CX310

Handheld DOCSIS 3.1 Installation Test Set

Suitable for Every Installer Technician

The CX310 is a lightweight, ultra-portable, low-cost meter equipped with a DOCSIS 3.1 Cable Modem. It supports true OFDM analysis and VeTest throughput measurements. Key SLM features include Single Channel, VeCheck Full Band Scan, and Ingress Scan.

Platform Highlights

- Intuitive presentation of measurements with test graphics
- High resolution color touch-screen viewable in any lighting condition fitted with protective cover
- Robust, handheld chassis packed with powerful and flexible features for demanding environments and test conditions
- Weighs about 2 lbs / 1 kg.
- Optimized for all technicians installing and maintaining DOCSIS 3.1/3.0 CATV networks
- IP connection for back office applications, workforce management
- 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
- Extend field testing time using interchangeable LiIon battery pack/s. Greater battery autonomy provided in standby mode
- WiFi Wiz with InSSIDer SSID Analysis
- Digital Fiber Inspection Scope USB accessory*
- OPX-BOXe OTDR USB accessory*
- Optical Power Meter accessory*
- WiFi, Bluetooth® wireless, and USB control

Key Features

- Frequency range from 5 to 1218 MHz
- DOCSIS 3.1 Cable Modem with true OFDM Analysis
- Key SLM features include fast VeCheck Full Band Scan and Single Channel QAM analysis
- MER and Pre/Post BER measurements of QAM carriers
- Analog Video Level measurements
- Return Path and Forward Path Ingress Scan
- VeTest Throughput tests
- Home Installation Process/Certification Auto Tests*
- Single 10/100/1000-T/X and 10 Gigabit Ethernet port (BERT, Throughput, RFC2544, and Loopback testing)*
- TDR for Cable Fault Location*

**Optional*

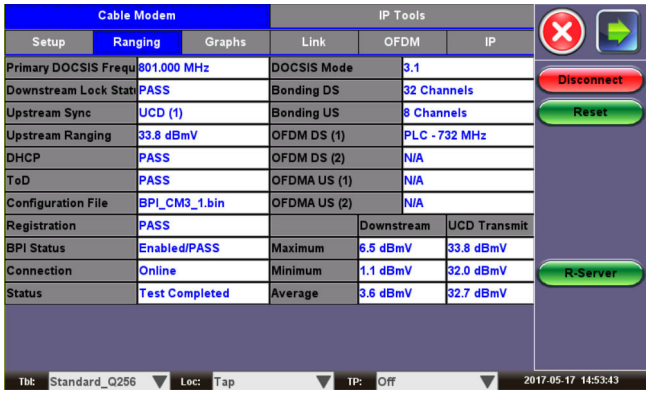
DOCSIS© 3.1/OFDM

DOCSIS 3.1/3.0 Modem Emulation

Equipped with a true DOCSIS 3.1 OFDM Cable Modem, the CX310 enables technicians to perform actual modem connection tests, without having to carry a separate modem on service calls. The Cable Modem also supports full DOCSIS 3.0 32x8 Channel Bonding.

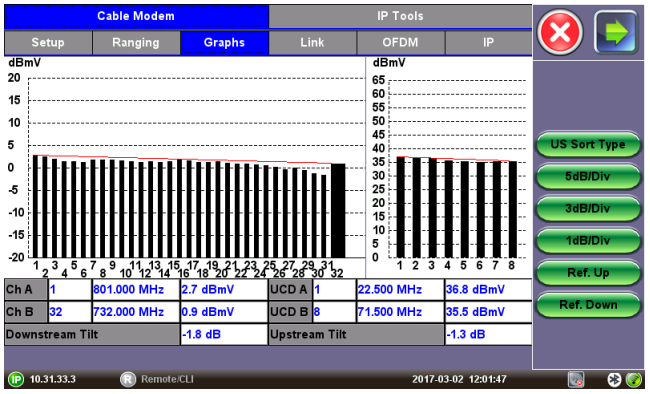
Intuitive Ranging Results

At a glance, the technician is able to view a summary of the ranging and registration process, check Baseline Privacy (BPI+) encryption status and identify which connection parameters have passed or failed.



Channel Power Graphs

Provides a single screen graphical overview of all DOCSIS Downstream carriers and active UCDs. Perform Tilt analysis.



Link Statistics

A range of live link connection parameters for all bonded DOCSIS downstream and upstream channels. Measurements include power level, MER, and Pre and Post BER.

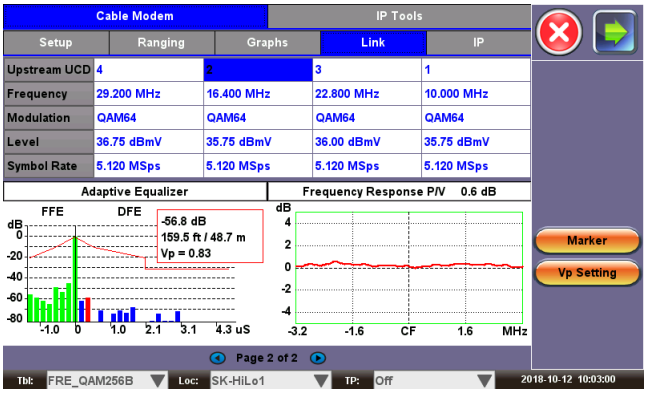
Additional DOCSIS Modem Features

- Enhanced Security – Advanced Encryption Standard (AES)
- Pass-Through testing – modem emulation to verify high bandwidth data transfer between PC and Network

Verifying Upstream Channel Bonding

DOCSIS 3.0/3.1 channel bonding provides cable operators a flexible way to increase bandwidth to customers. Upstream speeds in particular have come under a lot of pressure due to a sharp increase in user generated content such as video and photo uploads, driven by the proliferation of social and networking sites.

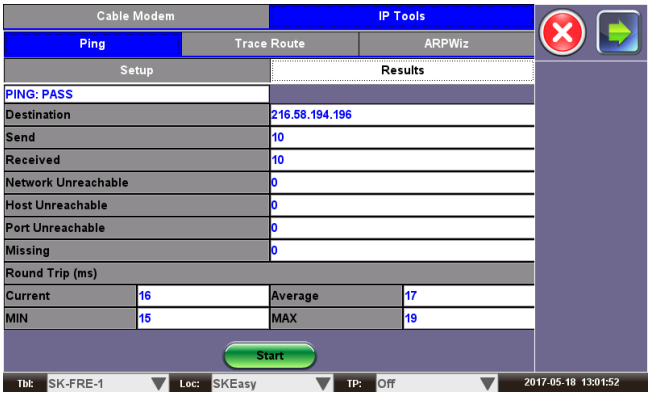
Checking RF Levels - Significant consideration must be given to the cumulative RF power loading that is realized with upstream channel bonding. Up to eight upstream DOCSIS channels, plus optional OFDMA, transmitting simultaneously can result in a large contiguous channel loading. To avoid excess power hitting the return path fiber-optic transmitter and to reduce the possibility of laser clipping, the power levels of each channel can be carefully monitored in the link measurement tab.



For advanced troubleshooting, Upstream Pre-Equalization Adaptive EQ parameters and In Channel Frequency Response can be viewed by tapping on the desired UCD number.

Advanced IP Testing

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, VoIP Call emulation and IPTV measurement have become routine measurements. IP verification on the CX310 is possible over the DOCSIS Cable Modem and 1000Base-T Ethernet test ports, while a subset of these tools is available using the built-in WiFi adapter.



DOCSIS 3.1 OFDM Testing

OFDM, combined with Low Density Parity Check (LDPC) advanced FEC technology, are the basis for DOCSIS 3.1 transmission. Key DOCSIS 3.1 measurements are derived from its OFDM/LDPC building blocks, which consist of the PHY Link Channel (PLC), Next Codeword Pointer Channel (NCP) and Modulation Profiles.

The Phy Link Channel is used as a message channel for bringing new Cable Modems online. The PLC contains critical information on how to decode the OFDM signal.

An OFDM Phy Channel consists of numerous multiplexed subcarriers. Each subcarrier can be either 25 kHz or 50 kHz wide. As an example, a single 192 MHz OFDM Channel can contain up to 3840 50 kHz wide subcarriers.

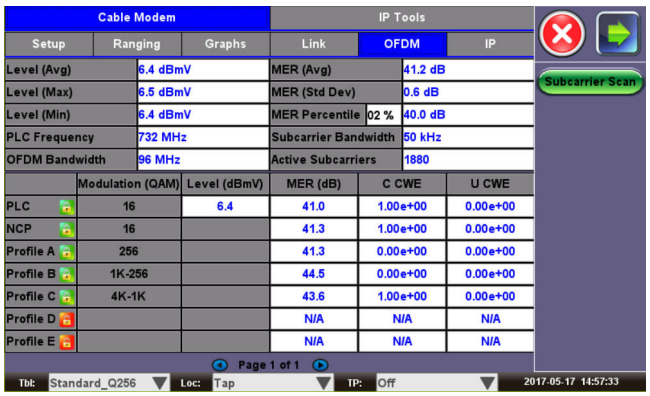
When Codewords (CW) are mapped to OFDM subcarriers within a symbol, a pointer is needed to identify where a data CW starts. This is known as the Next Codeword Pointer (NCP).

A Modulation Profile is a list of modulations that are used for the subcarriers within an OFDM channel.

- Profile A is the boot profile that cable modems first receive when they initialize and register with the CMTS. All DOCSIS 3.1 Cable Modems must support the base Profile A, as it is a prerequisite for D3.1 transmission
- Profiles B, C, D: line conditions are continuously monitored and when a sufficiently high SNR threshold is achieved for a given OFDM subcarrier, higher modulation schemes can be used for greater spectral efficiency. The Profiles can be tailored to the line conditions of each subcarrier

Powerful Built-in OFDM Analyzer

- The fundamental D3.1 test pertains to locking to the PLC. Key PLC measurements include Level, MER performance, Corrected CW and Uncorrected CW
- NCP based tests include verification for lock status, MER, Corrected and Uncorrected CW
- Modulation Profile analysis, for the Boot Profile A and higher modulation profiles, are done to check for Lock status, MER, and Corrected/Uncorrected CW
- OFDM Channel status for actual bandwidth, subcarrier bandwidth, and the active number of subcarriers
- An overall OFDM channel performance assessment, including average overall MER, and the worst performing subcarriers based on a user settable MER Percentile setting.



OFDM Subcarrier Scans

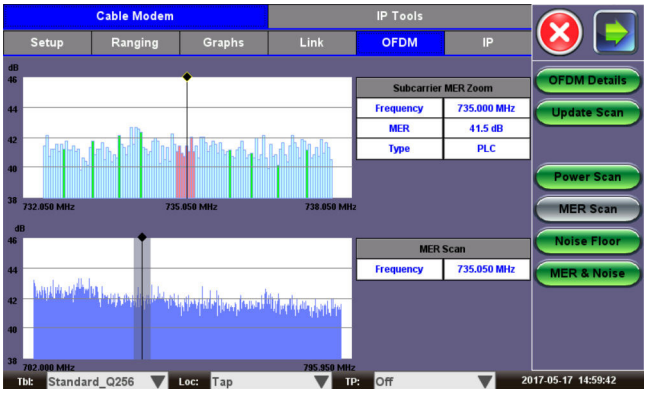
In depth OFDM analysis is made possible with detailed subcarrier scans, which are presented in intuitive, graphical format.

Subcarrier Power Scan

More precise OFDM power levels can be measured using the Power Scan. The OFDM channel is sectionalized to provide 6 MHz power measurements. Color coding clearly identifies the QAM modulated subcarriers, PLC subcarriers, and continuous pilots.

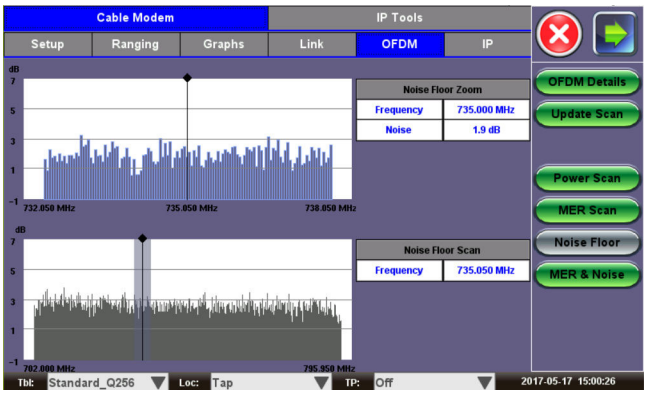
Subcarrier MER Scan

The full MER scan is presented on a per subcarrier basis.



Subcarrier Noise Scan

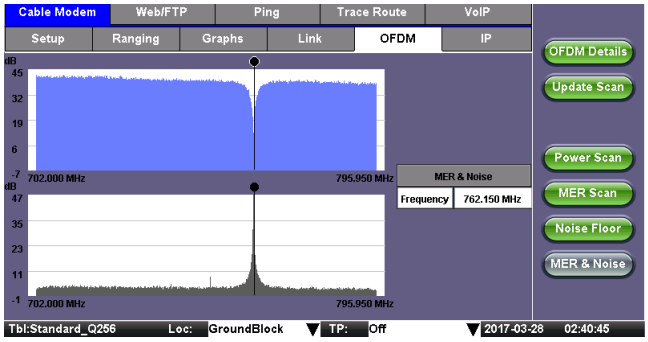
A full OFDM noise floor scan provides insightful indications of disturbers that may be present.



Throughput Testing

Detect Noise Under the OFDM Channel

The MER and Noise subcarrier scans can be overlayed in a MER and Noise graphical view, which ultimately can help identify service impacting plant impairment issues, namely hidden noise under the OFDM Channel.

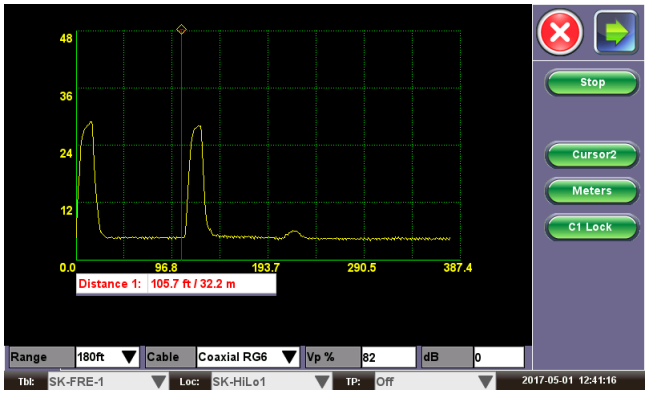


Time Domain Reflectometer (TDR)

The optional TDR applies advanced signal processing techniques to detect opens, short circuits, splices, taps, water ingress and other elusive impedance mismatches on coaxial cables up to distances of 5000 ft (1.5 km). The cable under test is scanned within seconds, allowing the user to view the full run and to identify faults quickly.

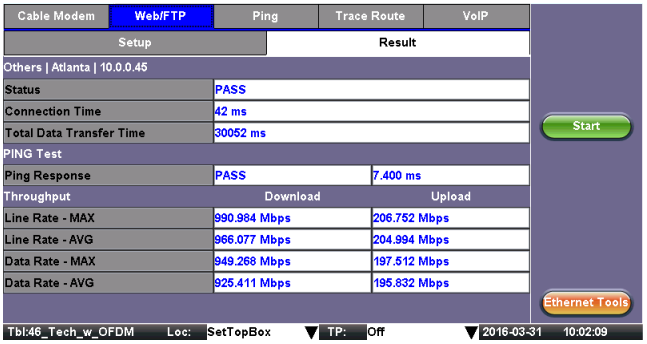
All major operating and setting parameters can be easily accessed using only 4 tabs located at the bottom of the screen.

Experienced technicians will benefit from selectable impedance settings and adjustable Velocity Propagation (VP) factors to perform various tests on different cables.



VeTest

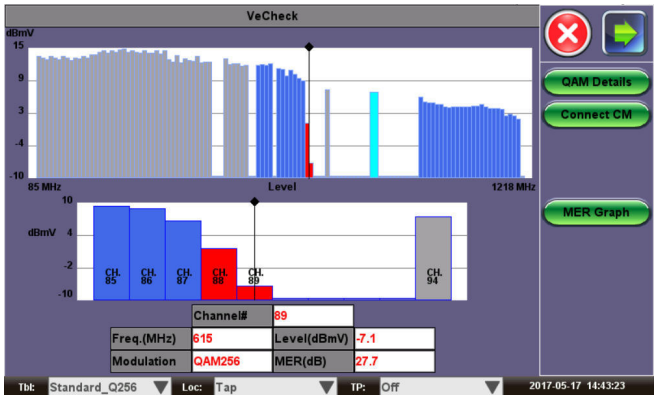
The VeTest feature qualifies network HTTP protocol performance by downloading and uploading files to a customer specific VeTest HTTP server. It can test up to the full line rate, depending on the server specifications and limitations. Connection time to the server, data transfer time, and line rate throughput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

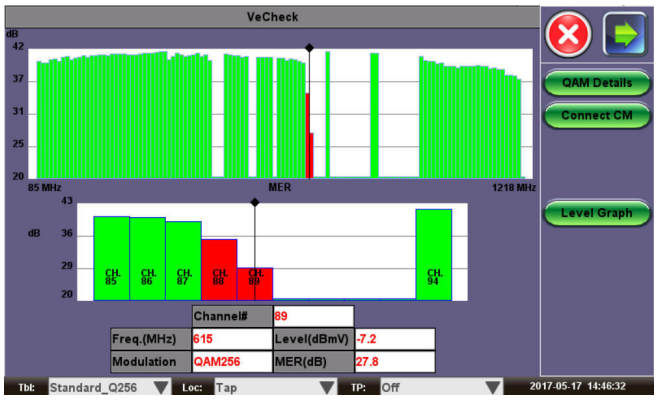


SLM and Other Features

VeCheck

VeCheck is a fast and powerful Full Band Scan for the Forward Path, covering up to 1218 MHz. Key metrics include Level, Modulation Type, and MER for digital QAM, Single-Carrier DOCSIS QAM, and OFDM presented in easy to view graphs.

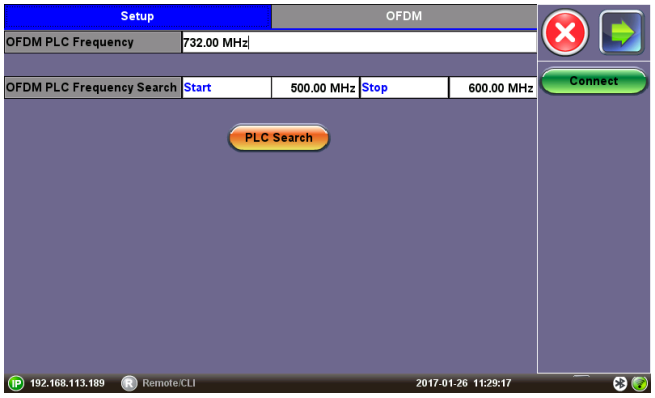




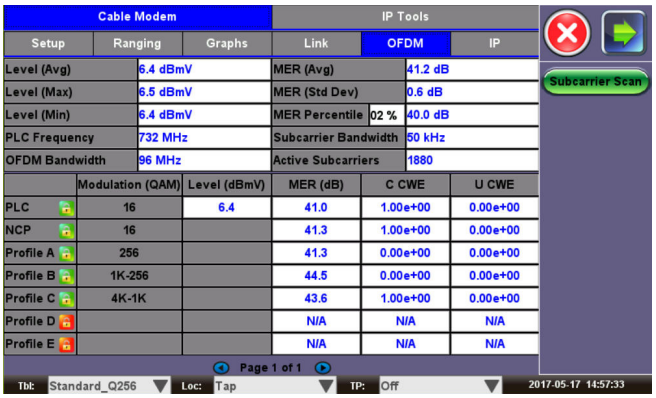
OFDM Analysis

The OFDM Check feature allows for true OFDM Signal Analysis, without having to go online in Cable Modem mode. This is extremely helpful if the DOCSIS signal is impaired or is not available.

A valuable tool is the OFDM PLC Search, which removes the guesswork for the PHY Link Channel frequency, if it is not known.

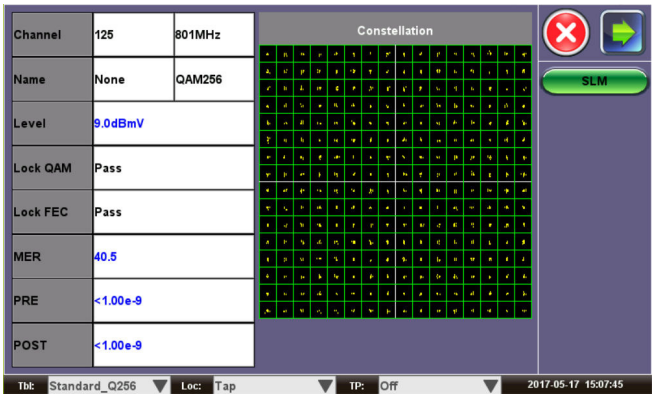


All OFDM measurements including the Subcarrier Power, MER, and Noise scans are available in this OFDM Check mode.



Single Channel Measurement

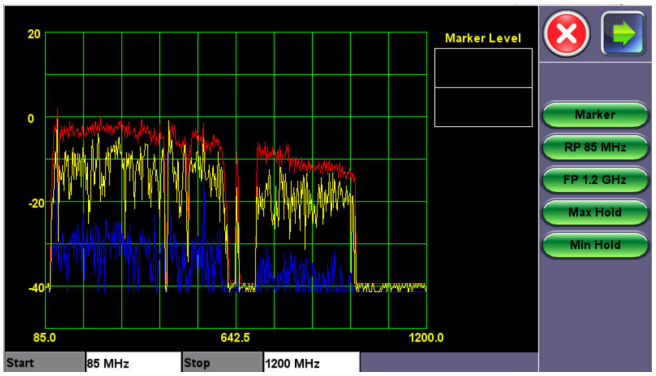
In **digital** mode, average power, MER, Pre-BER, Post-BER, Error seconds, and constellation diagram are displayed. User programmable location thresholds and test point compensation are useful utilities enabling fast, simple and automated testing of carrier signals.



In **analog** mode, video carrier level are measured.

Ingress

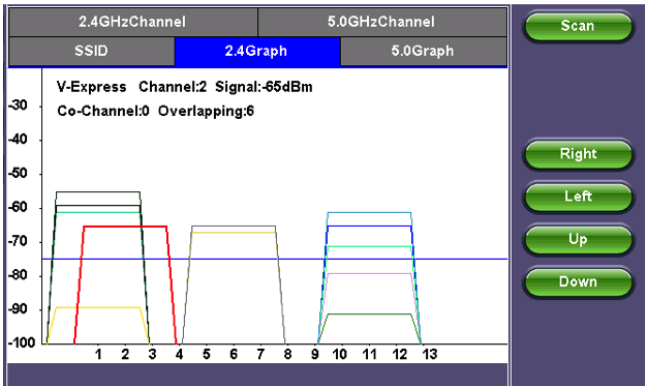
Poorly shielded coaxial cable and fault terminations (CPD) are sources and causes of ingress noise. Ingress is troublesome for return path communications in CATV networks due to the large number of subscriber-generated signals being funneled towards the headend. The combined and amplified interference is often responsible for service disruption, therefore the ingress test is a valuable tool to check the forward and reverse paths for interference and related problems.



WiFi InSSIDer

The WiFi InSSIDer provides the best tools for WiFi networks discovery and performance troubleshooting. With the optional, built-in WiFi adapter for 802.11 a/b/g/n/ac wireless in 2.4 GHz and 5 GHz bands the InSSIDer provides a clear picture of the environment. It helps identify poor channel placement, low signal strength and interferences in easy to understand graphs and tables.

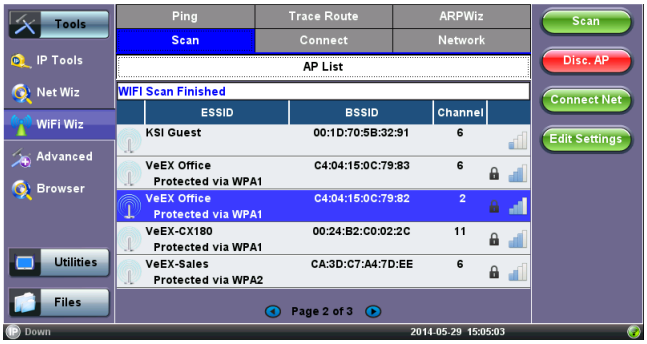
Network scan results in Graphical or table format
Lists: Network names, BSSID, encryption type, channel allocation, signal strength, co-channels and overlapping channels



WiFi Wiz

The WiFi Wiz function with the built-in WiFi adapter for 802.11 a/b/g/n/ac wireless in 2.4 GHz and 5 GHz bands makes troubleshooting WiFi connectivity issues a simple task. Scan for available networks and view all access points detailed information along with SSID, signal strength and channel allocation. Connect to Access Points with WEP/WPA or WPA2 encryption and verify IP capabilities to ensure the wireless network is properly installed and configured. A full suite of IP testing features is supported (ping, trace, web browser, etc.).

Access Points scan with signal level and link quality measurement
WEP/WPA1/WPA2 encryption
IP Connectivity test (Ping, trace route, ARPWiz, Web browser)
Provides WiFi LAN access to the test set (e.g. VeExpress, R-Server, Remote Control, ReVeal)



Fiber Optic Tools

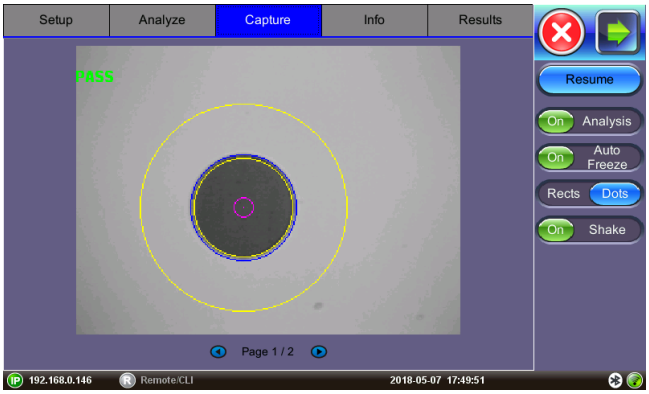
Digital Fiber Inspection Scope

Dirty connectors can damage or degrade the performance of expensive optical modules, or produce inaccurate results. Inspecting and cleaning patch cords and pluggable optics connectors before mating them is always recommended.

This option allows digital video microscope probes* to be connected directly to the test set through a USB port. Featuring live video feed on the screen for visual analysis. It offers image capture, compare (before and after), IEC 61300-3-3 Sect 5.4 Pass/Fail templates for SMF and MMF, save, export and generate report to USB flash drives.

Visual Inspection

- Visual file selector
- Image comparison for before-after reports



Auto-Focus Detection and Analysis option

Test set automatically detects when image is in-focus, captures the image and analyzes it. This process is faster than complex mechanically-driven auto-focus systems as it uses human fast reaction and finesse.

- Analysis per IEC 61300-3-3
- SMF and MMF templates (Core, Cladding, Adhesive and Contact areas)
- Dots or square to highlight contamination, debris and scratches
- Report Generation

**USB Fiber Scope sold separately. Check its datasheet for details.*

Optical Power Meter GUI**

An optional OPM tethered via USB measures optical power levels prior to making an optical connection or running a test.

- Numerical readout
- Hold and Save result functions
- Measurement Units: dB, dBm, mW, µW & nW
- WaveID when paired with compatible VeEX light source
- Relative Loss function with zeroing function
- Nulling to eliminate any dark currents

*** OPM sold separately. For available Wavelengths, Power Range, Accuracy and Optical adaptors, please refer to the OPM specs*

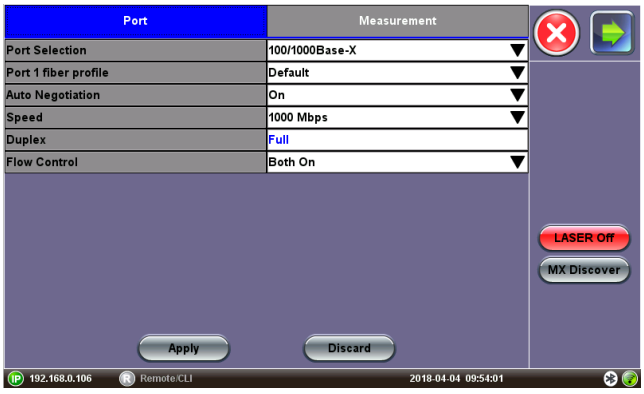
OPX-BOXe Optical Time Domain Reflectometer (OTDR)

The VeEX OPX-BOXe is an ultra-compact OTDR that can be controlled by the CX310 using a WiFi, Bluetooth, or USB connection. Once connected or paired to an OPX-BOXe OTDR, the CX310 displays a virtual OTDR user interface that is used to remote control the unit and perform measurements. Since fibers are common place in CATV networks, having a companion add-on OTDR reduces truck rolls since there is less dependence to call on specialized fiber construction crews to verify or troubleshoot fiber related problems.

Ethernet*

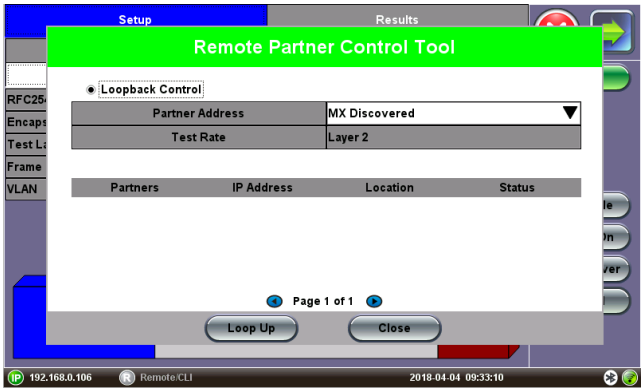
Test Interfaces

Single copper (RJ45) and optical test ports (SFP+) support 100% wire speed traffic generation and reception for 10/100/1000Base-T, 1000Base-SX, 1000Base-LX or 1000Base-ZX, and 10GE LAN/WAN full-duplex networks at all packet sizes.



RFC2544 Compliance Testing

Automated test suite performs throughput, latency, frame loss, and back-to-back frame tests, and checks all industry recommended frame sizes (including two user defined frame sizes) up to full line rate. The test can be performed with a far end test partner in loopback mode (symmetrical traffic) or peer-to-peer mode (asymmetrical traffic). User defined test thresholds ensure accurate SLA assurance/verification while an advanced SLA mode generates background streams to closely approximate actual live traffic conditions.



Intelligent Loopbacks

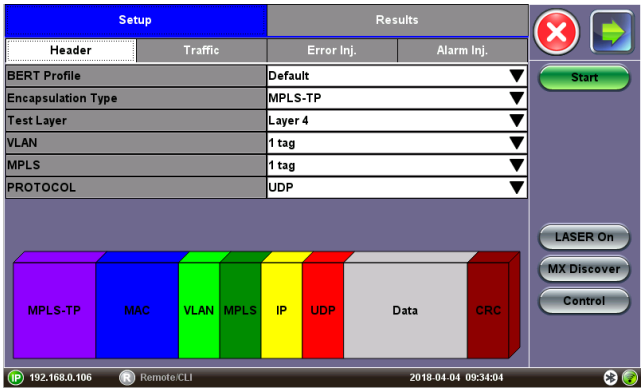
Four modes are available for looping test traffic:

- Layer 1 - incoming traffic is looped back unaltered
- Layer 2 - incoming unicast traffic is looped back with MAC source/destination addresses swapped
- Layer 3 – same as layer 2 with both MAC and IP addresses swapped
- Layer 4 – same as Layer 3, with UDP/TCP ports swapped

BERT

Layer 1, 2, 3, and Layer 4 BER tests are supported. PRBS, stress or user defined test patterns simulate various conditions. Service disruption measurements including CRC error checking are performed. BER testing is possible using a physical loop at the far end (Layer 1), or using a second test unit or intelligent loopback device in Smart Loop or in Peer-to-Peer mode.

VLAN stacking (Q-in-Q) is supported for Metro and Carrier Ethernet applications. Up to three tags makes provision for carrier/service provider assigned VLANs, while retaining the VLAN of customer traffic.

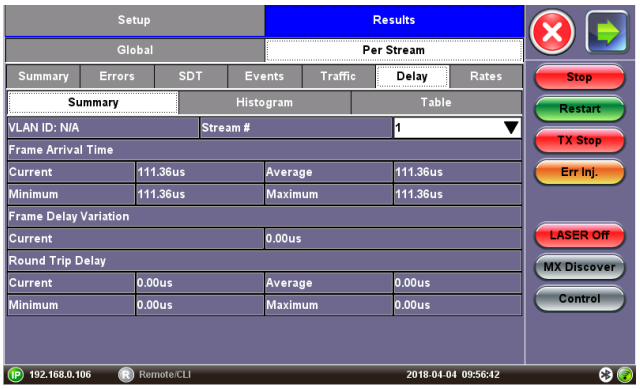


Throughput Testing

Testing with multiple streams enables service providers to simulate and qualify a variety of applications and perform Ethernet QoS measurements.

- **Multiple Streams Generation**
  Up to eight individual traffic streams can be configured with independent VLAN stacking (802.1ad Q-in-Q), VLAN ID (802.1Q), VLAN Priority (802.1p), ToS and DSCP settings.

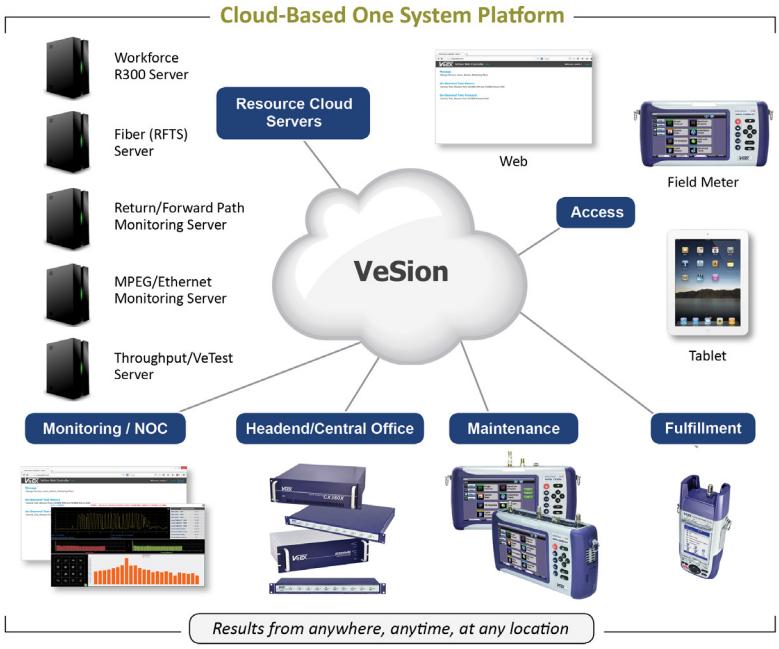
- **Delay and Jitter Measurements**
  Frame delay (PDV) and inter frame delay variation (IPDV) measurements based on RFC3393 recommendations are performed on test traffic during BER or throughput tests when unit is equipped with the Jitter software option.



**Ethernet features are applicable for the Advanced 10G model only.*

VeSion R300 Productivity Server

A software application specifically designed for medium-to-large CATV operators facing the enormous challenge of coordinating hundreds of installations per day, collecting the field test results for billing/record purposes and having to maintain a large inventory of test sets in parallel. When used in conjunction with the Home Installation Process (HIP) and Signature Pad features, the application becomes a powerful tool to reduce customer call-backs and associated truck rolls, maximizing workforce efficiency and lowering operational costs.



Home Installation Process (HIP)

A customized test procedure that can be downloaded and programmed into each test set. The step-by-step script eliminates guesswork and rogue installation practices ensuring consistent service turn-up and delivery. This disciplined technique ensures the "Birth Certificate" of each new installation conforms to operating guidelines and ISO quality standards.

Advanced Management

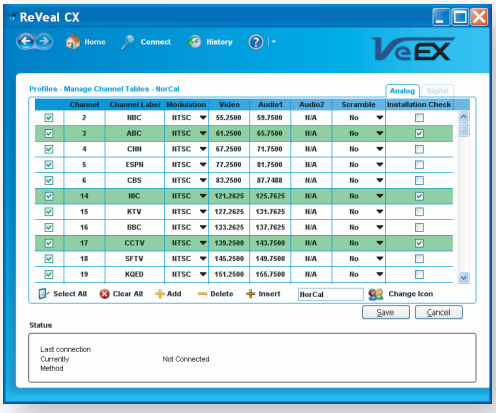
Authorized test sets register with specific ReVeal R300 Server/s to download new channel tables, test profiles, measurement thresholds and job cards. Test results can be uploaded via LAN, WiFi or DOCSIS connection running over the existing RF network. Signature Pad electronically captures the customer signature which is automatically appended to the test results upon work order completion.

Benefits

- Centralized storage of test profiles, software versions, and measurement thresholds
- Registered test sets are informed of new test profiles, software versions and channel tables
- Test set software versions are maintained and synchronized
- Results are collected electronically while technician is on site, thus billing transactions can be processed sooner
- Operates with Operator and Contractor owned test sets giving operational statistics for both activities
- Provides theft prevention, test set lockout, time lock and other security features

ReVeal PC Tool

A software package shipped standard with each CX test set. Channel tables, location thresholds, and other installation data can be created and edited on a PC for upload to the test set via USB, LAN, WiFi or DOCSIS 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.



CX310 Configuration Comparison

	CONFIGURATIONS		
TEST FEATURES	Basic	Advanced 1G	Advanced 10G
DOCSIS 3.1 with OFDM Analysis	Yes	Yes	Yes
SLM Features	Yes	Yes	Yes
Coaxial TDR	No	Optional	Optional
VeTest Speed Test	No	Up to 4 Gbps for Cable Modem; 1 Gbps for Ethernet	Up to 4 Gbps for Cable Modem; 10 Gbps for Ethernet
10/100/1000Base-T (RJ45)	No	Optional: Supports VeTest and Layer 4+ features only	Optional
100/1000Base-X (SFP)	No	No	Optional
10GEBase-X (SFP+)	No	No	Optional
WiFi Connectivity	2.4 GHz (802.11 b/g/n)	2.4/5 GHz (802.11 a/b/g/n/ac)	2.4/5 GHz (802.11 a/b/g/n/ac)

Specifications

General

Input Impedance: 75Ω
Frequency Range: 5 MHz to 1218 MHz

DOCSIS 3.1/3.0 Cable Modem

Downstream/Receiver

- Frequency Range with Standard Dual 85/204 MHz Diplexer
  – 108 to 1218 MHz (with 85 MHz Diplexer setting)
  – 258 to 1218 MHz (with 204 MHz Diplexer setting)
- Bandwidth
  – 6 or 8 MHz DOCSIS carriers and 25 or 50 kHz OFDM Sub-carriers
- Channel Bonding: Up to 32 Single Channel QAM and Dual 192 MHz OFDM Channels (with DOCSIS 3.1 setting)
- Maximum Speed: Up to 4 Gbps
- Input Power Level: -15 dBmV to +15 dBmV per digital channel, typical

Upstream/Transmitter

- Frequency Range with Standard Dual 85/204 MHz Diplexer
  – 5 to 85 MHz (with 85 MHz Diplexer option)
  – 5 to 204 MHz (with 204 MHz Diplexer option)
- Channel Bonding: Up to 8 Single Channel QAM and Dual 96 MHz OFDMA Channels (with DOCSIS 3.1 setting)
- Maximum Speed: Up to 1 Gbps
- Output Signal Level: Up to +68 dBmV

OFDM

- OFDM input range: -20 dBmV to +30 dBmV
- OFDM MER range: 20 dB to 43 dB
- Bandwidths: 24 MHz to 192 MHz
- FFT size
  – FFT size = 4k (50 kHz carrier spacing)
  – FFT size = 8k (25 kHz carrier spacing)
- Profiles: Supports up to 5

General

- IPv4 and IPV6 support
- DHCP client obtains IP and DNS server address from DHCP server automatically
- Time of Day (ToD) support for local & MSO time synchronization
- TFTP Client support for cable modem configuration file download
- Security: BPI+ and AES support
- Pass-Through testing (1000BaseT port): Verify high bandwidth data transfer between PC and Network

Digital QAM Channel Measurements

Level Range:-40 dBmV to +40 dBmV
Level Accuracy: +/- 2dB
Level Resolution: 0.1 dB
Demodulation: standard QAM64 & QAM256 Annex A/B/C
Symbol Rate: 1-7 MSPS, automatically detected
Constellation Display: QAM64 & QAM256
Minimum QAM Locking Level: -15 dBmV
MER Range: 21 to 43 dB

Analog Channel Measurements

Level Range:-40 dBmV to +40 dBmV
Level Accuracy: +/- 2dB
Level Resolution: 0.1 dB

TDR

Range: 5000 ft / 1.5 km
Pulse width: 10 nS to 10 uS, that is automatic with range
Accuracy: +/- 1% of selected range
Minimum resolution: 0.08 ft / 2.5 cm

General Specifications

Size	150 x 150 x 80 mm (5.9 x 5.9 x 3.1”)
Weight	Basic Model: 1.0 kg (2.3 lbs) Advanced Model: 1.2 kg (2.6 lbs)
Battery	Extended Lithium-ion battery, 75 Wh
Operating Time	> 8 hours, typical operation with Extended Battery
AC Adapter	Input: 100-240 VAC, 50-60 Hz Output: 15 VDC, 3.5A Operating
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	5” WVGA 800x480 TFT color LCD touch-screen
Connectivity	micro-B USB 2.0 USB-A via OTG cable 10/100 Base-T (RJ45) via optional OTG adapter Bluetooth®, WiFi
Water resistance	May be used in light rain
Languages	Multiple languages can be supported

The Verification Experts

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