



## 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

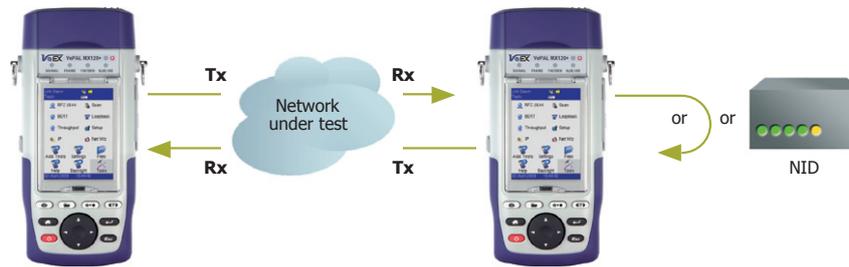
### Key Features

- 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 tests (per ITU-T Y.1564)
- Ethernet BER 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
- 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 Applications

### End-to-End Performance Testing

Irrespective of Ethernet service being installed, it is always necessary to verify that the network can carry out and cope with the allocated bandwidth required by the customer. Service Level Agreements (SLA) thus compel service providers to measure network throughput and other performance characteristics to ensure that bandwidth associated with different service types conform to customer expectations.



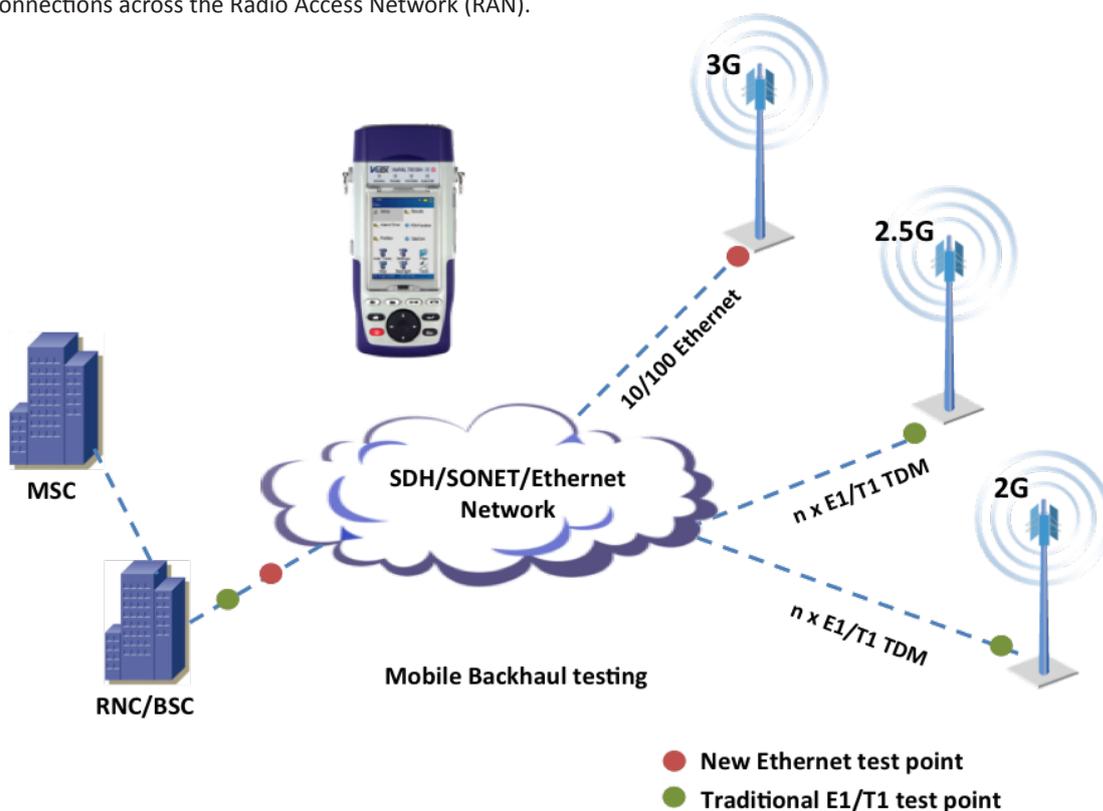
### Network Troubleshooting

Service providers constantly face the hard challenge of troubleshooting poor or unsatisfactory network performance. In these circumstances for example, the service provider must determine whether the poor performance is associated with it's own or the customer network. Network monitoring tools play an important role in this troubleshooting process.



### Mobile Backhaul Testing

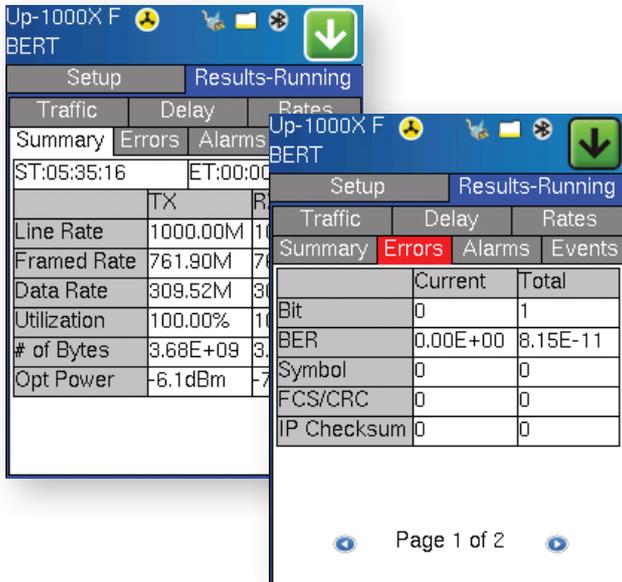
Mobile operators confronted with the explosive growth of data-centric services driven by 3G and LTE Smartphone applications, are urgently upgrading and migrating traditional TDM backhaul networks to Ethernet/IP packet-based technologies. The MX100e+ tester equipped with a rich variety of test applications and multiple stream analysis is perfectly equipped to test IP transport over both copper and fiber backhaul connections across the Radio Access Network (RAN).



## Ethernet Features

### BERT

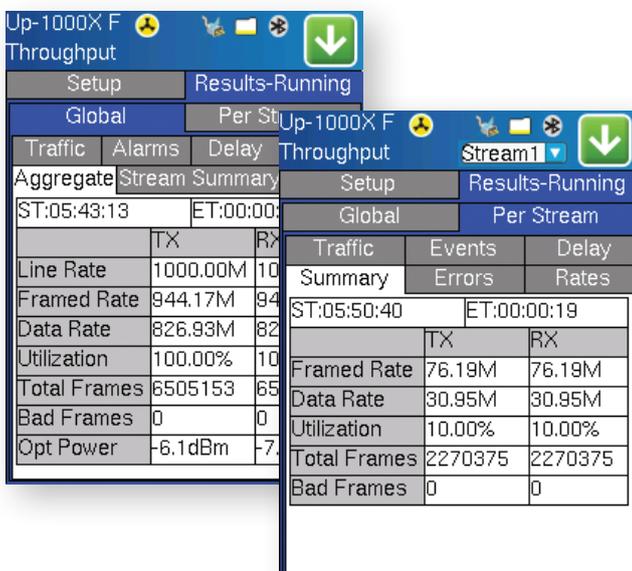
Layer 1, 2, 3, and Layer 4 BER testing is supported. The BER test can be configured to use regular PRBS test patterns, stress patterns or user defined test patterns to simulate various conditions. All patterns are encapsulated into an Ethernet frame to verify bit-per-bit performance of circuit under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

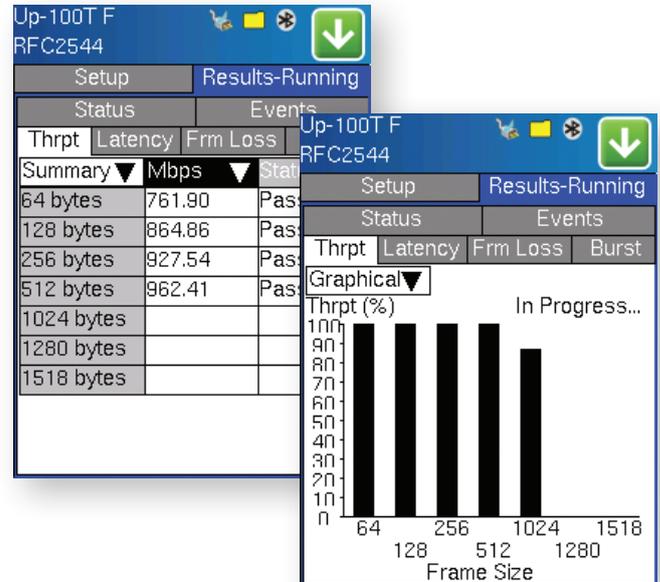
### Multiple Streams Generation - Throughput Test

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.



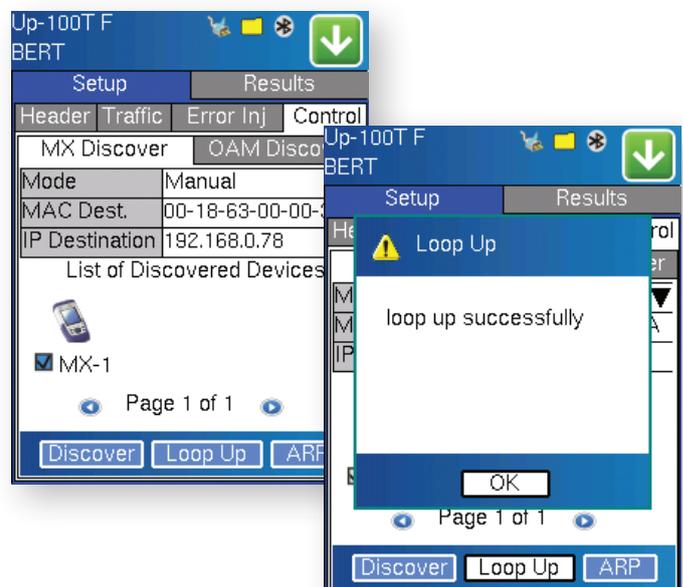
### RFC2544 Compliance Testing

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.



### Intelligent Network/Device Discovery

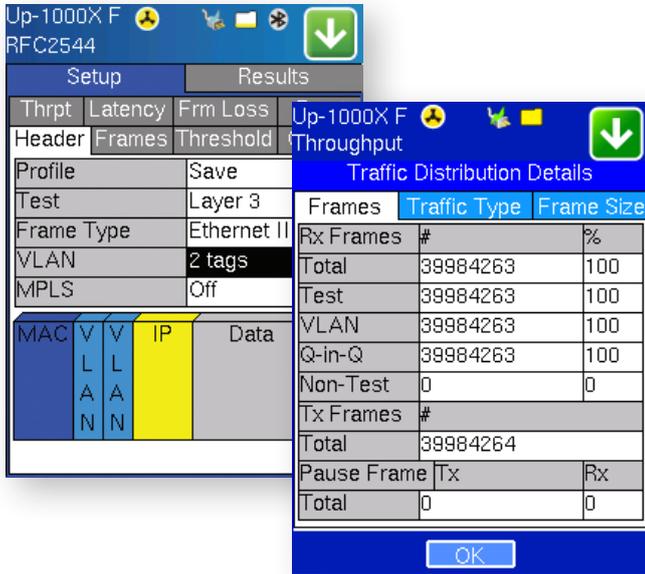
Easily discover and select another VeEX Ethernet tester or loopback device on the network under test for loopback testing applications. The local device will control the operation of the far end device, in either loopback or peer-to-peer mode (or symmetrical or asymmetrical traffic generation mode).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

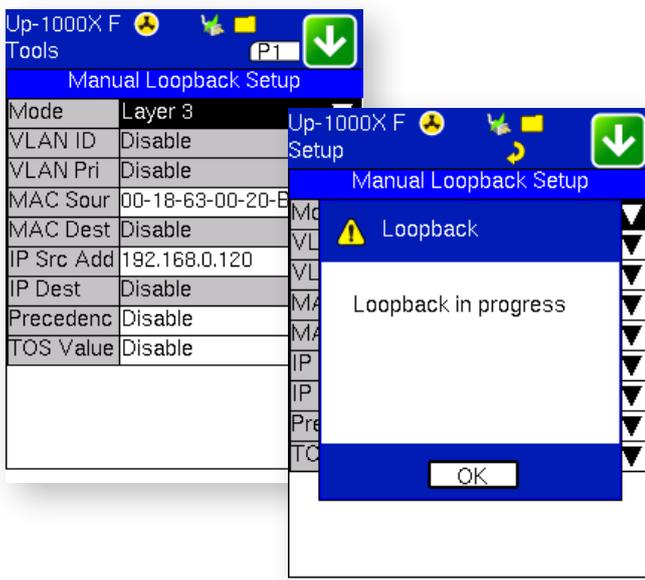
For Metro and Carrier Ethernet applications, VLAN stacking, also known as Q-in-Q, is supported. This feature makes a provision for carrier/service provider assigned VLANs, but also retains the VLAN of customer traffic.



### 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.



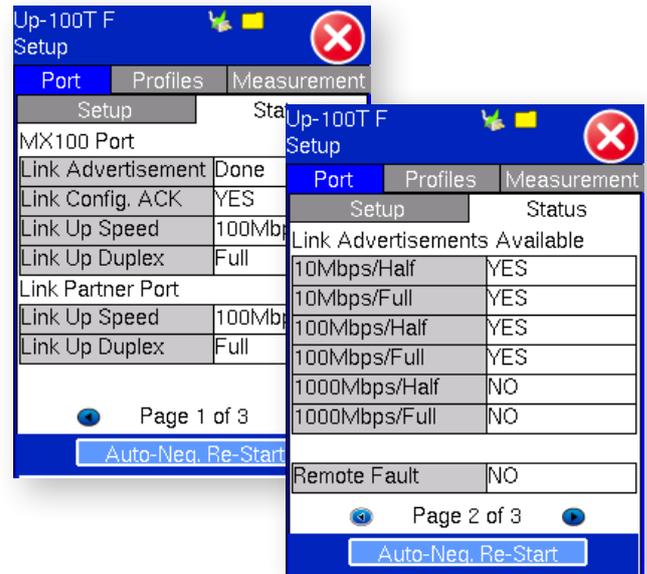
### VLAN Scan and Traffic Monitor

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

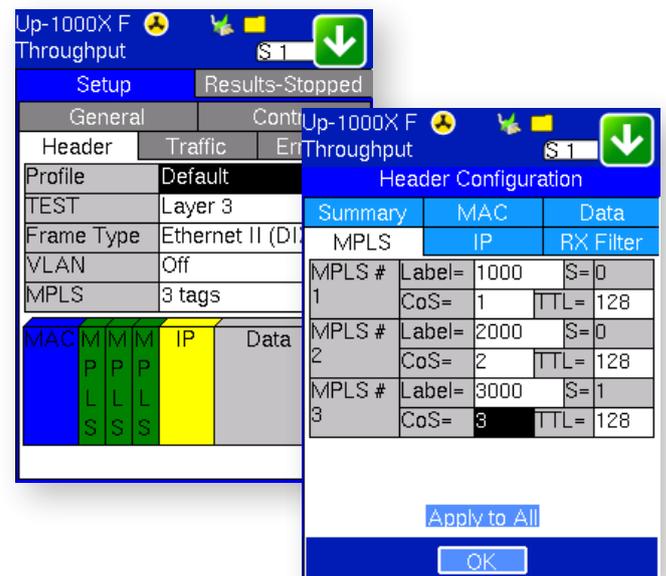
Auto-negotiation is a function that enables Fast Ethernet devices to automatically exchange information over a link about speed and duplex abilities. A common cause of performance issues on 10/100T Ethernet links occurs when one port on the link operates at half-duplex while the other port operates at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



### Delay and Jitter Measurements

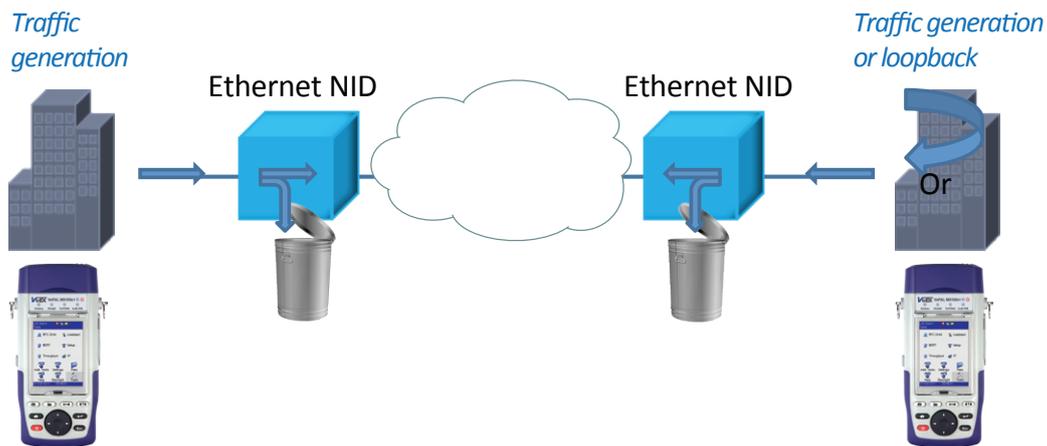
Frame delay and frame delay variation - Jitter measurements are performed on the test traffic during BER tests or throughput tests.

## 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.

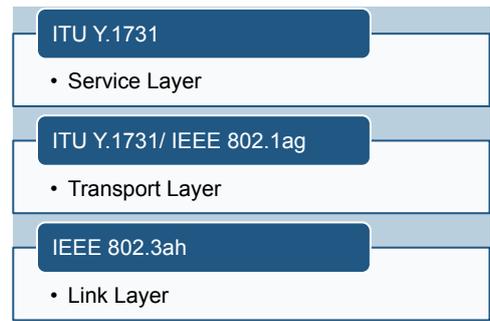
Up-1000T F V-SAM			
Setup		Results-Stopped	
Conf. Test	Perf. Test	Events	
Summary		Services	
Performance Test: Failed ET:00:01:00			
	Min	Mean	Max
IR(Mbps)	41.788	44.042	44.418
FTD(ms)	0.009	0.009	0.014
FDV(ms)	0.000	0.037	5.554
FL Count	1846		
FLR(%)	0.85		
AVAILABILITY(%)	100.00		
Page 1 of 2			

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)			
OK			

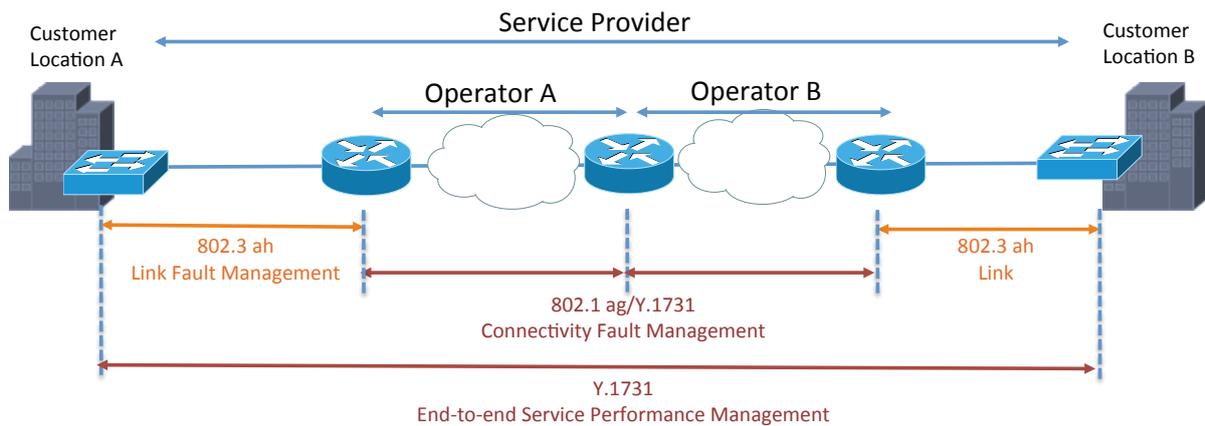
## OAM

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:

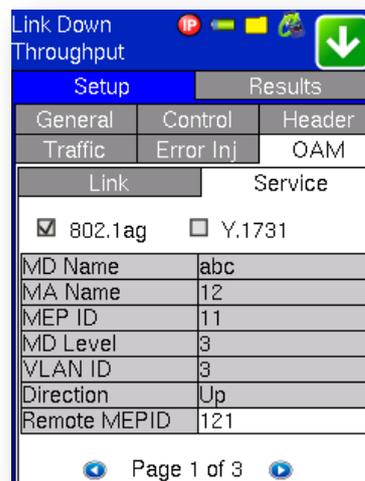
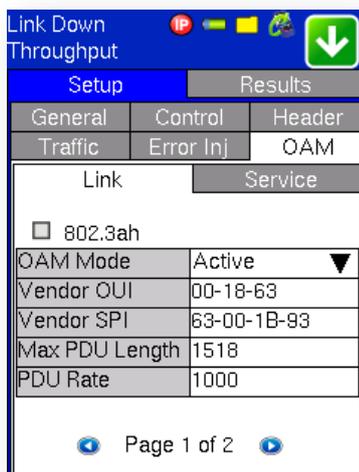
- Discovery mechanism to verify capabilities and provisioning of link partner
- Remote Loopback command for link performance testing
- Critical Link Event Notification

**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

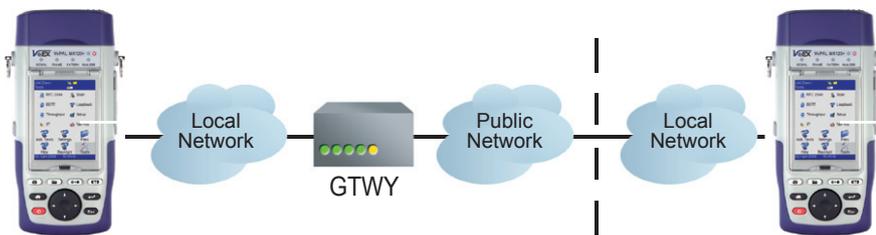
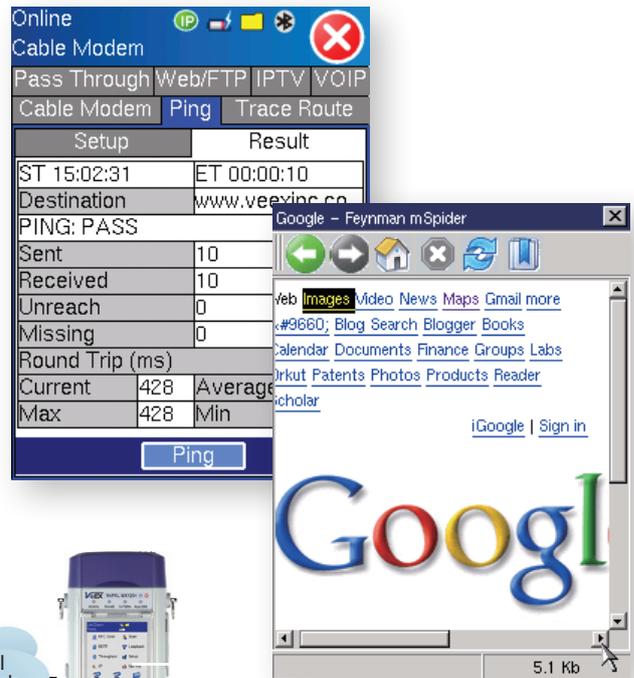
**Performance Management testing** with Y.1731, capabilities include:

- 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.



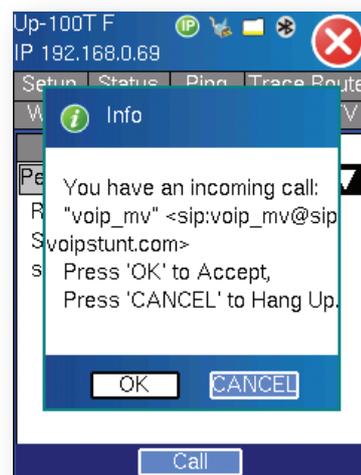
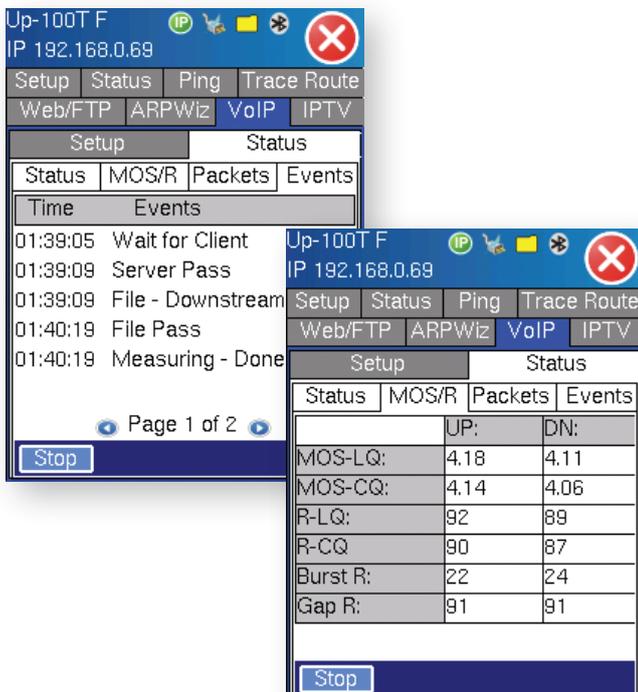
## VoIP Testing

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.

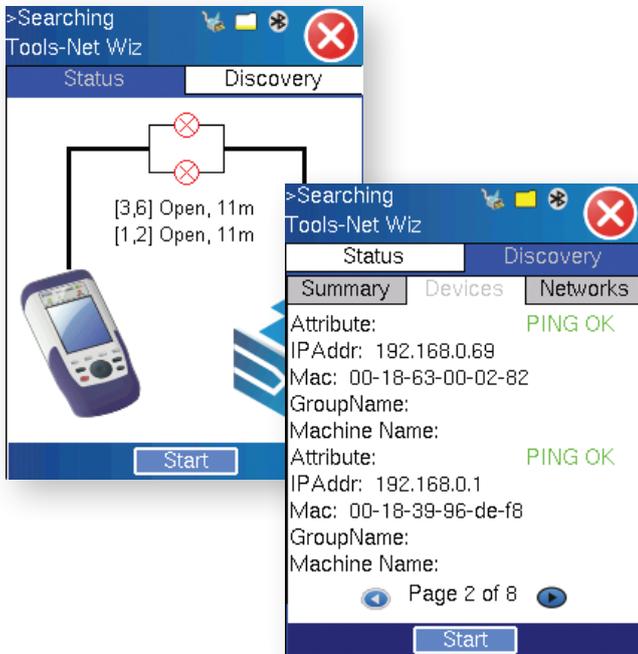
**VoIP Expert** – Generates industry standard wave files to verify MOS and R-Factor values of upstream and downstream paths and includes QoS measurements such as packet jitter, packet loss, and delay. Compatible with all VeEX testers including VX1000 VoIP server software.

**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.



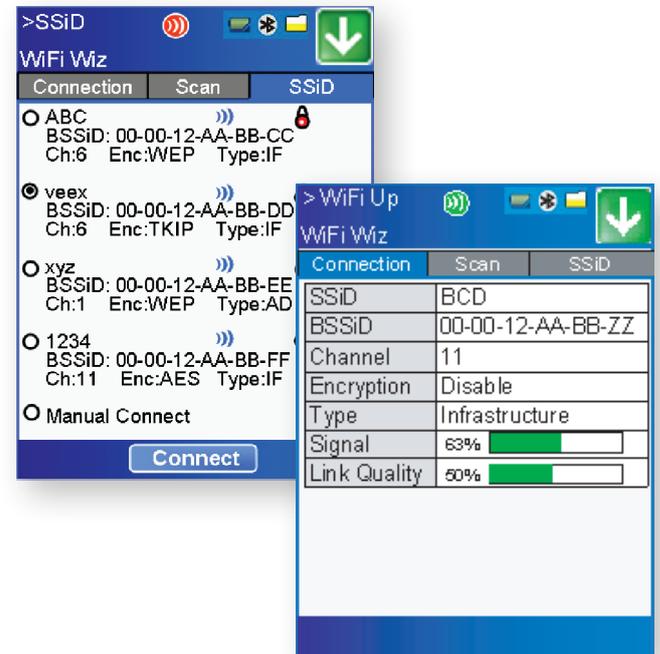
## Net Wiz

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.



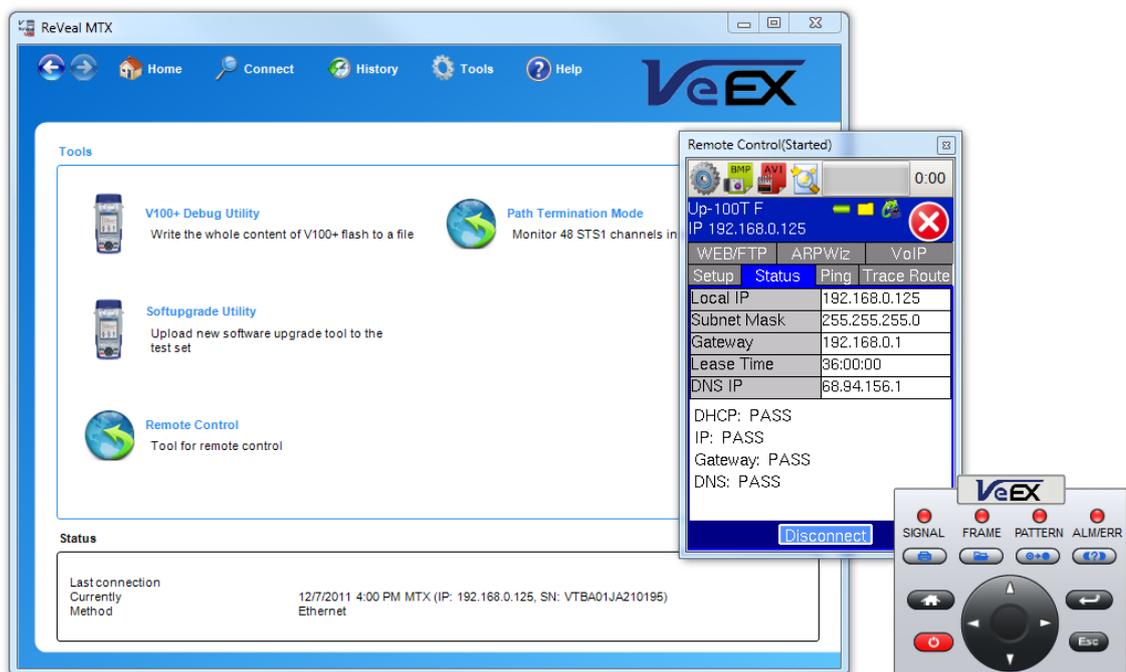
## WiFi Wiz

All VePAL products adopt a USB WiFi adaptor to make 802.11 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.



## 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

## Traffic Generation

Layer 1 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 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, 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 with 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.

Transceiver	SFP				
	1000Base-X			100Base-FX	
Data rate	1000Base-X			100Base-FX	
Part No.	301-01-001G	301-01-002G	301-01-003G	301-01-013G	301-01-014G
Wavelength (nm)	850	1310	1550	1310	1310
Range	300m	10km	80km	2km	15km
Connector	LC	LC	LC	LC	LC
Line coding	NRZ	NRZ	NRZ	NRZ	NRZ
Tx Laser	VCSEL	DFB	DFB	LED	FP
Tx Spectral width (nm)	0.85	1	1	175	7.7
Tx Power (dBm)	-9 to -3	-6 to -1	0 to +5	-20 to -15	-15 to -8
Rx Detector	PIN	PIN	APD	PIN	PIN
Rx Sensitivity					
1.25 Gbps	-20 to 0	-22 to 0	-22 to 0	n/a	n/a
125 Mbps	n/a	n/a	n/a	-31 to -14	-28 to -8

*\*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 exercise caution.*

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

## 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

## 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

**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

**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)

**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

**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	3.5" QVGA 320x240 full color touch-screen
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

**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 802.11b, 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, 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)

Z03-00-010P VePAL MX100e+, Handheld Ethernet Test Set

### Ethernet Software Options

499-05-014	MPLS Tags
499-05-015	Jitter Measurements
499-05-058	MAC Flooding
499-05-059	Asymmetric Testing
499-05-093	VLAN Flooding
499-05-106	1000Base-T Ethernet BERT, Throughput, RFC2544
499-05-113	100-FX, 1000Base-X Ethernet BERT, Throughput, RFC2544
499-05-114	Multi Stream Test
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

(via USB or 10/100Base-T Management Ports)

499-05-003	Remote Control
499-05-175	USB Bluetooth Dialing and File Transfer Support (USB Bluetooth adaptor not included)
Z88-00-001G	WiFi Wiz, incl. USB WiFi Adaptor

(via 10/100/1000Base-T or 100-FX/1000Base-X Ports)

499-05-001	Web Browser (requires Advanced IP option)
499-05-002	NetWiz
499-05-095	VoIP G.723 Codec
499-05-096	VoIP G.729 Codec
499-05-102	VoIP Check
Z33-00-001	VoIP Expert, incl. VoIP Check option
Z88-00-001P	VoIP Call Expert, incl. VoIP USB Adaptor & Earpiece
Z88-00-005G	Advanced IP, incl. Ethernet Cable

### 1000Base-X and 100FX SFP Transceiver Options

301-01-001G	850 nm SX (550m) SFP - 1GE
301-01-002G	1310 nm LX (10km) SFP - 1GE
301-01-003G	1550 nm ZX (90km) SFP - 1GE
301-01-013G	1310 nm 100FX MM (2km) SFP - 100 Mbps
301-01-014G	1310 nm 100FX SM (15km) SFP - 100 Mbps

### Recommended Accessories

A02-00-001G	Car Adaptor
C02-00-008G	Carrying Pouch for V100 w/GPS Data Card
D09-00-010	MX100e+ Test Report
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
Z77-00-006G	LCD Protective Film (pack of 5)
Z99-00-007G	USB Bluetooth Adaptor (requires 499-05-175)

### Replacement Items

403-99-011G	RJ45 Dust Plug
403-99-017G	SFP Dust Plug
405-02-001G	Screen Protector
405-02-002G	Top Connector Cover
A01-00-001G	V100 AC Adaptor
A01-00-002G	AC Adaptor (3-prong adaptor) for Metal Box
B02-03-002G	Battery Pack for V100
B02-06-002G	Extended Battery Pack for V100
C01-00-001G	V100 Carrying Case
C03-00-001G	V100 Shoulder Strap
E01-00-004G	USB Memory Stick, 4GB (Kingston)
F02-00-001G	Ethernet Cable RJ45 to RJ45 2 m
F04-00-001G	Power Cord - US 2 m (6 ft)
F04-00-002G	Power Cord - EU 2 m (6 ft)
F04-00-003G	Power Cord - UK 2 m (6 ft)
F04-00-007G	Power Cord - AU 2 m (6 ft)
F04-00-008G	Power Cord - US 2 m (6 ft) with PSE
Z77-00-001G	V100/V300 Stylus with String (Pack of 5)
Z77-00-024G	Top Connector Cover Hinge (Pack of 5)
Z99-99-001G	WiFi USB Adaptor w/ CD Driver (for IP connection only)
Z99-99-001P	VoIP USB Audio Adapter
Z99-99-002G	SFP Container
Z99-99-020G	Over-the-Head Headset (2.5 mm Type)



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