VePAL TX300

Portable OTN, SONET, Ethernet, and Fibre Channel Test Set

Next Generation Transport, Metro and Carrier Ethernet Testing

VeEX™ VePAL TX300 is the industry's smallest portable test solution for OTN/SONET, DS1/DS3 and Ethernet/Metro Transport and Core Networks carrying data, voice and video.

Platform Highlights

- Intuitive presentation of measurements with test graphics
- High resolution color touch-screen viewable in any lighting conditions
- Robust, handheld chassis packed with powerful and flexible features for demanding environments and test conditions
- Optimized for field engineers or technicians installing and maintaining OTN and SONET networks transporting legacy and next generation Ethernet services
- Test set connectivity via 10/100Base-T Management interface, WiFi, Bluetooth, or Data Card for back office applications and workforce management
- User defined test profiles and thresholds enable fast, efficient and consistent turn-up of services
- Fast and efficient test result transfer to USB memory stick
- Maintain instrument software, manage test configurations, process measurement results and generate customer test reports using included ReVeal™ PC software
- Interchangeable Li-ion battery pack extends field testing time
- Ideal for lab testing and field testing environments

3.072 Unframed Testing (CPRI)

- 3.072 Gbps interface per Common Public Radio Interface standard
- BER testing with PRBS stress patterns
- Latency measurements

OTN/SONET/DS1/DS3

- Optical SONET/SDH testing for OC-1/3/12/48 and OC-192; also supports STS-1/3 Electrical (STM-0/1E)
- OTN testing for OTU-1, OTU-2; OTU-1e/OTU-2e (Optional)
- DSn testing at DS1, DS3 bit rates; E1, E2, E3, and E4 (Optional)
- Dual DS1, E1, DS3 Rx BERT
- Non-intrusive Pulse Mask Analysis at DS1, DS3 and E1, E3 rates
- Optical Power, Electrical Level and Frequency measurements
- Path Trace and Pointer Generation and Analysis
- Automatic Protection Switching
- Round Trip Delay on all interfaces and payload mappings
- Overhead Monitoring and Byte decoding
- Tandem Connection Monitoring
- Jitter/Wander Analysis (DS1, DS3, E1, E3 and OC-3, STM-1o)

Ethernet/Fibre Channel (optional)

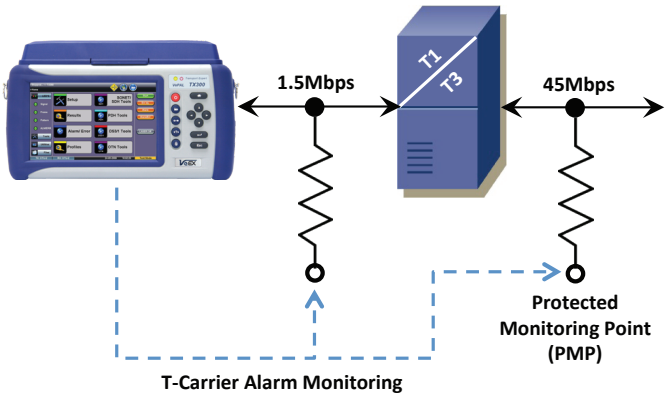
- Single 10GE LAN/WAN XFP, Dual 1000Base-X SFP, Dual 10/100/1000T RJ45, and Dual 100Base-FX (with Media converter)
- 1G/2G/4G/8G/10G Fibre Channel support for Storage Area Networks
- V-SAM test suite compliant with ITU-T Y.1564 standard
- IPv4 and IPv6 traffic generation
- Throughput, latency, frame loss, and back-to-back tests per RFC2544
- IEEE 802.3ah, ITU-T Y.1731, and IEEE 802.1ag OAM support
- Q-in-Q (VLAN stacking) and multiple MPLS tag support
- VLAN scan and traffic monitor
- BER testing at unframed Layer 1, Layer 2, Layer 3 and Layer 4
- Multiple streams traffic generation and analysis for end-to-end QoS verification of multiple services

Transport Expert

DS3/DS1 Applications

T-Carrier multiplexing and transmission systems developed in the 1960s and 1970s comprise the first generation of digital telecommunications network technology. While these networks have subsequently evolved to include long-distance, high-capacity trunks and OTN/SONET rings, T-Carrier network segments are frequently retained for access, service delivery, and economic reasons. As such, testing T-Carrier networks will continue for several years to come.

The TX300 provides test capabilities and sub-rates from 45 Mbps (DS3), 1.5 Mbps (DS1), down to N/M × 56 kbps. Additional T-Carrier test features include simultaneous multilayer G.821, G.826, M.2100 results, Pulse Mask analysis and Round Trip Delay. The test rates also empower the mapping and de-mapping of DS1 and DS3 payloads in virtual containers and testing of TU-11, and STS-1 overheads, making it ideal for testing hybrid T-Carrier/SONET networks.



DS3/DS1 Features

Auto Configuration

Auto configure simplifies instrument setup when properties of the incoming test signal is unknown. This feature allows novice users to start performing measurements quickly.

Multi-BERT™

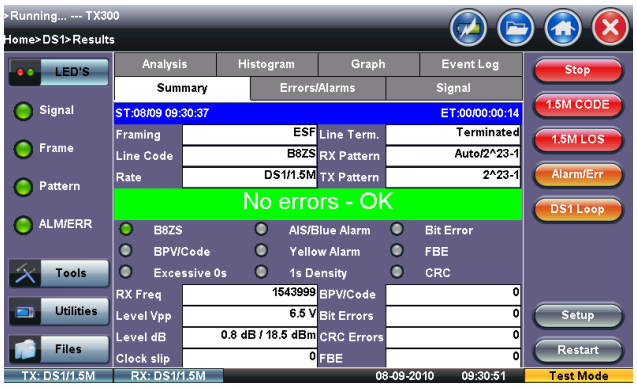
Bring into service and troubleshoot DS1 links quickly by automatically generating different test patters in a sequential BER test. Since certain test patterns can help identify and test for specific problems or behaviors, the test sequence can be customized with specific test patterns and timings to target specific test scenarios, like checking for proper line coding settings, framing, or clock recovery.

DS1 Loopback Commands

Enhanced DS1 Loopback commands enable users to single-handedly test DS1 links by activating automated loopbacks in the desired network elements.

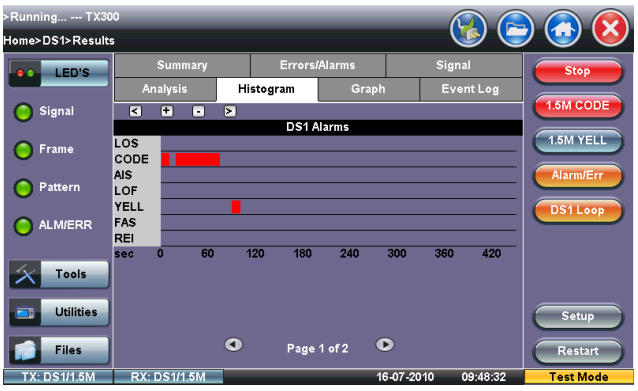
Intuitive Test Results

A summary screen quickly reports signal status and critical Error and Alarm parameters with easy-to-read Pass/Fail indicators. Additional screens accessed via a simple tab system display signal levels, anomalies and events.



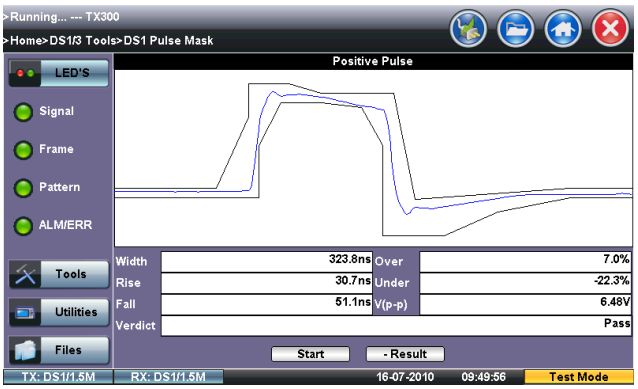
Powerful Measurement Histograms

Visual presentation of simultaneous measurement results with 1-second resolution simplifies correlation of alarms and errors.



Pulse Mask Analysis

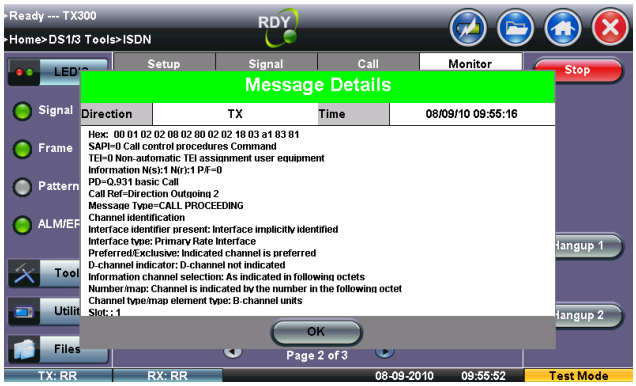
DS3/DS1 signals frequently fail pulse mask requirements due to interference, excessive cable length, improper impedance, or poor transmitter design. In such cases, G.703, ANSI T1.102, T1.403, T1.404 pulse mask compliance is very useful in diagnosing related problems.



ISDN Testing

The ISDN option provides most of the functionality necessary for testing and troubleshooting DS1 or E1 Primary Rate connections. Operating in TE or NT modes, the unit is able to setup and receive ISDN calls with user-defined parameters including call control protocol, called number and related facilities.

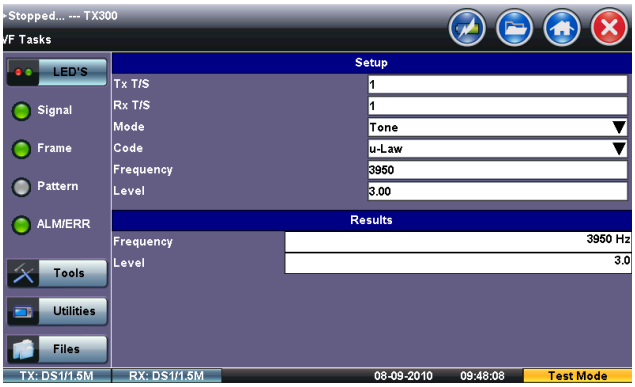
Protocol functions feature detailed signaling statistics, message monitoring and decode, and complete result presentation. With these capabilities, analysis of international and national ISDN, and other access protocols is possible.



VF Testing

The Voice Frequency (VF) option is a basic diagnostic tool to install, verify and troubleshoot voice circuits. Digital to analog conversion tests are performed by inserting/measuring tones with user defined frequency and level on selected sub-rate channels.

A microphone/headset jack enables Talk/listen capability on a selected timeslot while a powerful function allows VF decoding at all DSn/PDH and SONET rates.



Jitter and Wander

Data integrity in synchronous networks depends largely on the phase stability of clock and data signals. Per the ITU-T G.810 recommendation, the term Jitter is employed when the frequency of the unwanted phase modulation is greater than 10 Hz. When the frequencies are less than 10 Hz, the unwanted modulation is referred to as Wander. In SONET/SDH networks there is a great potential for the accumulation of jitter to degrade network performance, thus it is imperative that components and the network as a whole be tested and screened regularly for jitter to ensure that optimum levels of quality can be maintained.

Jitter Metrics

Output jitter performance mandated by ITU-T 0.171/0.172 and Telcordia GR-499/253 standards is evaluated by measuring the recovered clock of the incoming signal (DS1, DS3, OC-3 and E1, E3, STM-1o) traversing the network.

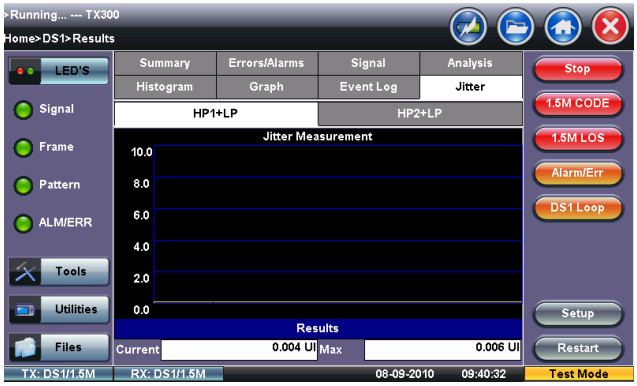
While the test duration is not defined in the mentioned standards, a measurement period time of 1 minute is recommended. Specified in unit intervals (UI), the maximum Peak-to-Peak Jitter is the most important parameter because Max values are indicative of performance, as these extremes generally cause errors. While jitter is defined as any phase variations above 10Hz, the incoming signal must be filtered in order to measure jitter – the user is therefore able to select between Wide band and High band filters to adjust the measurement bandwidth as required.

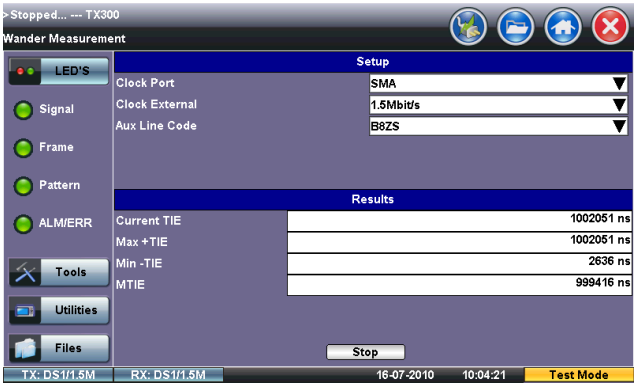
Wander Metrics

Wander is measured against an external reference clock whereas jitter is normally measured with reference to the clock extracted from the incoming data signal.

The wander external reference clock input accepts clock signals at 1.5MHz and 2MHz including signals with bit rates of 64 kbps, 1.544 Mbps and 2.048 Mbps.

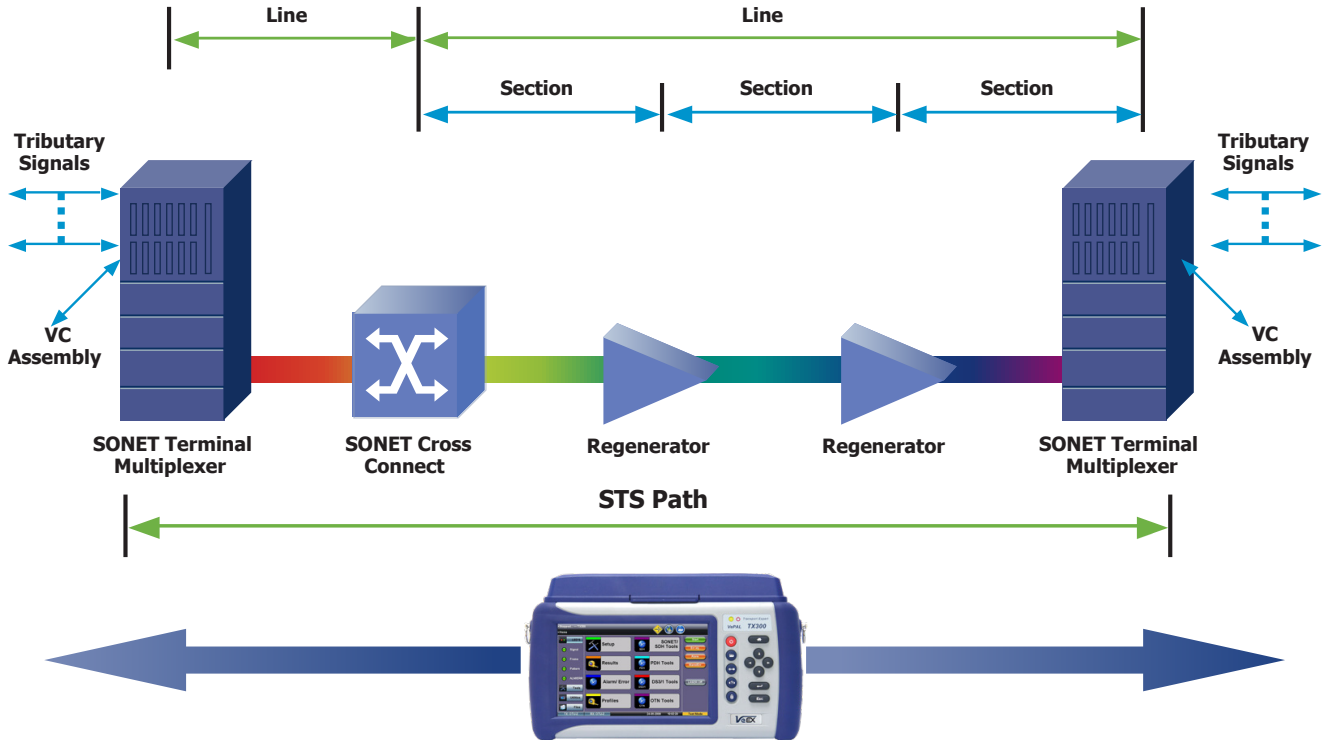
Measuring the input signal (DS1, DS3, OC-3 and E1, E3, STM-1o) with reference to the external clock signal, the time interval error (TIE) is derived. Unlike jitter results which are reported in Unit Intervals, TIE values are given as absolute time values (ns). MTIE (Maximum Time Interval Error) results report the largest peak-to-peak TIE observed during the measurement period.





SONET Applications

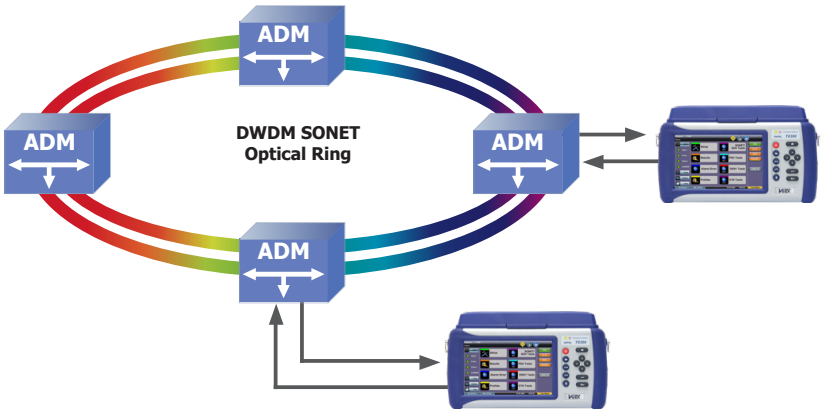
Installation, commissioning, monitoring and maintenance of SONET and DS1/DS3 networks is simplified thanks to a combination of intuitive features and powerful test functions. SONET signals are often compromised by various impairments in the multiplexing process therefore defining the type of anomaly or defect to isolate the network element or signal path causing the problem is crucial. Fast troubleshooting and comprehensive analysis of transmission problems can be performed using intrusive, non-intrusive and monitoring test modes. Novice users will benefit from the easy-to-use Auto-configuration and Tributary Scan test modes, while experienced users will appreciate the array of advanced features such as Overhead Monitoring and Byte Control, Pointer Test Sequences, Path Trace Generation, Tandem Connection Monitoring and lots more.



Out-of-Service Testing

Applications include:

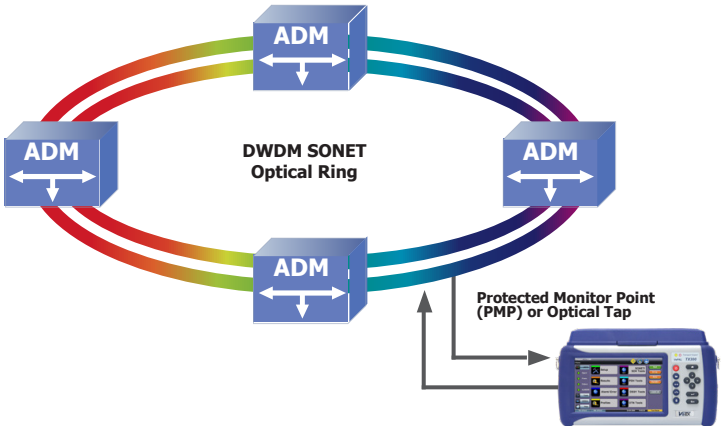
- BERT
- Tributary Mapping/de-Mapping
- Path/Section Trace Generation
- Bringing Into Service (M.2100)
- Pulse Mask Analysis (DS1/DS3/E1/E3)
- Mux Testing
- Round Trip Delay
- Pointer Test Sequences
- Jitter Generation, MTJ, JTF



In-Service Monitoring

Applications include:

- Optical Power and Frequency
- Tributary Scanning
- Performance Analysis per G.826, G.828, G.829, M.2101
- Pointer Analysis and Generation
- APS Measurement
- Tandem Connection Monitoring
- Overhead Byte Control and Decode
- Jitter and Wander Measurements



SONET Features

Quick and Easy Graphical Setup

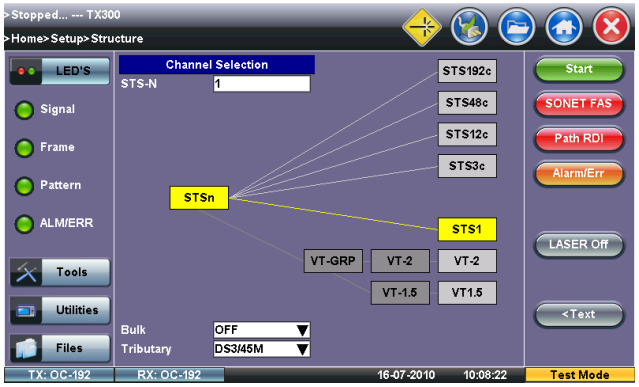
Complex daily tasks is common in today's network environment, therefore technicians need a tester that is quick and easy to configure. Intuitive graphics, drop down menus and touch -screen operation greatly simplify test interface, signal structure, payload mapping and test pattern setup.

Physical Layer Testing

Verifying analog parameters are within prescribed specifications and limits is recommended prior to performing framing and payload analysis. High optical power levels can saturate receiver equipment, while low power levels are susceptible to noise which result in bit errors. Clock tolerances for each individual signal hierarchy is clearly defined by Bellcore/ ITU-T recommendations and should be verified as part of any acceptance/conformance test.

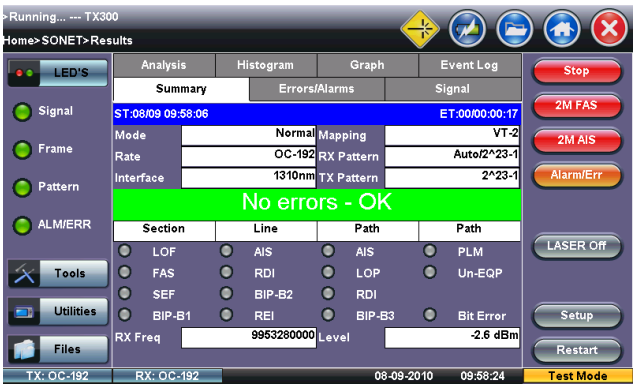
Payload Mappings

Test the operation of Add/Drop Multiplexers, Digital Cross Connects and other Network Elements (NE) by verifying the mapping and de-mapping of different tributaries and payloads into SONET containers and monitor anomalies and defects according to Telcordia GR-253 recommendations.



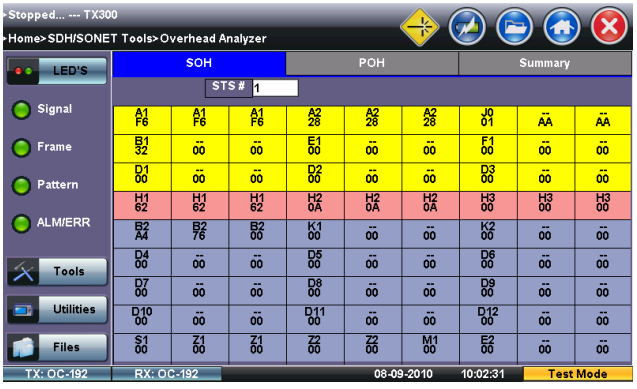
Performance Analysis Summary

Performance of each hierarchy is based on Byte Interleaved Parity (BIP) checksums which are calculated on a frame by frame basis. These BIP checks are inserted into the Regenerator, Multiplexer and Path Overhead, all of which form an integral part of the performance monitoring capabilities of an SONET/ SDH network. The TX300 analysis screens present Pass/Fail criteria for each performance parameter according to ANSI/ ITU-T recommendations.



Overhead Analysis

Binary and hexadecimal decode of all Section and Path overhead bytes are performed and a summary of the most important bytes is displayed.

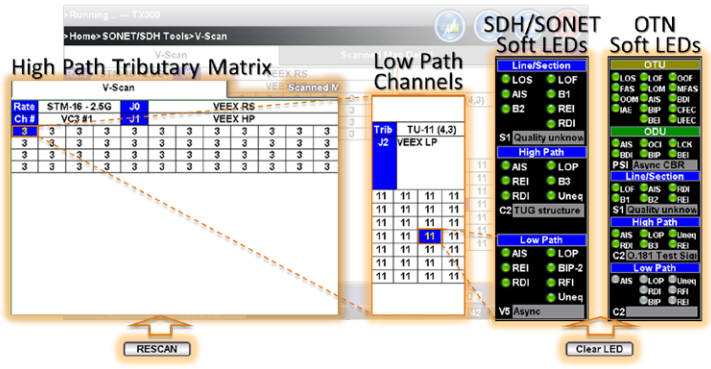


Overhead Byte Control

Manipulation of transmitted overhead bytes in both signal and payload through modes enables the user to stress the network's response to various conditions.

V-SCAN™

This mixed-payload monitoring option allows deep analysis and troubleshooting of real-life SONET, SDH, and OTN signals and their payloads, down to individual VT1.5/VC11 tributaries and concatenated payloads. A single screen presents the snapshot of all the tributaries, provides indication of health for each one, and allows access to lower order tributaries with just one click. A detailed soft-LED panel provides information about the exact defects or anomalies present on any selected payload



OTN Applications

Introduction

The OTN test application provides technicians and engineers with a comprehensive and powerful set of test functions required for installing, commissioning, and troubleshooting OTN networks. The optional OTN test suite can be easily activated using a password and ReVeal MTX300 software.

Bit Rates

The TX300 offers various software options to verify compliance to the ITU-T G.709 standard including extended (over clocked) bit rates to ITU-T series G supplement 43 standards. The following OTN test interfaces are available:

- SFP transceiver supports OTU-1 (2.66Gbps)
- XFP transceiver supports OTU-2 (10.7Gbps), OTU1e (11.049Gbps) and OTU2e (11.095Gbps)

G.709 Defined Rates (in Gbps)					
Based on support for OC48/STM16	ODU1	2.499	--->	OTU1	2.666
Based on support for OC192/STM64	ODU2	10.037	--->	OTU2	10.709

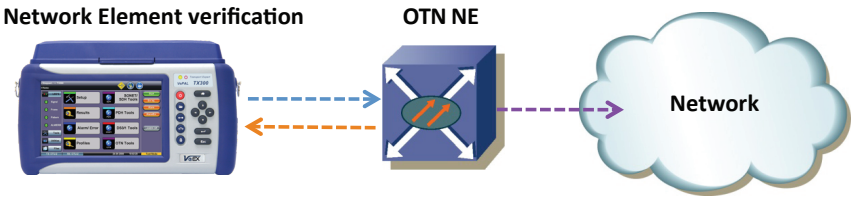
Non-Standard Supplemental Rates (in Gbps)					
Based on support for 10GE*	ODU1e	10.356	--->	OTU1e	11.049
Based on support for 10GE**	ODU2e	10.400	--->	OTU2e	11.095

* Transparent 10.3125 Gbps bitstream ** Transparent 10.3125 Gbps bitstream (includes fixed stuff bytes)

Test Applications

Similar to SONET/SDH, OTN networks require both in-service and out-of-service tests to be performed. *In-service* testing involves monitoring an operational network for alarms and errors over a period of time while *out-of-service* testing is typically performed during the commissioning phase to ensure that a network is fully functional before transmitting live traffic.

The network element response test involves sending a stimulus (error or alarm) signal into the OTN Device Under Test (DUT) and monitoring its output and proper response. The response test must be repeated for all possible input stimuli that the DUT is expected to respond to.

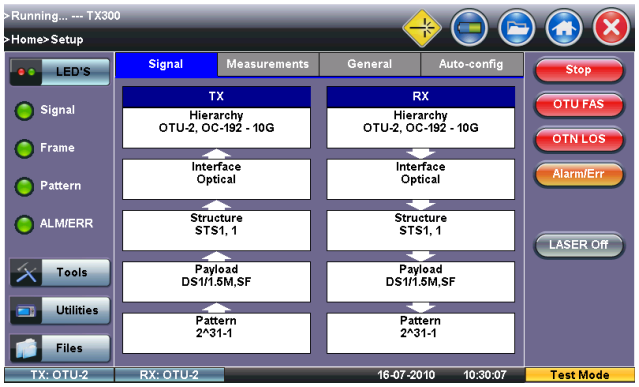


Stimulus	Downstream response	Upstream response
-------->	<--------	-------->
LOS-P, LOF, AIS-P, LOM	OTU BDI	OTU AIS
OTU BIP-8	OTU BEI	-
OTU TIM	OTU BDI	OTU AIS
OTU IAE	OTU BIAE	-
ODU AIS	ODU BDI	ODU AIS
ODU BIP-8	ODU BEI	-
ODU TIM	ODU BDI	-
ODU OCI	ODU BDI	ODU AIS
ODU PLM	-	ODU AIS

OTN Features

Intuitive Test Signal Setup

Transmitting and receiving ITU-T G.709 compliant OTN signals is quick and simple. The transmitter and receiver can operate independently, or they can be coupled depending on test setup. Framed signals can be equipped with unstructured or structured payloads – a user-selected test pattern fills the entire payload (Bulk) or a structured payload (SONET/SDH framed client signal) is used. Scrambling and Forward Error Correction (FEC) can be enabled or disabled to verify applicable circuitry.

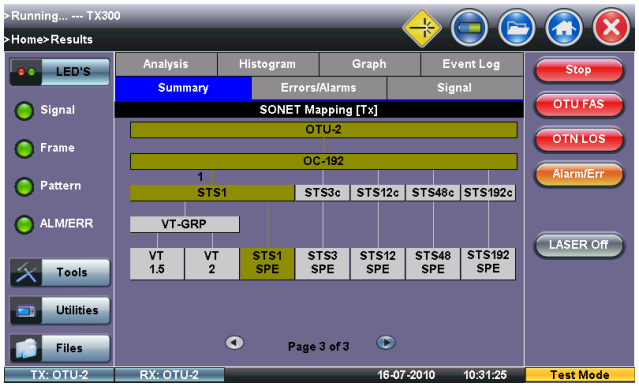


Monitoring Errors and Alarms

It is possible to monitor OTN anomalies and the errors in the SONET/SDH payload signals. Similarly, bit errors are monitored when the OTN signal payload is a test signal. Soft LEDs display event status continuously while a test is running – errors and alarms are color coded to show present and historical conditions.

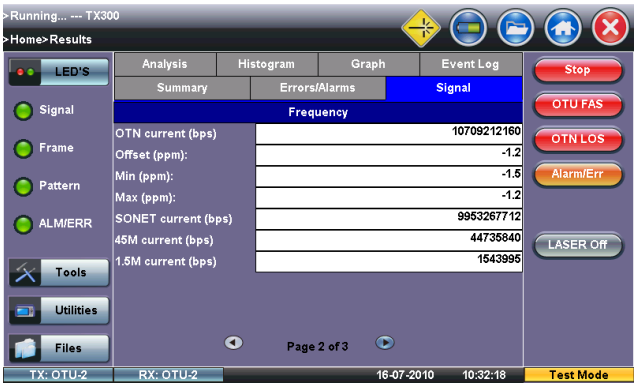
Advanced Mapping Capability

SONET/SDH client signals can be mapped using bit-synchronous or asynchronous modes. Synchronous means the Optical Payload Unit (OPU) clock is derived from the mapped client signal while Asynchronous means the OPU clock is independent. The mapping structure can be viewed and checked in the Signal summary tab.



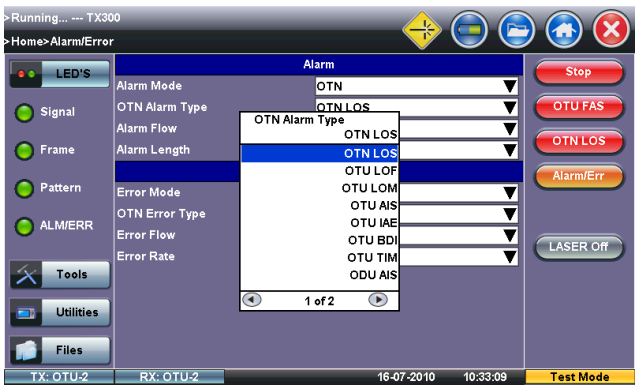
Line and Payload Frequency Analysis

Frequency offset present in the Optical Transport Unit (OTU) line frequency or Optical Payload Unit (OPU) are measured accurately. Furthermore, frequency offset applied to the signal by the user regardless of the clock source can also be analyzed.



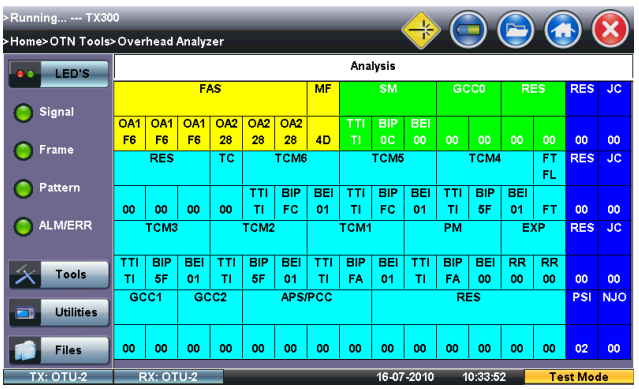
Error Insertion and Alarm Generation

Alarms and Errors can be applied to the OTN signal or to the payload itself. A full range of DSn/PDH and SONET/SDH anomalies and alarms are supported depending on payload setup. Single errors, preset rates or user-defined error rates are supported.



Overhead Byte Analysis

All overhead bytes in the OTU are captured and displayed in hexadecimal format. Direct access to overhead bytes ensures that the DUT performs termination and pass-through operations accurately, giving you confidence in your design.

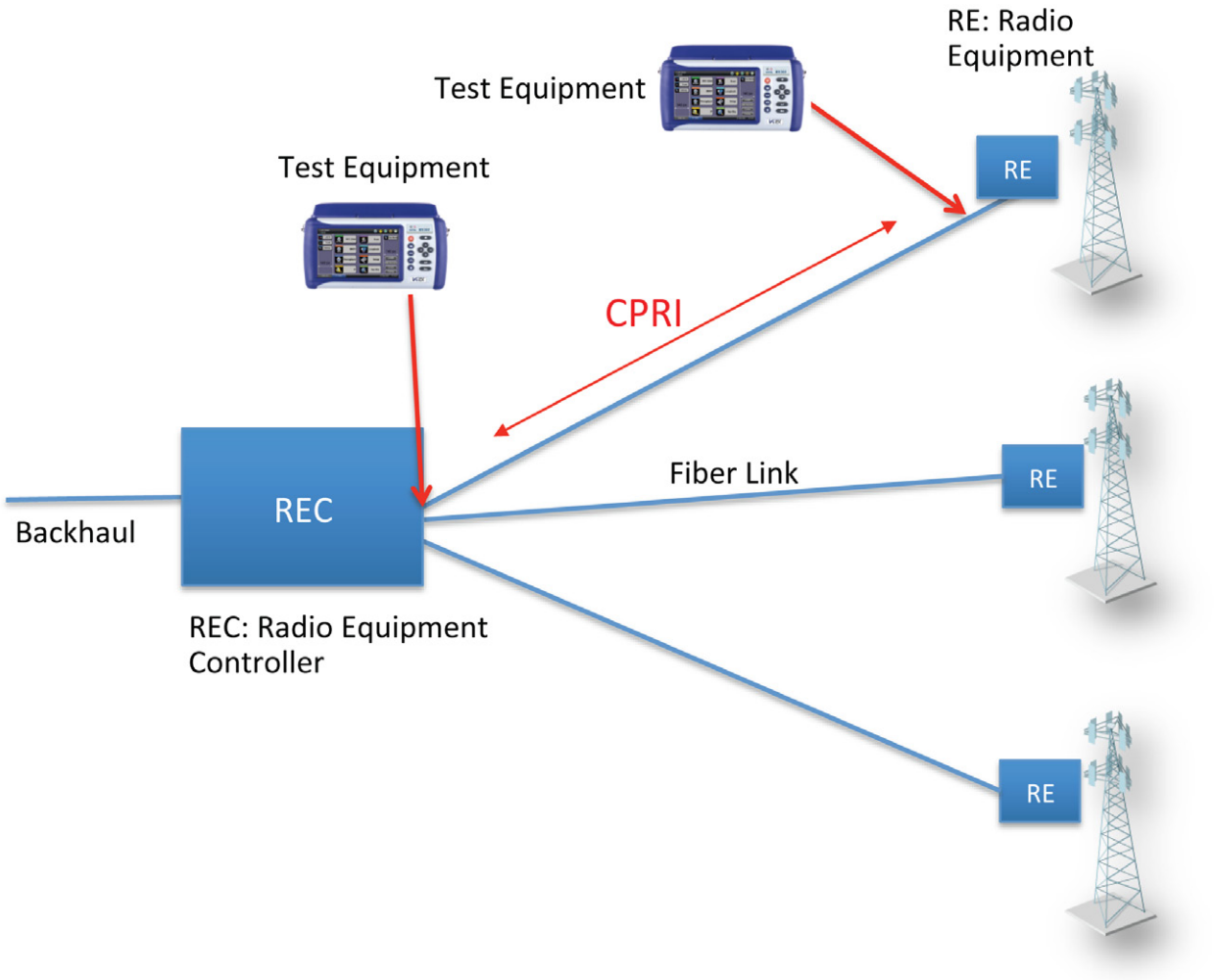


3.072 Gbps Unframed Testing (CPRI)

Traditional deployment of the base station functions are co-located with the radio tower at the base of the antenna or basement of a tall building.

The Common Public Radio Interface (CPRI) protocol introduces a distributed model where one REC (Radio Equipment Controller) can manage many REs (Radio Equipment). The REC can be physically located far from radio towers in a centralized indoor location and temperature controlled environment. REC to RE optical link allows long distances (up to 10 km) without loss.

Simplified RE function makes it more compact, easier to install, and therefore increases the number of possible sites. Further Capex and Opex improvements are possible by having one REC manage many towers, and increased deployment flexibility to add new cell sites.



CPRI Testing

BERT

3.072Gbps unframed BERT with PRBS stress patterns allows for verification of physical layer compliance with CPRI standard BER requirements. Alarm detection indicates Loss of signal and Pattern loss.

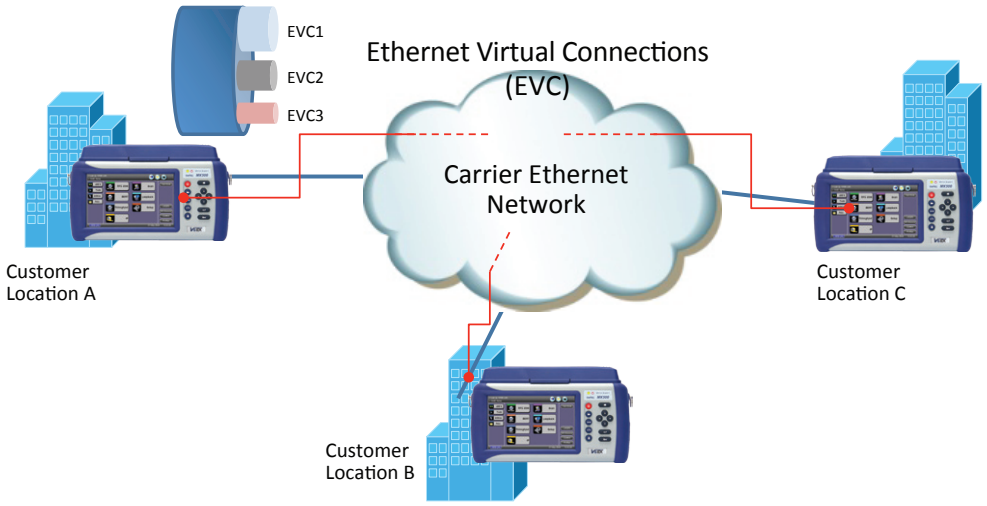
Latency Measurement

Highly accurate latency measurements ensures that CPRI traffic between controller and the radio equipment stays below standard specifications.

Ethernet Applications

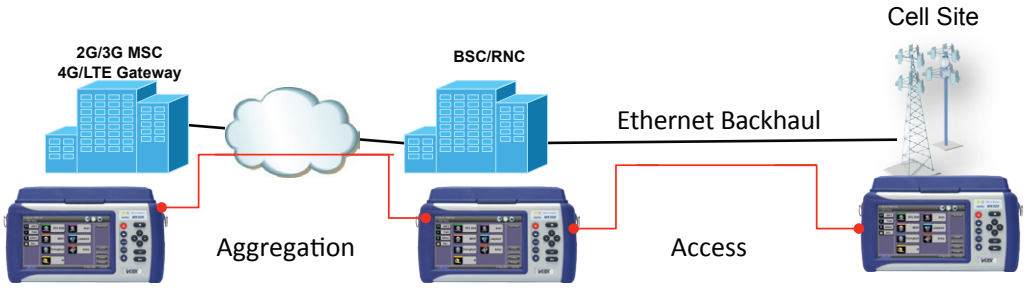
Carrier Ethernet Testing

Reliability, Scalability and Quality of Service are the attributes needed for Ethernet to turn into Carrier-grade Ethernet. With standard features including RFC2544, Y.1564 Service Activation Methodology and Ethernet OAM, MPLS and VLAN support, the TX300 has all the tools necessary to truly ensure end-to-end carrier-grade Ethernet services.



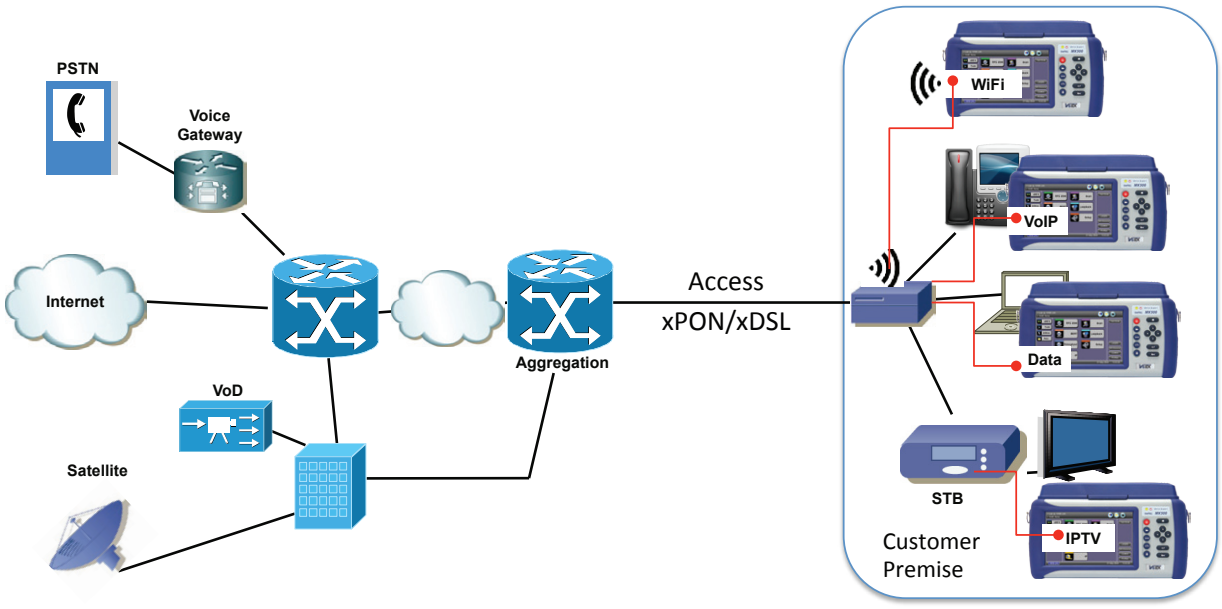
Mobile Backhaul Testing

With the rapid roll out of 3G and 4G/LTE networks and the growing demand for high bandwidth services, Mobile Ethernet Backhaul deployments are accelerating. Network performance evaluation is a critical step for carriers who must transition from highly reliable legacy TDM networks to packet based services. With the TX300 all services Key Performance Indicators like bandwidth, delay, and jitter can be measured and quickly evaluated for suitable service deployment.



Triple Play Testing

The TX300 is uniquely positioned to provide all the tools necessary to deploy successful triple-play services. With VoIP, IPTV, WiFi and Data tests capabilities, the TX300 is truly the only tool technicians will ever need to commission triple-play deployments.

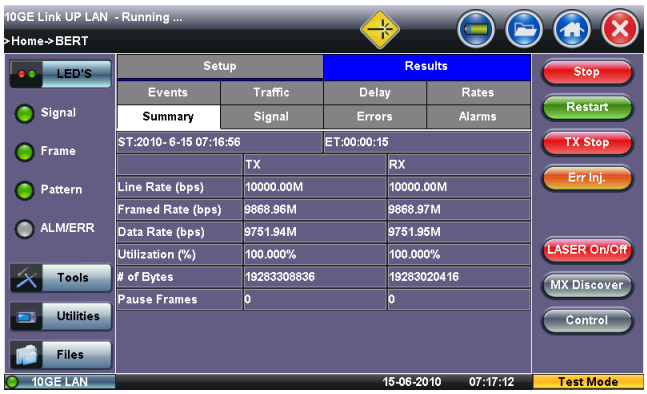


Ethernet Features

BERT

Layer 1 unframed (optical ports only), Layer 1, 2, 3, and Layer 4 BER testing are supported. The BER test can be configured to use regular PRBS test patterns, IEEE stress patterns for 1GE and 10GE LAN unframed modes, or user defined test patterns to simulate various conditions.

One traffic stream is transmitted across the network under test and bit-per-bit error checking is then performed on the received traffic. Service disruption measurements as well as CRC error checking are also performed. The BER test can be performed with a physical loop (or plug) at the far end (for a layer 1 circuit), or a second test unit or intelligent loopback device in Smart Loop or in Peer-to-Peer mode.

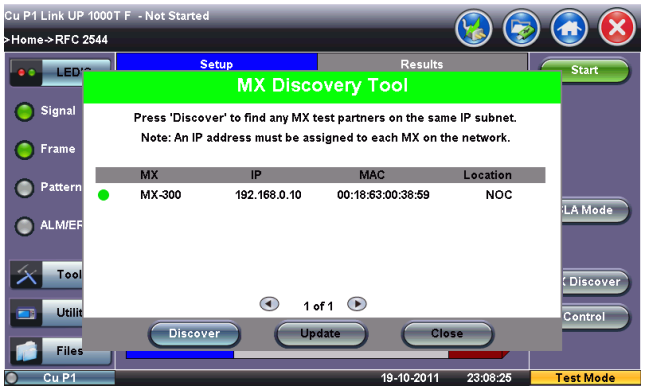


Q-in-Q (VLAN stacking)

VLAN stacking, also known as Q-in-Q, makes a provision for carrier/service provider assigned VLANs (SP-VLAN), but also retains the VLAN of customer traffic (CE-VLAN). Up to three layers of VLAN tagging supported on RFC2544, V-SAM, BERT, and Multi-streams throughput test, with configurable VLAN ID, Priority, and VLAN type.

Intelligent Network/Device Discovery

Easily discover and select another VeEX Ethernet tester or loopback device on the network under test for loopback testing applications. The local device will control the operation of the far end device, in either loopback or peer-to-peer mode (or symmetrical or asymmetrical traffic generation mode). This feature greatly simplifies field testing since there is no need for a second technician to be at the far end configuring the test partner device.

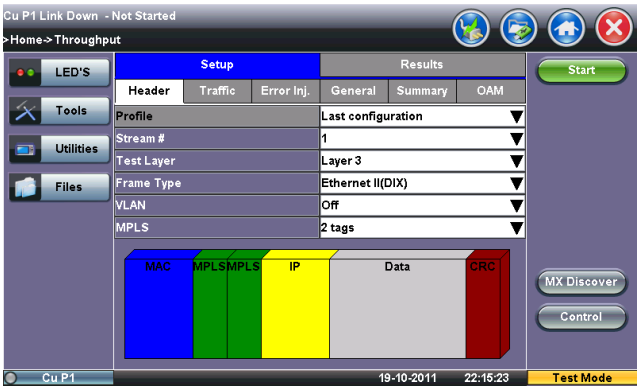


Delay and Jitter Measurements

Frame delay and frame delay variation - Jitter measurements are performed on the test traffic during BER tests, V-SAM, RFC 2544 multi-streams, or throughput tests.

MPLS Measurements

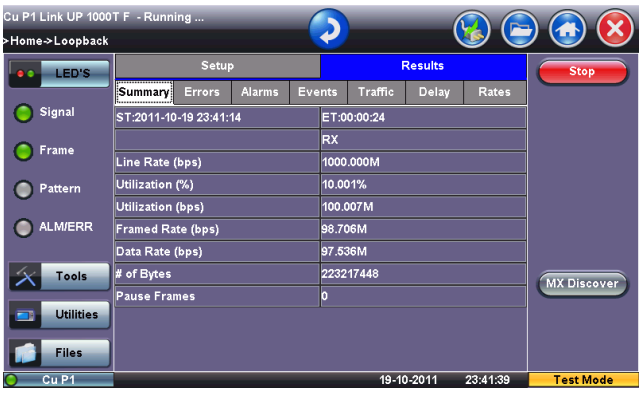
Multiple Protocol Label Switching is a technology that allows for a more efficient routing of Ethernet/IP packets via the use of MPLS routers in the network. MPLS labels reside between the MAC (Layer 2) and IP layers (Layer 3). Up to three MPLS tags can be configured in the traffic stream with user configurable Label, CoS, and TTL fields.



Smart Loopbacks

Four modes are available for looping back test traffic. At Layer 1, all incoming traffic is looped back unaltered. At Layer 2, all incoming unicast traffic is looped back with the MAC source and destination addresses swapped. At Layer 3, all incoming unicast traffic is looped back with the MAC and IP source and destination addresses swapped, and at Layer 4, all incoming unicast traffic is looped back with the MAC, IP, and UDP/TCP ports swapped.

Configurable traffic filters are supported on all MAC, IP, and VLAN fields to allow full control over looped traffic. Traffic is monitored while being looped and key traffic metrics such as frame type, rate, and error/alarms are displayed on screen. These can be compared to results at the far end to pinpoint issues more easily.

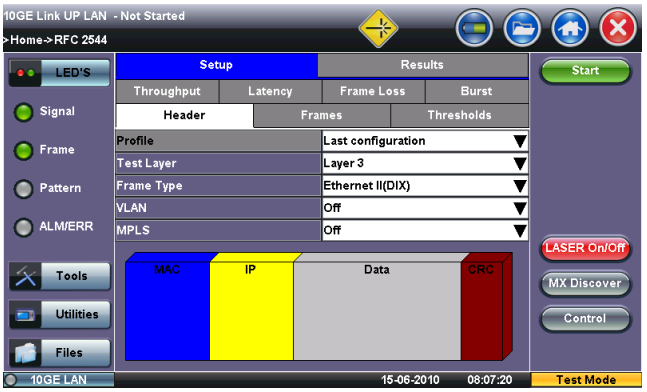


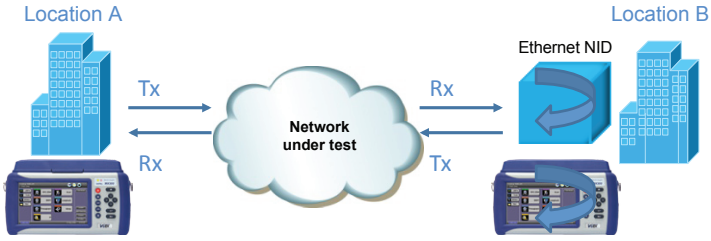
VLAN Scan and Traffic Monitor

Scan up to 4096 VLAN IDs for switch configuration verification. Verify which VLAN IDs are the top bandwidth users and monitor up to eight live traffic streams (in terminate mode).

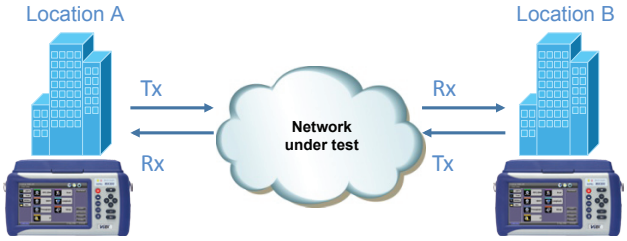
RFC2544 Compliance Testing

Performs the RFC2544 automated test suite at all recommended frame sizes as well as user configurable frame sizes and up to full line rate. The test suite can be performed with the far end test partner in loopback mode or peer-to-peer mode - the latter allowing for symmetrical/asymmetrical testing. Thresholds may be configured for accurate SLA assurance and verification. The automated tests supported are throughput, latency, frame loss, and back-to-back frames.





Remote Loopback to VeEX Ethernet tester or Ethernet Network Interface Device



Peer to peer test: Symmetrical or Asymmetrical traffic generation
Remote control from a single unit; Test results available for each direction

Advanced SLA Mode

This feature combines the powerful multiservice throughput test capabilities with the RFC2544 industry test suite for SLA verification. Using this test function, service providers are able to verify SLAs while end-to-end QoS is assessed properly. By configuring one primary test stream and up to seven background streams each with independent frame size, bandwidth, and more importantly QoS levels, simulating different service applications is now realized. The Advanced RFC2544 SLA mode provides detailed visibility of the test parameters for each of the traffic streams being measured, providing an efficient in-depth qualification in a fast and automated way.

Multiple Streams Generation - Throughput

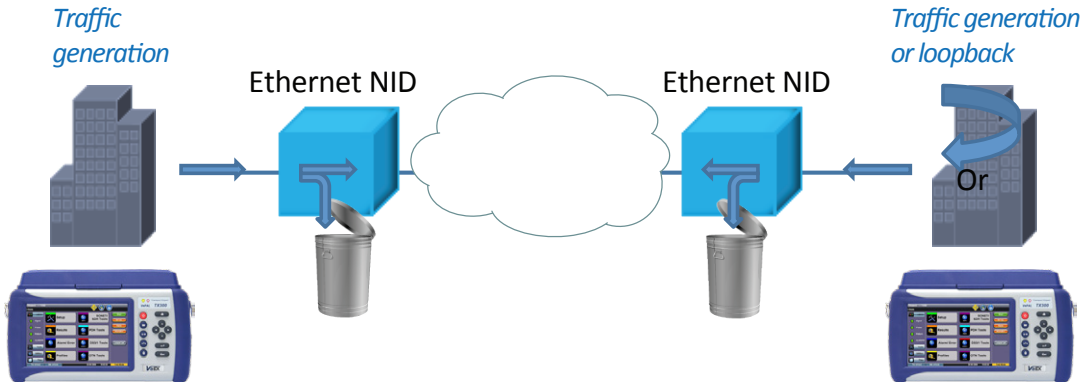
Up to ten traffic streams can be independently configured with CoS (VLAN priority) and QoS (TOS/DSCP) prioritization. This traffic feature simulates multiple service conditions (e.g. Triple Play), and facilitates end-to-end QoS performance verification. The multiple stream throughput test may be performed with a second test unit at the far end in Smart Loop mode or Peer-to-Peer mode.

Y.1564 V-SAM Test

VeEX's V-SAM test suite is fully compliant with ITU-T Y.1564 and offers an efficient method to qualify and troubleshoot Ethernet Services. V-SAM addresses some of RCF2544 limitations by testing multiple services at once and providing simultaneous measurements of key SLA parameters.

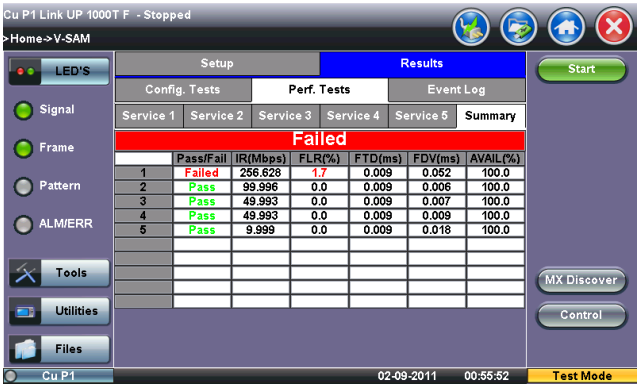
The purpose of the SAM test suite is to verify that the service is compliant to its Bandwidth Profile and Service Acceptance Criteria. The test is broken down into two phases:

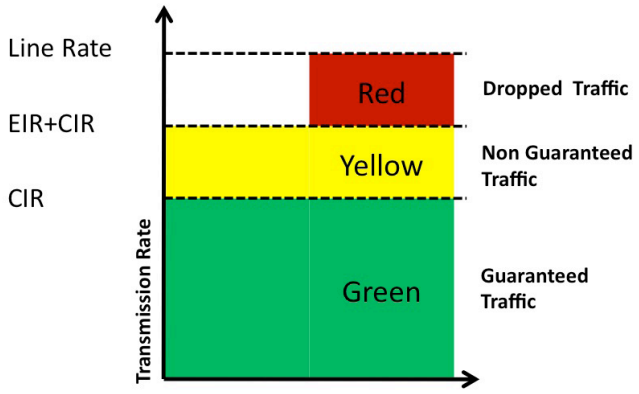
- Phase 1: Service Configuration test. The services running on the same line are tested one by one to verify the correct service profile provisioning.
- Phase 2: Service Performance test. The services running on the same line are tested simultaneously over an extended period of time, to verify network robustness.



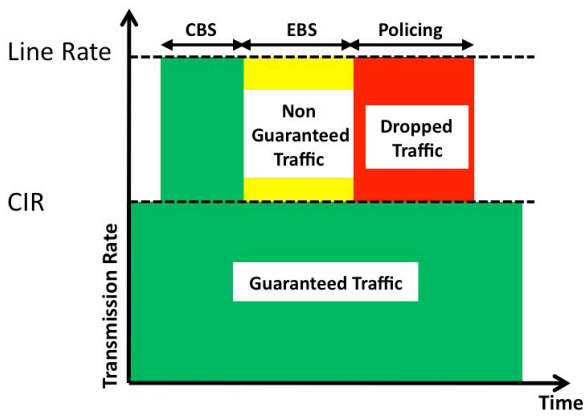
This test suite was designed with the end user in mind and allows for quick provisioning, execution and analysis of the test results, even without prior detailed knowledge of the standard:

- Test profiles can be stored and recalled, and even created offline on a PC and loaded on the test set, to facilitate quick setup.
- A visual Pass/Fail banner and summary tables provides a quick overview of the status of all services.
- Color highlighting the failing parameters facilitates a quick understanding of the problem if troubleshooting is required.





Service Information Rate

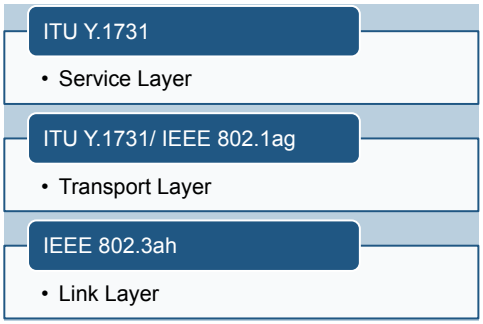


Service Burst Rate

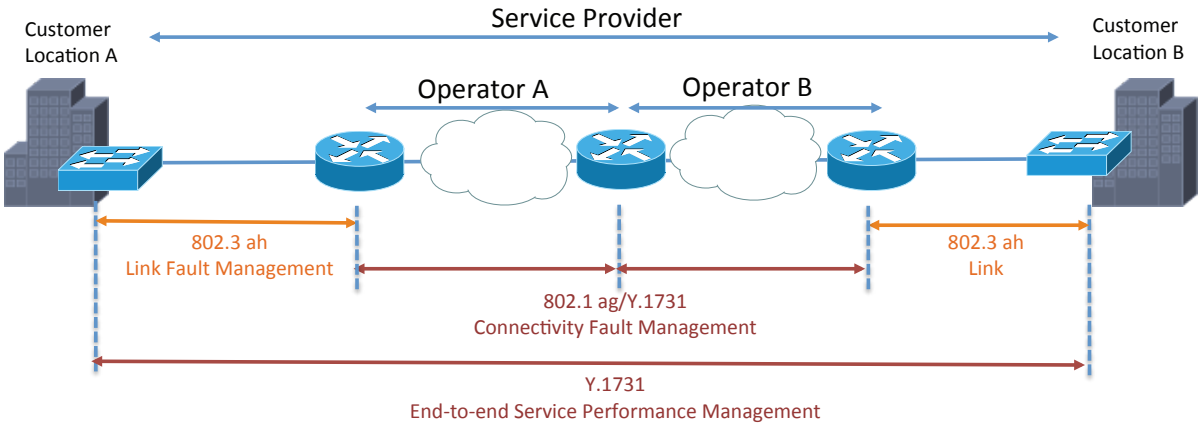
OAM

To achieve Carrier Class Ethernet, networks need to be managed and monitored by service providers in order to guarantee SLAs, and need to support automated defect detection and performance measurement. Standard bodies have developed protocols to achieve this.

- IEEE 802.3ah OAM for single segment “first mile” link fault management
- IEEE 802.1ag and ITU Y.1731 OAM for transport connectivity fault management
- ITU Y.1731 for end to end service level performance verification



The TX300 offers a complete tool set for Link Level (IEEE 802.3ah) and Service Level (IEEE 802.1ag/ ITU- Y.1731) OAM for monitoring and maintaining carrier grade Ethernet services.



Link Fault Management testing with 802.3ah OAM offers a full set of capabilities including:

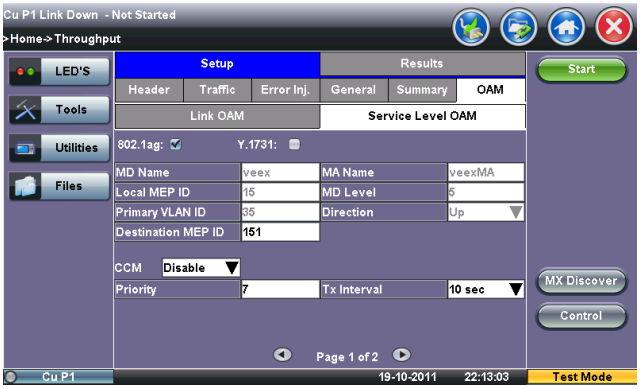
- Discovery mechanism to verify capabilities and provisioning of link partner
- Remote Loopback command for link performance testing
- Critical Link Event Notification

Connectivity Fault Management testing with 802.1ag and Y.1731, capabilities include:

- Linktrace message to perform path discovery
- Loopback message to test connectivity and isolate faults
- Continuity check messages to detect connectivity issues

Performance Management testing with Y.1731, capabilities include:

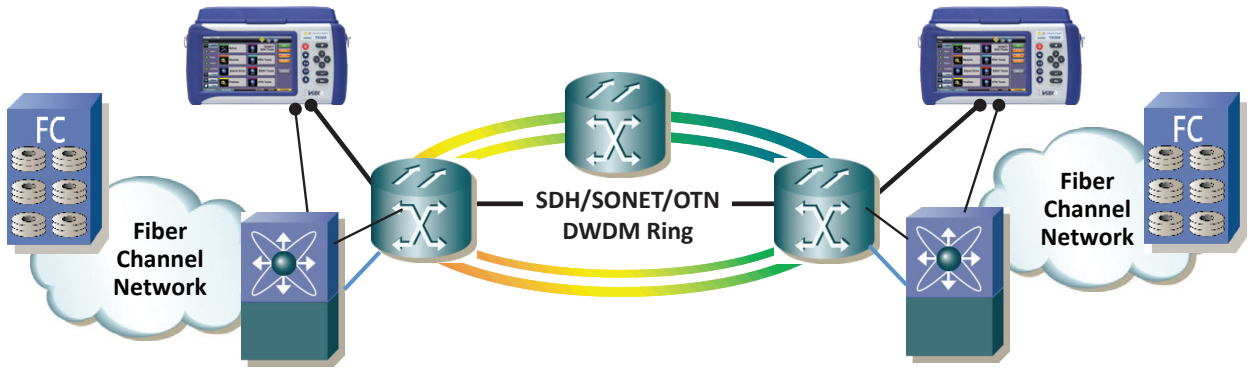
- Frame Loss Measurement (ETH-LM) function for service frame loss ratio measurement
- Delay Measurement (ETH-DM) function for frame delay and frame delay variation measurement



Fibre Channel Applications

Introduction

Enterprises worldwide rely on complex IT infrastructures to store and maintain critical data and applications. Storage Are Networks (SANs) have evolved to improve availability, resiliency, performance, modularity and geographical distribution of data storage systems and Fibre Channel is an important technology for linking SANs together.



Key Test Applications

Most customers or providers transporting Fibre Channel are not necessarily trained or concerned with testing the higher protocol layers – instead the transport groups tasked with transporting this data across a point-to-point or ring type DWDM network are more likely to ask: Did data arrive error free or were any bit errors encountered? Was the CRC corrupted or were any code violations experienced? Testing the transport layer is crucial and normally includes the FC-0 layer, FC-1 layer and parts of the FC-2 layer where:

- FC-0 addresses the physical layer: the optical fiber, connectors and associated optical signal parameters.
- FC-1 addresses the transmission protocol encoding/decoding, and special characters used for protocol management.
- FC-2 addresses the signaling protocol layer, which comprises the framing protocol and the flow control process.

The TX300 Fibre Channel option addresses all the transport layers by measuring the optical power level and supporting the generation/analysis of bit errors, order sets, frame delimiters, frame transmission, and the generation of primitive sequences. User defined bytes, fixed test patterns or industry-standard PRBS patterns can be selected and inserted into the payload field depending on test layer. Bit error, CRC error and Code violation insertion are useful features to verify Mux/Demux equipment for error monitoring and detection.

Buffer-to-Buffer Credit Estimation - to avoid loss of frames during transmission, the Fibre Channel protocol uses a buffer-to-buffer flow control mechanism between link partners. During the login process, the remote node informs the local node as to the number of receive buffers it has available. For each frame received, the remote port returns a R_RDY frame to indicate that one of the receive buffers is now free - the local port in turn increments its available credit counter by one for each R_RDY acknowledgement frame it receives. However, as the distance between nodes or link partners increases, so does the time it takes for the transmitting node to receive the R_RDY frame because of signal propagation delay. The standard practice for a 1Gbps Fibre Channel link is to allow 1 buffer credit for each 2km of distance.

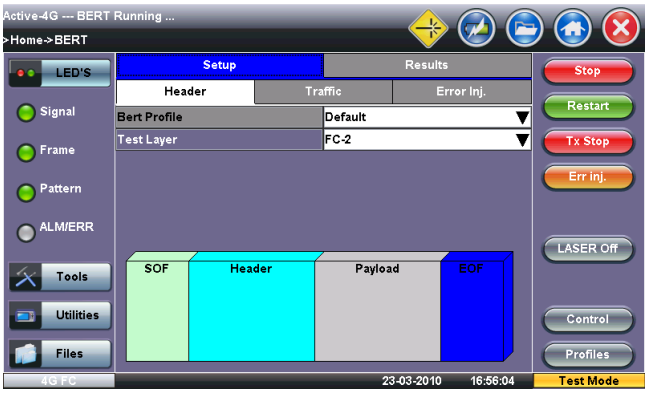
Fibre Channel Features

Key Features

- Full line-rate traffic generation/analysis at 1.0625, 2.125, 4.25, 8.5, and 10.52 Gbps
- Traffic generation from 0.01% to 100%
- FC-1 and FC-2 BERT
- FC-1 Test Patterns: CJTPAT, CRPAT, CSPAT
- FC-2 Test Patterns: ITU-T PRBS, 2^{11}-1 , 2^{15}-1, 2^{23}-1, 2^{31}-1
- Flow Control Support with configurable buffer-to-buffer credits
- FC-2 Frame Header configuration
- Primitive Sequence Protocol support, link initialization, link reset, link failure
- Frame Length configuration up to 2148 bytes
- Traffic shaping: Constant, Ramp, and Burst profiles
- Performance Measurements – Delay, Packet Jitter, Sequencing
- RFC2544 Verification – Throughput, Latency, Frame Loss, Burstability (Back-to-Back Frames)
- Automated Test Reports and Event Log based on Errors and Alarms
- Service Disruption Measurement
- FC-2 Smart Loop mode

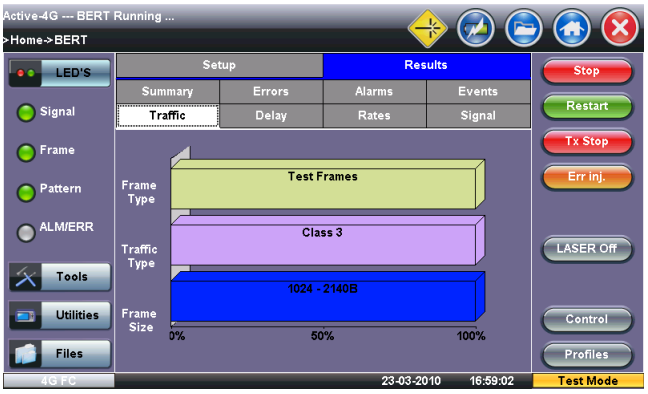
Bit Error Rate Test (BERT)

The Fibre Channel protocol specifies a maximum allowable Bit Error Rate (BER) of ≤ 1 x 10^{-12} that must be achieved. The TX300 allows the user to stress FC-1 and FC-2 network layers to ensure accurate benchmarking. For FC-1, frequency fluctuations, transceiver noise and phase jumps are tested using CRPAT, CSPAT, and CJPAT patterns while PRBS patterns check data dependency and behavior of network components at the FC-2 logical layer.



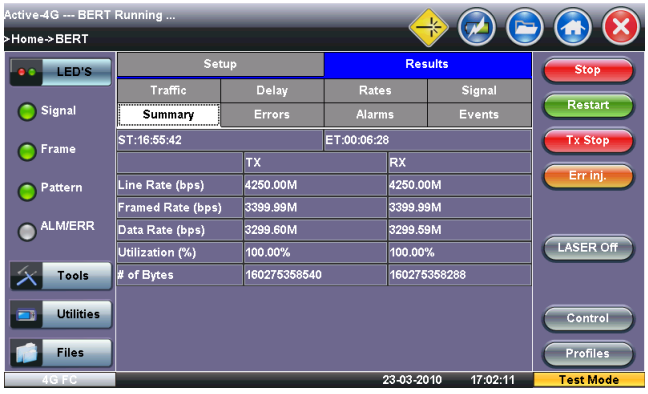
Test Traffic Analysis

Graphical representation of Frame type, Traffic type and Frame size provide a useful snapshot of incoming test traffic. Round Trip Delay (RTD) measurement, a critical parameter for delay sensitive applications such as Fibre Channel is only a tab away while optical power can be checked quickly in the signal tab.



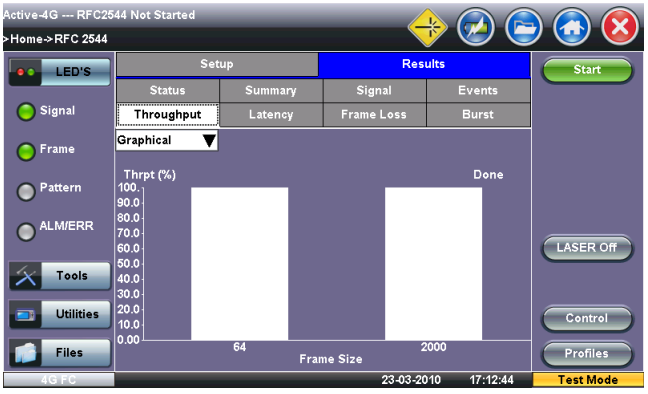
Detailed Statistics

Soft bi-color LEDs indicate Signal, Frame and Test pattern status and report Alarm/Error conditions so user can respond to issues quickly. Dedicated result tabs display individual measurements for easy viewing and fast troubleshooting.



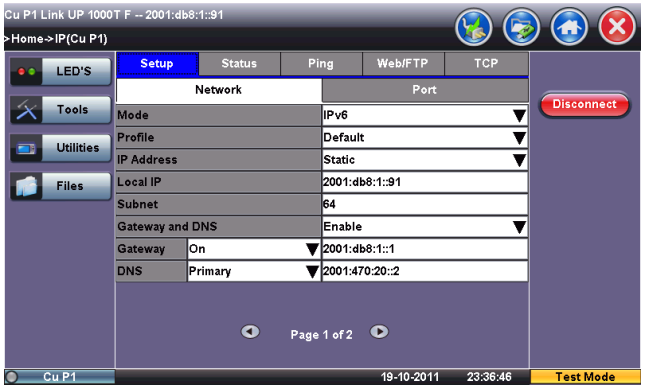
RFC2544 Benchmarking

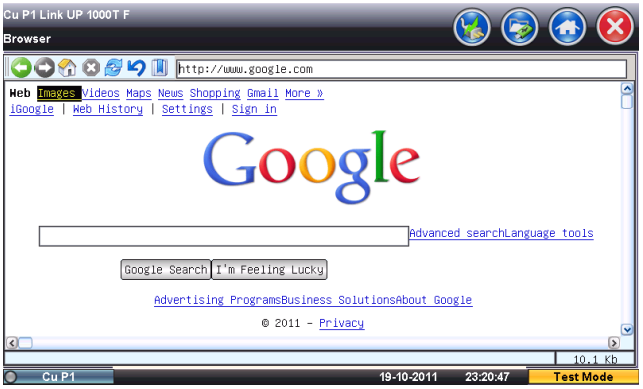
Based on the Ethernet test methodology, the RFC2544 routine has been adapted to Fiber Channel circuits where flow-control and buffer verification is important. The feature checks throughput at various buffer sizes to verify optimal buffer size and best possible link performance.



IP Testing

Complementary to the transport layer tests provided with the RFC2544 and V-SAM Y.1564 test suites, the TX300 provides advanced application layer test capabilities with the following functions: Ping test and Trace route, ARP network discovery, HTTP Web browsing and web speed test, FTP throughput test, Stateful TCP throughput test, VoIP, and IPTV.



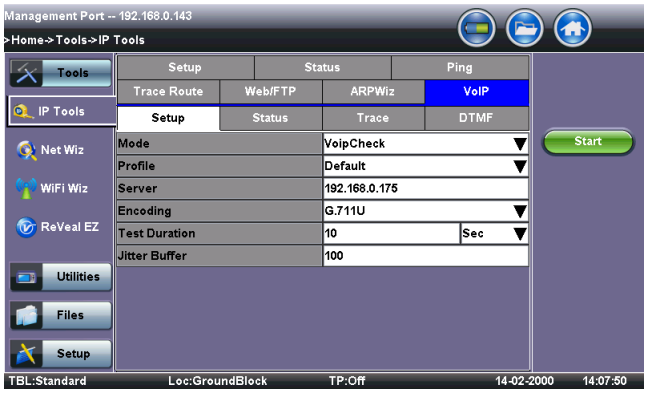


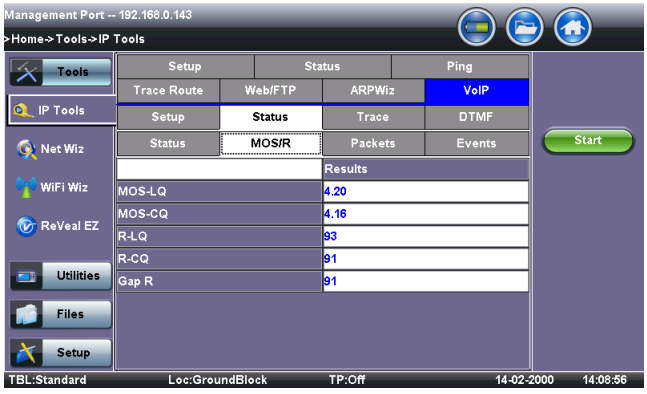
IPv4 and IPv6 networks testing is available on all Ethernet test ports, while a subset of these tools is available using the USB WiFi adaptor and PPPoE.

VoIP Testing

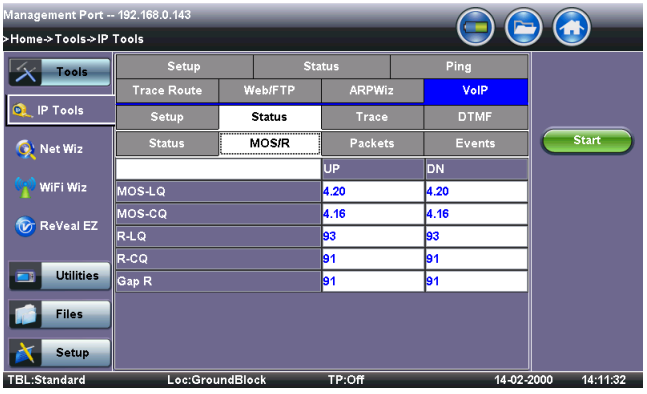
Take advantage of the three software options offering different test methods to verify and provision your VoIP network over the Ethernet or Gigabit Ethernet test ports.

VoIP Check – Simulates a VoIP call to the nearest router and measures the round trip MOS score and related VoIP parameters.

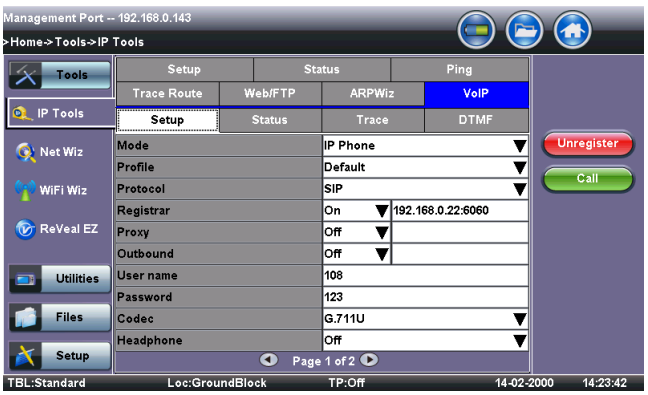




VoIP Expert – Generates industry standard wave files to verify MOS and R-Factor values of upstream and downstream paths and includes QoS measurements such as packet jitter, packet loss, and delay. Compatible with all VeEX testers including VX1000 VoIP server software.



VoIP Call Expert – Emulates an IP phone and can place and receive calls using SIP or H.323 protocols. Comprehensive Codec support and call destination options verify voice encoding and translation provisioning. Real-time evaluation of voice quality (MOS and R-factor) is made possible using the patented Telchemy® test method.



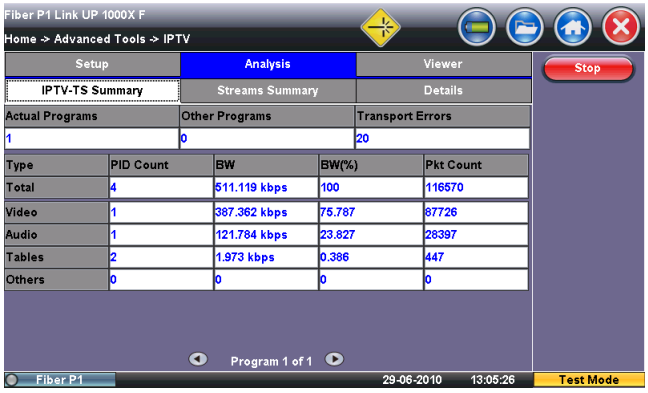
IPTV Explorer

IPTV Service Providers nowadays have to ensure the transport layer and MPEG payload are both within defined limits, because simply checking packet loss, jitter and related impairments of the Ethernet distribution network is not enough to evaluate the quality of the IPTV content carried in the upper protocol layers. The TX300 IPTV Explorer option extracts the MPEG payloads from the Ethernet streams, decodes and displays them to check transport and programming content so that QoS and QoE can all be assessed.

Media-Stream-Based Algorithm

A proprietary and sophisticated algorithm analyzes the IP stream to assess and derive video quality and improve accuracy of quality scores.

- **Frame structure/GoP detection** – Identifies I, B, and P frames in both unscrambled and encrypted video streams, to determine GoP length and the rate and distribution of packet loss in each frame.
- **Per-frame quality computation** – Quality in each frame using the frame type, frame size, codec type, bandwidth, and packet loss data. For P and B frames, TX300 models the loss propagated from earlier reference (I or P) frames.
- **Bandwidth estimation** – the bandwidth used by certain types of video frames is analyzed to estimate the quantization level applied by the video encoder.

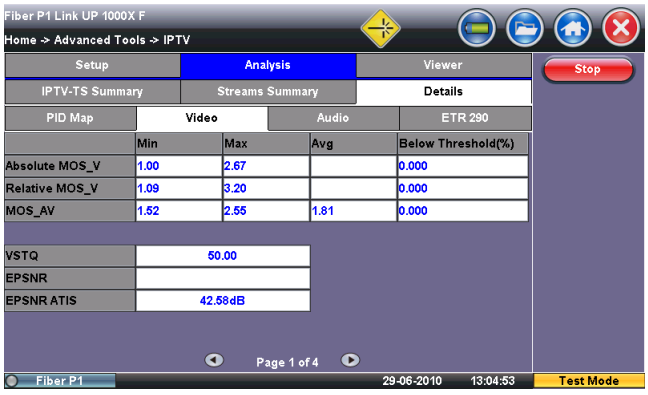


Program Identifier (PID) Statistics

PID statistics provide critical information about the MPEG transport stream. The bandwidth and packets associated with each individual stream are listed allowing the technician to check the video, audio and data content and to check for any "illegal" PIDs. Identification of uncorrected packet errors provides valuable clues to picture impairments.

Transmission Quality Score

MOS scores associated with the particular video/audio codec used and transmission quality are reported. **VSTQ** (Video Service Transmission Quality), is a codec-independent scoring that rates the ability of the network to reliably transport video.



Quality of Service (QoS) Measurements

QoS parameters are evaluated and presented in an intuitive manner so that technicians unfamiliar with MPEG signals are able to make accurate decisions to ensure maximum service availability. To compare quality in different video service types such as HDTV and SDTV, both Absolute and Relative MOS scores are reported:

Perceptual Quality Metrics

- **MOS-V** – Video MOS, a score that considers the effects of the video codec, frame rate, packet loss distribution, and GoP structure on video quality.
- **MOS-A** – Audio MOS, a score that considers the effects of the audio codec, bit rate, sample rate, and packet loss on viewing quality.
- **MOS-AV** – Audio-Video MOS, a score that considers the effects of both picture and audio quality and the audio-video synchronization on the overall user experience.
- **Absolute MOS-V** – considers the image resolution, frame rate, codec and compression level, the effects of transmission impairments and frame loss concealment, but not the physical size of the display.
- **Relative MOS-V** – a MOS score relative to the ideal for the particular codec and image resolution in use.

I/B/P Frame Statistics

Packet loss in the video stream may or may not be apparent to viewers, depending on whether encoding errors affect I, B, or P frames in the Group of Pictures. To accurately assess Quality of Experience (QoE), it is necessary to know which frame types were affected.

Detailed statistics for each frame type (I, B, P), including the number of received, lost, and discarded frames and the proportion of each frame type impaired by packet loss and discard are reported. These metrics can be useful for troubleshooting and can help determine which GoP type and length should be used to obtain the best performance from the video service.

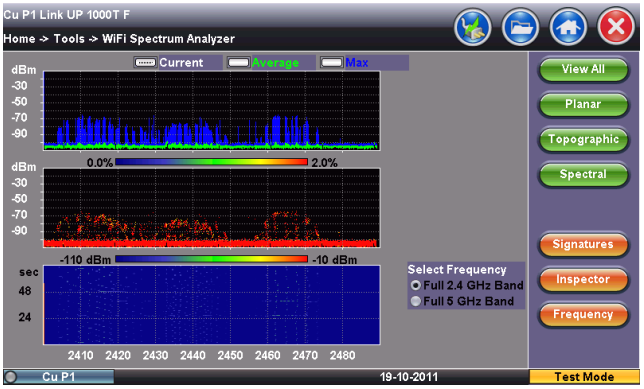
TR 101 290 Support

The ETSI TR 101 290 recommendation is a very good indicator of when a MPEG-2 stream has been transported error-free across a network. The MPEG Explorer option features a dedicated measurement tab displaying Priority 1 alarms which are key indications of synchronization, continuity errors and major table errors while Priority 2 impairments which include transport error indicators, Cyclic Redundancy Check (CRC), errors in elementary streams and PCR timing impairments are also displayed.

WiFi Spectrum Analyzer

The TX300 offers a powerful portable spectrum analyzer on a USB dongle that displays all RF activity in the WiFi bands. With dual 2.4GHz and 5GHz bands support, the analyzer covers all 802.11a/b/g/n networks and is the ideal tool for enterprise environments with a mix of wireless technologies.

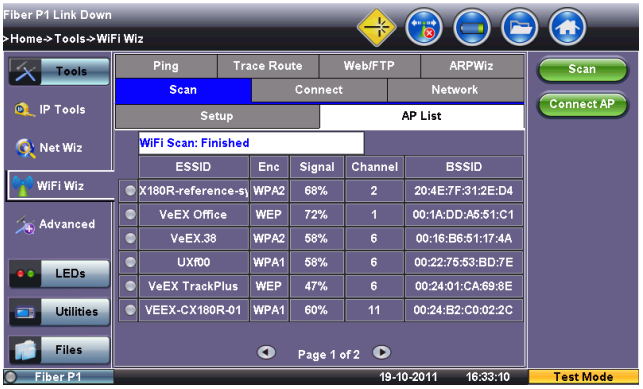
With multiple graphical format displays it helps to visualize and locate RF signals in the spectrums as well as locate and eliminate interference sources (cordless phones, microwave ovens, Blue-tooth devices ,etc.), discover and remedy competing access points.



WiFi Wiz

All VePAL products adopt a USB WiFi adaptor to make 802.11 b/g/n wireless installations a simple task.

Scan for available networks or perform signal strength and quality measurements to determine the best location for a new wireless access point. The IP Ping capability ensures the wireless network is properly installed and configured. A full suite of IP testing features is supported (ping, trace, web browser, etc.).



Net Wiz

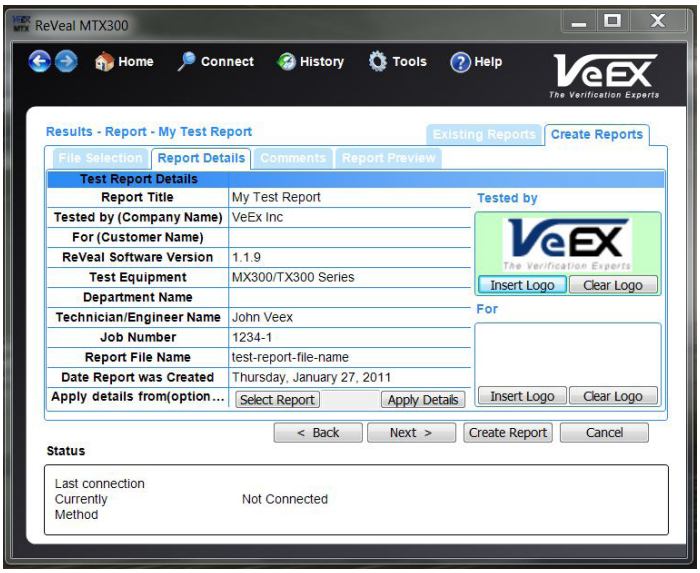
Ethernet network installation is simplified using this basic, yet powerful feature. A built-in TDR identifies distance to short, distance to open, wire cross, and other anomalies associated with CAT-5 structured cabling. “Sniff” the network using the one-touch discovery feature. Identify routers, gateways, printers, PCs and other devices connected to the network within seconds.

ReVeal MTX300

Included standard with each test set, ReVeal PC software provides an easy-to-use and intuitive interface that allows you to take full advantage of your TX300 test unit by providing the following productivity tools:

- Easy software update process
- Convenient test profile management
- Flexible test results management
- Powerful report generation
- Unit remote control (optional)

Compatible with Windows XP, Windows Vista and Windows 7, 32 bits or 64 bits operating systems.



SONET/SDH/PDH Interfaces

Electrical

Dual Bantam (100Ω balanced)

Rates and line code

- 1.544 Mbps, AMI & B8ZS, 100Ω balanced
- 2.048 Mbps, HDB3 & AMI, 120Ω balanced (Optional)

BNC (75Ω unbalanced)

Rates and line code

- 2.048 Mbps, HDB3 & AMI (Optional)
- 8.448 Mbps, HDB3 (Optional)
- 34.368 Mbps, HDB3 (Optional)
- 44.736 Mbps, B3ZS
- 51.84 Mbps, B3ZS
- 139.264 Mbps, CMI (Optional)
- 155.520 Mbps, CMI (Optional)

Compliant to ITU-T G.703, G.823, G.824, G.772 and ANSI T1.102

Clock recovery (pulling range) per ITU-T G.703

Receiver Sensitivity

1.544 Mbps (DS1)

- Terminate: ≤ 26dB (cable loss only) at 0 dBdsx Tx
- Monitor (PMP): ≤ 26dB (20dB resistive, 6dB cable loss)
- Bridge: ≤ 6dB (cable loss only)

44.736 Mbps (DS3) and 51.84 Mbps (STS-1/STM-0E)

- Terminate: ≤ 10dB (cable loss only)
- Monitor (PMP): ≤ 26dB (20dB resistive, 6dB cable loss)

2.048 Mbps (E1) (Optional)

- Terminate: ≤ 6dB (cable loss only)
- Monitor (PMP): ≤ 26dB (20dB resistive, 6dB cable loss)
- Bridge: ≤ 6dB (cable loss only)

8.448 Mbps (E2) (Optional)

- Terminate: ≤ 6dB (cable loss only)
- Monitor (PMP): ≤ 26dB (20dB resistive, 6dB cable loss)

34.368 Mbps (E3) (Optional)

- Terminate: ≤ 12dB (cable loss only)
- Monitor (PMP): ≤ 26dB (20dB resistive, 6dB cable loss)

139.264 Mbps (E4) and 155.520 Mbps (STS-3) (Optional)

- Terminate: ≤ 12dB (E4), 12.7dB (STS-3) (coaxial cable loss only)

Clock Synchronization

Internal: ± 3.5 ppm stability per ITU-T G.812

Recovered: from the incoming signal

External reference via SMA connector

- Clock: 1.544 MHz, 2.048 MHz (sine wave or TTL)
- Signal: 1.544 Mbps (B8ZS), 2.048 Mbps (HDB3)
- 64kbps co-directional

Tx Frequency Offset: Up to 50 ppm (25,000 ppm for E1) in steps of 0.1 ppm for both optical and electrical interfaces

Optical*

SFP and XFP transceivers conforming to Multi Source Agreement (MSA) specifications

ROHS compliant and Lead Free per Directive 2002/95/EC

Operating temperature range: -10˚C to 70˚C

Safety: Class 1, per FDA/CDRH, EN (IEC) 60825 eye safety regulations

Compliant to ITU-T G.957/G.691 Optical interfaces and systems relating to SDH

Optical Power Measurement: ± 2dB accuracy, 1dB resolution

See table below.

Transceiver	SFP						XFP		
Data rate	OC-1/3/12; STM-0/1/4 (51/155/622 Mbps)			OC-1/3/12/48; STM-0/1/4/16 (51/155/622/2488 Mbps) OTU-1 (2666 Mbps)			OC-192; STM-64 (9.953 Gbps) OTU-2 (10.7Gbps) OTU-1e (11.049Gbps) OTU-2e (11.095Gbps)		
Part No.	301-01-004G	301-01-005G	301-01-006G	301-01-007G	301-01-008G	301-01-009G	301-04-002G	301-04-003G	301-04-004G
Wavelength (nm)	1310	1310	1550	1310	1310	1550	1310	1550	1550
Range (km)	15	40	80	15	40	80	10	40	80
Connector	LC	LC	LC	LC	LC	LC	LC	LC	LC
Line coding	NRZ	NRZ	NRZ	NRZ	NRZ	NRZ	NRZ	NRZ	NRZ
Tx Laser	FP	DFB	DFB	DFB	DFB	DFB	DFB	DFB	DFB
Tx Spectral width (nm)	2.5	1	1	1	1	1	1	1	1
Tx Power (dBm)	-15 to -8	-3 to +2	-3 to +2	-5 to 0	-2 to +3	-2 to +3	-6 to -1	-3 to +2	0 to +4
Rx Detector	PIN	PIN	PIN	PIN	APD	APD	PIN	PIN	APD
Rx Sensitivity									
155 Mbps	-28 to -8	-28 to -8	-28 to -8	-23 to -10	-30 to -15	-30 to -15	n/a	n/a	n/a
622 Mbps	-28 to -8	-28 to -8	-28 to -8	-22 to 0	-29 to -9	-29 to -9	n/a	n/a	n/a
2488 Mbps	n/a	n/a	n/a	-18 to 0	-27 to -9	-28 to -9	n/a	n/a	n/a
2666 Mbps	n/a	n/a	n/a	-18 to 0	-27 to -9	-28 to -9	n/a	n/a	n/a
9.953 Gbps	n/a	n/a	n/a	n/a	n/a	n/a	-14.4 to +0.5	-16 to -1	-24 to -7
10.7 Gbps	n/a	n/a	n/a	n/a	n/a	n/a	-14.4 to +0.5	-16 to -1	-24 to -7
11.049 Gbps	n/a	n/a	n/a	n/a	n/a	n/a	-13.4 to +0.5	-15 to -1	-22 to -7
11.095 Gbps	n/a	n/a	n/a	n/a	n/a	n/a	-13.4 to +0.5	-15 to -1	-22 to -7

**Data rates, performance, and supported transmission protocols are only guaranteed for SFPs and XFPs supplied by VeEX Inc. If selecting or using other vendors, users should excercise caution.*

SONET/SDH Functions

Operating Modes

Terminate mode
Monitor mode
Payload Through mode (Intrusive)
- Modification of selected TOH bytes
- Alarm Generation/Error Insertion of selectable defects/ anomalies

Line Through mode (transparent)
- Passes entire signal through without modifying overhead bytes

SONET Mappings (According to Telcordia GR-253/ANSI T1.105)

VT-1.5 (unstructured or framed DS1, asynchronous or float byte synchronous)
STS-1 SPE (unstructured or framed E3 or DS3)
STS-3c SPE (unstructured or framed E4)
STS-12c SPE (Bulk)
STS-48c SPE (Bulk)
STS-192c SPE (Bulk)

Optional
VT-2 (unstructured or framed DS1)

SDH Mappings (According to ITU-T G.707)

C-12 (unstructured or framed E1, asynchronous or byte synchronous)
C-3 (unstructured or framed E3 or DS3) via AU-3 or AU-4
C-4 (unstructured or framed E4)
C-4-4c (STM-4 and STM-16)
C-4-16c (STM-16)
C-4-64c (STM-64)

Optional
C-11 (unstructured or framed DS1)

Patterns

The following test patterns can be generated
- PRBS: 2^{31}-1 , 2^{23}-1, 2^{20}-1, 2^{15}-1, 2^{11}-1: normal or inverted
- Fixed: 0000, 1111, 1010, 1000 and 1100
- 10 User programmable words up to 32 bits each

Errors

Insertion
- FAS, B1, B2, REI-L, B3, REI-P, REI-V, BIP-V, and bit errors
- Mode: Single and rate (1×10^{-3} to 5×10^{-6})

Detection
- FAS, B1, B2, REI-L, B3, REI-P, REI-V, BIP-V, slips and bit errors

Alarms

Generation
- LOS, LOF, AIS-S, RDI-S, TIM-P, LOP-P, AIS-P, UNEQ-P, PLM-P, RDI-P, LOM-V, LOP-V, AIS-V, UNEQ-V, PLM-V, RDI-V, RFI-V, TIM-V, DS1-AIS, DS1-LOF, 2M-AIS, 2M-LOF, 2M-RDI, 45M-AIS, 45M-LOF
- Mode: Static (Enable/Disable)

Monitoring and Detection
- LOS, LOF, OOF, AIS-S, RDI-S, TIM-P, LOP-P, AIS-P, UNEQ-P, PLM-P, RDI-P, LOM-V, LOP-V, AIS-V, UNEQ-V, PLM-V, RDI-V, RFI-V, TIM-V

Automatic Configuration

Configures tester to the incoming signal - Bit rate, framing, line code and test pattern are identified in accordance with ITU-T G.707, G.703, O.151 and O.181

Overhead Analysis and Generation

Network Architectures supported
- Linear (per ITU-T G.783)
- Ring (per ITU-T G.841)

Analysis – Decode and Display
TOH/POH bytes in hexadecimal, binary or ASCII formats
- S1 synchronization status
- C2 STS path signal label
- J0 trace identifier (16 bytes) in ASCII format
- J1 trace identifier (16 or 64 bytes) in ASCII format
- J2 trace identifier (16 or 64 bytes) in ASCII format
- K1, K2 APS Control
- V5 VT path signal label

Generation - Programmable Bytes
Section Overhead
- J0 trace: 1 byte hexadecimal or 16 byte ASCII sequence with CRC-7

Line Overhead
- K1, K2 APS bytes per ITU-T G.783 and G.841
- S1 synchronization status message

STS-POH (STS-N SPE, STS-1 SPE)
- J1 trace: 16 byte ASCII with CRC-7 or 64 byte ASCII sequence
- C2 signal label
- H4 Sequence/Multiframe Indicator
- G1 (bit 5): End-to-end path status (RDI generation)
- K3 (bits 1-4) APS signaling

STS-POH (STS-1 SPE)
- J1 trace: 16 byte ASCII with CRC-7 or 64 byte ASCII sequence
- C2 signal label
- G1 (bit 5): End-to-end path status (RDI generation)
- K3 (bits 1-4) APS signaling

VT-POH (VT-1.5, VT-2)
- V5 (bits 5-7) VT signal label
- J2 trace: 16 byte ASCII with CRC-7 or 64 byte ASCII sequence
- K4 (bits 3-4) VT APS signaling

Pointer Analysis and Generation

Analysis
- Current value, increments, decrements, sum, difference
- New Data Flags (NDF)
- Tributary frequency offset (ppm of STS/VT)

Generation
- Single pointer, increment, decrement, or increment/ decrement
- Programming of SS bits
- Pointer Sequences (ITU-T G.783, Telcordia GR-253)
  – Single, Double Alternating
  – Regular Add, Regular Cancel
  – Burst, Trans. Burst
  – 87/3, 87/3 Add, 87/3 Cancel
  – Periodic Add, Periodic Cancel

Tributary Scan

Automatically scans VT-1.5 or VT-2 for errors, alarms and events using a sequential BER tests

PDH Functions

Operating Modes

Terminate, Monitor; Bridge (DS1 & E1)

Signal Structure

1.544 Mbps (DS1)

- Unframed or Framed SF (D4), ESF per ANSI/Telcordia standards
- Test signal in N x 64 kbps, N x 56 kbps where N=1 to 24

44.736 Mbps (DS3)

- Unframed or Framed M13 & C-Bit Parity per ITU-T G.752/G.704

Optional

2.048 Mbps (E1)

- Unframed or Framed with/without CRC per ITU-T G.704 (PCM30, PCM30C, PCM31, PCM31C)
- Test signal in N/M x 64 kbps, N x 56 kbps where N=1 to 30/31

8.448 Mbps (E2)

- Unframed or Framed according to ITU-T G.742

34.368 Mbps (E3)

- Unframed or Framed according to ITU-T G.751

139.264 Mbps (E4)

- Unframed or Framed per ITU-T G.751

Patterns

The following test patterns can be generated

- PRBS: 2^{31}-1, 2^{23}-1, 2^{20}-1, 2^{15}-1, 2^{11}-1, 2^{9}-1, 2^{7}-1, QRSS
- Fixed: 0000, 1111, 1010, 1100, 1in8, 2in8, 3in24, DALY, NET55, and OCT55
- 10 user programmable words: up to 32 bits; normal or inverted generation

Errors

Insertion

- 1.544 Mbps (DS1): Code, FAS, Bit, Frame, CRC
- 44.736 Mbps (DS3): Code, FAS, MFAS, P/C-Parity, Bit errors

Optional

- 2.048 Mbps (E1): Code, FAS, CRC, EBIT, Bit errors
- 8.448 Mbps (E2): Code, 8M FAS, 2M FAS, 2M CRC, 2M RDI, Bit errors
- 34.368 Mbps (E3): Code, 34M FAS, 8M FAS, 2M FAS, 2M CRC, 2M RDI, Bit errors
- Single or continuous rate (1 x 10^{-3} to 5 x 10^{-6})
- 139.264 Mbps (E4): Code, FAS, Bit errors

Measurement

- 1.544 Mbps (DS1): Code, FAS, Bit, Frame, CRC
- 44.736 Mbps (DS3): Code, FAS, MFAS, P/C-Parity, Bit errors

Optional (E1, E2, E3, E4) – where applicable

- Code, FAS, MFAS, 2M CRC, P/C-Parity, Bit errors

Alarms

Generation

- 1.544 Mbps (DS1): AIS, yellow, idle, LOS, LOF
- 44.736 Mbps (DS3): LOS, LOF, OOF, AIS, Parity
- Mode: Static (Enable/Disable)

Optional

- 2.048 Mbps (E1): LOS, AIS, LOF, RDI
- 8.448 Mbps (E2): 8M AIS, 8M LOF, 8M RDI, 2M AIS, 2M LOF, 2M RDI
- 34.368 Mbps (E3): 34M LOS, 34M AIS, 34M LOF, 34M RDI, 8M AIS, 8M LOF, 8M RDI, 2M AIS, 2M LOF, 2M RDI
- 139.264 Mbps (E4): AIS, FAS RDI

Measurement

- 1.544 Mbps (DS1): AIS, yellow, idle, LOS, LOF, LSS
- 44.736 Mbps (DS3): LOS, LOF, OOF, AIS, Parity, LSS

Optional (E1, E2, E3, E4)

- LOS, AIS, LOF, OOF, RDI and LSS

Measurement Functions

Test Results

Error count, ES, %ES, SES, %SES, UAS, %UAS, EFS, %EFS, AS, %AS, and rate for all events: errors, alarms and pointer events

Performance Analysis

Measurements according to:

- ITU-T G.821: ES, EFS, SES and UAS with HRP 1% to 100%
- ITU-T G.826: EB, BBE, ES, EFS, SES, UAS; HRP of 1% to 100%
- In Service Measurement (ISM) using B1, B2, B3, FAS, CRC or Code (DS1)
- Out of Service measurement (OOS) using bit errors (Test Sequence Error)
- ITU-T G.828: ES, EFS, SES, BBE, SEP, UAS with HRP 1% to 100%
- ITU-T G.829: ES, EFS, SES, BBE, UAS on TOH (B1), (B2) or TSE
- ITU-T M.2100: ES, EFS, SES, UAS with HRP 1% to 100%
- User defined thresholds for Maintenance (MTCE) and Bringing into Service (BIS) objectives
- ITU-T M.2101: ES, EFS, SES, BBE, SEP, UAS with HRP 1% to 100%
- User defined thresholds for Maintenance (MTCE) and Bringing into Service (BIS) objectives. In service measurements on both near and far ends of path using TSE, P-BIP (B3), L-BIP (B2), S-BIP (B1) and V-BIP (V5)

SONET, DSn/PDH Measurement Options

Pulse Mask Analysis

DS1/DS3

- Bit rates: 1.544 Mbps (DS1) and 44.736 Mbps (DS3)
- Conformance Masks: ITU-T G.703, ANSI T1.102, T1.403, T1.404

PDH (E1/E3)

- Bit rates: 2.048 Mbps (E1) and 34.368 Mbps (E3)
- Conformance Mask: ITU-T G.703

Mode: Non-Intrusive

Display: Pulse shape with Conformance mask verification

Parameters: Width, Rise/Fall time, Overshoot/Undershoot

Automatic Protection Switching (APS)

Measurement of disruption time on SONET, DS3/1 & PDH interfaces

Tributaries: PDH (E1), SONET

Pass/Fail range: 15 ms to 10 seconds

Resolution: 1 ms

Triggers: LOS, LOF, SONET FAS, B1, B2, B3, AIS-L, RDI-L, REI-L, AIS-P, LOP-P, RDI-P, REI-P, AIS-V, 2M-LOF, 2M-AIS, LSS

APS Byte (K1/K2) capture and decode

Pointer Analysis and Generation

Generation: ITU-T G.783 pointer sequences

Tandem Connection Monitoring (TCM)

Generation and analysis of Z5 and Z6 bytes

Errors generated: TC-IEC, TC-BIP, TC-REI, OEI

Alarms generated: TC-RDI, TC-UNEQ, TC-LTC, TC-AIS, TC-ODI

Detection, display, analysis and storage of events:

- TC-IEC, TC-AIS, TC-REI, TC-RDI, TC-OEI, TC-LTC, TC-UNEQ, TC-ODI, TC-TIM
- Analysis and generation of APId (Access Point Identifier)

OTN Functions

- OTU1 (2.7Gbps) and OTU2 (10.7Gbps) bit rates
- OTU1e (11.049Gbps) and OTU2e (11.095Gbps) over-clocked bit rates
- Frequency offset generation of bit rates by ± 50 ppm
- EoOTN testing - internally generated 10 GigE LAN signal mapped into OTU1e and OTU2e
- Synchronous and asynchronous mapping of SONET/SDH signals within OTN
- Forward error correction (FEC) testing
- OTU, ODU, OPU overhead manipulation and monitoring
- OTU, ODU and OPU layer alarms/errors generation and analysis
- OTU, ODU trace messages
- ODU multiplexing alarm-generation and analysis

OTN

Standards: ITU-T G.709, ITU-T G.798, ITU-T G.872
Test rates: OTU (2.7Gbps), OTU2 (10.7Gbps); Optional OTU1e (11.0491Gbps), OTU2e (11.0957Gbps)
Signal types

- All SONET/SDH mappings supported
- Optional ODU0 into OTU2 and ODU0 into ODU1 multiplexing, with Ethernet or PRBS (CBR) payloads
- Optional ODUflex into OTU2, with Ethernet or PRBS (CBR) payload

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
Trace Generation: 64-byte Trail Trace Identifier (TTI)

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
Trace Generation: 64-byte Trail Trace Identifier (TTI)

ODU Multiplexing

Alarms: OPU-MSIM, ODU-LOFLOM

OPU Layer

Alarms: OPU-PLM
Payload Type (PT): Generates and displays received PT value

Forward Error Correction (FEC)

Errors: FEC-Correctable, FEC-Uncorrectable

Ethernet over OTN (EoOTN)

Mapping: Direct mapping into OTU1e or OTU2e
BERT: Framed Layer 2 supported with or without VLAN
Test Pattern (payload)

- Fixed: 1s and 0s
- PRBS: 2^9-1 , 2^{11}-1, 2^{15}-1, 2^{20}-1, 2^{23}-1, 2^{31}-1 with inversion

Error Insertion: FCS, code violations, bit
Error Measurement: Jabber/giant, runt, undersize, oversize, FCS
Error Measurement (BERT): Bit error
Ethernet Statistics: Multicast, broadcast, unicast, N-unicast, frame size distribution, bandwidth, utilization, frame rate

Common Functions & Measurements

SONET/DSn/PDH/OTN

Auto Configuration (available on all interfaces)
Identification of received signal - instrument configuration based on network type, bit rate, line coding, framing, mapping, and test pattern

Frequency Measurement
Optical and Electrical Interfaces: Hz and ppm
Resolution: 1Hz
TIE measurement on Pointer Justification Events

Round Trip Delay (available on all interfaces & mappings)
Measurement Range: 1µS to 10 seconds
Resolution: ±1µs or 1 U.I.

Event Logging
Date and time stamped events in tabular format

Histograms (available for all interfaces)
Display of Errors and Alarms versus time
Resolution: Seconds, minutes, hours and days

LED Indicators
Fixed LEDs for Signal, Framing, Pattern and Errors/Alarms
Soft LEDs for alarms/Errors displaying historical events and conditions

Ethernet/Fibre Channel Interfaces

Electrical

Dual 10/100/1000Base-T Ports: RJ45 connector
Ethernet Classification: Per IEEE 802.3

Optical (1/2/4G SFP)*

Dual 1000Base-X SFP Ports: LC connector
Single 1/2/4G Fiber Channel SFP Ports: LC connector
100Base-T to 100Base-FX (Media converter)
SFP transceivers per Multi Source Agreement (MSA)
ROHS compliant and Lead Free per Directive 2002/95/EC
Operating temperature range: -10˚C to 70˚C
Eye Safety: Class 1, per FDA/CDRH, EN (IEC) 60825
Power Measurement: ± 2dB accuracy, 1dB resolution

Transceiver	SFP					
Data rate	1GE, 1G/2G FC			1GE, 1G/2G/4G FC		
Part No.	301-01-001G	301-01-002G	301-01-003G	301-01-010G	301-01-011G	301-01-012G
Wavelength (nm)	850	1310	1550	850	1310	1310
Range	300m	10km	80km	300m	4km	10km
Connector	LC	LC	LC	LC	LC	LC
Line coding	NRZ	NRZ	NRZ	NRZ	NRZ	NRZ
Tx Laser	VCSEL	DFB	DFB	VCSEL	FB	DFB
Tx Spectral width (nm)	0.85	1	1	0.85	1	1
Tx Power (dBm)	-9 to -3	-9.5 to +0.3	0 to +5	-9 to -2.5	-8.4 to -3	-8.4 to -1
Rx Detector	PIN	PIN	APD	PIN	PIN	PIN
Rx Sensitivity						
1.25 Gbps (GE)	-20 to 0	-22 to 0	-22 to 0	-20 to 0	-22 to 0	-22 to 0
1.0625 Gbps (FC)	-20 to 0	-22 to 0	-22 to 0	-20 to 0	-22 to 0	-22 to 0
2.125 Gbps (FC)	-18 to 0	-21 to 0	-21 to 0	-18 to 0	-21 to 0	-21 to 0
4.25 Gbps (FC)	n/a	n/a	n/a	-15 to 0	-18 to 0	-18 to 0

Optical (8G/10G XFP)*

Single 8G/10G FC XFP Port, 10GE LAN and 10GE WAN PHY, LC connector
XFP transceivers per Multi Source Agreement (MSA)
ROHS compliant and Lead Free per Directive 2002/95/EC
Operating temperature range: -10˚C to 70˚C
Eye Safety: Class 1, per FDA/CDRH, EN (IEC) 60825
Power Measurement: ± 2dB accuracy, 1dB resolution

Transceiver	XFP					
Data rate	10GE LAN and WAN, 10G FC				8G FC	
Part No.	301-04-001G	301-04-002G	301-04-003G	301-04-004G	301-04-005G	301-04-006G
Wavelength (nm)	850	1310	1550	1550	850	1310
Range	300m	10km	40km	80km	150m	10km
Connector	LC	LC	LC	LC	LC	LC
Line coding	NRZ	NRZ	NRZ	NRZ	NRZ	NRZ
Tx Laser	VCSEL	DFB	EML	EML	VCSEL	DFB
Tx Spectral width (nm)	0.4	1	1	1	0.6	1
Tx Power (dBm)	-5 to -1	-6 to -1	-1 to +3	-1 to +3	-8 to -1	-8 to 0
Rx Detector	PIN	PIN	PIN	APD	PIN	PIN
Rx Sensitivity						
9.53 Gbps (10GE WAN)	-11.1 to +0.5	-14.4 to 0.5	-16 to -1	-24 to -7	n/a	n/a
10.3 Gbps (10GE LAN)	-11.1 to +0.5	-14.4 to +0.5	-16 to -1	-24 to -7	n/a	n/a
8.5 Gbps (FC)	n/a	n/a	n/a	n/a	-12.5 to +1	-15 to +0.5
10.52 Gbps (FC)	-11.1 to +0.5	-14.4 to +0.5	-16 to -1	-24 to -7	n/a	n/a

**Data rates, performance, and supported transmission protocols are only guaranteed for SFPs and XFPs supplied by VeEX Inc. If selecting or using other vendors, users should excercise caution.*

Media Converter (optional)

Optical interface testing with VeEX media converter

The MC100 is a rate-switching 10/100 UTP copper to 100BASE-FX fiber media converter providing cost-effective connectivity with 100 Mbps legacy fiber-based networks.

The media converter employs Small Form Pluggable (SFP) transceivers to support different fiber types, data rates and distances. It can be powered by an external 5 Volt AC power supply or directly from the USB port on the TX300 unit.

Ethernet

Ethernet Features

Auto Negotiation, Full and Half Duplex, Flow Control
10G Frequency Offset: ± 150 ppm

Modes of Operation

Terminate
Pass Through Monitor (between 2x 1GE copper ports, 2x 1GE fiber ports)
Loopback
Dual Port operation: Independent traffic generation and test capabilities on any two ports selected

Traffic Generation

Layer 1 Unframed/Framed (BERT only), Layer 2, Layer 3, Layer 4
Test Frame Header:

- IEEE 802.3 and Ethernet II (DIX) frames
- Configurable Source and Destination MAC and Ethernet Type
- VLAN stacking up to 3 Q-in-Q tags w/configurable priority & type
- Fully configurable IPv4 or IPv6 header
- MPLS up to 3 labels with configurable Label/S/CoS and TTL fields (optional)
- UDP/TCP header with configurable Source & Destination ports

Frame size 64 to 1518 bytes and jumbo frame up to 10000 bytes
Traffic Pattern (Throughput Test and BERT only): Constant, Ramp, Multi Bursts, Single Burst
Error Injection (Throughput Test and BERT only): Bit, CRC, IP Checksum, TCP/UDP checksum, Pause, Symbol (Layer 1 Unframed)
MAC flooding feature generates test frames with up to 4096 incrementing Source and/or Destination MAC addresses (optional)
VLAN flooding feature generates test frames with up to 4096 incrementing VLAN IDs (optional)

ITU-T Y.1564 V-SAM Test

V-SAM test suite compliant with ITU-T Y.1564 standard
Support for Multi-stream traffic generation, Service Configuration and Service Performance tests
Independently configurable for each stream: Bandwidth profile parameters (CIR, EIR, Traffic Policing) and Service Acceptance criteria (FLR, FTD, IFDV, AVAIL)
Simple summary Pass/Fail results tables and drill down capability with detailed measurements (Frame Loss, Frame Transfer Delay, Frame Delay Variation, Availability) for each service

Link Level OAM - IEEE 802.3ah

Modes: Active and Passive, with configurable Vendor OUI, Vendor SPI, MAX PDU length, and PDU rate
Discovery capabilities: remote loopback, link events, MIB retrieval
Link Events Notifications: Link Fault, Critical Event, Dying Gasp

Service Level OAM - IEEE 802.1ag and ITU-T Y.1731

MEP emulation with configurable MD name, MA name, local MEP ID, MD level, VLAN ID
Continuity Check Message (CCM): with priority level & interval selection
Loopback Messages (LBM/LBR): loopback message generation and response to destination MEP or MAC address
Link Trace Messages (LTM/LTR): link trace message generation and response to destination MEP or MA address wit configurable TTL.
Loss Measurement Messages (LMM/LMR): loss measurement message generation and response to destination MEP or MAC with configurable rate and number of messages.
Delay Measurement Messages (DMM/DMR): delay measurement message generation and response to destination MEP or MAC with configurable rate and number of messages

RFC2544 Compliance Testing

Automated tests compliant with RFC2544 with configurable threshold values and maximum transmit bandwidth settings
Throughput, Latency, Frame Loss, and Back-to-Back (burst) tests
Frame sizes: 64, 128, 256, 512, 1024, 1280, and 1518 bytes including 2 user configurable frames
Test can be done to a remote loopback or to a remote test set with remote control of traffic generation and measurements at each end (requires asymmetric test option)

RFC2544 Advanced SLA Mode

RFC2544 compliant test on primary test stream with up to 7 independent background traffic streams
Each background stream can be set with independent frame size, bandwidth, traffic profile, and QoS levels
Test can be done to a remote loopback or to a remote test set with remote control of traffic generation and measurements at each end (requires asymmetric test option)

Bit Error Rate Testing

Single Stream test with test pattern PRBS: 2^{31}-1, 2^{23}-1, 2^{20}-1, 2^{15}-1, 2^{11}-1, normal and inverted patterns, All 0s, All 1s and User Defined
Layer 1 Framed: CRPAT, CSPAT, CRTPAT
1GE Layer 1 Unframed: HFPAT, LFPAT, MFPAT
10GE Layer1 Unframed: PRBS Seed A and B

Multiple Streams Throughput Testing

Up to 8 independent traffic streams generation and analysis, with configurable filters on 1 GE interface
Up to 10 independent traffic streams generation and analysis, with configurable filters 10GE interface
Each stream can be set with independent frame size, bandwidth, traffic profile, and QoS levels

Smart Loopback Mode

Layer 1: loops back all incoming traffic
Layer 2: all incoming unicast traffic is looped back with MAC source and destination addresses swapped
Layer 3: all incoming unicast traffic is looped back with MAC and IP source and destination addresses swapped
Layer 4: all incoming unicast traffic is looped back with MAC, IP, and UDP/TCP ports swapped
All key measurements on received traffic provided on loopback unit

Key Measurements

Error Measurements: Bit/BER (BERT and single stream Throughput Test), CRC, symbol, IP checksum, TCP/UDP checksum, jabber frames, runt frames, Frame loss (count and %), OSS
Alarm Detection: LOS, pattern loss, service disruption
Frame/Packet Statistics: Multicast, broadcast, unicast, pause frames, frame size distribution
Rates (min, max, average and current): frame rate, bandwidth utilization, frame rate, line rate, data rate
Delay (min, max, average and current): round trip delay, inter frame gap, jitter

Ethernet *cont'd*

VePAL Discovery Function and Remote Control

Discovery function to all VeEX VePAL devices within subnet or manual control of VeEX VePAL devices in routed network
Remote Control of Loopback capability
Remote Control of Asymmetric test capability for end-to end RFC2544 test (optional)

VLAN Scan and Monitor

Scans incoming traffic and discovers all VLAN flows including Q-in-Q tagging
Key statistics on traffic rates, alarms and errors are reported for monitored streams (up to 8)

Pass Through Monitor Mode

Pass through monitoring function between 2x 1GE Copper ports or 2x 1GE fiber ports
Key statistics on traffic rates, alarms and errors are reported as well as configurable performance thresholds

IPv6

IPv6 compliant test traffic generation and analysis for all test applications (Y.1564 V-SAM, RFC2544, BERT and Multi-stream Throughput)
IPv6 Loopback capability
IPv6 Static or Stateless Auto Configuration, Ping and Trace Route functions

IP Test Suite

IP Configuration and validation (IPv4, IPv6, Static, DHCP, PPPoE)
MAC address (configurable or default)
Ping and traceroute tests (IP address or URL)
Web test: Web browser and Web page download speed test (optional)
FTP Upload/Download speed test (optional)
Network discovery/ARP wizard (optional)
Stateful TCP Throughput test with configurable window size (optional)

Packet Capture

Packet capture from all interfaces (10/100/1000Base-T, 1000Base-X, and the 10/100Base-T management port)
Configurable capture filters

- MAC and IP
- UDP and/or TCP
- Multicast, Broadcast, IP Checksum error, UDP/TCP Checksum Error events

Packet captures can be saved and exported
PCAP capture format, compatible with Wireshark™

Fibre Channel

Fibre Channel Speeds

1.0625, 2.125, 4.25, 8.5, and 10.52 Gbps

Modes of Operation

Terminate, Loopback

Fibre Channel Topology

Point-to-Point

Primitive Sequence Protocols

Link Protocols: Link initialization, link rest, link failure

Flow Control

Buffer-to-Buffer Credit Configuration: 1-65535
Buffer-to-buffer credit

Traffic Generation

FC-1 (with SOF and EOF frame delimiters) and FC-2 Frames
Class 3 Service frames
Configurable Header fields
Configurable EOF, SOF
Traffic Shaping: constant, ramp, burst
Frame Length Configuration: 2148 bytes maximum

RFC2544 Compliance Testing

Automated tests compliant with RFC2544 with configurable threshold values and maximum transmit bandwidth settings
Throughput, Latency, Frame Loss, and Back-to-Back (burst) tests
Frame sizes: 64, 128, 256, 512, 1024, 1280, and 2000 bytes including 2 user configurable frames

Bit Error Rate Testing

NCITS-TR-25-1999 Patterns (FC-1): CRPAT, CSPAT, CJTPA
PRBS Patterns (FC-2): 2^{31}-1, 2^{23}-1, 2^{15}-1, 2^{11}-1, normal and inverted selections, and user defined patterns
Error Injection: Bit and CRC

Loopback Mode

FC-1
FC-2 (Layer 2): swaps the destination and source IDs (D-ID and S_ID)

Key Measurements

Error Measurements: Bit, CRC, symbol, Oversize, Undersize, Frame loss (count and %)
Alarm Detection: LOS, pattern loss, service disruption
Traffic Statistics: Bandwidth utilization, data rate, frame count, byte count, frame size distribution, buffer-to-buffer credit count, RR_RDY count, frame loss count and round trip delay
Rates (min, max, avg, current): frame rate, bandwidth utilization, frame rate, line rate, data rate
Delay (min, max, avg, current): round trip delay, inter frame gap

VF Measurement

VF (Talk, Tone) drop/insert via Headset
Time Slot: Channel to test for both transmitting and receiving
- DS1: 1 – 24
- E1: 1 – 30/31

Code: u-Law or A-Law

Tone Generation/Measurement

Setup
- Transmitted Frequency: 50 to 3950 Hz
- Transmitted Level: -60 to 3 dBm
- Programmable ABCD: Manual edit ABCD or ON-HOOK, OFF-HOOK, WINK for DS1, and IDLE, SEIZE for E1

Results
- Measure signal frequency and level in selected timeslot
- Listen to the voice channel in selected timeslot via external headset.
- ABCD bits monitor and View Data in selected T/S channel

ISDN PRI Testing

TE/NT Emulation
Place/Receive voice and data calls
D-channel monitor with full decode: Layer 2 (Q.921) and Layer 3 (Q.931)
23B+D, 46B+2D, 47B+D, Dual 23B+D, 30B+D, Dual 30B+D
Non-facility Associated Signaling (NFAS) support
Protocols
- DS1: National ISDN, AT&T, Nortel DMS
- E1: ETSI (Euro – ISDN)
- Bidirectional protocol capture and decode

Voice call talk and listen via headset
In-band DTMF generation
Supports multirate N x 64k data calls
Parallel and sequential multi-call channel test
- All calls to a single number
- Multiple numbers from a programmable list

Supplementary Services Test: Automatically tests the provisioning of the following: CLIP, CLIR, COLP, CFU, CFB, CFNR, SUB, MSN, DDI, HOLD, UUS, TP, AOC-S, AOCD, AOCE, MCID, CUG

V-SCAN

The V-SCAN function allows users to monitor the health and status of individual channels/tributaries in real-life mixed-payload OTN, SDH and SONET signals.
- High-order and low-order channel matrix
- Monitor individual tributaries and concatenated payloads
- Current and history status for each channel
- Scanned map details provides a list of all channels with their trace identification, signal label (type), channel number, and container types
- SONET: OC-3 to OC-192 signals with VT1.5, VT2, STS-1, STS-3c, STS-6c, STS-12c, STS-24c, STS-48c. STS-192c payloads
- SDH: STM-1 to STM-64 signals with VC11, VC12, VC3, VC4, VC4-2c, VC4-3c, VC4-4c, VC4-8c, VC4-16c, VC4-64c payloads
- OTN: OTU2 signasl with STM-64 or OC-192 structured payload

Note: On OC-198 signals, STS-24c SPE tributaries must be aligned as the first channel of any 48c block; Similarly, on an STM-64 signal, VC-4-8c tributaries must be aligned as the first channel of any 16c block.

Jitter/Wander Analysis

Jitter Measurements

Fully compliant to ITU-T O.171 and O.172
HP1+LP (Wide-band Jitter) filter
- E1 (2M) (20 Hz to 100 kHz)
- E3 (34M) (100 Hz to 800 kHz)
- DS1 (1.5M) (10 Hz to 40 kHz)
- DS3 (45M) (10 Hz to 400 kHz)
- OC-3 (155M Optical) (500 Hz to 1.3 MHz)

HP2+LP (High-band Jitter) filter
- E1 (2M) (18 Hz to 100 kHz)
- E3 (34M) (10 Hz to 800 kHz)
- DS1 (1.5M) (18 Hz to 100 kHz)
- DS3 (45M) (30 Hz to 400 kHz)
- OC-3 (155M Optical) (65 Hz to 1.3 MHz)

Parameters: Current peak-peak, Maximum peak-peak
Complete Jitter Test Suite
- Output Jitter measurement
- Jitter generation (1Hz to 40 kHz)
- Maximum Jitter Tolerance test
- Jitter Transfer Function test

Color-coded Pass/Fail indication according to ITU-T limits
Standard Pass/Fail masks
Units: UI (Unit Interval)
Resolution: 0.01 UI
Accuracy: Per ITU-T O.171 and O.172
Test Duration: Continuous

Wander Measurement

Fully compliant to ITU-T O.171 and O.172
Test Interfaces: E1 (2M), E3 (34M), DS1 (1.5M), DS3 (45M), and OC-3 (155M Optical)
Reference Clock
- Clock Port: SMA and Balanced RX2
- Clock Source: 2Mbps (or 1.5Mbps) signal or 2MHz (or 1.5MHz), 64kbps Co-directional

Parameters:
- Real Time Measurements
- Time Interval Error (TIE), Maximum TIE (MTIE) per O.171

MTIE/TDEV Wander Data Logging Option

Saves long-term real-time TIE samples directly to a USB memory for further MTIE and TDEV post-analysis, using VeEX's Wander Analysis PC software
Sample rates: 1, 5, 10, 30 samples/s
Resolution: Down to 7 ns
Standard masks included
User-defined masks

3.072 Gbps Unframed (CPRI) Testing

3.072Gbps interface per CPRI (Common Public Radio Interface) standard
Unframed BER test with PRBS stress test pattern
Bit Error injection
Optical power measurement
Error measurements: Bit, BER error detection
Alarms: LOS and Pattern Loss detection
Latency measurement

Additional Options

VoIP Testing

Codecs: G.711 µ-law, G.711 A-law, G.723.1 (optional), G.729 (optional)
Measurements: MOS (CQ and LQ) and ITU-T G.107 R-factor (CQ and LQ)
Packet Statistics: Data throughput rate, packet loss, packet discard, OOS, duplicate, jitter
VoIP Check

- Simulates VoIP call to the nearest router by sending ICMP traffic with payload/rate mimicking VoIP traffic

VoIP Expert

- Client/Server mode provides bi-directional measurements
- Compatible with any VeEX field tester or centralized VeEX VX1000 Server software

VoIP Call Expert

- VoIP call setup: supports SIP and H.323 protocols
- Configurable jitter buffer (fixed or dynamic)
- Incoming call Auto Answer
- STUN support
- Talk/Listen with USB headset
- DTMF test (RFC4733)
- Signaling trace with protocol decode

IPTV

Mode: Monitor
Stream configuration: Unicast, multicast, IP address, Port number
Codecs: MPEG2, MPEG4 (Part2) and MPEG4 Part10 (H.264)
Probe function with streams auto-detection
Real time viewer
Stream Analysis

- PIDs count
- PID MAP
- Transport Error count
- Data rates: Video, Audio, Data (Bandwidth and Packet Counts)

Video Analysis

- MOS_Video , Video Service Transmission Quality (VSTQ), Estimated Peak Signal to Noise Ratio (EPSNR ATIS)
- I/B/P Frame statistics (Bandwidth, # Frames Received, Lost, Impaired)

Audio Analysis

- MOS_Audio

TR 101 290 Metrics

- Sync loss, sync byte error, PAT/PAT2 error, Continuity error, PMT/PMT2 error, PID error, transport error, CRC error, PCR discontinuity, PCR accuracy error.

Fiber Scope

Handheld probe connected via USB port
Results displayed and stored on test set
Magnification: 400x
Field of View: 400µm x 300µm
Resolution: 1.5µm
Focus: Manual adjustment, 2mm max travel
Light Source: Blue LED

Net Wiz

Available on 10/100/1000Base-T test port
Detect distance to open/short, wire cross, impedance mismatch
Network device discovery; Auto Ping verification
TDR accuracy: ± 3 meters

WiFi Wiz

USB Wi-Fi adapter 802.11b, 802.11g, 802.11n
Access Points scan signal level and link quality measurement
WEP/WPA1/WPA2 encryption
IP Connectivity test (Ping, trace route, Web/FTP test, Web browser, (requires additional options)

WiFi Spectrum Analyzer

Supports 802.11a/b/g/n networks
Equipped with RP-SMA antenna jack
Amplitude range: -100 dBm to -6.5 dBm
Frequency resolution: 26 kHz to 3 MHz, 24 kHz to 3 MHz
Planar, topographic, spectral view

Additional Test Features

Profiles: Save and recall test profiles
Screen capture: Screen shots in .bmp format
Remote control: VNC or via ReVeal MTX300 PC software
Results saving: Memory SD card 860MB (approx 1000 results)
Report generation: test results generation in pdf format
Export test results via USB, web browser, FTP, ReVeal MTX300 software
Advanced saving capabilities: Signature pad

ReVeal MTX300 PC Software

Remote Control (optional)
Remote screen capture and movie capture
Remote Software management: software upgrade, software option management
Test results management
Advanced report generation with html, pdf, or csv formats, combine test results, add logos and comments
Test profiles management online or offline test profile creation, upload and download

General

Size	11.40 x 5.50 x 2.60 in (W x H x D) 290 x 140 x 66 mm
Weight	Less than 6.6 lb (less than 3 kg)
Battery	Li-ion smart battery 5200 mAh 10.8 VDC
Power Supply (AC Adaptor)	Input: 100-240 VAC, 50-60 Hz Output: 15 VDC, 5.33 A
Operating Temperature	32˚F to 113˚F (0˚C to 45˚C)
Storage Temperature	-4˚F to 158˚F (-20˚C to 70˚C)
Humidity	5% to 95% non-condensing
Display	TFT 7” full color touch-screen display
Ruggedness	Survives 1 m drop to concrete on all sides
Management Interfaces	USB, RJ45, 10/100-T Ethernet, Bluetooth (optional), Data Card/GPS (optional) WiFi (optional)
Languages	Multiple languages can be supported
System Memory	128 Mbyte RAM, 2 Gbyte SD

Ordering Information

Z04-00-004P	VePAL TX300 Portable SONET/Ethernet Test Set

Hardware Options

10/100/1000T-X (must select one)

Z66-00-012P	Two 10/100/1000Base-T and two 1000Base-X ports. All interfaces enabled and Dual Port testing enabled (SFP optical modules must be ordered separately).

10G Rates (must select one)

Z66-00-013P	10G Optical Interface. Includes one test protocol - 10GE LAN (XFP optional)
Z66-00-039P	10G Optical Interface. Includes one test protocol - STM64/OC-192 Mapping (XFP optional)
Z66-00-044P	10G Optical Interface (HW load only)
Z66-00-045P	10G Optical Interface. Includes one test protocol - OTU-2 with No Mapping (XFP optional)
Z66-00-049P	10G Optical Interface - 10GE WAN (XFP optional)
Z66-00-050P	10G Optical Interface. Includes one test protocol - 10G Fibre Channel (XFP optional)
Z66-00-052P	10G Optical Interface. Includes 10GE LAN, OTU1e, and OTU2e

8G and 10G Rates (must select one)

Z66-00-042P	10G Optical and 8G Fibre Channel Interface. Includes one test protocol - 10GE LAN (XFP optional)
Z66-00-051P	8G Fibre Channel and 10G Optical Interface. Includes 8G Fibre Channel (XFP optional)
Z66-00-057P	10G Optical and 8G Fibre Channel Interface. Includes one test protocol - STM64/OC-192 Mapping (XFP optional)
Z66-00-058P	10G Optical and 8G Fibre Channel Interface. Includes one test protocol - OTU-2 with No Mapping (XFP optional)
Z66-00-059P	10G Optical and 8G Fibre Channel Interface. Includes one test protocol - 10GE WAN (XFP optional)
Z66-00-060P	10G Optical and 8G Fibre Channel Interface. Includes one test protocol - 10G Fibre Channel (XFP optional)

STM1/4/16, E3, E1 Interface (must select one)

499-05-018	Without STM1/4/16, E3, E1 or OC3/12/48, DS3, DS1 Interface
Z66-00-022P	OC3/12/48, DS3, DS1 interface (SFP optical modules must be ordered separately)
Z66-00-047P	DS1/DS3/STS1 option
Z66-00-055P	OC3/12/48, DS3, DS1 interface (SFP optical modules must be ordered separately) with OTN OTU-1 G.709 FEC
Z66-00-062P	Purchased 10G/8G FC HW; OC3/12/48, DS3, DS1 Interface not necessary

1G/2G FC and 4G FC (optional)

Z66-00-008P	Fibre Channel 1G/2G Hardware Option
Z66-00-020P	Fibre Channel 4G Hardware Option

3.072G (optional)

Z66-00-048P	3.072G Layer 1 Unframed Testing (Fibre Channel 4G Hardware option and 4G SFP)

PDH & DSn Interface/Test Software Options

499-05-042	155Mbps Electrical Testing
499-05-043	155Mbps Optical Testing (requires SFP option)
499-05-044	155/622Mbps Optical Testing (requires SFP option)
499-05-045	155/622/2488Mbps Optical Testing (requires SFP option)
499-05-049	2Mbps and 34Mbps Pulse Mask Analysis
499-05-050	1.5Mbps Pulse Mask Analysis
499-05-051	45Mbps Pulse Mask Analysis
499-05-052	139Mbps Testing
499-05-097	DS1/E1 Jitter Measurement, Max Jitter, Jitter Transfer
499-05-098	DS3/E3 Jitter Measurement, Max Jitter, Jitter Transfer
499-05-099	Basic STM-1, E3 Wander Measurement
499-05-100	2.048 Mbps (E1) Testing with VT-2 Mapping
499-05-101	34 Mbps (E3) Testing
499-05-140	STM-1/OC-3 Jitter Measurement, Max Jitter, Jitter Transfer
499-05-149	DS1/E1 Jitter Measurement
499-05-152	DS3/E3 Jitter Measurement
499-05-168	STM-1/OC-3 Jitter Measurement
499-05-169	Basic E1 Wander Measurement
Z88-00-010G	ISDN PRI (ANSI, ETSI) Call Setup, incl. Earpiece
Z88-00-014G	VF Measurements, incl. Earpiece

STM-1/4/16/64 Optical Interface/Test Software Options

499-05-046	APS
499-05-047	Tandem Connection Monitoring
499-05-048	ITU-T G.783 Pointer Test Sequences
499-05-109	10G APS
499-05-110	10G Tandem Connection Monitoring
499-05-111	10G ITU.783 Pointer Test Sequences
499-05-112	OTN OTU-2 G.709 FEC
499-05-124	STM64/OC-192 Mapping
499-05-141	OTU-1e (requires Z66-00-013P or Z66-00-039P/045P/etc with 499-05-122)
499-05-164	10G Optical Interface Software Option (for unit with pre-loaded hardware), incl. one test protocol (XFP optional)
499-05-174	OTU-2e (requires Z66-00-013P or Z66-00-039P/045P/etc with 499-05-122)
499-05-190	V-Scan automatically detects and monitors SONET or SDH Payload

8G/10G FC Software Options

499-05-005	8G Fibre Channel
499-05-139	10G Fibre Channel

10GE Software Options

499-05-060	10GE WAN
499-05-066	10GE Layer 1 Unframed BERT
499-05-122	10GE LAN
499-05-130	10GE Multiple Streams
499-05-131	10GE MPLS
499-05-132	10GE Jitter
499-05-133	10GE MAC Flooding
499-05-134	10GE VLAN Flooding
499-05-135	10GE Asymmetric Testing

10GE and 1GE Software Bundles

(Purchasing any of these bundles enables the same option for the 10GE, 10/100/1000T, and 1000Base-X interfaces)

Z33-00-003	10GE/1G Multiple Streams
Z33-00-004	10GE/1G MPLS
Z33-00-005	10GE/1G Jitter
Z33-00-006	10GE/1G MAC Flooding
Z33-00-007	10GE/1G Asymmetric Testing
Z33-00-008	10GE/1G VLAN Flooding

10/100/1000T & 1000Base-X Software Options

499-05-013	Multi Stream Test
499-05-014	MPLS Tags
499-05-015	Jitter Measurements
499-05-034	Fibre Channel 1G/2G Test Suite (requires Z66-00-008P)
499-05-058	MAC Flooding
499-05-059	Asymmetric Testing
499-05-093	VLAN Flooding
499-05-123	Fibre Channel 1G/2G/4G Test Suite (requires Z66-00-008P and Z66-00-020P)
499-05-128	Basic TCP/IP Throughput
499-05-189	CPRI 3.072G Testing (requires Z66-00-048G)
499-05-199	Service Level Ethernet OAM, IEEE 802.1ag and ITU-T Y.1731
499-05-200	Link Level Ethernet OAM, IEEE 802.3ah
Z33-00-013	499-05-199 and 499-05-200 bundle

Additional Options

499-05-001	Web Browser (requires Advanced IP option)
499-05-002	NetWiz
499-05-003	Remote Control
499-05-095	VoIP G.723 Codec
499-05-096	VoIP G.729 Codec
499-05-102	VoIP Check
499-05-167	Fiber Scope Expert (requires external Fiber Scope)
499-05-171	IPTV Explorer
499-05-175	USB Bluetooth Dialing and File Transfer Support (USB Bluetooth adaptor not included)
Z33-00-001	VoIP Expert, incl. VoIP Check option
Z88-00-001G	WiFi Wiz, incl. USB WiFi Adaptor
Z88-00-001P	VoIP Call Expert, incl. VoIP USB Adaptor & Earpiece
Z88-00-005G	Advanced IP, incl. Ethernet Cable
Z88-00-007G	WiFi Spectrum Analyzer, incl. USB WiFi Spectrum Dongle

Media Converter Options

Z77-00-002P	MC100, 100-T to 100-FX Media Converter with USB Power Cord (requires SFP options)
301-01-013G	1310nm 100FX MM (2km) SFP - 100Mbps
301-01-014G	1310nm 100FX SM (15km) SFP - 100Mbps
A03-00-006G	AC Adaptor, US Plug (for Media Converter)
F02-00-026G	USB Power Cord

1GE & 1G/2G/4G/8G FC SFP; SDH/1GE & 1G/2G FC SFP; 10G XFP Transceiver Options

301-01-001G	850nm SX (550m) SFP - 1GE, 1G/2G FC
301-01-002G	1310nm LX (10km) SFP - 1GE, 1G/2G FC
301-01-003G	1550nm ZX (90km) SFP - 1GE, 1G/2G FC
301-01-004G	1310nm IR (15km) SFP - 155M/622M STM1/4 - OC3/12
301-01-005G	1310nm LR (40km) SFP - 155M/622M STM1/4 - OC3/12
301-01-006G	1550nm LR (80km) SFP - 155M/622M STM1/4 - OC3/12
301-01-007G	1310nm IR (15km) SFP - 1GE, 1G/2G FC, 155M/622M/2.5G STM1/4/16 - OC3/12/48
301-01-008G	1310nm LR (40km) SFP - 1GE, 1G/2G FC, 155M/622M/2.5G STM1/4/16 - OC3/12/48
301-01-009G	1550nm LR (80km) SFP - 1GE, 1G/2G FC, 155M/622M/2.5G STM1/4/16 - OC3/12/48
301-01-010G	850nm SX (550m) SFP - 1GE, 1G/2G/4G FC
301-01-011G	1310nm LX (4km) SFP - 1GE, 1G/2G/4G FC
301-01-012G	1310nm LX (10km) SFP - 1GE, 1G/2G/4G FC
301-04-001G	850nm SR (300m) 10GE XFP
301-04-002G	1310nm SR (10km) 10G XFP
301-04-003G	1550nm IR (40km) 10G XFP
301-04-004G	1550nm LR (80km) 10G XFP
301-04-005G	850nm (150m) 8G FC XFP
301-04-006G	1310nm (10km) 8G FC XFP

Recommended Accessories

304-02-001G	LC/PC to LC/PC (Male/Female) SM 1310/1550nm Attenuator 5dB
304-02-002G	LC/PC to LC/PC (Male/Female) SM 1310/1550nm Attenuator 10dB
D02-00-005P	Quick Reference Guide, TX300 DS1 BERT
D02-00-008P	Quick Reference Guide, TX300 ISDN PRI
D02-00-009P	Quick Reference Guide, TX300 DS3 BERT
D02-00-010P	Quick Reference Guide, TX300 Ethernet BERT
D02-00-011P	Quick Reference Guide, TX300 RFC2544
D02-00-012P	Quick Reference Guide, TX300 SONET BERT
D02-00-013P	Quick Reference Guide, TX300 Throughput
D02-00-019P	Quick Reference Guide, TX300 3.072G Layer 1 Unframed Testing
D02-00-020P	Quick Reference Guide,Fiber Scope Inspector
D02-00-025P	Quick Reference Guide, TX300 DS1 Monitor
D02-00-026P	Quick Reference Guide, TX300 DS3 Monitor
D02-00-027P	Quick Reference Guide, TX300 VF Testing
D02-00-028P	Quick Reference Guide, TX300 DS1 Loop
D02-00-029P	Quick Reference Guide, V300 VoIP Call Expert
D09-00-001	TX300 Test Report
F02-00-009G	RJ48 to 3-Pin Banana Test Cable, 2 m
F02-00-010G	BNC to BNC Test Cable, 2 m
F02-00-011G	Bantam to Bantam Test Cable, 2 m
F02-00-022G	RJ48 to Bantam Test Cable, 2 m
F02-00-023G	RJ48 to RJ48 Test Cable, 2 m
F05-00-001G	LC-LC-M Patch Cord
F05-00-002G	LC-LC-S Patch Cord
F05-00-003G	LC-SC-M Patch Cord
F05-00-004G	LC-SC-S Patch Cord
F05-00-005G	LCPC to LCPC Duplex SMF Optical Patchcord, 2 m
F05-00-006G	LCPC to SCPC Duplex SMF Optical Patchcord, 2 m
F05-00-007G	LCPC to FCPC Duplex SMF Optical Patchcord, 2 m
Z77-00-014G	Fiber Inspection Probe w/Tips, incl. Pouch and Box
Z99-99-006G	Lock Mechanism Option, incl. Locking Hook on Unit and Cable/Lock
Z99-99-007G	USB Bluetooth Adaptor (requires 499-05-175)
Z99-99-011G	USB Hub with 4 Ports

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