measurements. The FTB-700G 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 FTB-700G V2 Series modules estimate buffer-to-buffer credit value requirements from the performed latency measurement.



Thanks to end-to-end network testing capabilities, EXFO's FTB-700G 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.

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 FTB-700G 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 FTB-700G 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.

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.

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

OPTICAL TECHNICAL SPECIFICATIONS [a]

TECHNICAL SPECIFICATIONS	FTB-720G V2 OTDR	FTB-730G V2 OTDR
Wavelength (nm) [b]	850 ± 20/1300 ± 20/1310 ± 20/1550 ± 20	1310 ± 20/1550 ± 20/1625 ± 10/1650 ± 5
SM live port built-in filter		1625 nm: highpass > 1595 nm isolation > 50 dB from 1270 nm to 1585 nm 1650 nm: bandpass 1650 nm ± 7 nm isolation > 50 dB out of 1650 nm ± 10 nm
Dynamic range at 20 µs (dB) [c]	27/29/36/35	39/38/39/39
Event dead zone (m)	Singlemode: 0.7 [d] Multimode: 0.5 [f]	0.5 [e]
Attenuation dead zone (m) [d]	Singlemode: 3 [d,g] Multimode: 2.5 [f]	2.5 [h]
Distance range (km)	Singlemode: 0.1 to 260 Multimode: 0.1 to 40	0.1 to 400
Pulse width (ns)	Singlemode: 3 to 20 000 Multimode: 3 to 1000	3 to 20 000
Launch condition [i]	Encircled Flux (EF)-compliant	
Linearity (dB/dB) [b]	±0.03	±0.03
PON dead zone (m) [j]	35	30
Loss threshold (dB)	0.01	0.01
Loss resolution (dB)	0.001	0.001
Sampling resolution (m)	Singlemode: 0.04 to 10 Multimode: 0.04 to 5	0.04 to 10
Sampling points	Up to 256 000	Up to 256 000
Distance uncertainty (m) [k]	±(0.75 + 0.0025 % x distance + resolution)	±(0.75 + 0.0025 % x distance + resolution)
Measurement time	User-defined (maximum: 60 minutes)	User-defined (maximum: 60 minutes)
Typical real-time refresh (Hz)	4	4
Stable source output power (dBm) [l]	Singlemode: –6 Multimode: –3	–2.5
Reflectance (dB) [b]	±2	±2

TECHNICAL SPECIFICATIONS (IN-LINE POWER METER) [a]	
Input power range (dBm)	1550 nm: –50 to 28
Broadband power meter spectral band (nm)	1270 to 1625
Power uncertainty (dB) [b]	±0.2
Calibrated wavelengths (nm)	1310, 1490, 1550 and 1625
Display resolution (dB)	0.1
Broadband power meter ORL (dB) [b]	–50

Notes

a. All specifications valid at 23 °C ± 2 °C with an FC/APC for the FTB-730C, unless otherwise specified.
b. Typical.
c. Typical dynamic range with longest pulse and three-minute averaging at SNR = 1.
d. Typical, for reflectance at –55 dB, using a 3 ns pulse.
e. Typical, for reflectance from –35 dB to –55 dB, using a 3 ns pulse.
f. Typical, for reflectance at –35 dB, using a 3 ns pulse.
g. Typical at 1310 nm. Attenuation dead zone is 4 m typical at 1310 nm with reflectance below –45 dB.
h. Typical at 1310 nm, for reflectance at –55 dB in singlemode. Attenuation dead zone is 3.5 m typical at 1310 nm with reflectance below –45 dB.
i. Compliant with Encircled Flux TIA-526-14-B and IEC 61280-4-1 Ed. 2.0 using an external EF conditioner (SPSB-EF-C-30).
j. Non-reflective FUT, non-reflective splitter, 13 dB loss, 50 ns pulse and typical value.
k. Does not include uncertainty due to fiber index.
l. Typical output power value at 1550 nm for singlemode and 1300 nm for multimode.

All specifications valid at 23 °C ± 2 °C with an FC/APC connector, unless otherwise specified.

TECHNICAL SPECIFICATIONS—FTB-740G V2 CWDM AND DWDM OTDR

	740C-CWDM	740C-DWC
Laser nominal wavelength (nm)	1270, 1290, 1310, 1330, 1350, 1370, 1390, 1410, 1430, 1450, 1470, 1490, 1510, 1530, 1550, 1570, 1590, 1610	C-Band tunable 1527.99-1563.86 nm ITU-T G694.1 Channels 17-62 (191.7 THz - 196.2 THz)
Central wavelength uncertainty (nm) [a]	±3	DWDM 50 Ghz channel wavelength control
Channel spacing tuning	N/A	50 GHz and 100 GHz increments on ITU-T G694.1 grid
Dynamic range at 20 µs (dB) [b]	> 37	40
Event dead zone (m) [c]	1.1	0.7
Attenuation dead zone (m) [c]	5	3.5
Distance range (km)	0.1 to 400	0.1 to 400
Pulse widths (ns)	5 to 20 000	5 to 20 000
Sampling points	Up to 256 000	Up to 256 000
Sampling resolution (m)	0.04 to 10	0.04 to 10
Distance accuracy (m) [d]	±(0.75 + 0.0025 % x distance + resolution)	±(0.75 + 0.0025 % x distance + resolution)

For complete details on all available configurations, refer to the ordering information section.

Notes

a. Typical, using 10 µs pulse.

b. Typical dynamic range with a three-minute averaging at SNR = 1.

c. Typical for reflectance at –45 dB, using a 5 ns pulse.

d. Does not include uncertainty due to fiber index.

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

For complete details on all available configurations, refer to the ordering information section.

Notes

a. Typical.

b. Typical, using 10 µs pulse.

c. Typical dynamic range with a three-minute averaging at SNR = 1.

d. Typical dead zone of singlemode modules for reflectance at –45 dB, using a 5-ns pulse.

e. Does not include uncertainty due to fiber index.

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	

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	BNC	BNC	BNC

WANDER REFERENCE INTERFACES

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

FIBRE CHANNEL FUNCTIONAL SPECIFICATIONS

Testing 1x, 2x, 4x, 8x and 10x	
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 credity estimation based on latency
Latency	Round-trip latency

SONET AND DSn 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
Frequency alarm on all supported interfaces			
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[b], 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
Pattern loss and bit error generation and analysis supported on all patterns			

Notes

a. 1.5M (DS1) and 45M (DS3) interfaces described under SONET and DSn column.

b. Not supported for E4 (140M).

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: **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 **Generation** › Pointer increment and decrement › Pointer jump with or without NDF › Pointer value **Analysis** › 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 FTB-700G V2 Series unit's transmitter back to its receiver after crossing a far-end loopback. Measurements are provided on all supported FTB-700G V2 Series 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 FTB-700G V2 Series 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. HO and LO supported as per ITU-T G.707 option 2.

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)
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 FUNCTION

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:
	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.

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 (64K or 56K), 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 FTB-700G V2 Series units.

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 up with single or multiple TCP connections from 10BASE-T up to 10G. Discovers the MTU, RTT, actual and ideal TCP throughput.
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 10 GigE full line-rate packet capture and decode. Ability to configure filter full line-rate data capture and decoding up to 10G; configuration of capture filters and triggers as well as capture slicing parameters.
Through mode	Sectionalize traffic between a service provider's network and customer premises equipment.
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 10G 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), EtherBERT, RFC 2544, and traffic generation and monitoring when using 10/100/1000 BASE-T, 100BASE-X, GigE and 10 GigE.

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/OBSAI BER testing	Includes unframed and framed BER measurment, bit error injection, round-trip delay measurement, and pass/fail verdicts
CPRI/OBSAI SDT	Measurements in ms for the longest, shortest, last, average, total and count of disruptions.
1588 PTP	Validates 1588 PTP packet network synchronization services, 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 FTB-700G V2 Series units and sets them to Smart Loopback mode.
Dual Test Set mode	Detects and connects to other FTB-700G V2 Series 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 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 [a]

Size (H x W x D)		210 mm x 254 mm x 96 mm (8 ¼ in x 10 in x 3 ¾ in)
Weight (with battery and modules)		3.3 kg (7.3 lb)
Temperature	Operating Storage	0 °C to 50 °C (32 °F to 122 °F) –40 °C to 70 °C (–40 °F to 158 °F)
Relative humidity		0 % to 85 %, noncondensing
Battery life (extended)		OTDR = More than 6h taking 12 single traces per hour 1G = Up to 3h 10G = Up to 2h
Battery charging time		Two hours from full discharge to full charge
Languages		English, Chinese, Japanese, Korean and Spanish

LASER SAFETY

Note

a. For FTB-1 Pro platform with modules.

FTB-720G V2/730G V2 ORDERING INFORMATION

FTB-7XXG-XX-XX-XX-XX-XX-XX-XX-XX-XX-XX-XX-XX-XX-XX

Model
FTB-720GV2-SM1 = OTDR 1310 nm/1550 nm
FTB-720GV2-Q1-Quad = OTDR 850 nm/1300 nm, 1310 nm/1550 nm
FTB-730GV2-SM1 = OTDR 1310 nm/1550 nm
FTB-730GV2-SM2 = OTDR 1310/1550 nm, and 1625 nm live port
FTB-730GV2-SM8 = OTDR 1310/1550 nm, and 1650 nm live port

Model options
Optical = Optical only (without Ethernet)
Ethernet = Enables 10M to 1000M Electrical and GigE
Combo = Enables Optical and Ethernet 10M to 1000M Electrical and GigE

Base software options [a]
OTDR = Enables the OTDR application only
iOLM = Enables the iOLM application only
Oi = Enables iOLM and OTDR applications

iOLM software options [b]
00 = iOLM Standard
iADV = iOLM Advanced [a]
iLOOP = iOLM loopback mode

Multimode connector [c]
EI-EUI-28 = UPC/DIN 47256
EI-EUI-89 = UPC/FC narrow key
EI-EUI-90 = UPC/ST
EI-EUI-91 = UPC/SC
EI-EUI-95 = UPC/E-2000
EI-EUI-98 = UPC/LC

Singlemode connector
EA-EUI-28 = APC/DIN 47256
EA-EUI-89 = APC/FC narrow key
EA-EUI-91 = APC/SC
EA-EUI-95 = APC/E-2000
EA-EUI-98 = APC/LC

Transport base options [d]
SONET = SONET testing
SDH = SDH testing
SONET-SDH = SONET and SDH testing

OTN rate options [d]
00 = Without OTN rate option
OTU1 = OTN optical rate 2.666 Gbit/s [e]
OTU2 = OTN optical rate 10.709 Gbit/s [f]
OTU2-1e-2e = OTN optical rates 11.049/11.096 Gbit/s [f]
OTU2-1f-2f = OTN optical rates 11.270/11.318 Gbit/s [f]
GCC-BERT = GCC 0/1/2 BERT test [f, g]

Example: FTB-730GV2-SM1-Combo-iOLM-iADV-EA-EUI-89-SONET-SDH-OTU1-TCP-THPUT-iSAM

CPRI/OBSAI rate options [d]
CPRI-OBSAI = Enables 1.2G to 3.1G CPRI, and 3.1G OBSAI [e]
CPRI-4.9G [f]
CPRI-6.1G [f]
CPRI-9.8G [f]
OBSAI-1.5G [e]
OBSAI 6.1G [f]

Transport rate options [d]
52M = 52 Mbit/s (OC-1/STM-0) [h, e]
155M = 155 Mbit/s (OC-3/STM-1) [e]
622M = 622 Mbit/s (OC12/STM-4) [e]
2488M = 2.5 Gbit/s (OC48/STM-16) [e]
9953M = 10 Gbit/s (OC192/STM-64) [h]

Ethernet rate options [d]
100optical = Enables 100 Mbit/s optical [e]
10GigE = Enables 10 GigE LAN/WAN [f]
GigE = 1000 Mbit/s optical and electrical [e]

Fibre Channel options [d, i]
FC1X = Enables 1x Fibre Channel interface [e]
FC2X = Enables 2x Fibre Channel interface [e]
FC4X = Enables 4x Fibre Channel interface [e]
FC8X = Enables 8x Fibre Channel interface [f]
FC10X = Enables 10x Fibre Channel interface [f]

Multiservice software options [d]
DS3-G.747 = G.747 test capability
DS1-FDL = DS1 FDL test capability
DUAL-RX = DS1/DS3 dual RX testing
DS3-FEAC = DS3 FEAC test capability
TCM = Tandem connection monitoring
DSn = DSn test capability
PDH = PDH test capability
ISDN-PRI = ISDN primary rate interface
NI-CSU = NI-CSU loopback emulation
Cable_test = Cable test
IPV6 = Internet protocol version 6
ETH-THRU = Through mode capability
MPLS = Enables MPLS
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
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 [i]
PoE = Enables Power-over-Ethernet capability
TRAFFIC-SCAN = Discover and monitor VLAN traffic flows on a live signal
DP-CPRI = Enables two CPRI
iOptics = Enables intelligent pluggable optics test application
CPRI-SPECTRUM = OpticalRF™ RF spectrum analysis over CPRI
CPRI-ALU-BBUe = Alcatel-Lucent BBU emulation over CPRI
WANDER = Enables time error testing for 1PPS [j]
DTS-NAT = Enables dual test set over NAT
TST-OAM = Enables OAM testing within EtherSAM application
G82751 = Enables ITU-T G.8275.1 profile

Notes

a. Available if Optical or Combo model option is selected.
b. Available for iOLM software only.
c. Available for model FTB-720G V2-Q1-Quad only.
d. Available if Ethernet or combo option is selected.
e. Requires purchase of SFP.
f. Requires purchase of SFP+.
g. Requires a minimum of one OTN rate.
h. Included if Ethernet selected.
i. Requires software option RFC6349.
j. Requires a GPS receiver kit for Wander measurements such as GP-2263.

TK-1V2-PRO-740GV2 ORDERING INFORMATION

TK-1V2-PRO-740GV2-XX-XX-XX-XX-XX-XX-XX-XX-XX-XX-XX-XX-XX-XX-XX-XX-XX-XX-XX-XX-XX-XX-XX

Model
TK-1V2-PRO-740GV2 = FTB-1V2-PRO dual module capacity platform

CWDM or DWDM OTDR model
CW10 = SM CWDM OTDR module with upper 10 wavelengths
CW18-M8W = SM CWDM OTDR module with 8 upper wavelength activated (ready to 18)
CW18-M10W = SM CWDM OTDR module with 10 upper wavelength activated (ready to 18)
CW18-M18W = SM CWDM OTDR module with all 18 activated wavelengths
DWC = SM tunable DWDM OTDR module C-Band 1528/1564 nm (ITU 17-62), 100/50 GHz, 40 dB (9/125 µm)

Display
S1 = Standard display
S2 = Enhanced display for outdoor use

WiFi/Bluetooth® option
00 = Without RF option enabled
RF = With RF option/capability (WiFi and Bluetooth)
NRF = Without RF hardware components [a]

Memory
128G = 128 GB internal memory (flash)

Power meter/VFL
00 = Without power meter (PM)/VFL
VPM2X = VFL platform, PM; GeX detector
VPM2X-CWDM = VFL platform; PM; GeX detector; CWDM wavelengths calibrated

Connector adapter [b]
FOA-22 = FC/PC, FC/SPC, FC/UPC, FC/APC
FOA-28 = DIN 47256, DIN 47256/APC
FOA-32 = ST: ST/PC, ST/SPC, ST/UPC
FOA-54B = SC: SC/PC, SC/SPC, SC/UPC, SC/APC
FOA-96B = E-2000 E-2000/APC
FOA-98 = LC

Inspection probe models
FP410B = Digital video inspection probe
Triple magnification
FP420B = Analysis digital video inspection probe
Automated pass/fail analysis
Triple magnification
Autocentering
FP425B = Wireless digital video inspection probe [c]
Automated pass/fail analysis
Triple magnification
Autocentering
FP430B = Automated analysis digital video inspection probe
Automated focus
Automated pass/fail analysis
Triple magnification
Autocentering
FP435B = Wireless analysis digital video inspection probe
Automated focus
Automated pass/fail analysis
Triple magnification
Autocentering

Base tips [d]
APC = Includes FIPT-400-U25MA and FIPT-400-SC-APC
UPC = Includes FIPT-400-U25M and FIPT-400-FC-SC

Software options
00 = Without any software option
FR2-PL = FastReporter 2 Software Fiber characterization package

Model options
Optical = Optical only (without Ethernet)
Ethernet = Enables 10M to 1000M Electrical and GigE
Combo = Enables Optical and Ethernet 10M to 1000M Electrical and GigE

Base software options [e]
OTDR = Enables the OTDR application only
iOLM = Enables iOLM application only
Oi = Enables OTDR and iOLM applications

iOLM software option [f]
00 = iOLM standard
iADV = iOLM advanced
iLOOP = iOLM loopback mode

CWDM wavelength options [g]
00 = No additional activated wavelengths
M1310W = Add 1310 nm wavelength

CPRI/OBSAI rate options [h]
CPRI-OBSAI = Enables 1.2G to 3.1G CPRI, and 3.1G OBSAI [i]
CPRI-4.9G [i]
CPRI-6.1G [i]
CPRI-9.8G [i]
OBSAI-1.5G [i]

Transport rate options [h]
52M = 52 Mbit/s (OC-1/STM-0) [i]
155M = 155 Mbit/s (OC-3/STM-1) [i]
622M = 622 Mbit/s (OC12/STM-4) [i]
2488M = 2.5 Gbit/s (OC48/STM-16) [i]
9953M = 10 Gbit/s (OC192/STM-64)

Ethernet rate options [h]
100optical = Enables 100 Mbit/s optical [i]
10GigE = Enables 10 GigE LAN/WAN [j]
GigE = 1000 Mbit/s optical and electrical [i]

Fibre channel options [h, j]
FC1X = Enables 1x Fibre Channel interface [i]
FC2X = Enables 2x Fibre Channel interface [i]
FC4X = Enables 4x Fibre Channel interface [i]
FC8X = Enables 8x Fibre Channel interface [i]
FC10X = Enables 10x Fibre Channel interface [j]

Multiservice software options [h]
DS3-G.747 = G.747 test capability
DS1-FDL = DS1 FDL test capability
DUAL-RX = DS1/DS3 dual RX testing
DS3-FEAC = DS3 FEAC test capability
TCM = Tandem connection monitoring
DSn = DSn test capability
PDH = PDH test capability
ISDN-PRI = ISDN primary rate interface
NI-CSU = NI-CSU loopback emulation
Cable_test = Cable test
IPV6 = Internet protocol version 6
ETH-THRU = Through mode capability
MPLS = Enables MPLS
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
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 [i]
PoE = Enables Power-over-Ethernet capability
TRAFFIC-SCAN = Discover and monitor VLAN traffic flows on a live signal
DP-CPRI = Enables two CPRI
iOptics = Enables intelligent pluggable optics test application
CPRI-spectrum = OpticalRF™ RF spectrum analysis over CPRI
PIM = Passive intermodulation (PIM) detection
CPRI-ALU-BBUe = Alcatel-Lucent BBU emulation over CPRI
WANDER = Enables time error testing for 1PPS [l]
DTS-NAT = Enables dual test set over NAT
G82751 = Enables ITU-T G.8275.1 profile

OTN rate options [h]
00 = Without OTN rate option
OTU1 = OTN optical rate 2.666 Gbit/s [i]
OTU2 = OTN optical rate 10.709 Gbit/s [j]
OTU2-1e-2e = OTN optical rates 11.049/11.096 Gbit/s [j]
OTU2-1f-2f = OTN optical rates 11.270/11.318 Gbit/s [i]
GCC-BERT = GCC 0/1/2 BERT test [k, m]

Transport base options [h]
SONET = SONET testing
SDH = SDH testing
SONET-SDH = SONET and SDH testing

CWDM or DWDM OTDR connector
EA-EUI-28 = APC/DIN 47256
EA-EUI-89 = APC/FC narrow key
EA-EUI-91 = APC/SC
EA-EUI-95 = APC/E-2000
EA-EUI-98 = APC/LC

Example: TK-1V2-PRO-740GV2-CW10-S1-RF-128G-VPM2X-CWDM-FOA-54B-FP435B-APC-FR2-PL-Combo-iOLM-00-EA-EUI-91-SONET-SDH-OTU1-OTU2-iSAM-iOptics-GigE-10GigE-52M-155M-622M-2488M-9953M

Notes

a. Available only with S1 display.
b. Additionnal selection of connectors adapters are available. For an exhaustive list, consult the FTB-1 V2/Pro dedicated spec sheet.
c. Requires RF capability (WiFi and Bluetooth hardware option).
d. This list represents a selection of fiber inspection tips that covers the most common connectors and applications but does not reflect all the tips available. EXFO offers a wide range of inspection tips, bulkhead adaptors and kits to cover many more connector types and different applications. Please contact your local EXFO sales representative or visit www.EXFO.com/FIPtips for more information.
e. Available if Optical or Combo model option is selected.
f. Please refer to the iOLM specification sheet for the complete and most recent description of these value packs.
g. Not available with DWC (DWDM) OTDR model selection.
h. Available if Ethernet or Combo model option is selected.
i. Requires purchase of SFP.
j. Requires purchase of SFP+.
k. Requires a minimum of OTN rate.
l. Requires a GPS receiver kit for Wander measurements such as GP-2263
m. Requires software option RFC6349.

EI CONNECTORS

To maximize the performance of your OTDR, EXFO recommends using APC connectors on singlemode ports. These connectors generate lower reflectance, which is a critical parameter that affects performance, particularly dead zones. APC connectors provide better performances than UPC connectors, thereby improving testing efficiency.

Note: UPC connectors are not available for singlemode port

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