RTU-310

IP SERVICES TEST HEAD

Please note that this model has been discontinued. For more information, visit EXFO.com

Fully integrated test head for centralized performance assessment of Ethernet transport networks

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

KEY FEATURES

Complete EtherSAM (ITU-T Y.1564) test suite. EtherSAM is the new standard for turning up and troubleshooting mobile backhaul and business Ethernet services

Throughput, back-to-back, latency and frame loss measurements as per RFC 2544 (bidirectional results)

Multistream generation and analysis, allowing quality of service (QoS) verification through VLAN and ToS/DSCP prioritization testing

True wire-speed, stateful TCP throughput test for undisputable SLA reinforcement for Ethernet services

IPTV testing and analysis

Complete Carrier Ethernet services portfolio: PBB-TE (MAC-in-MAC), MPLS, MPLS-TP 802.3ah and IPv4/IPv6

1x and 2x Fibre Channel testing

Interoperable with the FTB-8510B Packet Blazer Ethernet Test Module and the AXS-200/850 Ethernet Test Set

Fully remote controllable via EX-Vu application

Integrated into Brix System for Ethernet SLA monitoring, service birth certificates, turn-up and troubleshooting
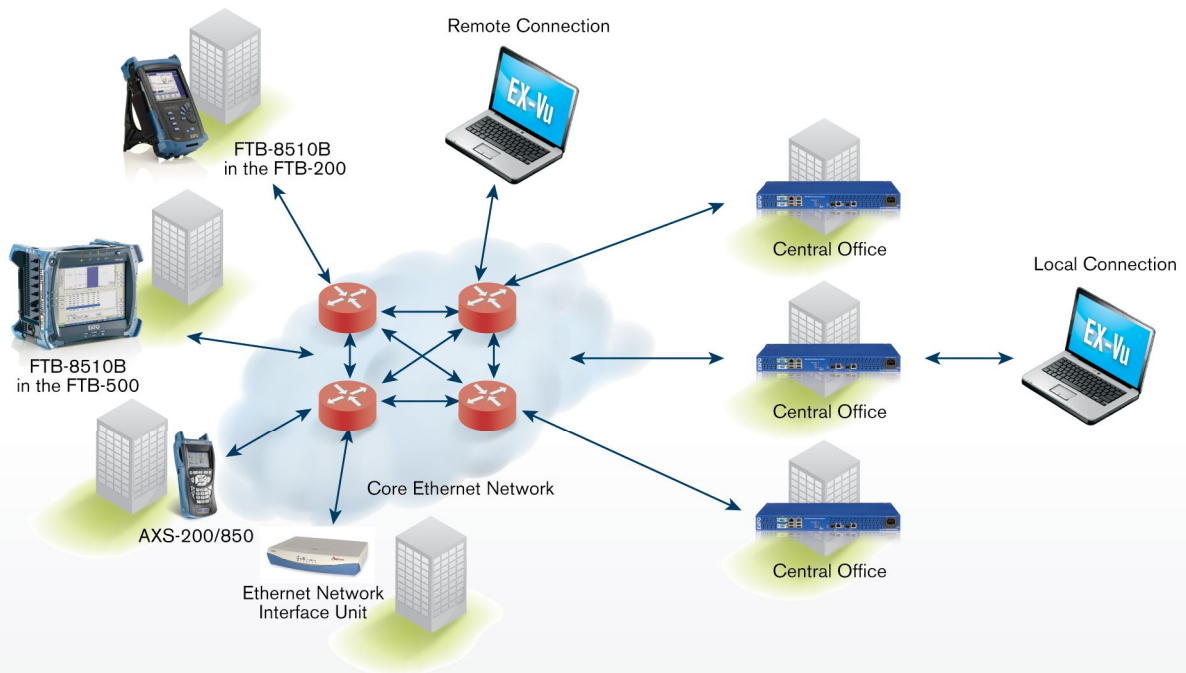
ASSESSING THE PERFORMANCE OF ETHERNET SERVICES

EXFO's RTU-310 IP Services Test Head enables carriers to ensure the reliability and performance of their Ethernet-based services. Its wide range of test functionalities provide all the necessary measurement tools for service turn-up, troubleshooting as well as verifying service-level agreements (SLAs) between service providers and their customers. This carrier-class 1U rack-mounted, central office (CO)-based device, combined with its portable counterparts, EXFO's award winning FTB-8510B Packet Blazer Ethernet Test Module or the FTB-860 Network Blazer, simplify and accelerate the deployment of Ethernet services. In fact, the RTU-310 is the functional equivalent of the FTB-8510B and supports all the test features found in the portable version.

FLEXIBLE END-TO-END TESTING FROM A CENTRALIZED POINT

With the RTU-310 IP Services Test Head, a single technician can perform end-to-end testing through control of the remote unit—either an FTB-8510B Packet Blazer or another RTU-310 via the LAN connection under test. This unique approach gives service providers access to test results for each direction of test, which is essential to fully qualify Ethernet services. It is also possible to perform end-to-end testing by using the Smart Loopback mode where the remote unit will return traffic to the local unit by swapping packet overhead up to layer 4 of the OSI stack.

The RTU-310 tests connectivity in its native format: 10/100/1000Base-T, 100Base-FX, 100Base-LX, 1000Base-SX, 1000Base-LX and 1000Base-ZX for LAN-to-LAN services delivered via next-generation SONET/SDH, SONET/SDH hybrid multiplexers, switched Ethernet, VLANs, dark fiber, WDM, FTTx systems or other means.

Remote Connection

FTB-8510B
in the FTB-200

FTB-8510B
in the FTB-500

AXS-200/850

Ethernet Network
Interface Unit

Core Ethernet Network

Central Office

Central Office

Central Office

Local Connection

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KEY FEATURES

› Complete EtherSAM (ITU-T Y.1564) test suite allowing full validation of today's Ethernet services (bidirectional results through dual test set)*

› Throughput, back-to-back, latency and frame loss measurements as per RFC 2544 (bidirectional results through dual test set)

› Multistream generation and analysis, providing per-stream measurements for throughput, latency, frame loss and packet jitter

› True wire-speed and stateful TCP throughput testing

› PBB-TE and MPLS support for Carrier Ethernet

› IPTV testing and analysis

› Packet jitter measurement (IP packet-delay variation as per RFC 3393) to qualify Ethernet transport networks for transmission of delay-sensitive traffic such as voice-over-IP (VoIP) and video

› Internet protocol version 6 (IPv6) testing

› Q-in-Q capability for up to three layers of stacked VLANs

› Dual port capability for simultaneous traffic generation and reception at 100 % wire speed for 10/100/1000Base-T, 100Base-FX, 100Base-LX, 1000Base-SX, 1000Base-LX or 1000Base-ZX full-duplex networks at all packet sizes

› Ethernet in the First Mile 802.3ah testing

› Fibre Channel 1x and 2x test suite

› Expert mode capability to set test thresholds for clear pass/fail test results

› Configurable advanced filters for in-depth network troubleshooting

› Service disruption time measurement

› Ethernet Through mode

› Remote control capability through EX-Vu or VNC software

› Easy-to-use smart user interface (SUI) for configurable screens, customization of test suites, as well as real-time and historical performance reporting

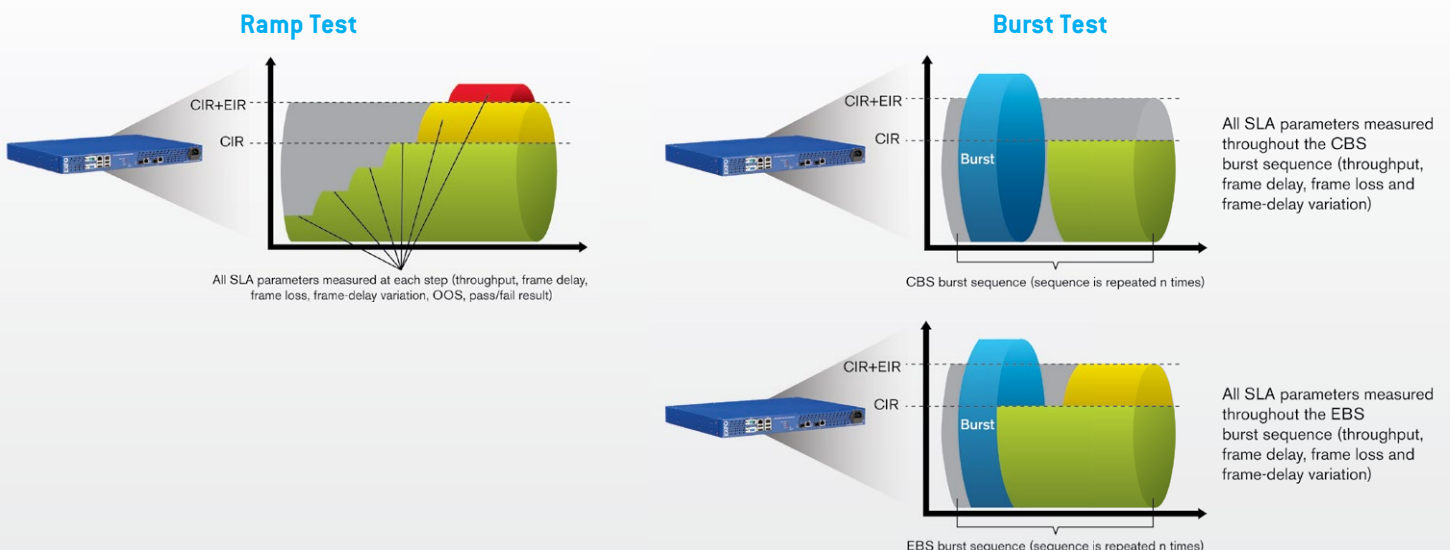› Up to 1 Gbit/s full-line-rate data capture and decode

Patent pending

EtherSAM: THE NEW STANDARD IN ETHERNET TESTING

ITU-T Y.1564 is the new standard for turning up and troubleshooting Carrier Ethernet services. This methodology is completely adapted to today's Ethernet services especially mobile backhaul and commercial services. Up to now, RFC 2544 has been the most widely used methodology. However, it was designed for network device testing in the lab, not for services testing in the field. ITU-T Y.1564 is the first testing standard developed for the field. It has a number of advantages over the RFC 2544 including validation of critical SLA criteria such as packet jitter and QoS measurements. This methodology is also significantly faster, therefore saving time and resources while optimizing QoS.

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

Service Configuration Test

The service configuration test consists in sequentially testing each service. It validates that the service is properly provisioned and that all specific KPIs or SLA parameters are met. A ramp test and a burst test are performed to verify the committed information rare (CIR), excess information rate (EIR), committed burst size (CBS) and excess burst size (EBS).

Ramp Test

CIR+EIR
CIR

All SLA parameters measured at each step (throughput, frame delay, frame loss, frame-delay variation, OOS, pass/fail result)

Burst Test

CIR+EIR
CIR
Burst

All SLA parameters measured throughout the CBS burst sequence (throughput, frame delay, frame loss and frame-delay variation)

CBS burst sequence (sequence is repeated n times)

CIR+EIR
CIR
Burst

All SLA parameters measured throughout the EBS burst sequence (throughput, frame delay, frame loss and frame-delay variation)

EBS burst sequence (sequence is repeated n times)

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# EtherSAM: THE NEW STANDARD IN ETHERNET TESTING (CONT'D)

Service Performance Test

Once the configuration of each individual service is 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—that is the highest level of confidence in service testing.
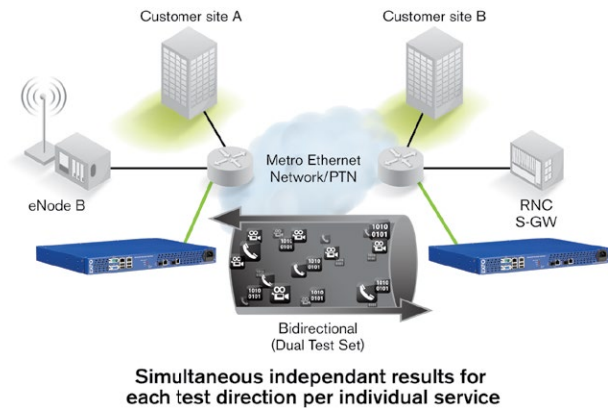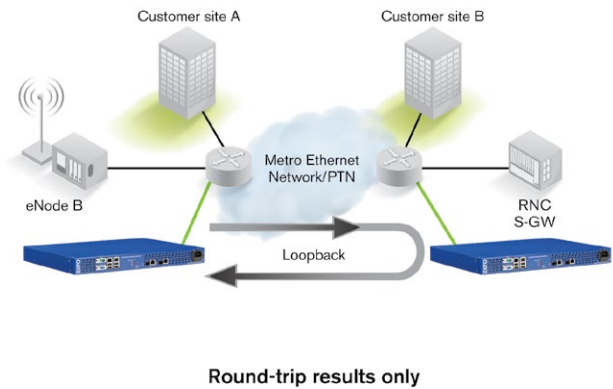
RFC 2544 Test Suite

The RTU-310 IP Services Test Head can perform the RFC 2544 test suite for 10/100/1000Base-T, optical 100 Mbit/s and GigE interfaces at all frame sizes and at full line rate, allowing the provider to certify that the circuit is efficient and error-free at 100 % utilization. More importantly, when in Dual Test Set mode, the RTU-310 allows bidirectional testing, providing independent RFC 2544 test results for both directions (local to remote and remote to local). This is especially important when testing Ethernet services as traffic from each direction often takes different paths in the network. Performance results can therefore vary depending on the direction. The RTU-310 supports automated RFC 2544 testing, which helps ensure repeatable results. Automation also provides ease of use for field technicians by enabling accurate, efficient measurements and results through a clear and simple pass/fail indication. In addition, the RTU-310 generates reports that can be given to customers for future reference related to their specific SLAs.
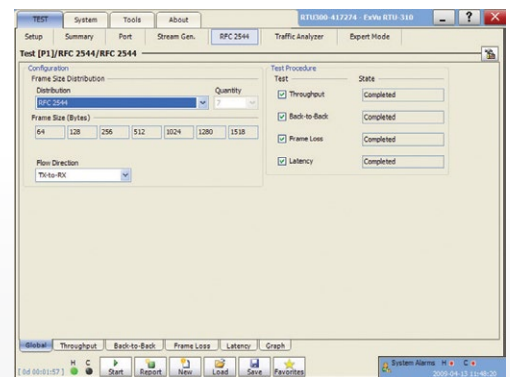
RFC 2544 testing.

EFFICIENT TESTING LEADS TO RELIABLE PERFORMANCE

TCP Throughput

The Internet protocol (IP) and transmission control protocol (TCP) together form the essence of TCP/IP networking. While IP deals with the delivery of packets, TCP provides the integrity and assurance that the data packets transmitted by one host are reliably received at the destination. Applications such as hypertext transfer protocol (HTTP), e-mail or file transfer protocol (FTP) depend on TCP as their delivery assurance mechanism within networks. Customers deploying such applications expect not only physical and link-level SLAs from their service providers, but assurance that their TCP traffic requirements will be supported across the network. The TCP throughput feature on the RTU-310 offers Ethernet service providers the capability of measuring and validating that the services offered to their customers support the TCP traffic performance they expect.

MPLS, MPLS-TP and PBB-TE: Carrier Ethernet Transport Solution Testing

As technologically sophisticated business and residential consumers continue to drive demand for premium, high-bandwidth data services such as voice and video, service providers worldwide are evolving their transport infrastructures to support these bandwidth and quality-intensive services. No longer is an all-IP core sufficient—providers must now expand their IP convergence to the edge/metro network in a cost-effective, quality-assured manner. Ethernet has long been accepted as an inexpensive, scalable, data-networking solution in LAN environments. The stringent QoS expectations require solutions that tap into the cost-effectiveness of Ethernet without sacrificing the benefits of connection-oriented (albeit it costly) TDM solutions such as SONET/SDH.

Ethernet tunneling technologies such as Provider Backbone Bridge-Traffic Engineering or PBB-TE (also referred to as PBT) and transport MPLS address these requirements. These technologies enable connection-oriented Ethernet, providing carriers with a means of offering scalable, reliable and resilient Ethernet services. The PBB-TE and MPLS options on the RTU-310 IP Services Test Head offer service providers a comprehensive field tool to efficiently qualify Ethernet services from end-to-end, validating metro and core tunneling technologies.

Ethernet Advanced Troubleshooting

The RTU-310 provides a number of advanced features essential for in-depth troubleshooting in the event of network failures or impairments. The advanced filtering option allows the user to configure up to ten filters each with up to four operands, which will be applied to the received Ethernet traffic. Detailed statistics are available for each configured filter, providing the user with critical information required to pinpoint specific problems. Additionally, the RTU-310 supports a traffic scan feature that allows quick identification and monitoring of VLAN and MPLS flows on the network. This can help clearly identify top bandwidth users.

The RTU-310 also supports full-line-rate data capture and decode. This key troubleshooting tool enables field technicians to easily identify complex network issues. The comprehensive capture feature includes the capability to configure capture filters and triggers to quickly zero-in on network events.

IPTV Testing and Analysis

The IPTV software option available on the RTU-310 leverages the current frame-analysis engine, delivering high-performing measurement capabilities and providing users with over 45 different IPTV metrics and statistics in a powerful fixed IPTV test platform. The key features and capabilities provided with this software option include RFC 4445 media delivery index (MDI)*, TR 101 290 priority 1 metrics, in addition to program clock reference jitter, IGMP support, stream rate and bandwidth utilization on 100 simultaneous MPEG-2, MPEG-4 or VC-1 streams. Usability features include user-configurable alarm thresholds for MDI and other selected metrics, enabling customizable test sequences as well as an auto-stream detection capability that automatically discovers valid IPTV streams within the Ethernet layer. Additionally, stream IP addresses can be linked to a user-definable stream name through an alias table typically containing the name of the broadcast channel.

The RTU-310 with its IPTV software option offers service providers the most effective tool to quickly and efficiently test and monitor IPTV streams over their network. For more information on the RTU-310 IP Services Test Head IPTV option, refer to the FTB-8510B specification sheet.

The MDI feature of the IPTV software option is not available in the USA.
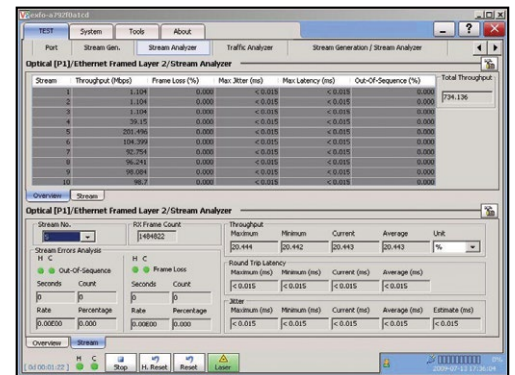
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EtherBERT™

Ethernet is increasingly being carried across a variety of layer 1 media over longer distances. This creates a growing need for the certification of Ethernet transport on a bit-per-bit basis, which can be done using bit-error-rate testing (BERT). BERT uses a pseudo-random binary sequence (PRBS) encapsulated into an Ethernet frame, making it possible to go from a frame-based error measurement to a bit-error-rate measurement. This provides the bit-per-bit error count accuracy required for acceptance testing of physical-medium transport systems. BERT-over-Ethernet should usually be used when Ethernet is carried transparently over layer 1 media, in cases such as Ethernet over DWDM, CWDM or dark fiber.
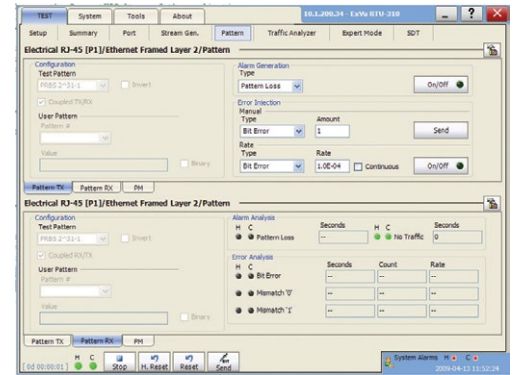
BERT analysis screen.

Ethernet QoS Measurements

Data services are making a significant shift toward supporting a variety of applications on the same network. Multiservice offerings such as triple-play services have fuelled the need for QoS testing to ensure the condition and reliability of each service and fully qualify SLA parameters. The RTU-310 allows service providers to simultaneously simulate and qualify different applications through its multistream application. The user has the capability to configure up to ten streams with different Ethernet and IP QoS parameters such as VLAN ID (802.1Q), VLAN Priority (802.1p), VLAN stacking (802.1ad Q-in-Q), ToS and DSCP. Specific stream profiles to transmit VoIP, video and data can be selected for each stream. Throughput, latency, frame loss and packet jitter (RFC 3393) measurements are also available simultaneously for each stream, allowing fast and in-depth qualification of all SLA criteria.

Statistics for each stream.

FIBRE CHANNEL NETWORK INTEGRITY TESTING

EXFO's RTU-310 IP Services Test Head also supports comprehensive Fibre Channel testing.

Interfaces

This head supports the following Fibre Channel interfaces:

INTERFACE	RATE
1x	1.0625 Gbit/s
2x	2.125 Gbits

Applications

Since most storage area networks cover large distances and Fibre Channel has stringent performance attributes that must be respected, testing at each phase of network deployment is imperative to ensure appropriate service levels. The RTU-310's Fibre Channel option provides full wire-speed traffic generation at FC-0, FC-1 and FC-2 logical layers, allowing BER testing for link integrity measurements. Latency, buffer-to-buffer credit measurements for optimization and login capabilities are also supported.

Buffer-to-Buffer Credit Estimation

Buffer-to-buffer credits are part of the flow control engine for Fibre Channel connections. 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 RTU-310 is capable of estimating buffer-to-buffer credit values with respect to latency by calculating the distance according to the round-trip latency time.

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COMMAND AND CONTROL

Remote Management

The user interface for the RTU-310 IP Services Test Head is accessible via EX-Vu remote management software. It enables a remote connection to the instrument, as well as providing the graphical user interface (GUI) for test setup and device management. The EX-Vu application is supported on any Windows based workstation and allows for simplified remote testing and data analysis, as well as remote monitoring. Up to five simultaneous EX-Vu sessions can be supported via a standard Ethernet connection to the platform.

Automated Test Scripting

The RTU-310 supports .NET programming environment for users who prefer to build their automation test routines. The unit comes with a built-in macro-recorder, which allows users to easily record their test actions and automatically create test scripts; this also enables them to build standard test routines that can easily be accessed and run by technicians with little or no manual intervention. Scripts from the macro-recorder can be used as the basis for larger automation routines, which can be created or edited in any .NET environment.

Test Logger and Reporting

The RTU-310 supports a detailed test logger and test reporting tools, enabling users to view any errors/alarms that occurred during the test interval, which can then be used for post-processing of results or SLA conformance validation.

TEST CONTROL THROUGH BRIXWORX™

RTU-310 is an integral part of EXFO's BrixNGN Service Assurance solution for Ethernet services. BrixNGN enables providers to continuously collect, correlate, analyze, and visualize critical QoS and QoE data for the Ethernet services they are selling to their customers. This solution enables capacity planning and service turn-up verification, as well as identification, diagnosis and quickly resolving network and service issues before customers are affected—thereby guaranteeing performance and quality.

As part of the BrixNGN solution, the RTU-310 is managed and test configurations are all performed via the BrixWorx software engine. The RTU-310 can be used for service turn-up, troubleshooting or ongoing 24/7 SLA monitoring. At service turn-up time, providers can run a series of tests that enable them to benchmark the service they are making available to their customers. This data can be used as a baseline for the performance of the service and can be used to produce birth certificates for the service. If a particular service shows quality problems, the RTU-310 platform can be used to launch diagnostic tests for that service to identify and isolate the source of the problem. Finally, the RTU-310 can be used for ongoing monitoring of services as part of an SLA agreement. Periodic tests are automatically launched that enable a provider to collect data about each of their services; this data, along with data reported by other test systems, is collected and stored in the BrixWorx central data storage. The data is then aggregated and analyzed to generate service-level alarms when thresholds are violated, as well as to provide executives and operations with historical reports of the service performance.

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ETHERNET INTERFACES

OPTICAL INTERFACES

Optical interfaces	Two ports at 100 M and GigE				
Available wavelengths (nm)	850, 1310 and 1550				
	100Base-FX	**100Base-SX**	**1000Base-SX**	**1000Base-LX**	**1000Base-ZX**
Wavelength (nm)	1310	1310	850	1310	1550
Tx level (dBm)	−20 to −15	−15 to −8	−9 to −3	−9.5 to −3	−30 to 5
Rx level sensitivity (dBm)	−31	−28	−20	−22	−22
Maximum reach	2 km	15 km	550 m	10 km	80 km
Transmission bit rate (Gbit/s)	0.125	0.125	1.25	1.25	1.25
Reception bit rate (Gbit/s)	0.125	0.125	1.25	1.25	1.25
Tx operational wavelength range (nm)	1280 to 1380	1261 to 1360	830 to 860	1270 to 1360	1540 to 1570
Maximum Rx before damage (dBm)	3	3	6	6	6
Measurement accuracy (uncertainty)					
Frequency (ppm) Optical power (dB)	±4.6 ±2	±4.6 ±2	±4.6 ±2	±4.6 ±2	±4.6 ±2
Jitter compliance	ANSI X3.166	IEEE 802.3	IEEE 802.3	IEEE 802.3	—
Ethernet classification	ANSI X3.166	IEEE 802.3	IEEE 802.3	IEEE 802.3	—
Laser type	LED	VCSEL	FP	FP	DFB
Eye safety	Class 1	Class 1	Class 1	Class 1	Class 1
Connector	LC	LC	LC	LC	LC
Transceiver type	SFP	SFP	SFP	SFP	SFP

ELECTRICAL INTERFACES

Electrical interfaces	Two ports 10/100BaseT half/full duplex, 1000BaseT [a] full duplex. Straight/crossover cable selection.		
Tx bit rate	10 Mbit/s	125 Mbit/s	1 Gbit/s
Tx accuracy (uncertainty) (ppm)	±100	±100	±100
Rx bit rate	10 Mbit/s	125 Mbit/s	1 Gbit/s
Rx measurement accuracy (uncertainty) (ppm)	±4.6	±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

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ETHERNET FUNCTIONAL SPECIFICATIONS

TESTING	
EtherSAM (ITU-T Y.1564)	Capability to perform the service configuration test, including the ramp and burst tests, and service performance test as per ITU-T Y.1564. Tests can be performed to a loopback or dual test set mode for bidirectional results.
RFC 2544	Throughput, back-to-back, frame loss and latency measurements according to RFC 2544. Frame size: RFC-defined sizes, user-configurable (bidirectional).
BERT	Unframed layer 1 up to layer 4 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 up to ten user patterns.
Error insertion (BERT)	FCS, bit, 64B/66B block.
Error measurement	LAN/WAN: jabber/giant, runt, undersize, oversize, FCS, 64B/66B block. WAN: B1, B2, B3, REI-L, REI-P, UDP, TCP and IP header checksum.
Error measurement (BERT)	Bit error, bit mismatch 0, bit mismatch 1, performance monitoring (G.821 and G.826).
Alarm insertion	LOS, link down, local fault, remote fault, LSS (BERT). WAN: SEF, LOF, AIS-L, RDI-L, AIS-P, RDI-P, LCD-P, LOP-P, ERDI-PSD, ERDI-PCD, ERDI-PPD, UNEQ-P.
Alarm detection	LOS, link down, local fault, remote fault, frequency offset, LSS (BERT). WAN: SEF, LOF, AIS-L, RDI-L, AIS-P, RDI-P, LCD-P, LOP-P, ERDI-PSD, ERDI-PCD, ERDI-PPD, PLM-P, UNEQ-P, link (WIS).
Service disruption time measurement (BERT)	Defect or No Traffic mode. Disruption time statistics include shortest, longest, last, average, total and count.
Multistream generation	Capability to transmit up to ten streams. Configuration parameters are: packet size, transmission mode (N-Frames, Burst, N-Burst, Ramp, N-Ramp and Continuous), MAC source/destination address, VLAN ID, VLAN priority, IP source/destination address, ToS field, DSCP field, TTL, UDP/TCP source/destination port and payload. Selectable predefined stream profiles for voice, video and data streams. VoIP codecs (G.711, G.723.1, G.729), video (MPEG-2 SDTV, MPEG-2 HDTV, MPEG-4 HDTV).
Multistream analysis	Capability to analyze packet jitter, latency, throughput, frame loss and out-of-sequence per-stream statistics.
VLAN stacking (Q-in-Q)	Capability to generate streams with up to three layers of VLAN (including IEEE802.1ad QinQ tagged VLAN) and to filter received traffic by VLAN ID or VLAN priority at any of the stacked VLAN layers.
Traffic analysis	Capability to analyze the incoming traffic and provide statistics according to a set of up to 10 configurable filters. Filters can be configured for MAC source/destination address, VLAN ID, VLAN priority, IP source/destination address, ToS field, DSCP field, TCP source/destination port and UDP.
Ethernet statistics	Multicast, broadcast, unicast, N-unicast, pause frame, frame size distribution, bandwidth, utilization, frame rate, frame loss, out-of-sequence frames, in-sequence frames.
Packet jitter statistics	Delay variation statistics (ms): min., max., last, average and jitter measurement estimate.
Flow control injection (frame analyzer)	Packet pause time.
Flow control statistics (frame analyzer and RFC 2544)	Pause time, last pause time, max. pause time, min. pause time, paused frames, abort frames, frames Tx, frames Rx.
Advanced filtering [a]	Capability to configure up to ten filters of four fields each that can be combined with and/or/not operations. A mask is also provided for each field value to allow for wildcards. Complete statistics are gathered for each defined filter.
PBB-TE [a]	Capability to generate and analyze streams with PBB-TE data traffic, including configuration of B-MAC (source and destination), B-VLAN and I-tag (as per 802.1ah), and to filter received traffic by any of these fields.
MPLS [a]	Capability to generate and analyze streams with up to two layers of MPLS labels and to filter received traffic by MPLS label or COS.
IPv6 [a]	Capability to perform BERT, RFC 2544, traffic generation and analysis and Smart Loopback tests over IPv6. Ping, traceroute, neighbor discovery and stateless auto-configuration.
Data capture [a]	Capability to perform 10G full-line-rate data capture and decode. Capability to configure detailed capture filters and triggers as well as capture slicing parameters.
Traffic scan [a]	Capability to scan incoming live traffic and auto-discover all VLAN/VLAN Priority and MPLS ID/COS flows. Capability to provide statistics for each flow including frame count and bandwidth.

Note

a. Available as a software option.

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ETHERNET FUNCTIONAL SPECIFICATIONS (continued)

ADDITIONAL TEST AND MEASUREMENT FUNCTIONS

Power measurement	Supports optical power measurement, displayed in dBm.
Frequency measurement	Supports clock frequency measurements (i.e., received frequency and deviation of the input signal clock from nominal frequency).

Frequency offset measurement

Range (ppm)	±120
Resolution (ppm)	1
Accuracy (uncertainty) (ppm)	±4.6

Frequency offset generation

Range (ppm)	±120
Resolution (ppm)	1
Accuracy (uncertainty) (ppm)	±4.6

Dual test set	Performs end-to-end, bidirectional performance testing (as required by leading standards bodies)—remote RTU-310 or FTB-8510B controlled via the LAN connection under test.
DHCP client	Capability to connect to a DHCP server to obtain its IP address and subnet mask for connecting on to the network.
Smart Loopback	Capability to return traffic to the local unit by swapping packet overhead up to layer 4 of the OSI stack.
TCP throughput measurements [a]	Capability to evaluate TCP throughput and to provide performance results and statistics: window size with corresponding throughput, number of transmitted and re-transmitted segments, round-trip time.
IPTV testing and analysis [a]	Capability to measure and auto-discover 100 IPTV streams and provide IPTV statistics on a per stream basis: MDI (RFC 4445), PCR jitter (TR 101 290 priority 1) transmission rate, instantaneous rate, % utilization, virtual buffer size, UDP/IP port no., packet size and packet count, threshold alarm reporting and alias table. Also supports IGMPv2.
802.3ah OAM testing [a]	Capability to test Ethernet OAM as per IEEE 802.3ah including connection establishment, OAM protocol statistics and loopback control.
IP tools	Capability to perform ping and traceroute functions.

ADDITIONAL FEATURES

Expert mode	Ability to set thresholds in RFC 2544 and BERT mode to provide a pass/fail status.
Scripting	The built-in Visual Basic .NET scripting engine and embedded macro-recorder provide a simple means of automating test cases and routines. Embedded scripting routines provide a powerful means of creating advanced test scripts.
Event logger	Supports logging of test results, and the ability to print, export (to a file) or export the information contained in the logging tool.
Power up and restore	In the event of a power failure to the unit, the active test configuration and results are saved and restored upon boot-up.
Save and load configuration	Ability to store and load test configurations to/from non-volatile memory.
Configurable test views	Allows users to customize their test views; i.e., to dynamically insert or remove test tabs/windows, in addition to creating new test windows, so as to accurately match their testing needs.
Report generation	Ability to generate test reports in the following user-selectable formats: .pdf, .html, .txt and .csv.
Screen capturing	Capability to gather a snap-shot of the screen for future use.
Graph	Allows to graphically display the test statistics of the performance (RFC 2544) and frame analysis tests.
Configurable test timer	Allows the user to set a specific start and stop time for tests.
Remote control	Remote control through Ex-Vu software or VNC. Ex-Vu is compatible with Windows 2000, XP and Vista operating systems.
Test favorites	Capability to select and load from predefined or user-modified test configurations.

Note

a. Available as a software option.

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FIBRE CHANNEL INTERFACES

FC-1X/2X

Wavelength (nm)	850	1310	1550
Tx level (dBm)	−9 to −3	−9.5 to −3	0 to 5
Rx level sensitivity (dBm)	−18 at FC-2X −20 at FC-1X	−21 at FC-2X −22 at FC-1X	−21 at FC-2X −22 at FC-1X
Maximum reach	550 m on 50/125 µm MMF at FC-1X 300 m on 50/125 µm MMF at FC 2X 300 m on 62.5/125 µm MMF at FC-1X 150 m on 62.5/125 µm MMF at FC-2X	10 km	80 km
Transmission bit rate (Gbit/s)	1.0625 to 2.125	1.0625 to 2.125	1.0625 to 2.125
Reception bit rate (Gbit/s)	1.0625 to 2.125	1.0625 to 2.125	1.0625 to 2.125
Tx operational wavelength range (nm)	830 to 860	1270 to 1360	1540 to 1570

Measurement accuracy (uncertainty)
    Optical power (dB)
    Frequency (ppm)
	
	±2
	±4.6
		
		±2
		±4.6
			
			±2
			±4.6

Maximum Rx before damage (dBm)	6	6	6
Jitter compliance	ANSI FC-PI-2	ANSI FC-PI-2	ANSI FC-PI-2
FC classification	ANSI FC-PI-2	ANSI FC-PI-2	ANSI FC-PI-2
Laser type	VCSEL	Fabry-Perot	DFB
Eye safety	Class 1	Class 1	Class 1
Connector	LC	LC	LC
Transceiver type	SFP	SFP	SFP

FIBRE CHANNEL FUNCTIONAL SPECIFICATIONS

TESTING 1X AND 2X

BERT	Unframed, framed FC-1, framed FC-2.
Patterns (BERT)	PRBS 2E31-1, 2E23-1, 2E20-1, 2E15-1, 2E11-1, 2E9-1 CSPAT, CRPAT, CJTPAT and 10 user-defined 32 bits patterns.
Error insertion	Bit error, symbol error, oversize error, CRC error, undersize error.
Error measurement	Bit error, symbol error, oversize error, CRC error, undersize error, performance management (G.821 and G.826).
Alarm insertion	LOS, pattern loss, link down.
Alarm detection	LOS, pattern loss, link down.
Buffer-to-buffer credit testing	Buffer-to-buffer credit estimation based on latency.
Latency	Round-trip latency measurement.

ADDITIONAL TEST AND MEASUREMENT FUNCTIONS (1X AND 2X)

Power measurement	Supports optical power measurement, displayed in dBm.
Frequency measurement	Supports clock frequency measurements (i.e., received frequency and deviation of the input signal clock from nominal frequency).

Frequency offset measurement
Range (ppm)	±120
Resolution (ppm)	1
Accuracy (uncertainty) (ppm)	±4.6

Frequency offset generation
Range (ppm)	±120
Resolution (ppm)	1
Accuracy (uncertainty) (ppm)	±4.6

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GENERAL SPECIFICATIONS

Communication interface	
LAN port	RJ45 Rates: 10/100 Mbit/s
Craft port	RJ45 Rates: 10/100 Mbit/s
Test interfaces 　Electrical	RJ45 Rates: 10/100/1000 Mbit/s
Optical	SFP Rates: 100/1000 Mbit/s
Other interfaces	Four USB ports Serial port (RS-232 DB-9) and VGA port
Size (H x W x D)	1U rack-mount unit 44 mm x 427 mm x 330 mmm (1 ¾ in x 16 ¹³/₁₆ in x 13 in) (19-inch and 23-inch rack-mount supported)
Weight	5.56 kg (12.3 lb)
Temperature 　operating 　storing	 0 ℃ to 50 ℃ (32 ℉ to 122 ℉) −40 ℃ to 60 ℃ (−40 ℉ to 140 ℉)
Power	AC (110/220 V) DC (−48 V); dual DC power feed
Power consumption	70 W
Certifications	NEBS Level 1, CE, CSA, UL, WEEE and RoHS

ORDERING INFORMATION

RTU-310-XX-XX-XX-XX

Model
RTU-310 = IP Services Test Head 10 M 100 M electrical
RTU-310-1 = IP Services Test Head 1 G electrical optical
RTU-310-2 = IP Services Test Head 1 G electrical optical (two ports)

Other Software Options
00 = Without other options
100optical = Enable support 100 M optical
IPTV_MON = IPTV monitoring up 10 streams
IPTV_MaxStream = IPTV monitoring up 100 streams [a]
TCP = TCP throughput testing
802.3AH = 802.3AH OAM
PBB-TE = PBB-TE testing
MPLS = MPLS testing
Adv_filtering = Advanced filtering capabilities
IPv6 = IPv6 testing
ETH-THRU = Ethernet Through mode
EtherSAM = EtherSAM (ITU-T Y.1564) testing capabilities
Data_Capture = Data capture and decode capabilities
TRAFFIC-SCAN = VLAN/MPLS traffic scan

Power Supply
AC = 100-240 VAC power supply
DC = −48 VDC power supply

Rate Fibre Channel
00 = Without Fibre Channel
FC1X = 1x and 2x Fibre Channel interface

Example: RTU-310-1-100OPTICAL-FC1X-FC2X-AC

Note
a. Available only if the IPTV_MON option is selected.

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