VePAL CX380s-D3.1
Super-Tech Maintenance Tool for CATV

Platform Highlights

- Robust, lightweight chassis packed with powerful features for demanding environments and test conditions
- High resolution color 7” touch-screen with graphical user interface
- Ethernet LAN management port for remote control, back office applications and workforce management
- Fast and efficient test result transfer to USB memory stick or FTP upload via LAN, DOCSIS, USB WiFi, USB data modem or USB Bluetooth
- Maintain instrument software, manage test setups and channel tables, process measurement results and generate customer test reports using included ReVeal™ PC software
- Extend field testing time using interchangeable LiIon battery pack/s
- Ability to lock user interface to prevent unwanted human interference during long-term testing
- WiFi Wiz with InSSiDer SSID Analysis*
- WiFi Spectrum Analyzer*
- VoIP and IPTV*
- Digital Fiber Inspection Scope*
- OPX-BOX+ OTDR USB accessory*

Key Features

- True Spectrum Analyzer with 30 ms sweep time to capture fast transient and impulse noise
- Spectrum Analysis frequency range from 5 MHz to 1.2 GHz, with optional 1.8 GHz extension
- Comprehensive SLM measurements (Single Channel, System Scan, Tilt and Installation Check)
- MPEG Explorer: QAM channel MPEG-TS analysis*
- Upstream Generator* (CW, QPSK, QAM 16/64/128/256 modulation)
- Forward and Return path QAM measurements (MER, Pre/Post BER, Constellation diagram, Histogram and Equalizer on/off mode)
- Advanced Digital measurements* (HUM, EVM, Phase Jitter, Symbol Rate Error, Frequency Response, Group Delay)
- DOCSIS 3.0 Cable Modem with up to 32x8 Channel Bonding
- DOCSIS 3.1 Cable Modem*
- FCC POP including Digital POP*
- Ethernet up to 10 GigE with SLA validation tests including BERT, Throughput, RFC2544 and Y.1564 SAM*
- Headend Check auto test for the entire selected Channel Table lineup*
- VeTest Throughput*
- Full compatibility with CaLan 3010H+ Sweep System, for Forward Path to 1.8 GHz and and Return Path to 204 MHz*

*Optional features
**Advanced Digital Channel Analysis**

Digital pictures do not show signal impairment until it is too late because the margin between acceptable quality and failure is quite small.

**Constellation diagrams** – A valuable tool to help detect the presence of noise, phase jitter, interference, gain compression, laser clipping and ingress, all of which impact overall signal quality and thus reduces Modulation Error Ratio (MER). The Advanced Digital Analysis option has added in depth analysis of a QAM carrier with Phase Jitter, Group Delay, Symbol rate error, Frequency error, Maximum Amplitude Change, HUM, C/I, C/N and Frequency response measurements.

**Adaptive Equalization** – The built-in equalizer does a great job of improving MER of a QAM signal, but it is also important for technicians to know how hard the system is working to ensure adequate margin for system degradation. The adaptive equalizer in the CX380s-D3.1 can be turned off to make troubleshooting marginal amplifiers, ingress, CPD and related impairments easier.

**System Scan**

Within seconds, all analog and digital channels at a service location are measured. Signal parameters including channel number, channel name, frequency, modulation type and power levels are measured. Signal degradation or tilt can be easily pinpointed using on-screen markers and the zoom mode.

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.
Histogram Analysis

Noise impulses can suddenly disrupt a digital carrier but it’s difficult to detect without monitoring the carrier over a period time.

The histogram feature records level, MER, Pre-BER, Post-BER and Error Seconds on per second time bucket for up to 60 minutes. The results are shown in graphical format that allows easy correlation of measured parameters down to one-second resolution.

Tilt

Tilt measurements identify distortion over the frequency range allowing technicians to apply correct equalization or compensation to the HFC network. Up to eight analog signals and digital carriers including DOCSIS channels can be predefined on a channel table and selected to perform the tilt measurement. The measurement can be performed between the lowest and highest channel or any user selectable channel by tapping the applicable bar on screen.

FCC POP

Proof of Performance tests are required by the FCC for MSOs to periodically prove their analog networks are within specified guidelines for performance. Carriers’ networks evolving to all-digital necessitates Digital POP tests.

The optional FCC POP Feature consists of various Auto Tests, including Digital POP and 24-Hour Analog Levels. Test Channels are based on a user configurable Channel Table. Standard test results are supported in both CSV and PDF Formats.

Installation Check

Up to 16 analog and 16 digitals are checked against preset location thresholds. The feature is particularly useful to verify and turn up of service at new installations or after service is restored, Pass and fail conditions are color coded for easy interpretation and test results are clearly displayed. This automatic test procedure adds consistency to the final service qualification. The CX380s-D3.1 can store up to 20 channel tables each of with can be pre-programmed with channels to be used for installation check.

Headend Check

The optional Headend Check feature is a more in-depth Installation Check. There is no channel limit, as it tests all of the channels that are configured and enabled in the selected Channel table. Key metrics are Level, MER, and BER for each Channel.
True Spectrum Analyzer

The CX380s-D3.1 offers a true Spectrum Analyzer, vastly superior to SLM-based measurements found in typical field meters. It incorporates advanced DSP technology to capture transient ingress across a wide frequency range, with 60 dB dynamic range. Adjustable sweep time, RBW and VBW settings optimize signal representation and noise floor performance. The default frequency range is now 5 MHz to 1200 MHz. An extended frequency range option to 1800 MHz is available, fully supporting the DOCSIS 3.1 specification.

The large 7” high resolution TFT LCD features a fast refresh rate, preserving and displaying the finest spectrum details. Touch-screen control allows rapid on-the-fly changing of test parameters and simplifies measurements while horizontal and vertical markers and min/max hold displays signal values instantly and varying signal parameters over time.

Test profiles consisting of user-settable parameters such as CF, Span, RBW, VBW and Marker positions can be saved and recalled for repeated testing. Waveform storage enables a user to compare and contrast a captured signal versus a current measurement, in both superimposed or split screen views.

Laser Clipping

Ingress and impulse noise can cause signal clipping when upstream fiber amplifier inputs are presented with excessive power levels. As more carriers are added to the return path using channel bonding, composite power to the laser will increase.

Common Path Intermodulation Distortion (CPID/CPIM)

Spurious signals appearing in the upstream composed of distortion products of the downstream signals. Lower frequency components are passed through the diplex filter and amplified by the return amplifier. Common Path Distortions are intermittent by nature and are directly related to poor connections, corrosion, kinks and radial cracks in the cable.

Upstream Ingress

The return path is more susceptible to RF impairments because this frequency spectrum is heavily used for Ham and Citizen BAND radio transmissions. Interference is not only limited to RF transmissions; Impulse noise generated by electric motors, switches, lightning strikes, high voltage power lines, vehicle ignitions, or household electrical appliances at the subscriber premise are particularly damaging to data transmissions where short bursts of interference can seriously reduce data throughput.

The return path is also very vulnerable to a phenomenon known as Noise funneling. The summation of all unwanted noise (Gaussian, ingress and impulse noise) coming from both subscribers and the cable plant itself affects the return transmission system and needs to be monitored.
DOCSIS® 3.1/3.0

DOCSIS 3.1/3.0 Modem Emulation
Equipped with a 32x8 DOCSIS 3.0/3.1 Cable Modem, the CX380s-D3.1 enables technicians to perform actual modem connection tests, without having to carry a separate modem on service calls.

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, SNR, 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.
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 Check**

The OFDM Check feature allows for true OFDM Signal Analysis without having to go online in Cable Modem mode. This is extremely valuable if the DOCSIS signal is impaired or is not available, which can be the case at some test points. OFDM Check only requires locking on the downstream PLC signal and provides a wealth of OFDM measurements.
VeTest Throughput

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.

IPv6 Support and Network Server Verification

Once successful upranging is complete, the DOCSIS modem registers with the Cable Modem Termination System (CMTS) and checks for an IPv6 address before looking for an IPv4 address. IP addresses from the network servers (DHCP, TFTP, TOD and DNS) are discovered and clearly displayed.

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 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.
**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.

**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.

**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.

**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.

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**Testing Premise**

From the Customer Premise, test directly at the RF interface or through the real Cable Modem’s Ethernet interface. At the CATV Headend office, connect a MPX100 or any other VeEX Ethernet test set behind the CMTS. Here the MPX functions as a Responder, with only an IP address needed to be configured on the test port. The CX380s-D3.1 functions as the Controller via the RF or Ethernet interface, running the RFC2544 Asymmetric test suite.

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**Ethernet over DOCSIS**

Today’s cable operator network infrastructure, which combines a 40G/10G backbone with DOCSIS 3.0 over HFC, has strongly positioned MSOs to offer business class Ethernet based services to small and medium businesses. Key service offerings include guaranteed data, hosted voice, online backup and security, and other cloud based services.

Using its built-in Ethernet test traffic engine, the CX380s-D3.1 can generate traffic over the DOCSIS test port to verify bi-directional, end-to-end DOCSIS throughput rates with a far-end Ethernet test device. Verification is done from the Customer Premise to the Headend CMTS.

In Ethernet over DOCSIS mode, the CX380s-D3.1 emulates the Cable Modem and simulates the customer’s Ethernet traffic, up to maximum DOCSIS 3.0 throughput rates. This unique capability is ideal for MSOs to verify their Metro and Carrier Ethernet Service offerings.

**True Gigabit Ethernet Throughput SLA**

Actual Cable Modem CPE verification can be performed by connecting the CX380s-D3.1’s Ethernet test port to the Cable Modem’s Ethernet port and generate test traffic to the far-end Ethernet test device connected behind the CMTS.

**Benefits**

- The Asymmetric RFC2544 test suite offers an automated verification of throughput rates.
- The Throughput application enables for deeper troubleshooting and verification with differentiation of traffic flow types (Constant, Ramp and Burst) and different frame size configurations.
MPEG Explorer

Cable Operators nowadays have to ensure that both the RF characteristics and digital payload of their QAM carriers are within defined limits, and simply viewing the QAM carrier “hay stack” is not enough to evaluate the protocol layer. The CX380s-D3.1 MPEG Explorer option extracts MPEG Transport Stream payloads from the QAM carrier and decodes them to check transport and programming content.

MPEG-TS Analysis

Detects the number of MPEG programs per channel. Provides PID MAP and streams information. Per program video, audio, and data streams rates and received packets count. Per stream PID numbers and Codec information.

Encryption Detection

Detects the encryption status of each stream (video and audio)

TR 101 290 Support

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

<table>
<thead>
<tr>
<th>MPEG Transport System Analysis Summary</th>
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</thead>
<tbody>
<tr>
<td>Test Result</td>
</tr>
<tr>
<td>PMT PID</td>
</tr>
<tr>
<td>#PIDs</td>
</tr>
<tr>
<td>Video Packet Statistics</td>
</tr>
<tr>
<td>Audio Packet Statistics</td>
</tr>
<tr>
<td>TR 101 290</td>
</tr>
<tr>
<td>PID Map</td>
</tr>
<tr>
<td>Encryption Status</td>
</tr>
</tbody>
</table>
Upstream Signal Generator (USG)

Evaluate the bandwidth and noise performance characteristics of the reverse path with a choice of CW, QPSK, 16 QAM, 64 QAM and 128 QAM modulation types using industry standard symbol rates. Transmitting a known reference signal between 5-65 MHz (Annex A) or 5-42 MHz (Annex B) into the reverse path at a user defined power level and modulation, allows a technician to evaluate phase and amplitude distortions resulting from any misalignment present in the network. Injected reference signals can be used to determine the headroom in the reverse path and to identify laser clipping resulting from signal overload.

The USG function fitted with Forward Error Correction (FEC) capability, is compatible with the Return Path analysis options found on other VeEX products, including the CX180R RPM System, CX3XX Series and CX150-D3+ CATV test sets, as well as select 3rd party CATV QAM analyzers. Depending on the companion analyzer used, Digital channel power, MER (equalized and unequalized), Pre/Post FEC, EVM, Phase Jitter, Hum, Group Delay and Symbol rate errors can all be evaluated. These tests are invaluable to characterize the in-channel flatness, in-channel group delay and adaptive equalizer operation.
Return Path Sweep

The CX380s-D3.1 incorporates a sweep transmitter (USG) capable of generating sweep tones over a 5 MHz to 65 MHz frequency range with 125 kHz resolution, and amplitude levels ranging from 0 to 58 dBmV with 1 dB resolution.

When paired with a companion CX380 Series handheld unit or a CX180R RPM System located in the Headend, the entire return path frequency spectrum can be precisely characterized for DOCSIS 3.0 communications. Protection “Guard Bands” can be pre-configured to prevent test tones interfering with active DOCSIS transmissions.

The sweep system communicates the user defined sweep tables and measured test data over the Internet, freeing up valuable downstream bandwidth typically used by conventional telemetry systems found in competitor systems.

Remote View

Return path troubleshooting and testing is simplified when the CX380 Series is equipped with the Remote View option.

Utilizing a wired (10/100BaseT or DOCSIS) or wireless (3G UMTS or 802.11 WiFi) Internet connection, a technician operating the unit in the field is able to view real time measurements being performed by the companion CX380 Series or CX180R RPM System located in an upstream Node or Headend itself.

Developed specifically for dual ended test applications, evaluating MER, BER and Constellation and other advanced measurements like group delay and frequency response is extremely fast and convenient. In addition to sweep, real-time return path ingress measurements performed in the Headend by the CX380s-D3.1 or CX180R spectrum analyzer can also be viewed, thus making it a truly unique solution for upstream testing and characterization.
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 CX380s-D3.1 is possible over the DOCSIS Cable Modem and 10/100Base-T Ethernet test ports, while a subset of these tools is available using the USB WiFi adaptor.

VoIP Testing

Take advantage of software options offering different test methods to verify and provision your VoIP network.

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

The VoIP check mode tests the network readiness for VoIP without placing an active VoIP call. This mode allows for service verification before SIP/H.323 infrastructure is in place or if credentials are not known. This test focuses on packet transmission quality and metrics by sending traffic (ICMP Ping) matching VoIP call traffic properties.

**VoIP Expert** – VoIP Expert is a simple and effective tool for pre-qualifying VoIP service and verifying triple play implementations.

The VoIP Expert Client/Server mode allows a test set connected to a VX1000 server to exchange upstream and downstream files to exercise the connection under VoIP calls conditions.

Bi-directional Mean-Opinion-Score (MOS), Transmission-Rating-Factor (R-factor) and other critical network related parameters are measured and test results are displayed on both field test units and the VX1000 software. The VX1000 software can be installed on any server and accepts up to 16 simultaneous VoIP test calls from compatible VePAL100+/300 series products.

**VoIP Call Expert** – Emulates an IP phone to place and receive calls using SIP or H.323 protocols. Real-time evaluation of voice quality with a complete set of measurements is available at the end of the call, including packet statistics, jitter statistics, and MOS and R-factor call quality scores. Support VoIP trunk test with bulk call generation of up to 24 simultaneous calls.

**VoIP Testing**

- **Codecs**: G.711 μ-law, G.711 A-law
- **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

*Note: these optional features require the Cable Modem or Ethernet option.*
IPTV Explorer

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

Media-Stream-Based Algorithm

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

- **Frame structure/GoP detection** – Identifies I, B and P frames in both unscrambled and encrypted video streams, to determine GoP length and the rate and distribution of packet loss in each frame
- **Per-frame quality computation** – Quality in each frame using the frame type, frame size, codec type, bandwidth and packet loss data. For P and B frames, TX300S models the loss propagated from earlier reference (I or P) frames
- **Bandwidth estimation** – the bandwidth used by certain types of video frames is analyzed to estimate the quantization level applied by the video encoder

Program Identifier (PID) Statistics

PID statistics provide critical information about the MPEG transport stream. The bandwidth and packets associated with each individual stream are listed allowing the technician to check the video, audio and data content and to check for any “illegal” PIDs.

Transmission Quality Score

QoS parameters are evaluated and presented in an intuitive manner so that technicians unfamiliar with MPEG signals are able to make accurate decisions to ensure maximum service availability.

- Audio and Video MOS scores associated with the particular video/audio codec used and transmission quality are reported
- VSTQ (Video Service Transmission Quality), is a codec-independent scoring that rates the ability of the network to reliably transport video
- ETSI TR 101 290 metrics are good indicator of transport associated errors

Requires Ethernet option

Mode: Monitor

Stream configuration: Unicast, multicast, IP address, Port number

Codescs: MPEG2, MPEG4 (Part2) and MPEG4 Part10 (H.264)

Probe function with streams auto-detection

IPTV image viewer for channel identification (does not decode encrypted streams)

Stream Analysis

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

Video Analysis

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

Audio Analysis

- MOS_Audio

TR 101 290 Metrics

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

WiFi Spectrum Analyzer*

The CX380s-D3.1 offers a powerful portable spectrum analyzer on a USB dongle that displays all RF activity in the WiFi bands. With dual 2.4 GHz and 5 GHz bands support, the analyzer covers all 802.11a/b/g/n/ac networks and is the ideal tool for enterprise environments with a mix of wireless technologies.

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

Supports 802.11 a/b/g/n/ac

Frequency Range: 2.400 to 2.495 GHz and 5.150 to 5.850 GHz

Amplitude Range: -100 to -6.5 dBm

Antenna: RP-SMA

Planar, topographic, spectral view
**WiFi InSSIDer**

The WiFi InSSIDer provides the best tools for WiFi networks discovery and performance troubleshooting. With compatible USB 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

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**WiFi Wiz**

The WiFi Wiz function with USB 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.).

Requires compatible USB WiFi adapter for a/b/g/n/ac networks in 2.4 GHz and 5 GHz bands

Access Points scan with signal level and link quality measurement

WEP/WPA1/WPA2 encryption

IP Connectivity test (Ping, trace route, ARP/Wiz, Web browser) Provides WiFi LAN access to the test set (e.g. VeExpress, R-Server, Remote Control, ReVeal)

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**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**

Supports USB OPM dongles

The optional OPM helps checking for proper output power from optical ports before safely making an optical connection or running a test
- Numerical and bar graph readings
- Hold function
- Display Units: dBm, mW and μW
- User definable Maximum and Minimum power limits, with color-coded Pass/Fail indication
- Optical Loss Meter function with zero reference calibration
- Loss limit settable in dB, dB/km and dB/mi

** OPM dongle sold separately. For available Wavelength Range, Calibrated Wavelengths, Power Range, Accuracy and Connectors, refer to the USB dongle specs
ReVeal CX300 PC Software

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 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.

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.

Advanced Management

Authorized test sets register with specific VeSion R300 Server/s to download new channel tables, test profiles, measurement thresholds and job cards. Test results can be uploaded via LAN interface 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
**Options**

**Upstream Signal Generator**

**CW Generator**
- Frequency Range: 5 MHz to 65 MHz
- Level Range: 0 to +58 dBmV
- Level Accuracy: ± 1 dB
- Level Adjustable Step: ± 1 dB
- Frequency Adjustable Step: 125 kHz/step
- Frequency Accuracy: 5 ppm
- Settling Time: less than 2 ms

**QAM Generator**
- Modulation Type: QAM 16/64/128/256 Annex A/B
- Symbol Rate: 1.28 MHz, 2.56 MHz, 5.12 MHz, programmable to 7 MHz
- Frequency Range: 5 to 65 MHz
- Level Range: 0 to +58 dBmV
- Level Accuracy: ± 1 dB
- Level Adjustable Step: ± 1 dB
- Frequency Adjustable Step: 250 kHz/step
- Frequency Accuracy: 5 ppm
- Settling Time: less than 5 ms

**Return Path QAM Analysis**
- Modulation: QPSK, QAM 16/64/256
- Symbol Rate: 1.28 MHz, 2.56 MHz, 5.12 MHz, programmable
- Minimum QAM Locking Level: -15 dBmV typical
- Constellation Diagram
- MER Range: 22 dB to > 40 dB, ± 1.5 dB
- Adaptive Equalizer Display
- Pre & Post BER Range: 0 to 9 x 10^-3
- Errored and Severely Errored Seconds
- Histogram Analysis: up to 60 min per minute and per second
  - MER, Pre BER, Post BER, Errored Sec, Severely Errored Sec
- Timed Stats

**Digital Channel Measurement**
- Level Range: -50 dBmV to +60 dBmV
- Level Accuracy: ± 1.5 dB
- Level Resolution: 0.1 dB
- Modulation: QAM 16/64/256, Annex A/B/C
- Symbol Rate: 1 to 7 MHz programmable
- Constellation Display: QAM 16/64/256 with zoom
- Minimum QAM Locking Level: -15 dBmV
- Adaptive Equalizer Display
- MER Range: 22 dB to > 40 dB, ± 1.5 dB
- Adjacent Channel
- Pre & Post BER Range: 0 to 9 x 10^3
- Errored and Severely Errored Seconds
- Histogram Analysis: up to 60 min per minute and per second
  - MER, Pre BER, Post BER, Errored Sec, Severely Errored Sec

**Spectrum Analysis**
- Span: 5 MHz to 1.2 GHz, with optional extension to 1.8 GHz, zero span
- Resolution Bandwidth: 1 MHz, 300 kHz, 100 kHz, 30 kHz, 10 kHz
- Video Bandwidth: 1 MHz, 100 kHz, 10 kHz, 100 Hz
- Minimum Sweep Time: 30 ms

**Other Measurements**
- System Scan: typical 30 seconds
- Tilt: up to 8 Analog plus 8 Digital channels
- Programmable Pass/Fail Threshold: 10 sets
- Programmable Channel Table: 20 tables
- Test Point Compensation: 10 sets
Cable Modem DOCSIS 3.0/3.1 cont’d

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

**Ethernet**

**Interfaces**

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

Single 1GE and 10GE LAN/WAN SFP+ optical Ports: LC connectors

**1000Base-SX**

- Wavelength: 850 nm
- TX level: -9 to -3 dBm
- RX level sensitivity: -20 dBm
- Max reach: 550m
- TX bit rate: 1.25 Gbps
- RX bit rate: 1.25 Gbps
- Jitter Compliance: According to IEEE 802.3 recommendations

**1000Base-LX**

- Wavelength: 1310 nm
- TX level: -9.5 to -3 dBm
- RX sensitivity: -22 dBm
- Max reach: 10 km
- TX bit rate: 1.25 Gbps
- RX bit rate: 1.25 Gbps
- Jitter Compliance: According to IEEE 802.3 recommendations

**1000Base-ZX**

- Wavelength: 1550 nm
- TX level: 0 to +5 dBm
- RX sensitivity: -22 dBm
- Max reach: 80 km
- TX bit rate: 1.25 Gbps
- RX bit rate: 1.25 Gbps
- Eye Safety: Class 1

**Ethernet Features**

- Auto Negotiation
- Full and Half Duplex
- Flow Control

**Modes of Operation**

- Terminate
- Monitor
- Pass through
- Loopback

**Traffic Generation**

- IEEE 802.3 and Ethernet II (DIX) frames
- Configurable MAC, Ethernet Type, VLAN, MPLS, IP, UDP header fields
- Constant, Ramp, and Burst traffic profiles with configurable bandwidth % utilization
- Jumbo Frame Support (10,000 bytes)
- Fixed, multiple and random frame size generation
- Traffic prioritization via VLAN priority field, MPLS CoS field and the IP TOS/DSCP fields
- Up to 3 VLAN and MPLS tags can be added to each user configured traffic stream

**RFC2544 Compliance Testing**

- Automated tests 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

**Bit Error Rate Testing**

- Patterns: PRBS 2^{23}-1, PRBS 2^{20}-1, PRBS 2^{15}-1, PRBS 2^{11}-1, CRPAT (Layer 1 only), CSPAT (Layer 1 only), CRTPAT (Layer 1 only), Normal and inverted patterns
- Error Injection: Bit, CRC, Symbol, IP Checksum
- One configurable stream with one fixed frame size

**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 with configurable MAC, VLAN, MPLS and IP fields including traffic prioritization via the VLAN tag priority field and the IP header TOS/DSCP field
- % of bandwidth allocation is configurable for each stream
- Different traffic profiles (constant, ramp or bursty) may be configured for different streams
- Different frame sizes are user configurable per stream

**Smart Loop**

- Layer 1: loops back all incoming traffic
- Layer 2: all incoming unicast traffic is looped back with MAC source and destination addresses swapped
- Layer 3: all incoming unicast traffic is looped back with MAC and IP source and destination addresses swapped
- Layer 4: all incoming unicast traffic is looped back with MAC, IP and UDP/TCP ports swapped

**Key Measurements**

- Error Measurements: Bit, CRC, symbol, IP checksum, jabber frames, runt frames, collisions, late collisions
- Alarm Detection: LOS, pattern loss, service disruption
- Frame/Packet Statistics: Multicast, broadcast, unicast, pause frames, frame size distribution, bandwidth utilization, frame rate, line rate, data rate, frame loss, frame delay variation
# General Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size</td>
<td>290 x 140 x 66 mm (W x H x D)</td>
</tr>
<tr>
<td></td>
<td>11.40 x 5.50 x 2.60 in</td>
</tr>
<tr>
<td>Weight</td>
<td>Less than 2.5 kg (less than 5.5 lb)</td>
</tr>
<tr>
<td>Battery</td>
<td>LiIon smart battery</td>
</tr>
<tr>
<td></td>
<td>5200 mAh 10.8VDC</td>
</tr>
<tr>
<td>Battery Operating Time</td>
<td>&gt; 4 hours continuous measurement</td>
</tr>
<tr>
<td></td>
<td>&gt; 9 hours idle</td>
</tr>
<tr>
<td>AC Adaptor</td>
<td>Input: 100-240 VAC, 50-60 Hz</td>
</tr>
<tr>
<td></td>
<td>Output: 15 VDC, 6A</td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>0°C to 45°C (32°F to 122°F)</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>-20°C to 70°C (-4°F to 158°F)</td>
</tr>
<tr>
<td>Humidity</td>
<td>5% to 95% non-condensing</td>
</tr>
<tr>
<td>Display</td>
<td>7” full color touch-screen display</td>
</tr>
<tr>
<td>Ruggedness</td>
<td>Survives 1m (3 ft) drop to concrete</td>
</tr>
<tr>
<td>Interfaces</td>
<td>USB 2.0, RJ45, 10/100-T Ethernet, Bluetooth 2.0 (optional)</td>
</tr>
<tr>
<td>Languages</td>
<td>Multiple languages support</td>
</tr>
</tbody>
</table>

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