



# VePAL MX100e+

## Handheld Ethernet Test Set



### Next Generation Mobile Backhaul and Carrier Ethernet Testing

VeEX™ VePAL MX100e+ Metro Expert is the next generation of field equipment for Carrier Ethernet, Mobile Backhaul, 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; fitted with protective cover
- Robust, handheld chassis packed with powerful and flexible features for demanding environments and test conditions
- Optimized for field engineers or technicians installing and maintaining Ethernet networks enabling Carrier Ethernet, Mobile Backhaul, or Triple Play services
- User defined test profiles and thresholds enable fast, efficient and consistent turn-up of services
- USB memory stick support and FTP upload capability for test result storage and file transfer respectively
- Maintain instrument software, manage test configurations, process measurement results and generate customer test reports using included ReVeal™ PC software
- Extend field testing time using interchangeable Lilon battery pack/s. Greater battery autonomy with extended battery pack
- Test set connectivity via 10/100Base-T management interface, WiFi, Bluetooth, and Data Card for back office applications and workforce management
- Remote control capability through ReVeal™ PC software

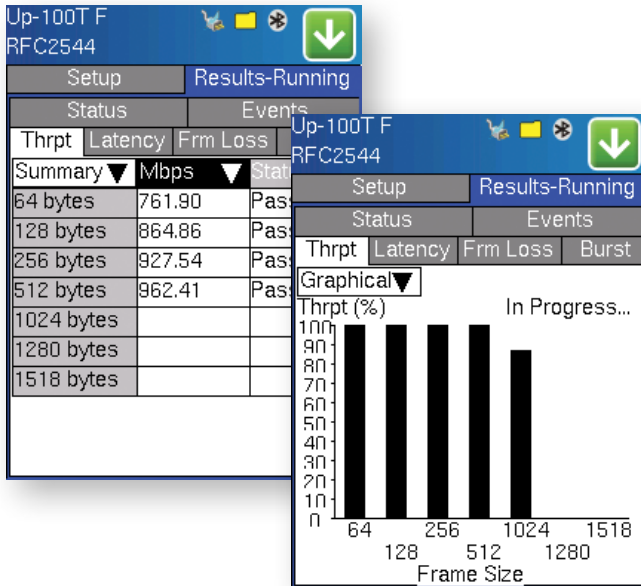
### Key Features

- All-in-one 10/100/1000Base-T, 100Base-FX, 1000Base-X tester
- Full Ethernet testing features on each operating port
- Throughput, latency, frame loss, and back-to-back measurements per industry-standard RFC2544 and V-SAM test suite compliant with ITU-T Y.1564 standard
- Ethernet throughput testing at Layer 1, Layer 2, Layer 3 and Layer 4 with or without VLAN and MPLS tags
- Unframed BER testing to validate error free connections
- Link Partner auto-negotiation advertisement analysis
- Q-in-Q (VLAN stacking) and multiple MPLS tag support
- MAC flooding and VLAN flooding
- IPv4 and IPv6 traffic generation
- Advanced IP testing: Network discovery, HTTP/FTP test, VoIP, IPTV
- Multiple stream traffic generation and analysis for end-to-end QoS verification of multiple services
- IEEE 802.3ah, ITU-T Y.1731, and IEEE 802.1ag OAM support
- Intelligent device discovery mode; discover other VeEX Ethernet testers or loopback devices on the network for quick and easy loopback control configuration
- Smart Loop mode for Layer 1, Layer 2, Layer 3, and Layer 4

## Ethernet Features

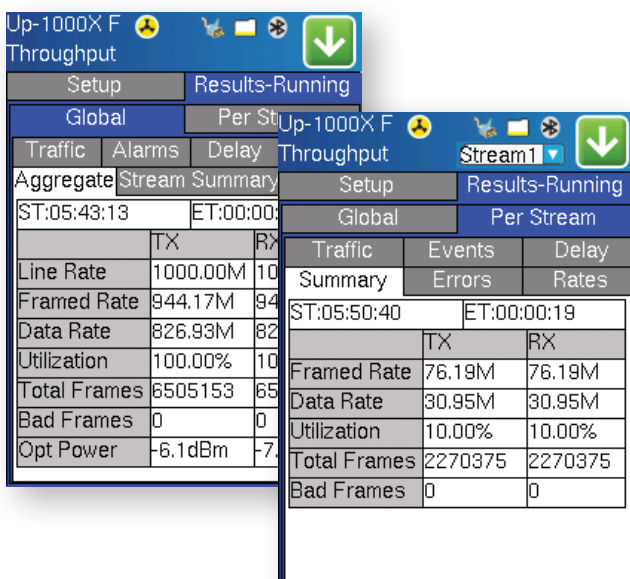
### RFC2544 Compliance Testing

Performs the RFC2544 automated test suite at all recommended frame sizes including user configurable frame sizes and up to full line rate. The test suite can also 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.



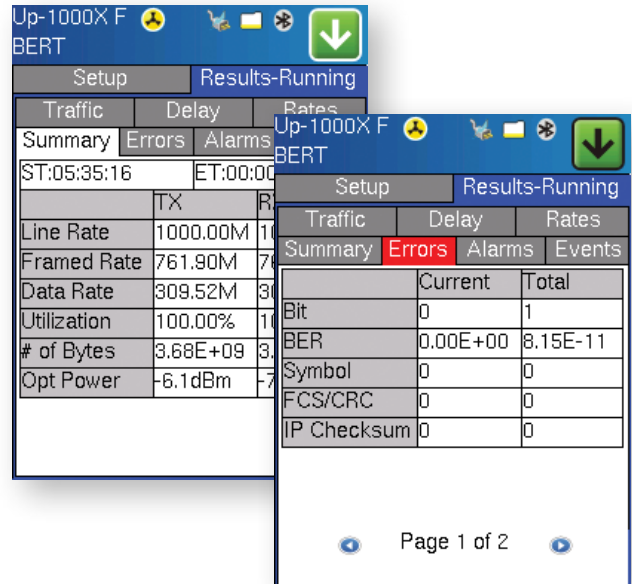
### Multiple Streams Generation - Throughput Test

Up to eight 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.



### BERT

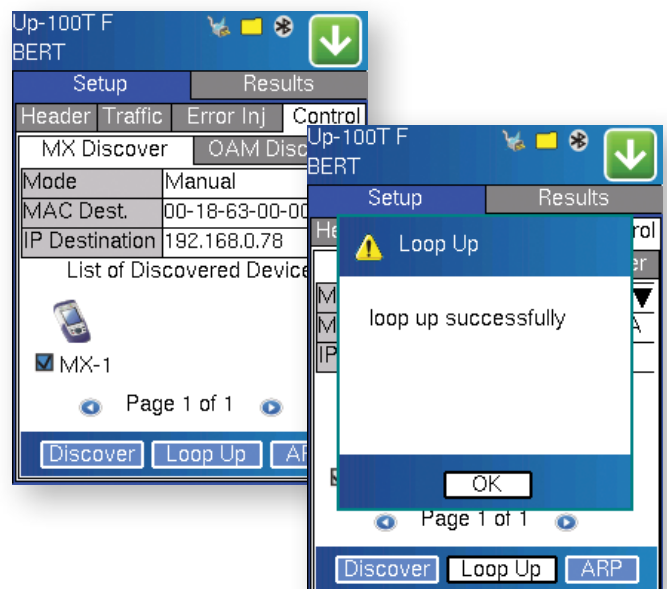
Unframed Layer 1, 2, 3, and Layer 4 BER testing is supported. The BER test can be configured to use regular PRBS test patterns, stress patterns or user defined test patterns to simulate various conditions. All patterns are encapsulated into an Ethernet frame to verify bit-per-bit performance of circuit under test.



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.

### Intelligent Network/Device Discovery

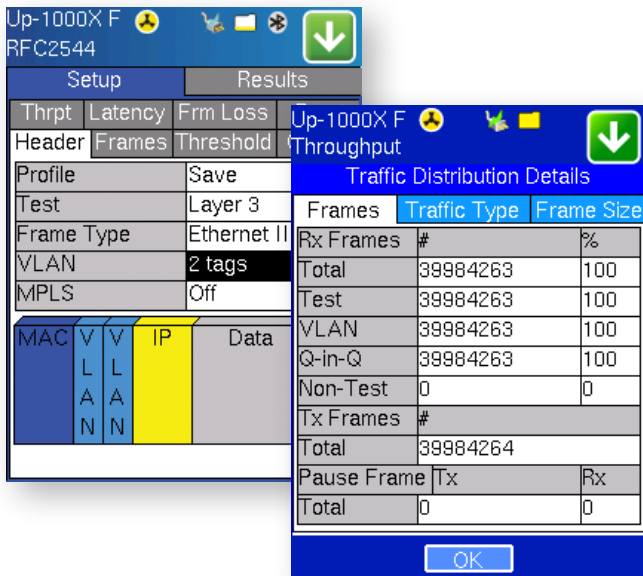
Easily discover and select another VeEX Ethernet tester or loopback device on the network under test for loopback testing applications. The local device will control the operation of the far end device, in either loopback or peer-to-peer mode (or symmetrical or asymmetrical traffic generation mode). 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.



## Ethernet Features *cont'd*

### Q-in-Q (VLAN stacking)

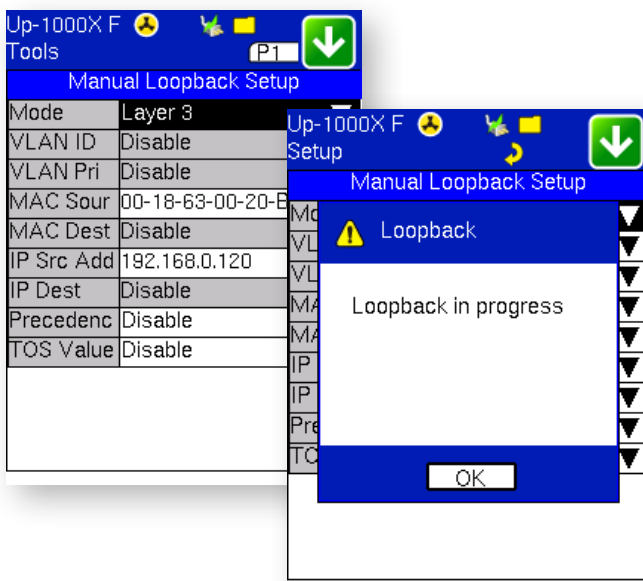
For Metro and Carrier Ethernet applications, VLAN stacking, also known as Q-in-Q, is supported. This feature makes a provision for carrier/service provider assigned VLANs, but also retains the VLAN of customer traffic.



### Smart Loopbacks

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

This feature also supports configurable traffic filter on all MAC, IP, and VLAN fields to allow full control over looped traffic.



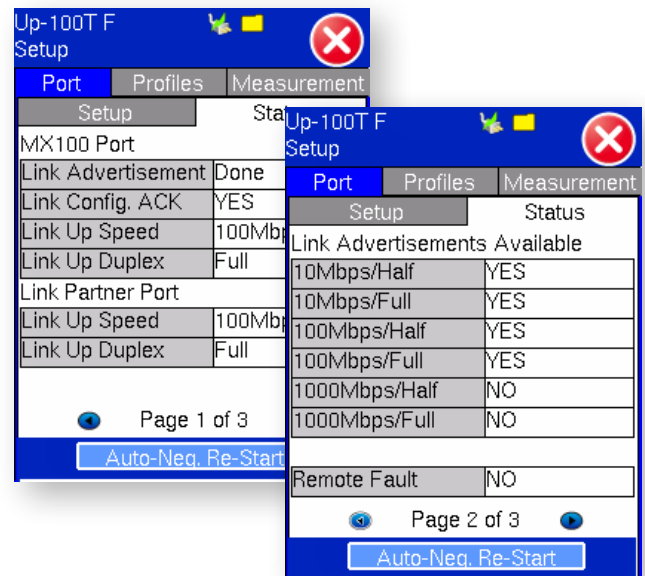
### VLAN Scan and Traffic Monitor

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).

### Test Port Status

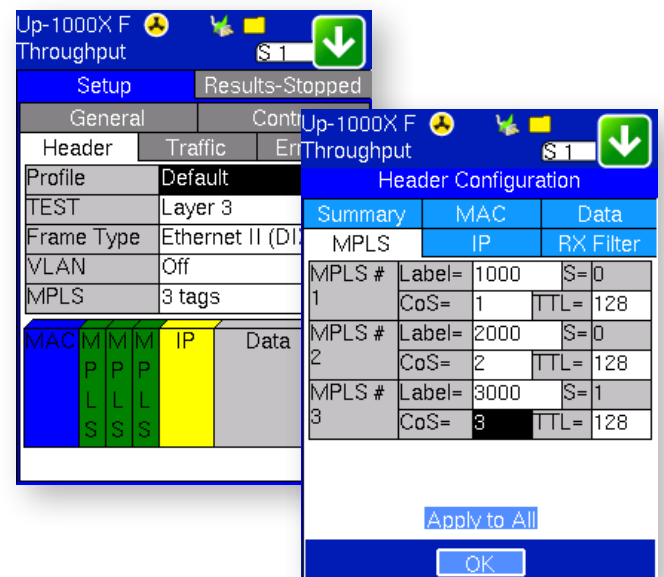
Auto-negotiation is a function that enables Fast Ethernet devices to automatically exchange information over a link about speed and duplex abilities. A common cause of performance issues on 10/100T Ethernet links occurs when one port on the link operates at half-duplex while the other port operates at full-duplex.

The port status feature of the MX100e+ reports the auto-negotiation and link advertisement parameters of both test set and link partner, which helps to reduce many link performance-related support calls.



### MPLS Measurements

Multiple Protocol Label Switching (MPLS) 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.



## Ethernet Features *cont'd*

### Auto Scripting

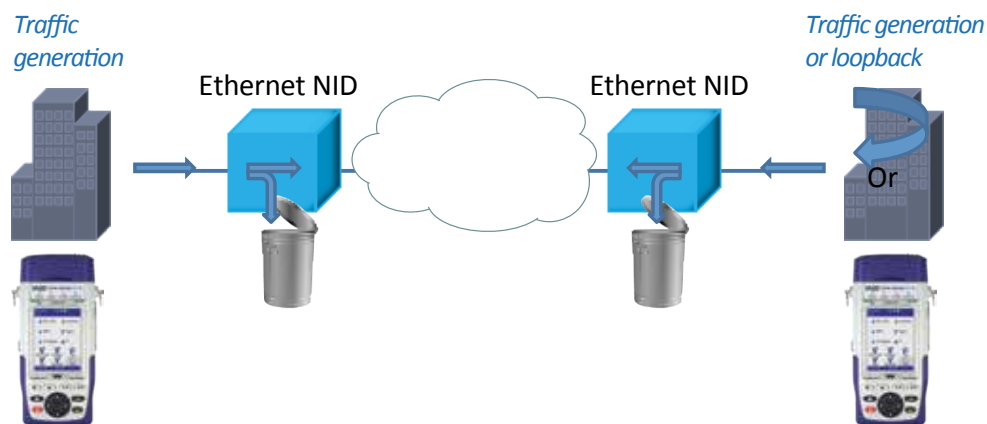
The Auto Scripting feature is the perfect tool for the lab environment where multiple short-term or long-term test configurations are required to stress the network equipment and/or network under test, in order to measure and qualify the performance capabilities. The feature is also important in field operations, not only to speed-up service turn-up times, but also to facilitate the entire workforce the same test profiles and test procedures for day-to-day operations. The Auto Scripting application is an automated sequence of tests that can be carried out by selecting previously configured Throughput or BERT profiles. The profiles can be created with ReVeal and then loaded to the unit or created directly on the unit in the Throughput and BERT applications. Users can select up to ten profiles, the test sequence will begin with the first profile configured with its corresponding duration, followed by each profile after that. At the end of a test, each profile's test result is stored automatically before the test sequence continues to the next profile.

### 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 RFC2544 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.

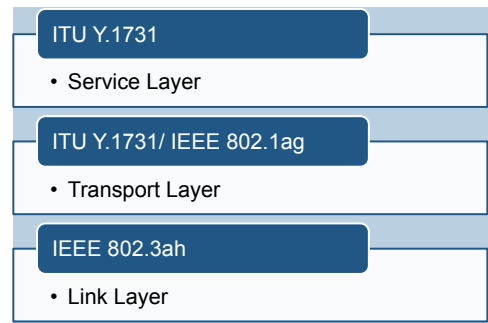
Up-1000T F			
V-SAM			
Setup		Results-Stopped	
Conf. Test	Perf. Test	Events	
Summary		Services	
Performance Test: Failed ET:00:01:00			
	Min	Mean	Max
IR(Mbps)	41.788	44.042	44.418
FTD(ms)	0.009	0.009	0.014
FDV(ms)	0.000	0.037	5.554
FL Count	1846		
FLR(%)	0.85		
AVAILABILITY(%)	100.00		
Page 1 of 2			

Up-1000T F			
V-SAM			
Summary Bandwidth per Service			
Service#	CIR (Mbps)	EIR (Mbps)	Traffic Policing
<input checked="" type="checkbox"/> 1	19.741	4.935	Yes
<input checked="" type="checkbox"/> 2	44.416	4.935	Yes
<input checked="" type="checkbox"/> 3	93.768	4.935	Yes
<input checked="" type="checkbox"/> 4	78.962	4.935	Yes
<input checked="" type="checkbox"/> 5	19.741	4.935	Yes
<input checked="" type="checkbox"/> 6	44.416	4.935	Yes
<input checked="" type="checkbox"/> 7	93.768	4.935	Yes
<input checked="" type="checkbox"/> 8	78.962	4.935	Yes
Total IR(CIR+EIR):513.255Mbps(52 0.000Mbps ULR)			

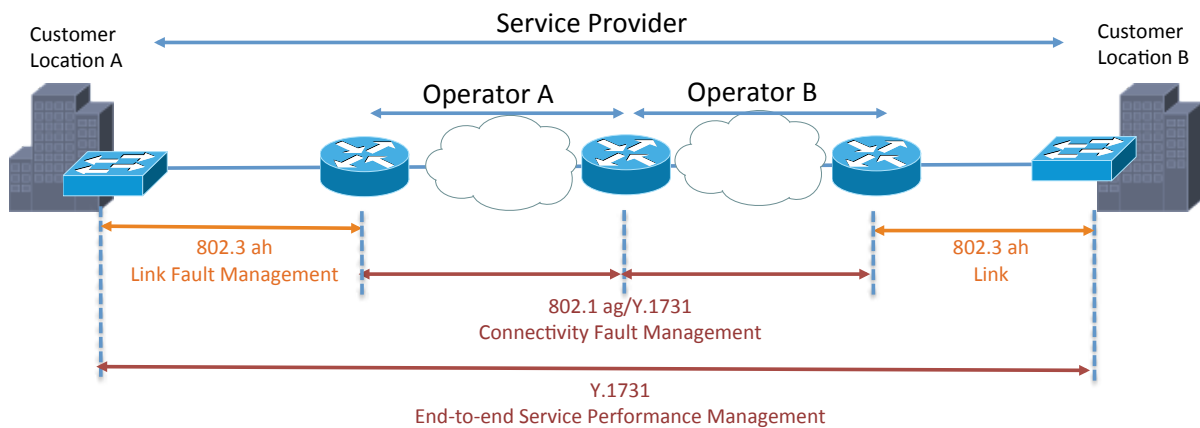
## OAM

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 MX100e+ 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:

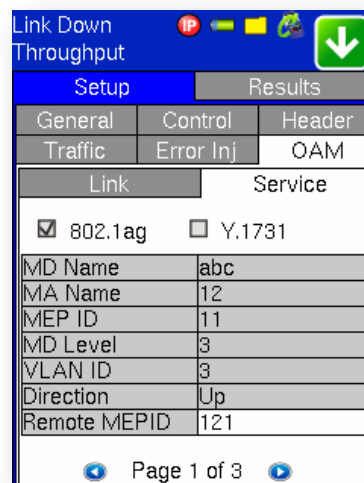
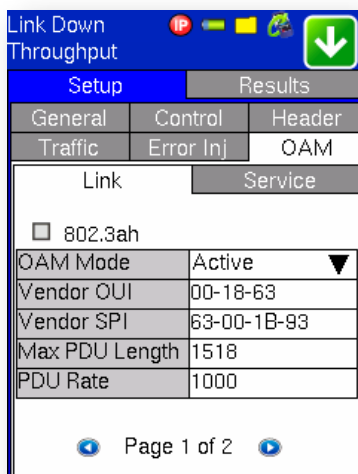
- Discovery mechanism to verify capabilities and provisioning of link partner
- Remote Loopback command for link performance testing
- Critical Link Event Notification

**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



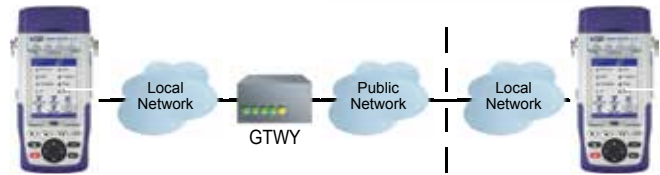
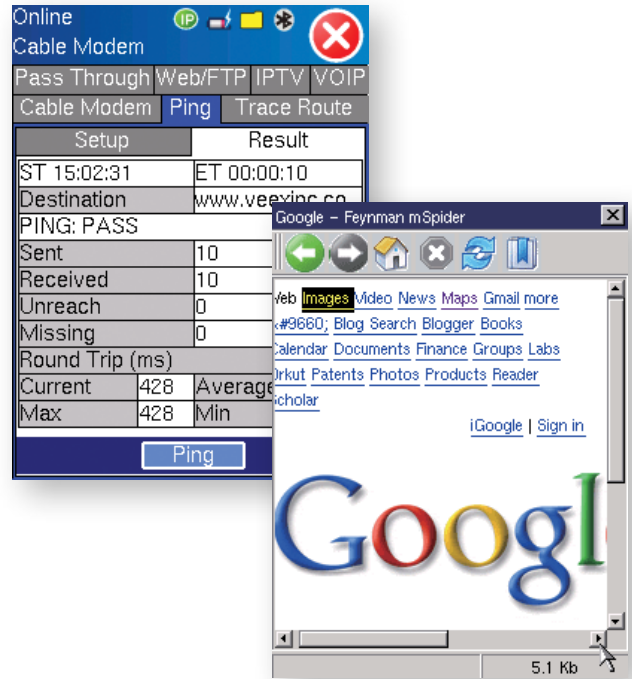


## IP Testing

Internet connection services require that the IP connectivity be verified up to the public network. For a routed network, verifying end-to-end connectivity is also important prior to testing the throughput performance. Triple Play services are IP centric, so IP test functions are no longer considered a luxury. On a daily basis, technicians verify network connections during service installation and restoration, so Ping test, Trace Route, ARP, Web browser, FTP throughput, and VoIP Call emulation have become routine measurements. IP verification for IPv4 networks on the MX100e+ is possible over the 10/100/1000Base-T, 100Base-FX, 1000Base-X test ports, while a subset of these tools is available for IPv6 and the USB WiFi adaptor.

### VeTest HTTP Throughput Test

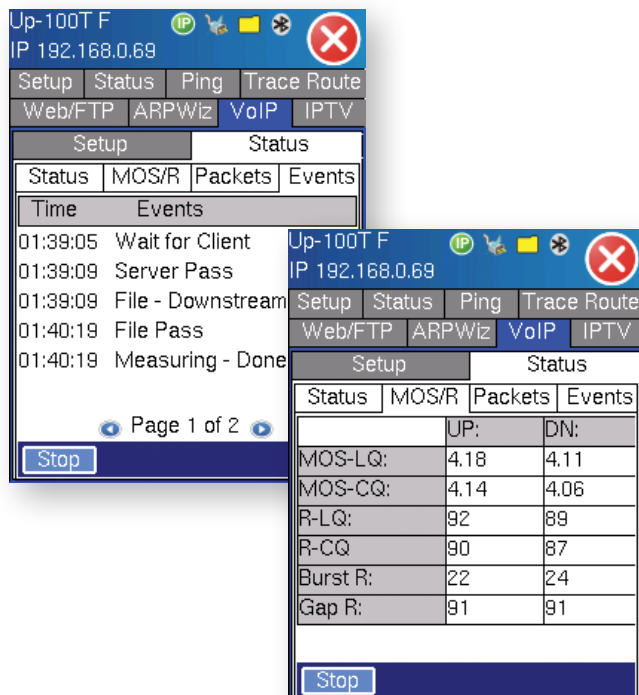
The VeTest feature qualifies network HTTP protocol performance by downloading and uploading files to a VeTest HTTP server. It can test up to the full line depending on the server specifications and limitations. Connection time to the server, data transfer time, line rate throughput rates, and protocol throughput rates key metrics are reported during the tests



## VoIP Testing

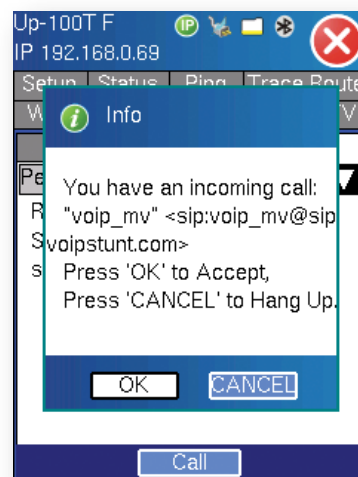
Take advantage of the three software options offering different test methods to verify and provision your VoIP network. Testing can be performed over any of the Ethernet test ports.

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



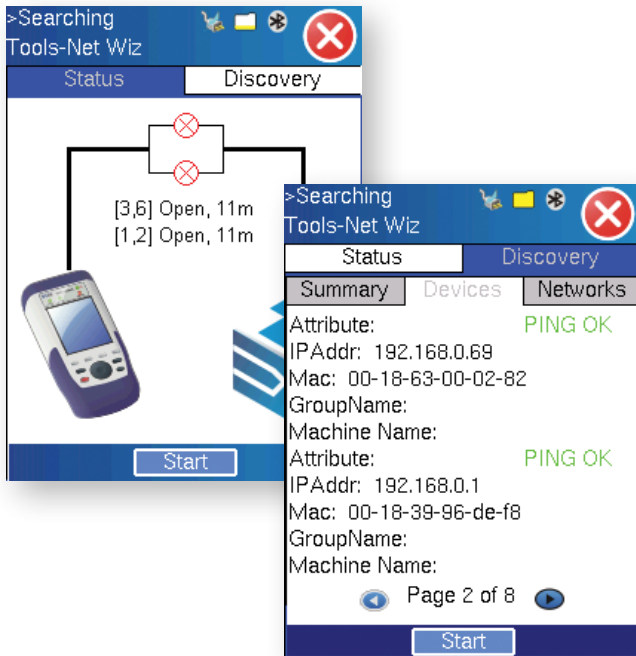
**VoIP Expert** – Generates industry standard wave files to verify MOS and R-Factor values of upstream and downstream paths and includes QoS measurements such as packet jitter, packet loss, and delay. Compatible with all VeEX testers including VX1000 VoIP server software.

**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 subjective voice quality is made possible using the Telchemy test method. Bulk call testing capability allows up to 24 simultaneous calls to be placed.



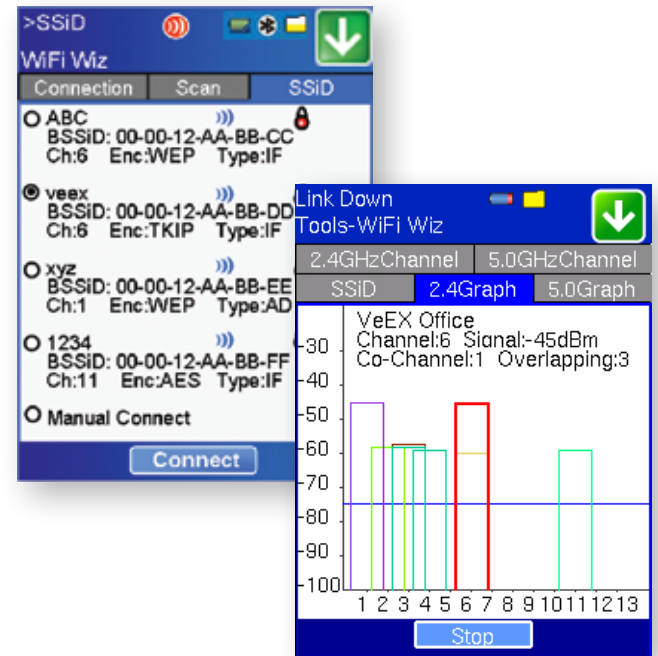
## Net Wiz

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.



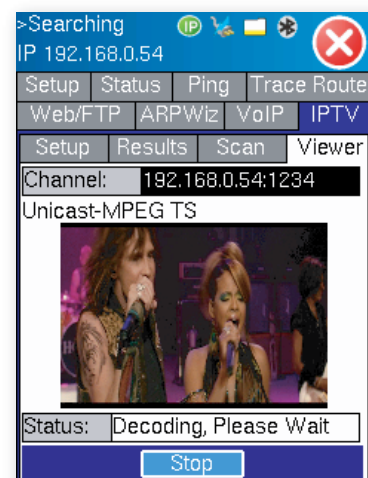
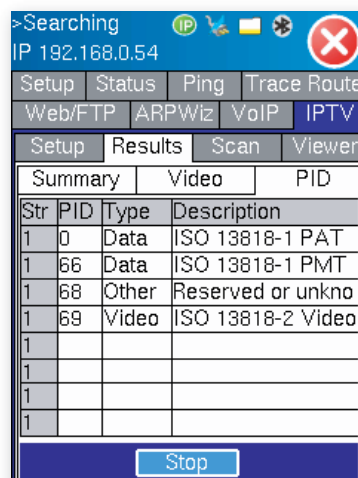
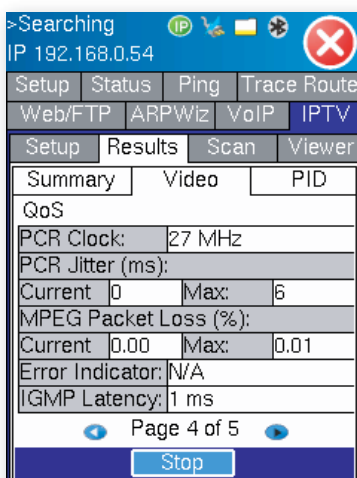
## WiFi Wiz

All VePAL products adopt a USB WiFi adaptor to make 802.11 a/b/g/n/ac 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.



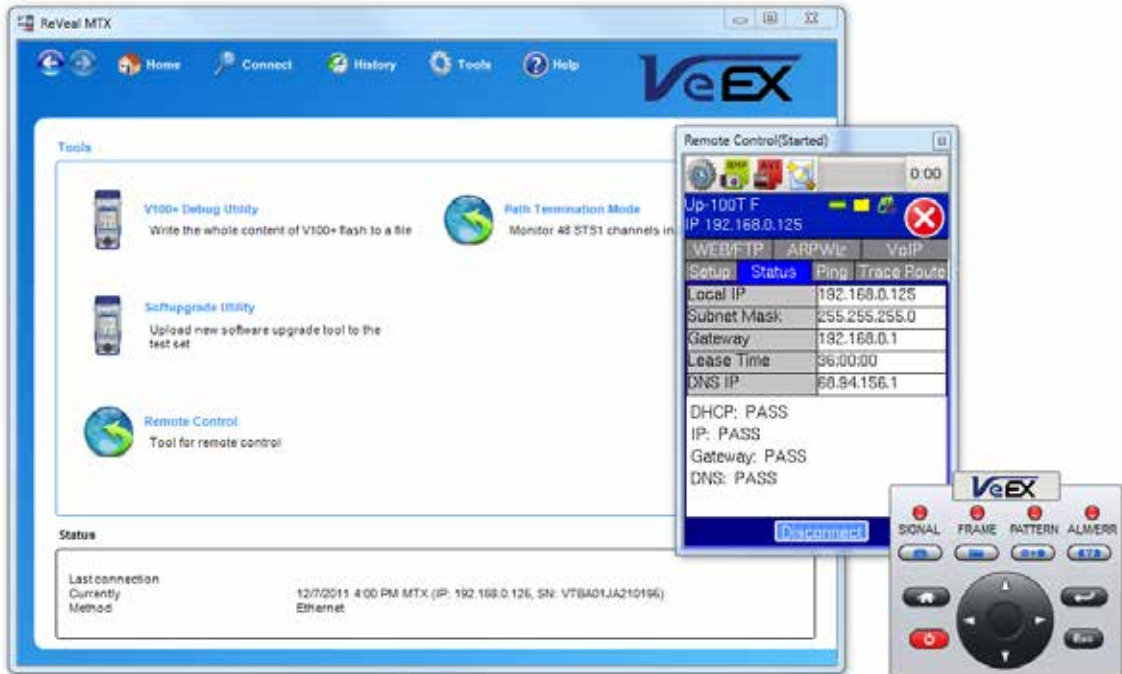
## IPTV Service Verification

Take advantage of the two separate software options offering Designed and optimized for technicians turning up IP video service. Set-Top Box (STB) emulation includes registration, IGMP and RTSP signaling for Broadcast and Video on Demand (VOD) applications. Transport stream analysis encompasses data/video/audio bit rates and Program Identification (PID) mapping. Packet jitter and loss, IGMP latency (channel zapping), PCR statistics and Viewer function complete the Video Quality of Service (QoS) application suite.



## ReVeal MTX PC Tool

A software package shipped standard with each test set. Test and other installation profiles can be created and edited on a PC for upload to the test set via LAN connection. Test results can be downloaded and saved to a PC, where test data management and report generation can be performed. Users are able to check and upgrade their test sets without having to return the unit to the supplier, thus reducing downtime.





**Ethernet Interfaces**

Single 10/100/1000Base-T Port: RJ45 connector  
 Ethernet Classification: Per IEEE 802.3 compliant

**Optical Interfaces**

Single 1000Base-X/100Base-FX SFP Port: LC connector  
 ROHS compliant and Lead Free per Directive 2002/95/EC  
 Eye Safety: Class 1, per FDA/CDRH, EN (IEC) 60825

**Ethernet Features**

Auto Negotiation , Full and Half Duplex , Flow Control

**Modes of Operation**

Terminate, Monitor, Loopback

**Multiple Streams Throughput Testing**

Up to eight independent traffic streams generation and analysis,  
 with configurable filters  
 Each stream can be set with independent frame size, bandwidth,  
 traffic profile, and QoS levels

**Key Measurements**

Error Measurements: Bit (BERT and single stream Throughput Test),  
 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  
 Service Disruption Time (SDT): per stream inter-packet gap based  
 measurement, configurable SDT measurement trigger and  
 violation threshold

**Traffic Generation**

Layer 1 Unframed and Framed, 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: Constant, Ramp, Multi Bursts, Single Burst

Error Injection: Bit, CRC, IP Checksum, TCP/UDP checksum, Pause,  
 Symbol (Layer 1 Unframed)

MAC flooding feature generates test frames with up to 4096  
 incremental Source and/or Destination MAC addresses (optional  
 single stream Throughput Test feature)

VLAN flooding feature generates test frames with up to 4096  
 incremental VLAN IDs (optional single stream Throughput Test)

**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, CBS, EBS, Traffic Policing, Color Mode) 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)

**Bit Error Rate Testing**

Single Stream test with test pattern: PRBS 2E31 -1, PRBS 2E23 -1,  
 PRBS 2E15 -1, PRBS 2E11 -1, Normal and inverted patterns, All 0s,  
 All 1s and User Defined  
 Layer 1 Framed: CRPAT, CSPAT, CRTPAT  
 Layer 1 Unframed: HFPAT, LFPAT, MFPAT, RDPAT, JTPAT, SNPAT

**Traffic Filters**

Up to eight traffic filters can be configured with MAC, VLAN, and IP  
 fields for Monitor and Loopback modes

**Smart Loopback Mode**

Layer 1: loops back all incoming traffic  
 Layer 2: all incoming traffic is looped back with MAC source and  
 destination addresses swapped  
 Layer 3: all incoming traffic is looped back with MAC and IP source  
 and destination addresses swapped  
 Layer 4: all incoming traffic is looped back with MAC, IP, and UDP/  
 TCP ports swapped  
 Loopback traffic filters with all MAC/VLAN/IP/UDP parameters  
 configurable

## Ethernet *cont'd*

### 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)

### Packet Capture

Line rate packet capture from test interfaces

Configurable capture filters (MAC and IP addresses)

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

## ReVeal MTX 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 .pdf or .csv formats, combine test results, add logos and comments

Test profiles management online or offline test profile creation, upload and download

## Additional Test Features

Profiles: Save and recall test profiles

Screen capture: Screen shots in .bmp format via ReVeal MTX PC software

Remote control: via ReVeal MTX PC software

Results saving: 1000 results

Export test results via USB, FTP, or ReVeal MTX PC software

### Test Profile Management & Auto Scripting

Save and Recall test profiles to internal memory

Auto Script uses up to 10 saved test profiles to run batch tests

## Options

### IP Testing

Ping, Trace Route, ARP, FTP/Web tests, Web-browser. These tests are done via the chassis 10/100/1000Base-T, 100-FX, and 1000Base-X ports.

### VoIP Testing

Codecs: G.711  $\mu$ -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
- Up to 24 simultaneous calls

### 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:  $\pm 3$  meters

### WiFi Wiz

USB Wi-Fi adapter 802.11 a/b/g/n/ac

Access Points scan signal level and link quality measurement

WEP/WPA/WPA2 encryption

IP Connectivity test (Ping, trace route, Web/FTP test, Web browser, VoIP) (requires additional options)

### 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)

### VeTest HTTP Test

HTTP Throughput Full line rate HTTP client mode Connection time to server Total Data Transfer time HTTP Throughput rates Requires VeTest Server

### IPTV

Provides STB emulation

Analyze up to 3 streams

Supports IGMP/RTSP signaling

Codecs MPEG2, MPEG4-part2, and MPEG4 part 10 (H.264)

IPTV image viewer for stream identification

PIDs count

Data Rates (Video, Audio, tables) and error counts

MDI score

Channel Zapping test

## General Specifications

Size	210 x 100 x 55 mm (H x W x D) 8.25 x 3.75 x 2.25 in
Weight	Less than 1 kg (less than 2.2 lb)
Battery	Lilon smart battery: 2800 mAh, 10.8VDC; Extended battery: 5600 mAh, 10.8 VDC
AC Adaptor	Input: 100-240 VAC, 50-60 Hz Output: 15VDC, 3.5A
Operating Temperature	-10°C to 45°C (14°F to 113°F)
Storage Temperature	-20°C to 70°C (-4°F to 158°F)
Humidity	5% to 95% non-condensing
Display (touch-screen)	3.5" QVGA 320x240 full color
Ruggedness	Survives 1.5 m (5 ft) drop to concrete on all sides
Interfaces	USB 2.0, RJ45, 10/100-T Ethernet, Bluetooth 2.0 (optional)
Languages	Multiple languages supported