



# 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 Lilon battery pack/s. Greater battery autonomy provided in standby mode
- WiFi Wiz
- PTG-BOX Home Pressure Test Kit\*
- 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
- Automatic Switching Dual Diplexer (85/204 MHz) (patent-pending)
- 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 supports VeTest and Layer 4+ features
- 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.

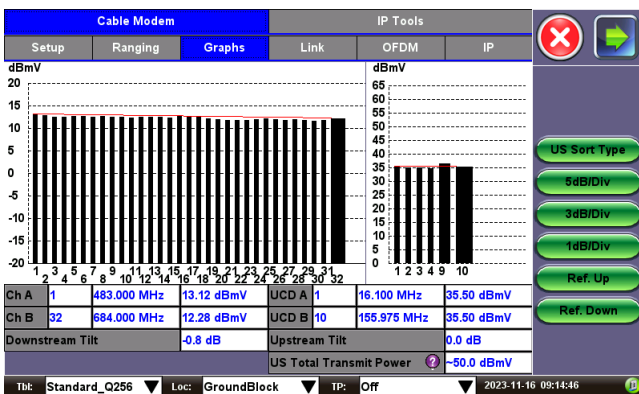
### Intuitive Ranging Results

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.

Cable Modem		IP Tools	
Setup	Ranging	Graphs	Link
Primary Freq	843.000 MHz	DOCSIS Mode	3.1
DS Lock Status	Pass	Bonding DS	32 Channels
US Sync	UCD (1)	Bonding US	2 Channels
US Ranging	46.20 dBmV	OFDM DS (1)	PLC - 642 MHz
DHCP	Pass	OFDM DS (2)	PLC - 1034 MHz
ToD	Pass	OFDMA US (1)	C/F - 156.03 MHz
Config File	^*1091218FB/	OFDMA US (2)	N/A
Registration	Pass	Downstream	UCD Transmit
BPI+Status	Enabled/Pass	Maximum	7.7 dBmV / 46.2 dBmV
Connection	Online	Minimum	3.3 dBmV / 43.5 dBmV
Status	Test Completed	Average	4.0 dBmV / 44.8 dBmV

### 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.

Cable Modem		IP Tools	
Setup	Ranging	Graphs	Link
Channel #	1	2	3
DS (MHz)	801.00	807.00	813.00
MSymbol/Sec	5.361	5.361	5.361
Modulation	QAM256	QAM256	QAM256
Level (dBmV)	5.5	5.1	4.5
MER (dB)	40.8	40.6	40.1
Pre BER	0.0e+00	0.0e+00	0.0e+00
Pre SEC	0	0	0
Post BER	0.0e+00	0.0e+00	0.0e+00
Post SEC	0	0	0

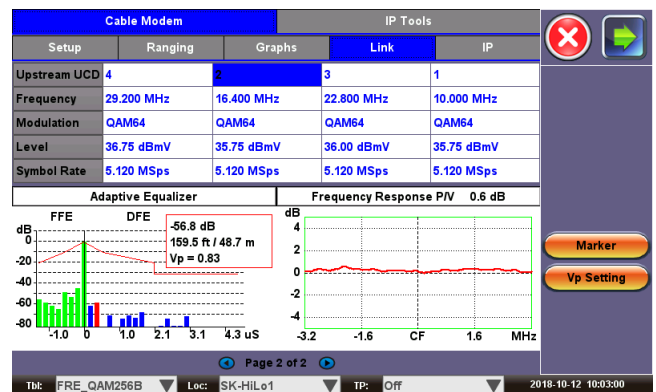
### Additional DOCSIS Modem Features

- 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.

Cable Modem		IP Tools	
Ping	Trace Route	ARPWiz	Results
PING: PASS			
Destination	216.58.194.196		
Send	10		
Received	10		
Network Unreachable	0		
Host Unreachable	0		
Port Unreachable	0		
Missing	0		
Round Trip (ms)			
Current	16	Average	17
MIN	15	MAX	19

### 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.

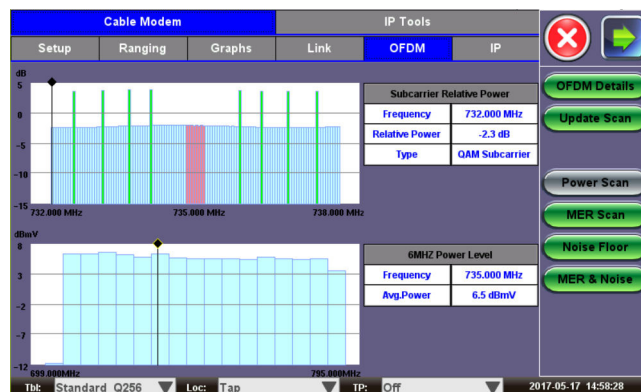
Cable Modem			IP Tools		
Setup	Ranging	Graphs	Link	OFDM	IP
Level (Avg)	6.5 dBmV	MER (Avg)	42.5 dB		
Level (Max)	6.6 dBmV	MER (Std Dev)	0.8 dB		
Level (Min)	6.5 dBmV	MER Percentile 02 %	40.8 dB		
PLC Frequency	642 MHz	Subcarrier Bandwidth	50 kHz		
OFDM Bandwidth	190 MHz	Active Subcarriers	3760		
Modulation (QAM)	Level (dBmV)	MER (dB)	C CWE	U CWE	
PLC	16	43.0		<1.00e-9	
NCP	16	42.7		<1.00e-9	
Profile A	25K	42.7	4.78e-05	<1.00e-9	
Profile B	1K	42.7	1.69e-01	<1.00e-9	
Profile C	2K	42.7	2.43e-01	<1.00e-9	
Profile D	4K	42.6	9.43e-01	<1.00e-9	
Profile E		N/A	N/A	N/A	

### OFDM Subcarrier Scans (Patented)

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.



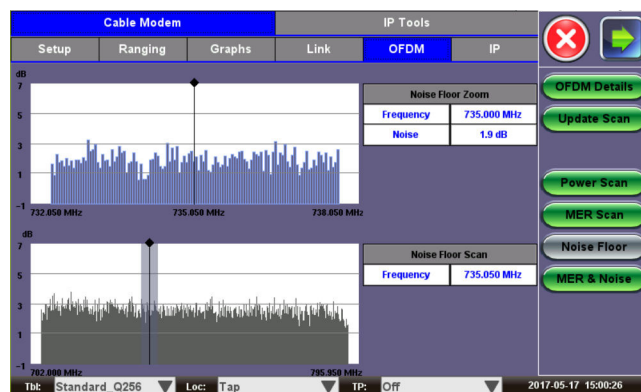
#### Subcarrier MER Scan

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



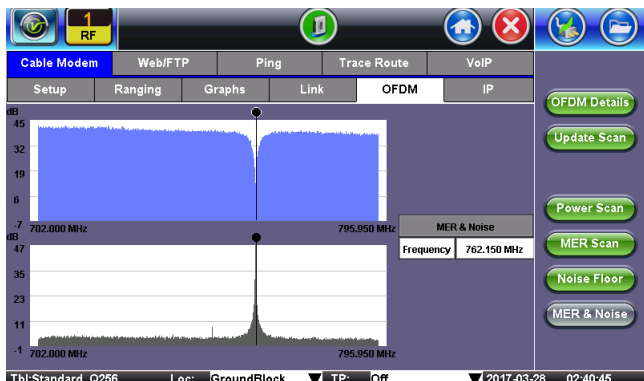
#### Subcarrier Noise Scan

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



### Detect Noise Under the OFDM Channel

The MER and Noise subcarrier scans can be overlaid 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.



## Throughput Testing

### VeTest

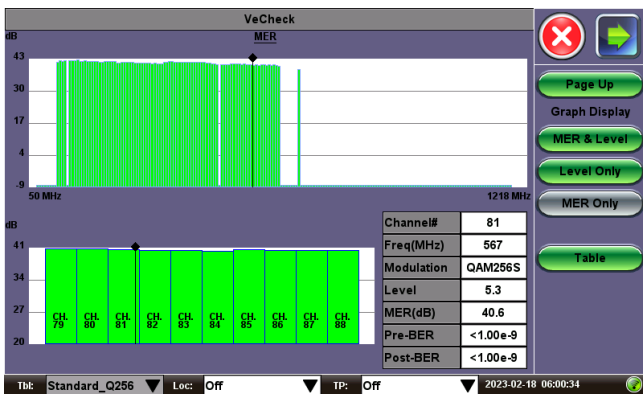
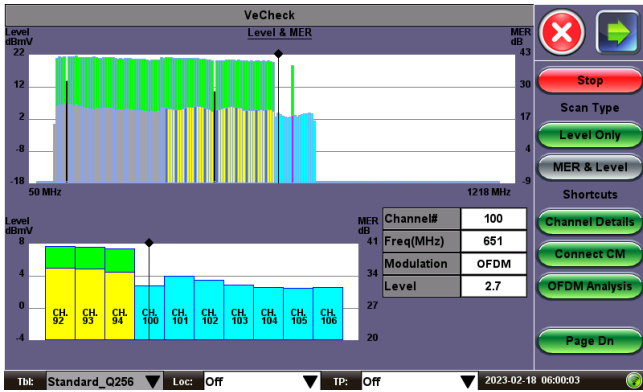
The VeTest feature qualifies network HTTP protocol performance by downloading and uploading files to a customer specific VeTest HTTP server. It can test up to the full line rate, depending on the server specifications and limitations. Connection time to the server, data transfer time, and line rate throughput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

Cable Modem		IP Tools	
Web/FTP	VoIP	Ping	Trace Route
Setup		Result	
Others   Atlanta 2   192.168.115.46:80			
Number of Active Test Engines		4 Active of 4 Configured	
Status		Pass	
Connection Time		8608 ms	
Total Data Transfer Time		60737 ms	
PING Test			
Ping Response		PASS 6.417 ms	
Throughput		Download Upload	
Line Rate - MAX		3563.384 Mbps 1092.267 Mbps	
Line Rate - AVG		3553.705 Mbps 1059.602 Mbps	
Data Rate - MAX		3412.505 Mbps 1083.674 Mbps	
Data Rate - AVG		3403.224 Mbps 1052.469 Mbps	

## 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.



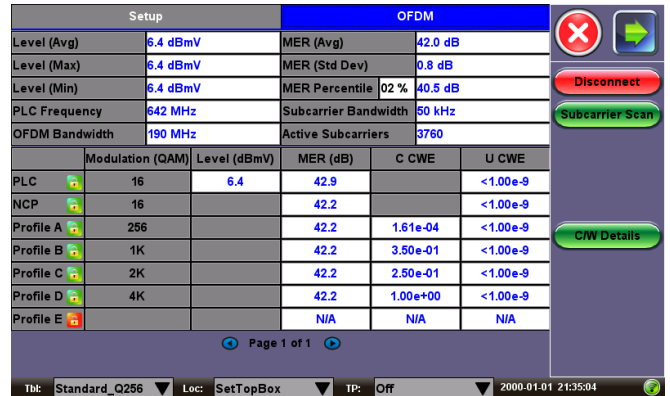
### OFDM Analysis

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.

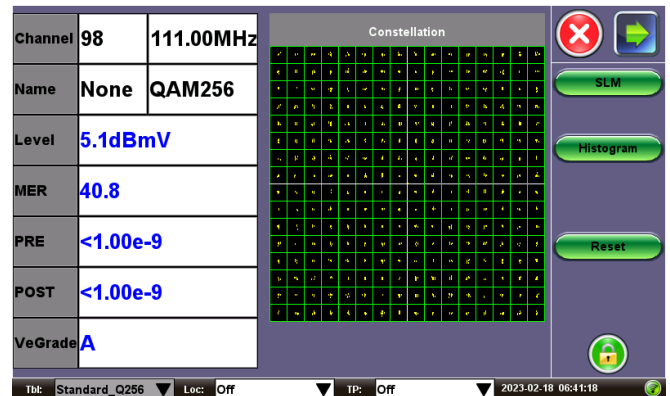


All OFDM measurements including the Subcarrier Power, MER, and Noise scans are available in this OFDM Check mode.



### Single Channel Measurement

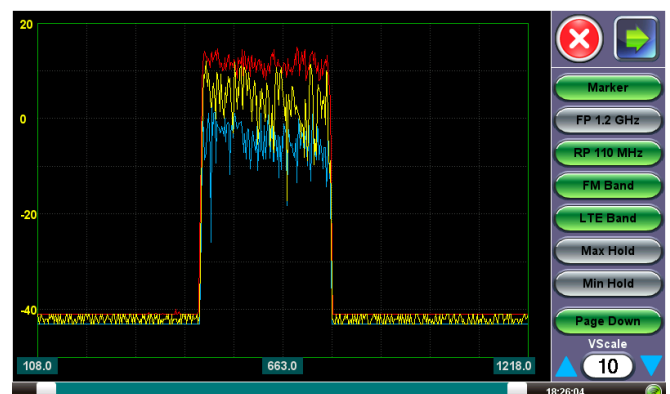
In **digital** mode, average power, MER, Pre-BER, Post-BER, Error seconds, VeGrade and constellation diagram are displayed. User programmable location thresholds and test point compensation are useful utilities enabling fast, simple and automated testing of carrier signals.



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.





## V-TEST Throughput

V-TEST Throughput Test supports VeEX Mode and Speedtest Powered™ Mode based on Ookla® technology.

The V-TEST feature qualifies network HTTP protocol performance by testing against a V-TEST HTTP server, up to the full line rate depending on the server specifications and limitations. V-TEST is supported for both the RF and Ethernet test interfaces.

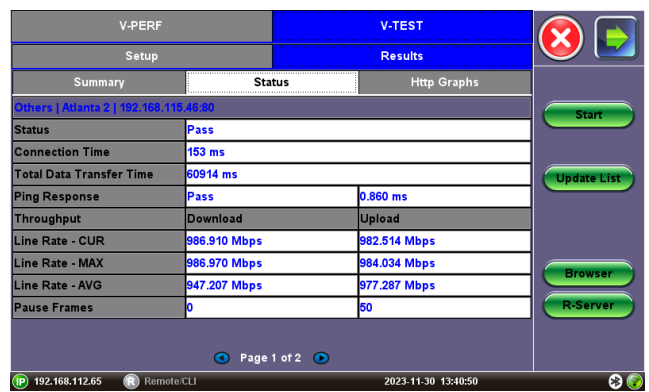
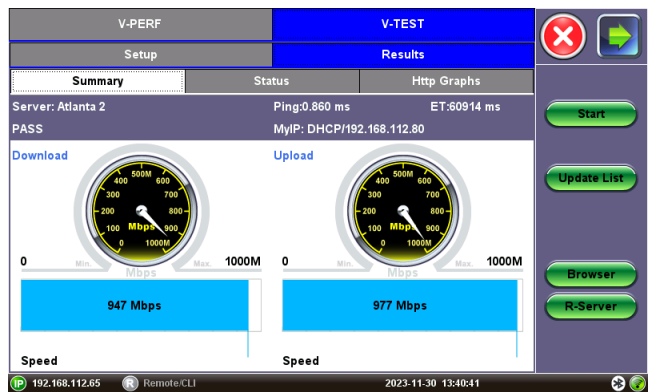
Connection time to the server, data transfer time, line rate and data rate are reported during the tests.

The V-TEST application is flexible enough to operate in different modes depending on user preference; VeEX Managed mode, Speedtest Powered mode based on Ookla technology, and User Managed mode.

In VeEX Managed mode, the customer’s servers are added to a customer server list that is maintained and managed by VeEX for the end-user’s ease of use and convenience. The full list of server IP addresses or URLs are provided to VeEX. Once added, all the user has to do is select the server from their company list and initiate the test to the selected server.

In Speedtest Powered mode, the test follows Ookla’s methodology and tests to the Speedtest® Server Network. In this mode, the test is compatible with Ookla’s protocol/methodology; it will scan nearby servers in the local market and test to the server with the fastest (lowest latency) response.

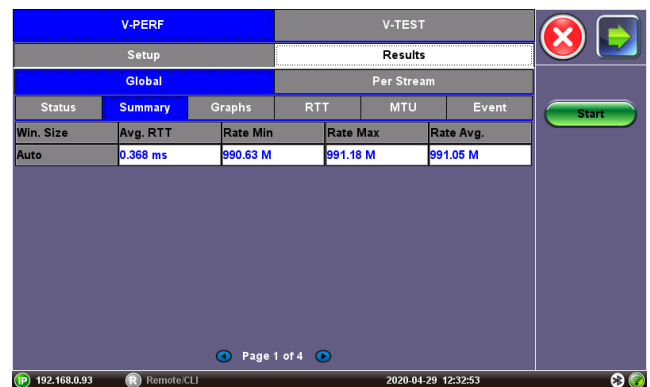
In User Managed mode, the user is allowed to enter the server IP/URL and save it to a server list that they can maintain and manage on their own.



## V-PERF TCP Test

A common source of customer complaints come from file transfer speeds not matching the throughput rates guaranteed in the SLA. While many factors affect TCP applications performance, including customer’s operating system hardware performance and settings (TCP window size), carriers need to prove SLA with a test tool that can show TCP performance independent of Operating System or Server limitations and present repeatable reliable results.

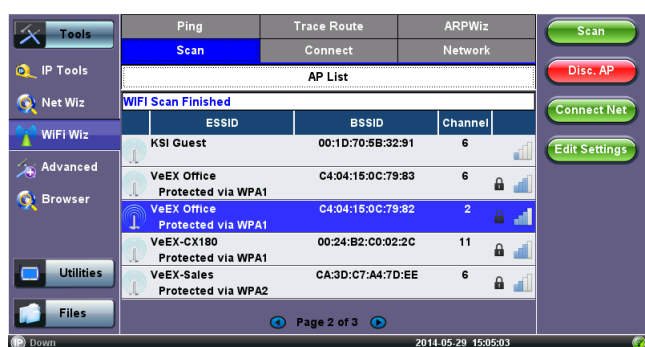
The V-PERF feature uses RFC6349 test methodology and metrics for qualifying network TCP performance. It offers a full line rate stateful TCP test with configurable window sizes, client and server modes as well as compatibility with iPerf servers.



## 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

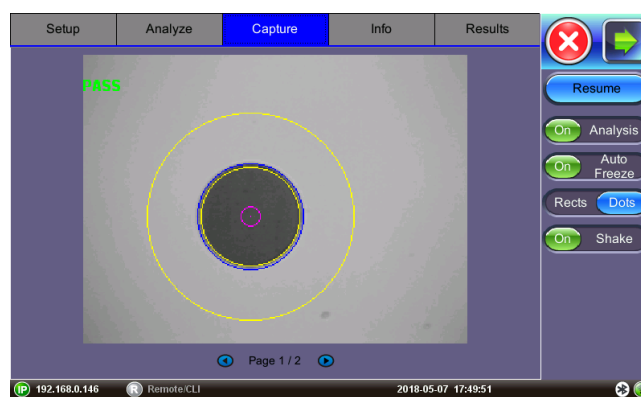
### Digital Fiber Inspection Scope

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)

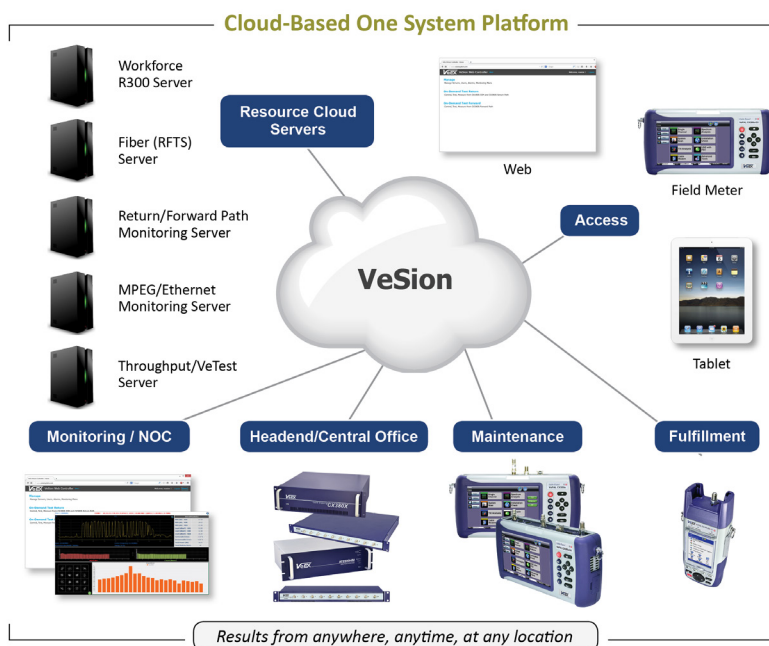
The VeEX OPX-BOXe is an ultra-compact OTDR that can be controlled by the CX310 using a WiFi, Bluetooth, or USB connection. Once connected or paired to an OPX-BOXe OTDR, the CX310 displays a virtual OTDR user interface that is used to remote control the unit and perform measurements. Since fibers are 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.





## VeSion 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

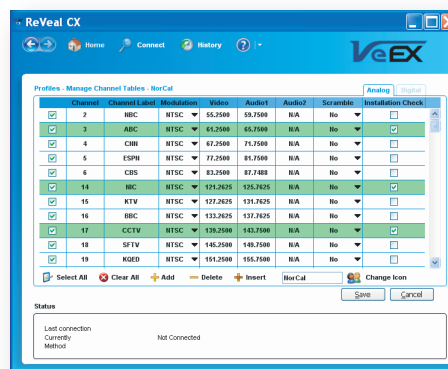
Authorized test sets register with specific ReVeal R300 Server/s to download new channel tables, test profiles, measurement thresholds and job cards. Test results can be uploaded via LAN, WiFi or DOCSIS connection running over the existing RF network. Signature Pad electronically captures the customer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



## 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 Automatic Switching Dual 85/204 MHz Diplexer (Patent Pending)
  - 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 Automatic Switching Dual 85/204 MHz Diplexer (Patent Pending)
  - 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 (max): Range from +49 to +68 dBmV, depending on US signal type and channel bonding configuration

OFDM

- OFDM input range: -20 dBmV to +20 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	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