USER MANUAL

VePAL CX380s-D3.1

Advanced All-In-One Installer Meter

Please direct all questions to your local VeEX Sales Office, Representative, or Distributor. Or, contact VeEX technical support at www.veexinc.com.

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1.0 About This Manual

Every effort was made to ensure that the information contained in this user manual is accurate. Information is subject to change without notice and we accept no responsibility for any errors or omissions. In case of discrepancy, the web version takes precedence over any printed literature.

This device uses software either developed by VeEX, Inc. or licensed by VeEX, Inc. from third parties and is confidential and proprietary of VeEX, Inc. The software is protected by copyright and contains trade secrets of VeEX, Inc. or VeEX's licensors. The purchaser of this device agrees that it has received a license solely to use the software as embedded in the device, and the purchaser is prohibited from copying, reverse engineering, decompiling, or disassembling the software.

This user manual is suitable for novice, intermediate, and experienced users and is intended to help you successfully use the features and capabilities of the VePAL CX380S-D3.1 test set. It is assumed that you have basic computer experience and skills, and are familiar with IP and telecommunication concepts, terminology, and safety.

For more technical resources, visit VeEX, Inc. web site at www.veexinc.com.

If you need assistance or have questions related to the use of this product, call or e-mail our customer care department for customer support. Before contacting our customer care department, you must have your product serial number and software version ready. Please provide this number when contacting VeEX customer service.

Customer Care:

Phone: + 1 510 651 0500
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Website: www.veexinc.com

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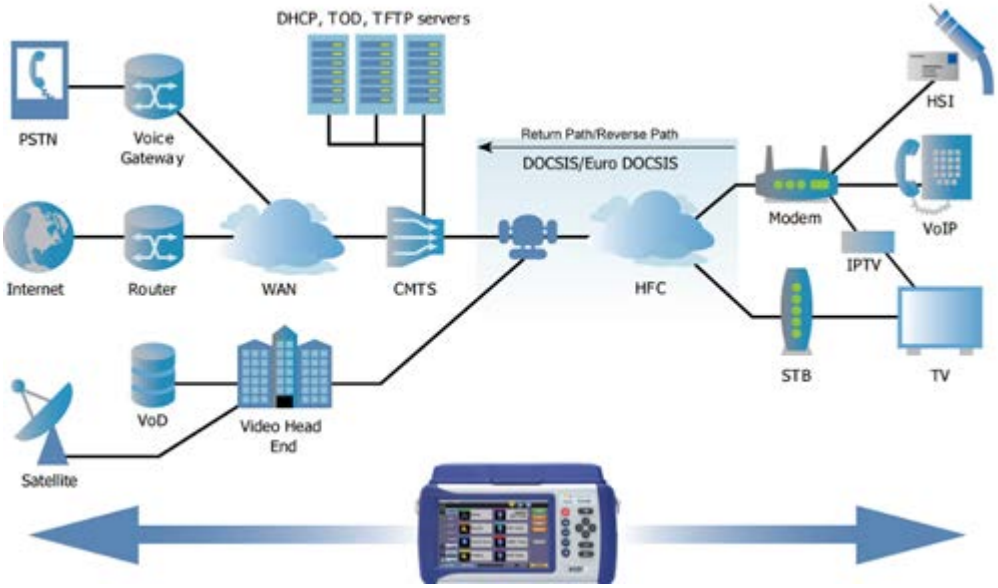
2.0 Introduction to CX380S-D3.1

The VeEX® VePAL CX380S-D3.1 is a next generation test solution for analog and digital cable TV networks. The unit is a lightweight and rugged instrument featuring Analog and Digital signal level meter capabilities and is equipped with enhanced spectrum, forward and return path analysis functions. The unit can be equipped with an optional DOCSIS 3.1/3.0 Cable Modem to validate DOCSIS and EuroDOCSIS based networks. Equipped with an Upstream QAM Signal Generator (USG), the unit is able to perform advanced reverse path QAM analysis and return path sweep.

The VePAL CX380S-D3.1 also supports optional 1 Gigabit and 10 Gigabit test ports. The test set can be used as an Ethernet tester supporting BERT, Throughput and RFC2544 applications.



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3.0 Safety Information

Safety precautions should be observed during all phases of operation of this instrument. The instrument has been designed to ensure safe operation however please observe all safety markings and instructions. Do not operate the instrument in the presence of flammable gases or fumes or any other combustible environment. VeEX Inc. assumes no liability for the customer's failure to comply with safety precautions and requirements.

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4.0 Basic Operations

The unit is powered on and off from the red key on the keypad area. In order to turn off the unit, press the Power key for at least two seconds. If the unit is not responding, holding the Power key down for more than 10 seconds will force the unit to power down.

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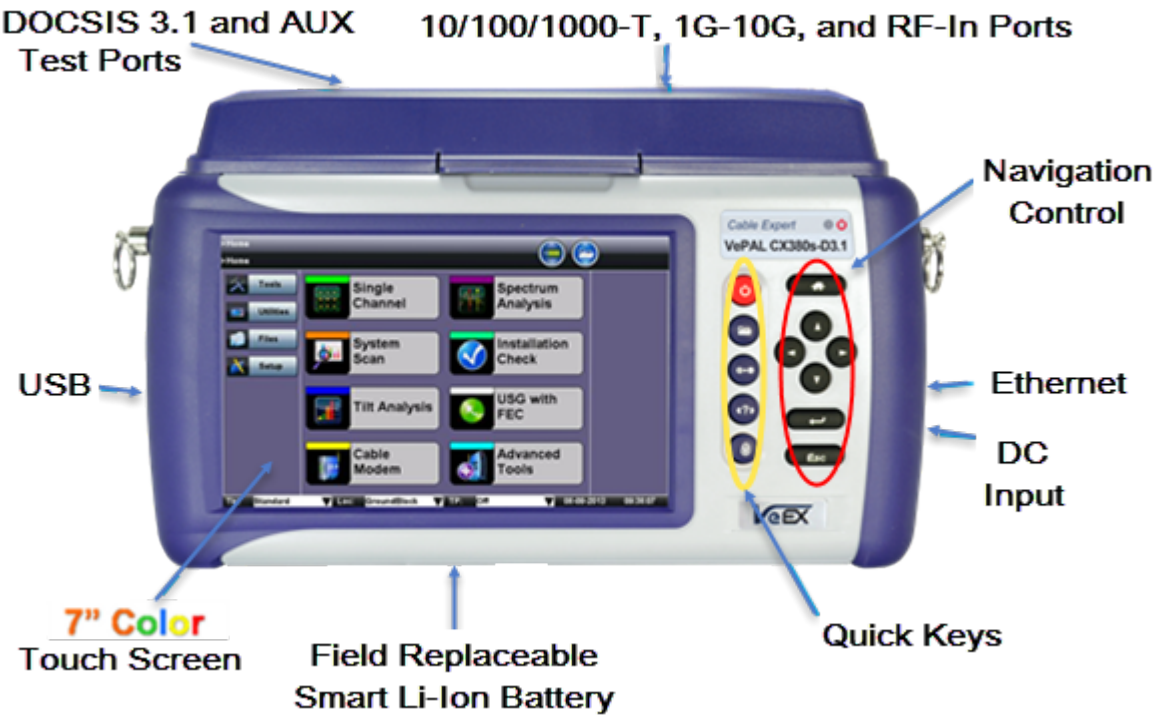
4.1 Compact Platform Overview



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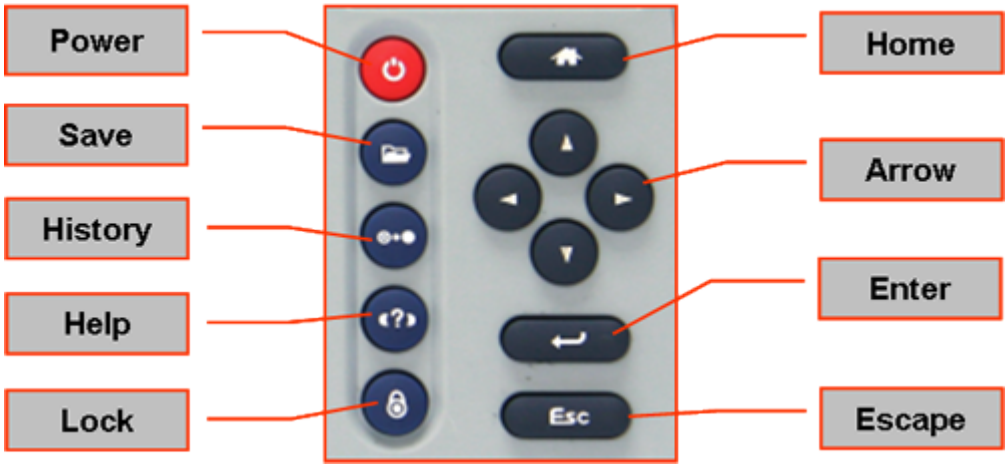
4.2 Keypad

The keypad comprises the following keys:



- **Power** key: The unit is powered on and off from the red key on the keypad. The button is recessed to prevent accidental power on. Press the key for 3-5 seconds to turn the unit on. To turn off the unit, press the Power key for at least two

seconds. If the unit does not respond, holding the Power key down for more than 10 seconds will force the unit to switch off.

- **Save** key: Saves test results in the unit's memory. If the measurement is still running, it will provide a snapshot the moment the key is pressed. The Save function provides automatic storage with automatic naming and time stamping function. To process a stored file, please go to Files.
- **History** key: Resets any blinking LED due to a history condition.
- **Help** key: Brings the user to online help, regardless of the current user interface location of the unit.
- **Lock** key: Can be configured to lock the keypad or capture the current screenshot.
- **Home** key: Brings the unit to its home menu regardless of its location on the user interface.
- **Arrow** key: Moves the cursor in any of the four supported directions (left, right, up, down). The Arrow key works in conjunction with the Enter and Escape keys.
- **Enter** key: Provides an enter sequence to the user interface. It is used in non touch screen operation mode to enter menus and functions.
- **Escape** key: Provides an escape sequence to the user interface. It is used in non touch screen operation mode to escape menus and functions.
- **Color Scheme:** Press the 'Esc' key for three seconds. This will switch to a 'High Contrast' mode, which makes the screen more suitable for outdoor visibility. Press the 'Esc' key again for three seconds to switch back to standard mode. This selection can also be made in: *Global/General Setting*.
- **Power Save Sleep Mode**: From the Home Screen, press the 'Home key' for three seconds. The unit will enter Sleep mode, shutting down most functions. You can check battery status by pressing the 'Enter' key for one second. To restore normal operation, press the 'Home' key for three seconds.

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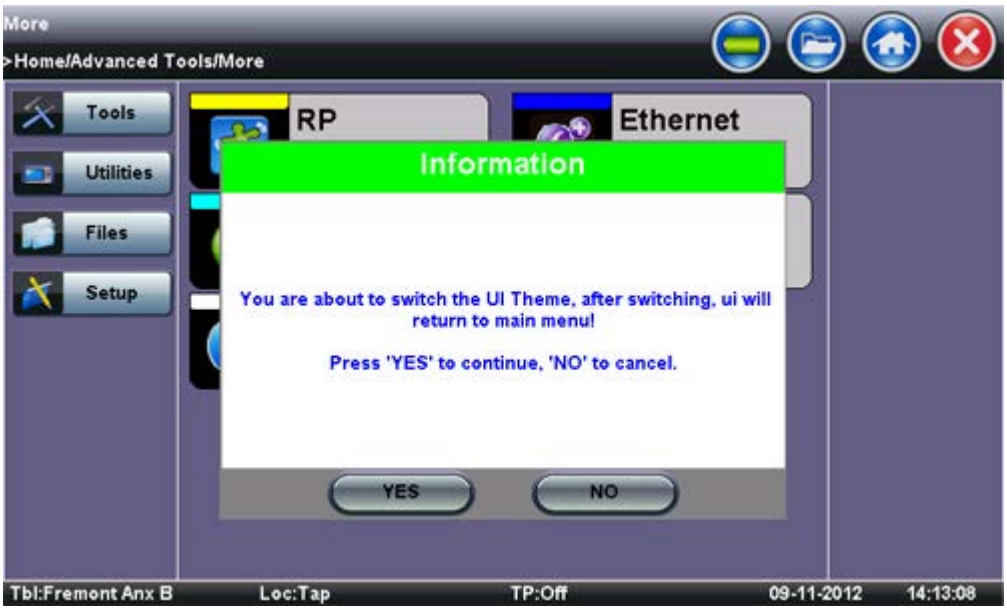
Switch UI Theme



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4.3 Touch Screen Display

The LCD supports touch screen operation. To operate the touch screen, use the stylus located in the top cover to navigate the menus and tabs. The unit can also be used in a non touch screen mode (i.e., using the Arrow, Enter, and Escape keys to navigate). The location of the cursor on the screen is indicated by a focus state. The focus state varies depending on the function or section of the test set. Please observe the following precautions:

- Never use excessive pressure on the touch screen as this may damage its functionality.
- Never use sharp objects such as a pen, screwdriver, etc., as this may damage the surface.
- Clean the surface of the touch screen using a soft cloth and mild detergent only. Do not use alcohol.

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4.4 Battery

The VePAL 300 chassis is equipped with an intelligent Li-ion rechargeable battery pack, which is located in the rear of the unit.

The battery will be partially charged upon delivery, so it is recommended to fully charge the battery before use. Please charge the battery at room temperature to preserve its life and to obtain maximum charge. The battery is charged during operation, provided the unit is connected to the AC Mains using the supplied AC adaptor. Removing the battery while the unit is powered on is not recommended - this may result in damage. Remove the rubber cover on the left side to connect the AC Main adaptor to the unit.

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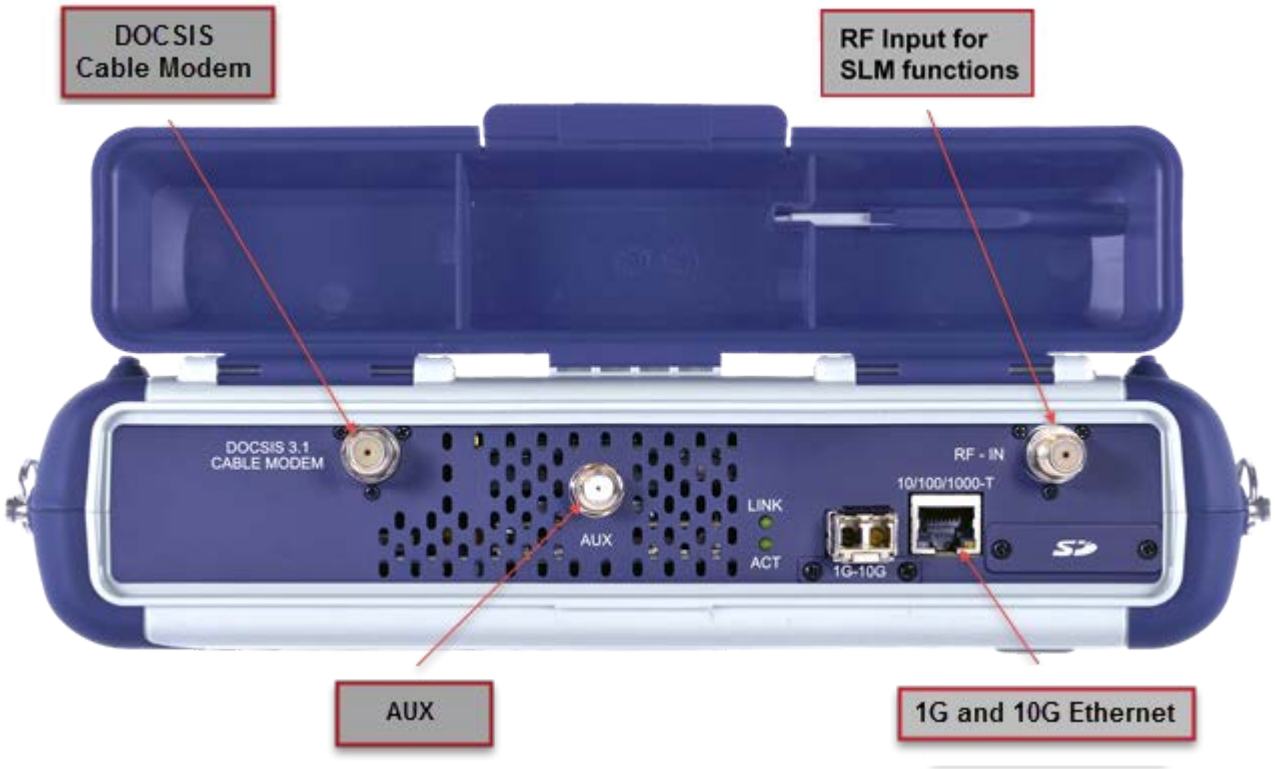
4.5 Connectors and Panels

4.5.1 Test Ports

To access the test connectors, please open the top cover.

Warning: The Cable Modem, USG, ASI and Sweep ports are neither AC nor DC voltage protected. Please use a Galvanic Isolator in between the test port and the test point in presence of AC or DC voltage.

The following test ports are available on CX380S-D3.1 models:



- **RF-in:**
  - "F" Connector, 75 ohms for connection to the CATV network
  - Provides access to:
    - Signal Level Meter (SLM) and associated functions
    - Reverse Path QAM analyzer
    - *Note:* Maximum Voltage input is 100VAC, 140VDC

- **DOCSIS 3.1 Cable Modem:**
  - "F" connector, 75 ohms for connection to the DOCSIS 3.1 cable modem

- **AUX:**
  - "F" connector, 75 ohms for Upstream Generator equipped with Enhanced Forward Error Correction (FEC) capability

- **10/100/1000-T:**
  - RJ45 connector. Used for Cable Modem emulation mode that allows an external PC to be connected.
  - Optionally, this port can be used for Ethernet testing (e.g., BERT, Throughput, and RFC2544)

- **1000-X/10G SFP:**
  - Can be optioned to support Ethernet testing at the optical interface (e.g., BERT, Throughput, and RFC2544—SFPs are sold separately).

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4.5.2 Utility Ports

The Ethernet and USB ports are located on the left and right side of the unit.

RJ45, 10/100Base-T Port:

To access the Ethernet port, remove the protective rubber cover on the right hand side of the unit to expose the connector. Ethernet applications include:

- IP connectivity testing
- Net Wiz testing
- WiFi Wiz testing
- Transfer measurement results and test profiles between the instrument and a computer using ReVeal CX300 software
- Upload/download channel tables between the instrument and a computer using ReVeal CX300 software

Remote control of the instrument using ReVeal CX300 software (optional)

USB Port:

To access the USB port, remove the protective rubber cover on the left hand side of the unit to expose the connector. The USB port supports:

- Memory drives for test results transfer and software upgrade
- WiFi adaptor for WiFi testing or IP connection
- Bluetooth adaptor for file transfer or coupled with a mobile phone for IP connection
- USB data modem for IP connection
- Digital Fiber Inspection Scope
- Optical Power Meter

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4.7 Software Upgrade

To update via USB port:

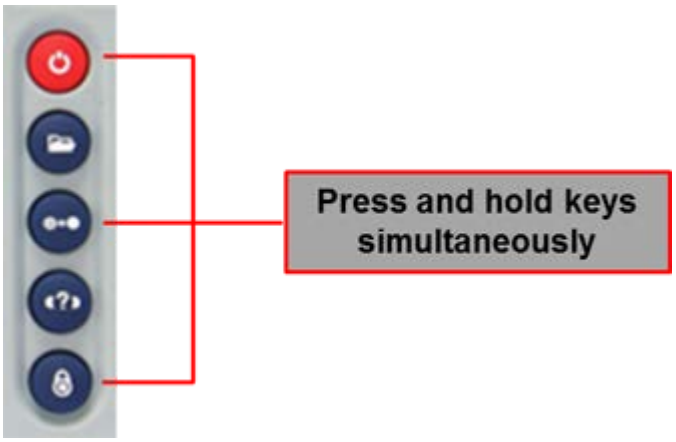
1. Download CX380S-D3.1 software from the VeEX website

- Enter Username and Password under **Customers Login**.
- Click on the **Customers** tab at the top of the screen after successfully logging in (2).
- Click on **Software**, located in the **Functions** toolbar on the left side of the screen. Search for and download the latest CX380S-D3.1 software onto the PC.

2. Install new CX380S-D3.1 software on to the test set

- Unzip the file. Search for a zip file with the phrase *veex-arm.tar.gz*, (e.g., "cx380sd31-veex-arm.tar.gz") and copy it onto a USB stick formatted in the FAT-32 file format.
- Verify that the CX380S-D3.1 unit is powered off and that the AC adaptor connected to the unit is charging the battery. Insert the USB stick on the right side of the unit.
- Press and hold the **Save**, **Lock**, and **Power** keys simultaneously. The unit should boot from the USB and load the new software.
- A message will appear on screen stating the upgrade is in progress. Installing the software will take around 10-15 minutes.

***Note**: Do not remove the USB memory stick until upgrade is complete. Doing so will interrupt the software upgrade and corrupt the upgrade progress.*



Updating CX380S-D3.1 Software via ReVeal CX300

For more information on using the ReVeal CX300 software, refer to the ReVeal CX300 PC Software for CX300 manual on www.veexinc.com.

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5.0 Home Screen and Menu

The Home menu can be accessed at anytime during operation by pressing the **Home** key on the rubber keypad.

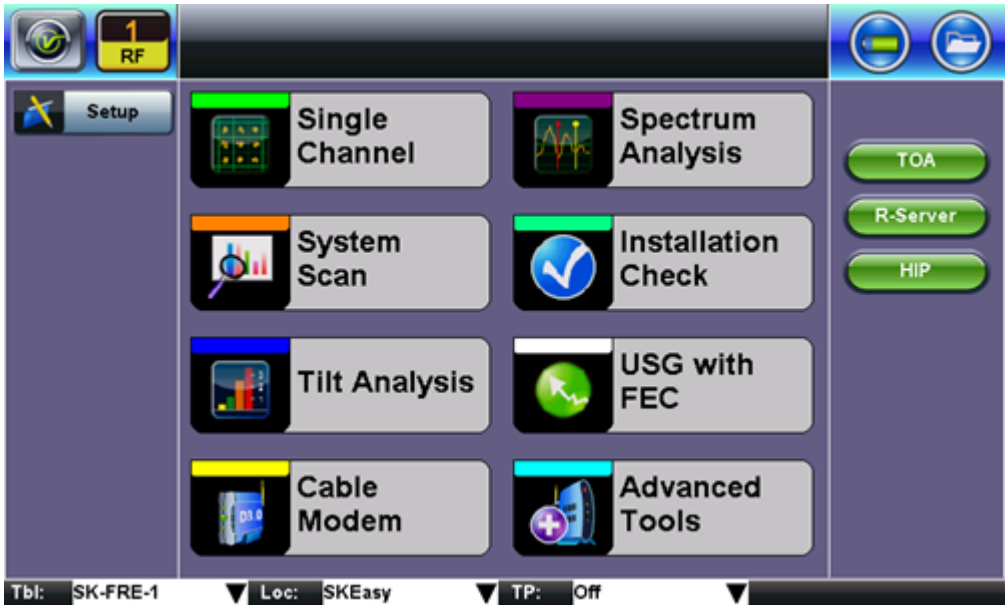
5.1 Screen Layout

The screen is divided into four presentation areas:

- **Left:**
  - **'V' Icon - Utilities Menu**
  - **Setup**
    - Main Menu
- **Middle:**
  - **Test Applications** specific to the test set:
    - Single Channel
    - System Scan
    - Tilt Analysis
    - Cable Modem
    - Spectrum Analysis
    - Installation Check
    - USG with FEC
    - Advanced Tools (to access more advanced features):
      - Return Path Analysis
      - Sweep Operations
      - MPEG Analysis
      - Ethernet Tools
      - Remote Operations
      - R-Server
      - TPS Control
      - RP Balancing
      - HIP
      - Headend Check
      - FCC POP
      - QAM Wiz
- **Right:**
  - Function keys
    - The function keys are application dependent.
- **Bottom:**
  - **Tbl (Channel Table):** Select a channel table to test.
  - **Loc (Location):** Select Location threshold.
  - **TP (Test Point):** Select test point compensation
  - **Date and Time**

Each of the menus listed above is described in detail in the relevant sections of this manual. Please refer to the Table Of Contents.

CX380S-D3.1 Home Menu



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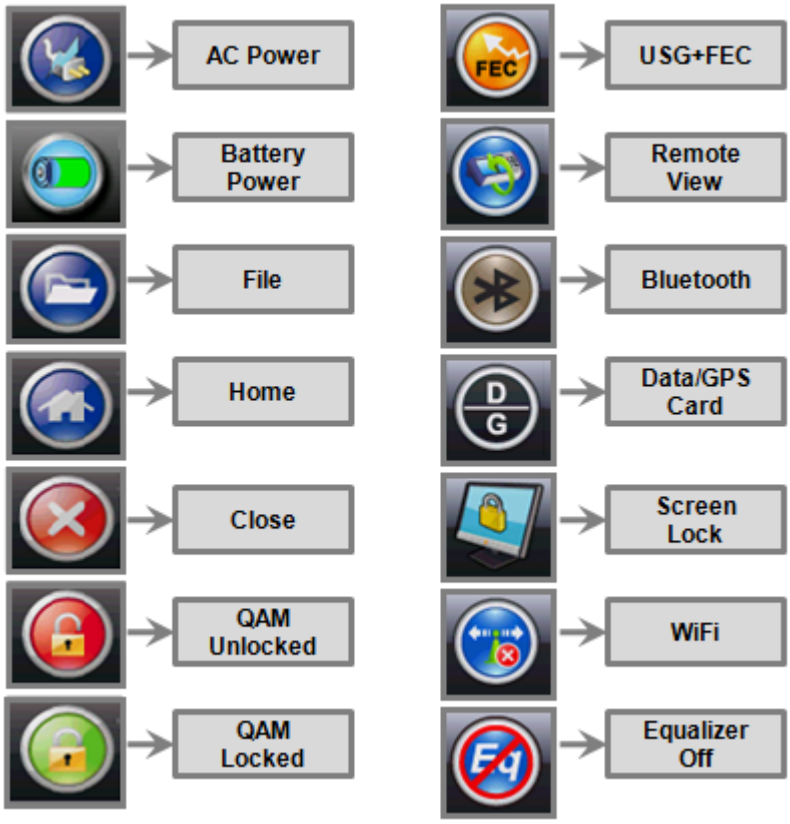
5.2 Screen Icons

The following icons are displayed and located at the top of the screen:

- **Power:** Indicates if the unit is being powered by the internal Li-ion battery or external AC power. Tap the icon for battery status if running on battery.
- **File:** Provides File Storage Information.
- **Home:** Provides instant navigation back to the main Home menu screen.
- **Close:** Closes screen and returns user to the previous screen.
- **QAM unlocked:** Indicates QAM lock has not been achieved on the digital carrier.
- **QAM lock:** Indicates QAM lock has been achieved on the digital carrier.
  (*Note:* QAM lock is required to make Constellation measurements)
- **USG+FEC:** On or Off.
- **Bluetooth:** Bluetooth detected.
- **Data/GPS card:** Data/GPS card detected.
- **Screen Lock**
- **WiFi:** Unit is connected to WiFi.
- **Equalizer Off**

CX380s-D3.1 Screen Icons



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6.0 Setup

Test mode, test port/s and network settings are required prior to performing any measurements or applications.

Note: 1G / 10G Ethernet
For more information on 1G / 10G Ethernet features, see the *TX300s/TX320s User Manual* on www.veexinc.com.

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6.1 Channel Tables and Locations

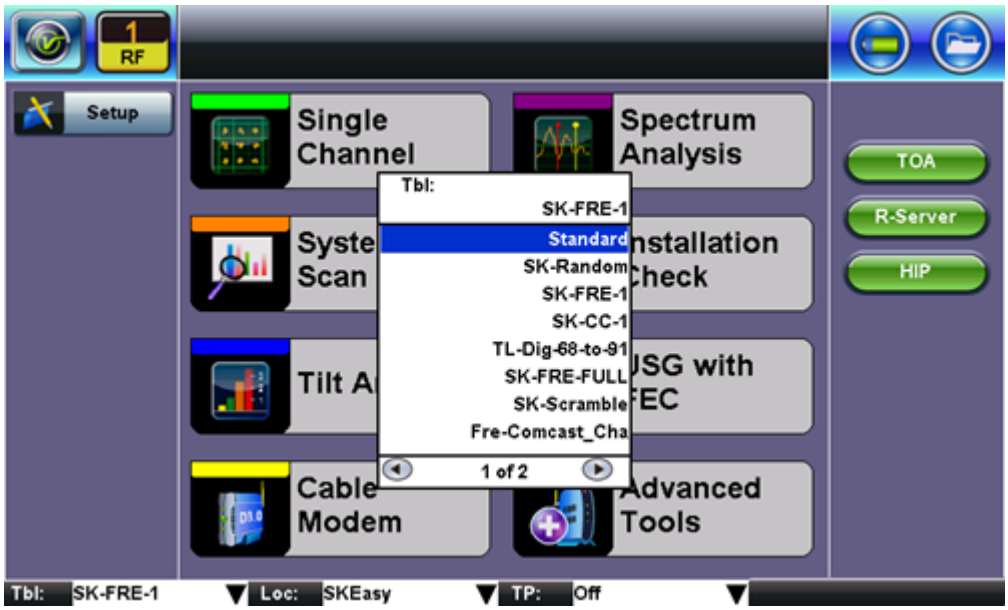
6.1.1 Channel Tables

The unit requires Channel Tables to perform measurements in Single Channel mode. By default, the unit is preloaded with several channel tables, according to industry standard Annex A, B, and C systems.

Selecting a Channel Table

Tap on ▼ next to **Tbl** to select a table from the drop-down menu.

Channel Table Selection



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Editing or Creating New Channel Tables

Alternatively, to create new channel tables or edit existing ones, tap on the following:

- Setup **Setup**
- Main Menu **Main Menu**
- **Channel Table** (▼ box)

- **Manage** (from drop-down menu)

Channel Table Selection

Channel Table Selection

Select a table and press the **Edit** button 

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Channel Table Editing

Creating Channel Tables with ReVeal CX300

Alternatively, the channel tables can be created and managed using ReVeal CX300 PC software, which is a standard accessory. Additional tables can be created from a blank table or from existing templates. The test set and the PC software can exchange the tables for easy update. Please refer to the ***ReVeal CX300*** manual on www.veexinc.com for more details.

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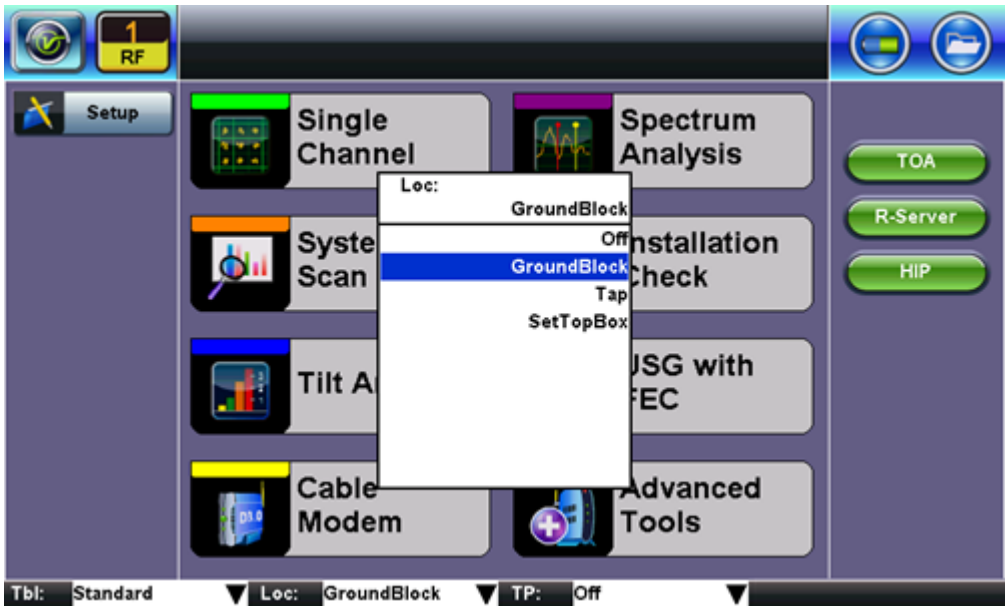
6.1.2 Locations

Location settings are pre-set measurement thresholds for analog and digital carriers. By default, the unit is pre-loaded with Groundblock, Set Top Box and Tap locators. When performing a measurement, one of these preset locations can be selected by tapping the check box.

Location Selection



The measurement thresholds for the preset locations can be edited via the Setup icon and Main menu.

The manage function allows the user to modify the threshold settings for Analog and Digital Channels. Once the new value has been entered, apply the threshold settings using the check box.

Location Editor

Location Editor - Digital

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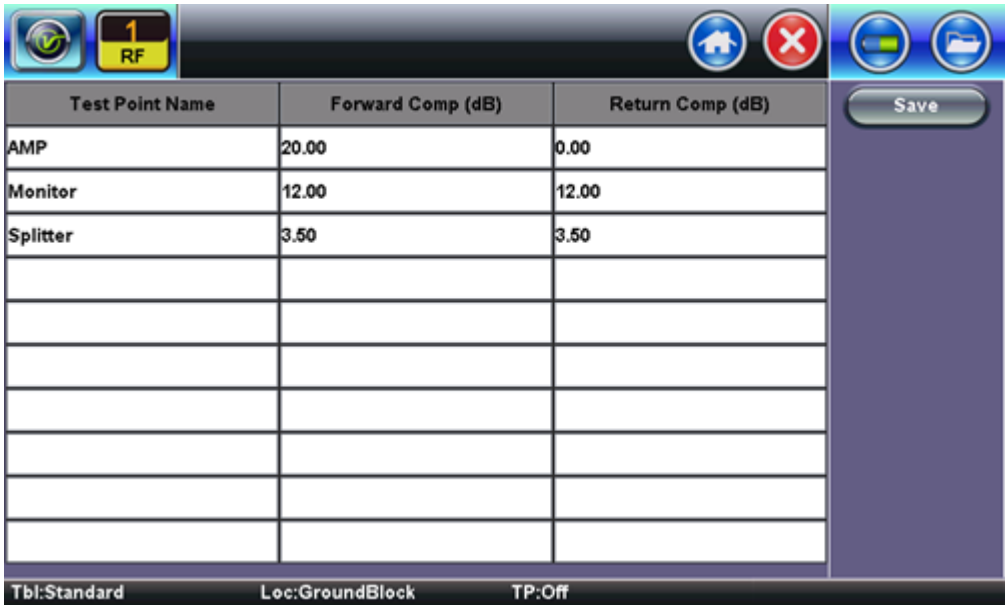
6.1.3 Test Point Compensation

Test point compensation allows the loss at a certain test point to be automatically compensated. When performing a measurement, one of these preset test points can be selected by tapping the check box. The test set stores 10 sets of TP compensation value by name.

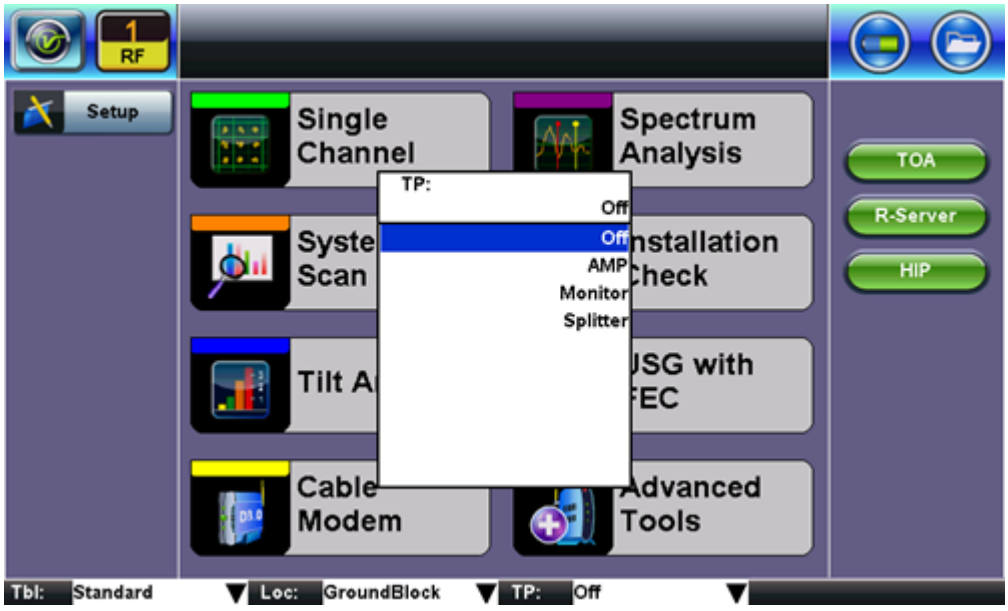
Forward Comp: applies to all Downstream related measurements, such as Single Channel, Installation Check, and Cable Modem Downstream Levels.

Return Comp: applies only to Cable Modem Upstream Transmit Levels.

TP Editor



TP Selection



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7.0 Test Applications

7.1 Single Channel Measurement

Overview:
The Single Channel SLM function performs a level measurement of a user-selected frequency or a channel that is defined in the selected and active channel table. The contents of the Single Channel screen will depend upon whether the selected channel contains an analog or digital signal.

In analog mode, both video and audio levels including Video/Audio (V/A) and Carrier to Noise (C/N) ratios are indicated. In digital mode, the average power of the QAM channel is measured and MER and BER performance and other related parameters are displayed.

The channel to be measured can be entered by either tapping on the Channel box or the Frequency box to the right and use the pop up keypad to enter the channel number or frequency respectively. After the first channel is entered, use the Arrow Up key or Down key to scroll through the next or previous channel in the channel table. About 3 seconds after the user releases the Arrow Up or Down key, the measurement will start. CX380S-D3.1. remembers the last channel measured, and upon entry, the last channel number will be used.

The CX380S-D3.1 supports histogram analysis, which records the current minute by second and past 60 minutes by minute.

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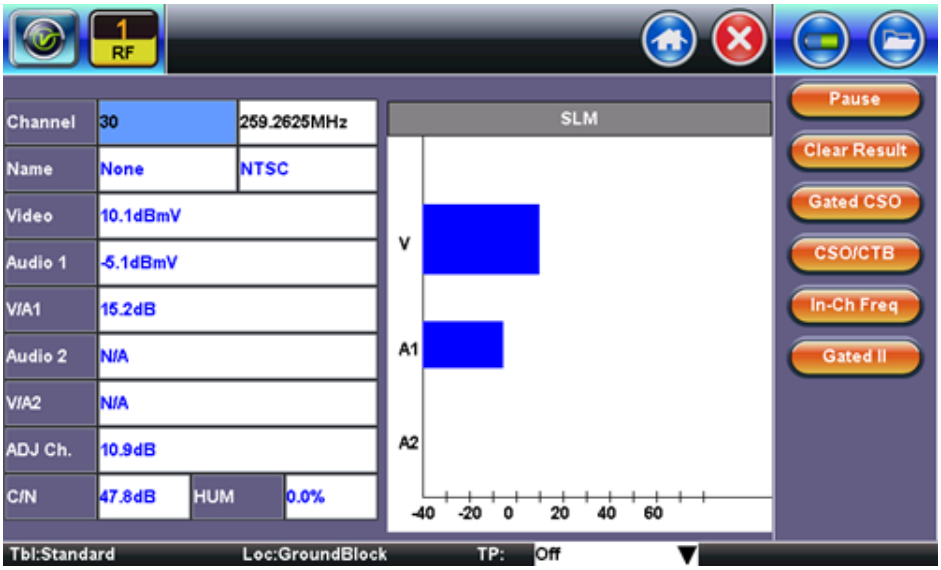
7.1.1 Analog Channel Measurements

The following measurement information is provided for analog signals:

- Channel number (defined in the channel table)
- Channel frequency (defined in the channel table)
- Video Power Level in dBmV/dBuV including graphic bar indication
- Audio1 Power Level in dBmV/dBuV including graphic bar indication
- Video/Audio1 ratio in dB
- Audio2 Power Level in dBmV/dBuV including graphic bar indication
- Video/Audio2 ratio in dB

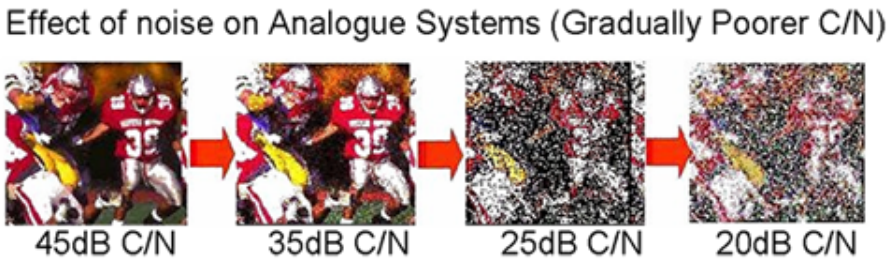
- Max Adjacent Channel in dB
- Carrier to Noise (C/N) in dB
- HUM in %

Single Channel - Analog Results



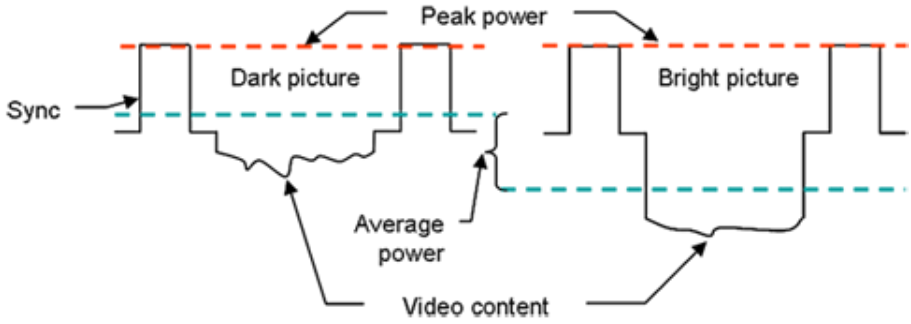
Note:

- The red blocks indicate the predefined threshold window for the measurement parameter.
- The effect of noise or poor C/N on analog video carriers is described below.



Note: The average power changes depending on the picture content e.g. dark scenes have a higher average power than bright scenes. Using the sync pulses, the carrier is at its peak power and it does not change from scene to scene therefore peak power has become the standard for analog video carrier level measurements. The CX380S-D3.1 measures the peak level for analog carrier.

Analog Carriers - Peak Power Measurement



CSO/CTB

The CX380S-D3.1 measures the CSO/CTB by taking the measurement at the programmed frequency offsets of an analog channel's video carrier. The frequency offsets can be programmed in Setup Main menu.

The default values are:

- CSO-1 offset: 1.25MHz
- CSO-2 offset: 0.75MHz

CTB offset : 0 MHz
- CSO-3 offset: -0.75MHz
- CSO-4 offset: -1.25MHz

The CX380S-D3.1 first measures the signal levels at those frequency offsets of a live carrier then prompts the user to either use a channel blocker or remove the carrier. The same frequency offsets will be measured after the carrier is removed or blocked and they are used to compare with the previously measured results with a live carrier to determine the final CSO/CTB values.

Alternatively, the CX380S-D3.1 can measure the CSOs of a live carrier without using a channel blocker or removal of the carrier by selecting the GATED CSO mode. In this mode, the CX380S-D3.1 measures the noise level at the frequency offsets during the sync pulse period where the carrier signal is quiet then compare with the measured levels during the non sync pulse period.

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7.1.2 Digital Channel Measurements

When testing a digital channel, the unit first tries to lock onto the QAM signal. Once the QAM signal is locked, the unit starts displaying the digital measurement results as well as the constellation diagram.

Note: QAM unlock

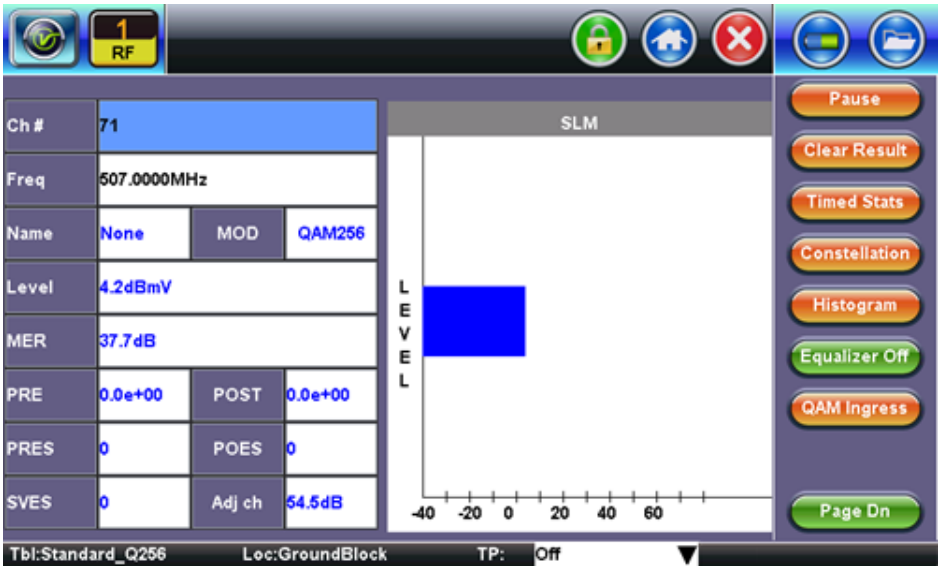
If the unit is unable to lock onto the digital channel, the following icon is displayed.
Always ensure QAM lock is achieved prior to making Constellation and related digital measurements.

SLM button: The following measurement information is provided for digital signals:

- Channel number (defined in the channel table)
- Channel frequency (defined in the channel table)
- Channel or program name
- Modulation type measured
- QAM Power Level in dBmV/dBuV including graphic bar indication
- Modulation Error Ratio (MER) in dB
- Pre BER & Pre Error Second ratio
- Post BER & Post Error Second ratio
- Severely Error Second count
- Max Adjacent Channel Delta in dB

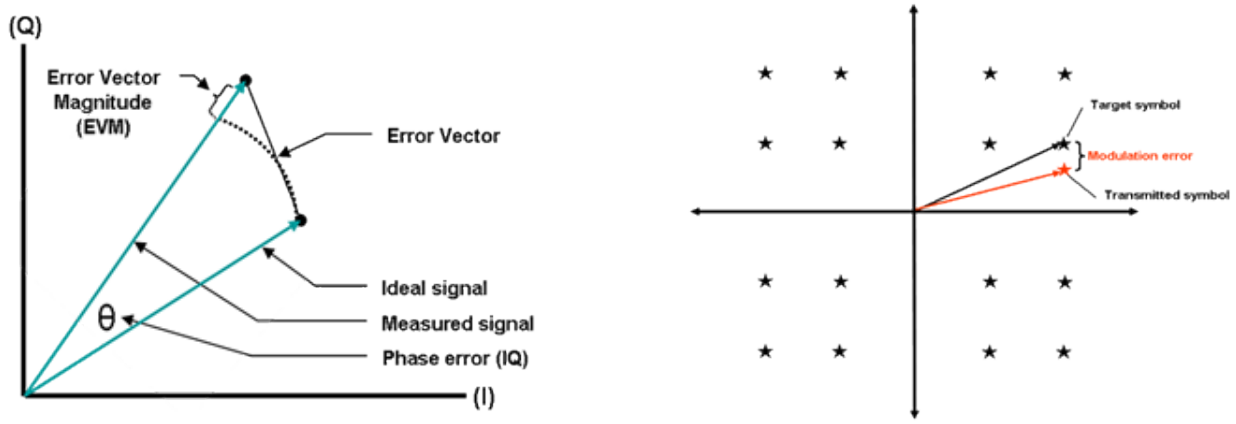
Graphic limit indicators are provided for all graphically displayed signal levels. Numeric data that is outside of limits are displayed in red.

SLM Measurement (Digital Carrier)



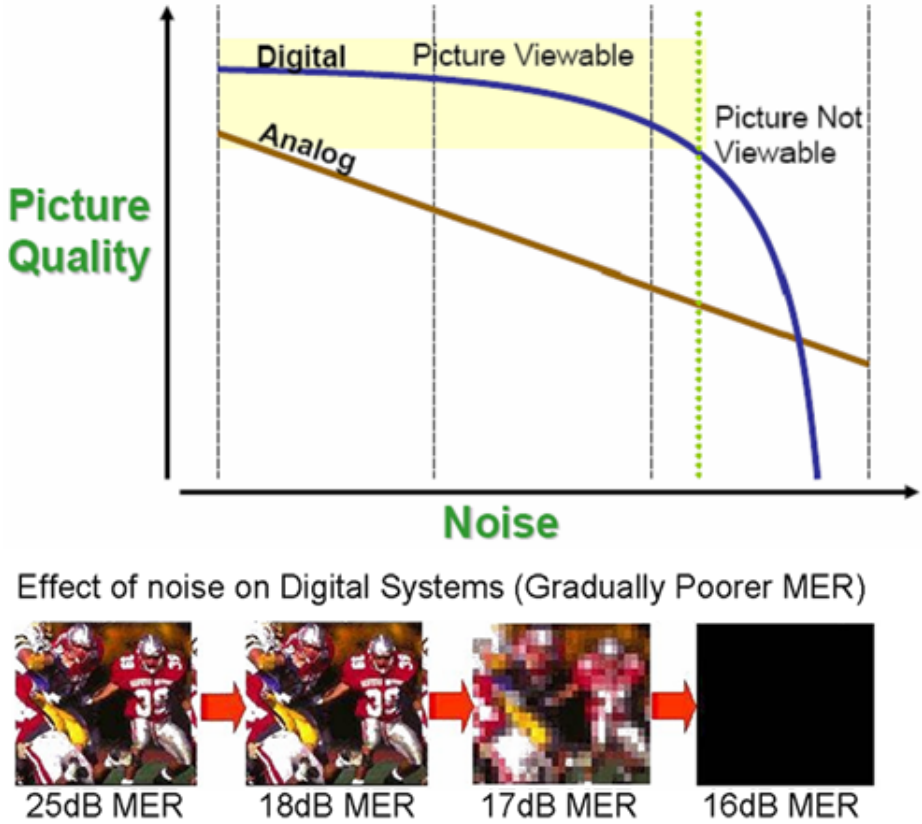
Note: Modulation Error Ratio (MER)
In digital systems, MER is very similar to Carrier to Noise (C/N) in analog systems. MER measures how tightly symbols are recorded with respect to an optimum location based on the Error Vector Magnitude (EVM).

Modulation Error Ratio (MER) and Error Vector Magnitude (EVM) Relationship



MER determines how much margin the system has available before a failure can be expected. A poor MER is not noticeable on the picture up until the point of system failure - this is often referred to as the "Cliff Effect". Ideally you should have at least 4 to 5dB of margin from the MER where significant errors occur to allow for system degradation. MER measurements are useful for early detection of non-transient (noise) impairments, such as system noise Ingress.

Cliff Effect - Digital Carriers



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7.1.3 Constellation Measurements

In contrast to the measuring techniques used on digital TV signals transmitted via satellite, a wider and necessary range of measuring techniques is provided for broadband cable testing. The influences acting on the broadband cable signal, which can be modulated with up

to 256QAM, are more varied and critical than in the satellite domain.

Constellation measurements are an example of such advanced measurements and are an ideal tool to identify QAM modulator problems.

Note: QAM lock

- Ensure QAM lock is achieved on the digital carrier prior to making any Constellation measurement.

Constellation button:

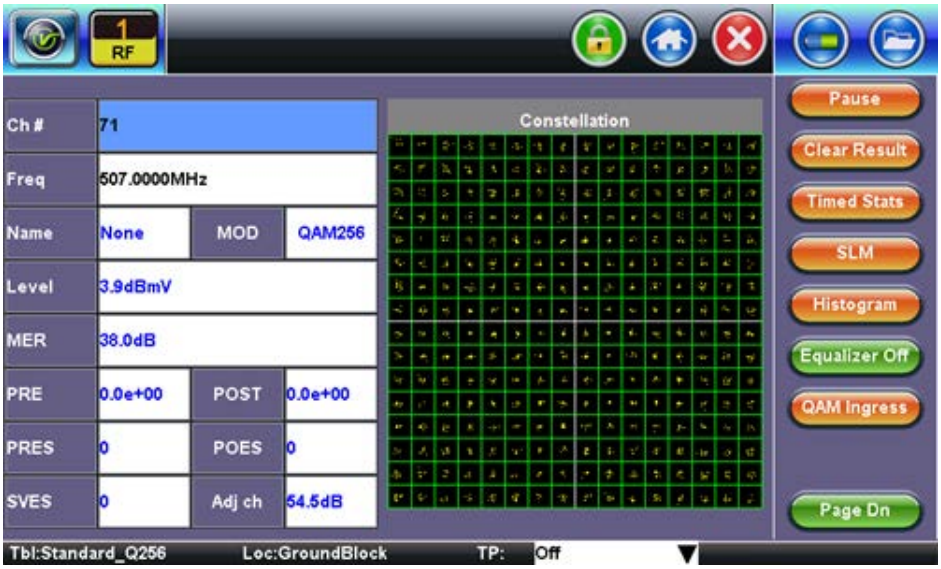
The following measurements are reported:

- QAM Power Level (numeric in dBmV/dBuV)
- MER (numeric in dB) is an indication of the operating margin of the system
- Pre BER & Pre Error Seconds (numeric) is the error rate of the incoming signal prior to being corrected FEC circuitry
- Post BER & Post Error Seconds (numeric) is the error rate of the signal after the FEC has corrected all the possible errors
- Severely Error Seconds (numeric)
- Max Adjacent Channel Delta (numeric in dB)
- Constellation (graphic)

The constellation display supports a zoom function.

- For QAM64 and QAM256 modulation, the constellation is split into 4 quadrants for simplified viewing. The user can tap on any of the four quadrants to zoom into this selected quadrant.

Constellation Diagram - Digital Carriers



Note: Bit Error Rate (BER)

- Bit Error Rate (BER) measures how often an error occurs in a given amount of data.
- The more errors, the more difficult it is for the FEC circuitry to correct those errors before picture problems occur.
- BER is useful for measuring long term system performance and periodic transient impairments that can occasionally affect system performance.
- BER is usually displayed in scientific notation e.g.;
  - where 1E-3 means one error in every 1000 bits
  - where 1E-6 is one error in every 1,000,000 bits
- Ideally, the signal should have the highest exponent value - the higher the number, the lower the errors.

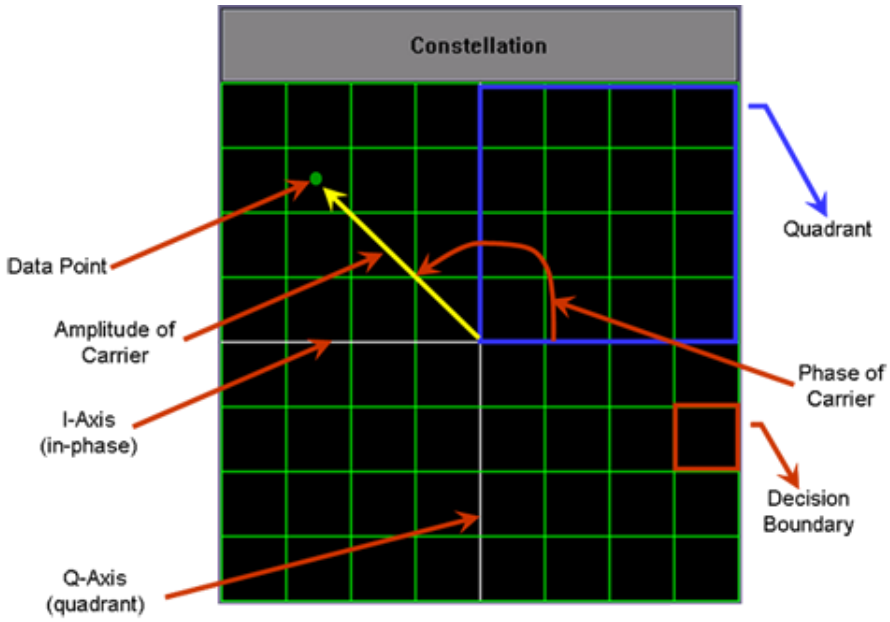
Constellation diagrams

- Constellation diagrams are used to graphically represent the quality and distortion of a digital signal.

The diagram is an X/Y plot of the I (In-phase) and Q (Quadrature) axis components of the QAM signal and is particularly useful for viewing impairments due to ingress and/or modulation problems present on the digital signal.

- A symbol (essentially a waveform representing one or more bits) should ideally appear as a compact or clean dot in the center of each symbol box. Decision boundaries exist within the constellation so that if the symbol falls within the boundary, the correct data is received.
- If due to noise or other interference, the symbol falls outside the boundary, the data is in error. Error detection and correction (e.g. FEC) will attempt to the correct these errors, thus avoiding video impairments.
- Observing the symbol's shape and location relative to their ideal positions allows you to draw some conclusions about the nature of an impairment

Understanding the Constellation Diagram



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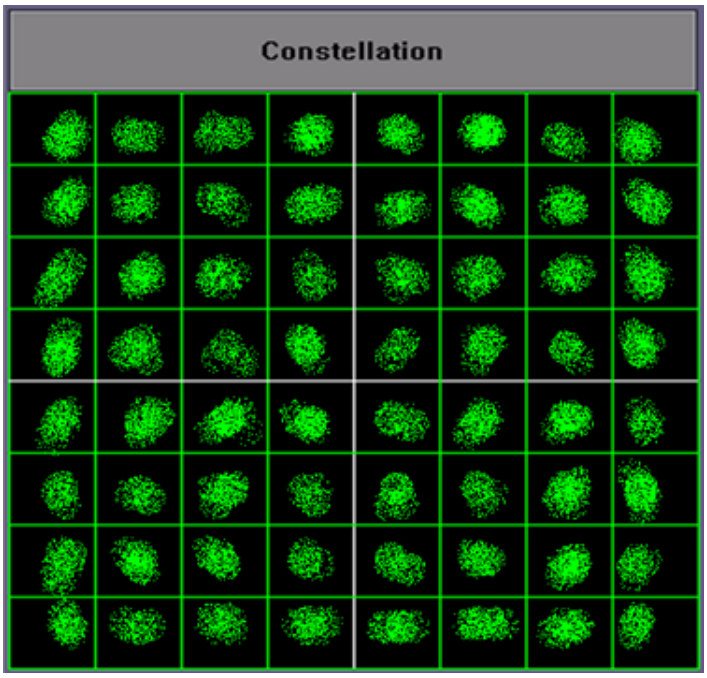
The following impairments can be assessed visually:

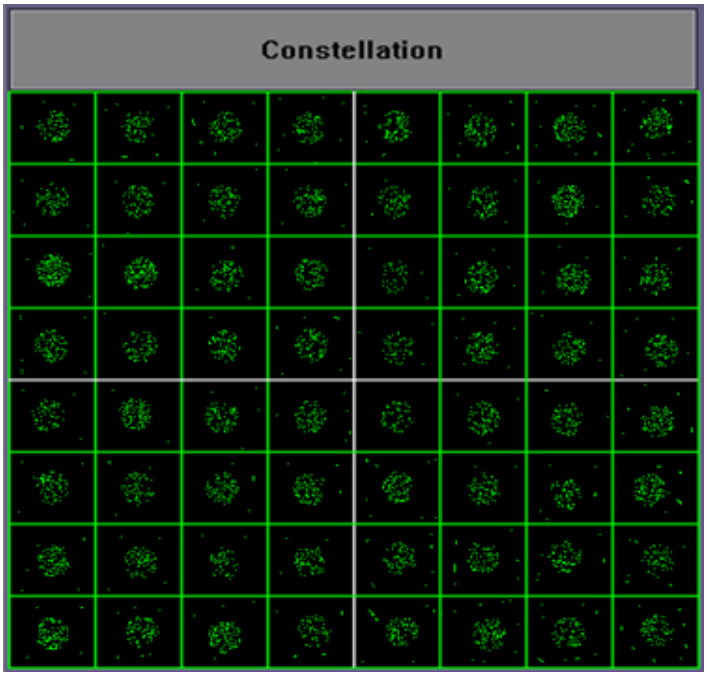
- **Gain compression** - Pulls the symbol clusters into the center while the middle ones are unaffected. Gain compression can result from poor or bad amplifiers, IF equalizers and up/down converters.

Gain Compression



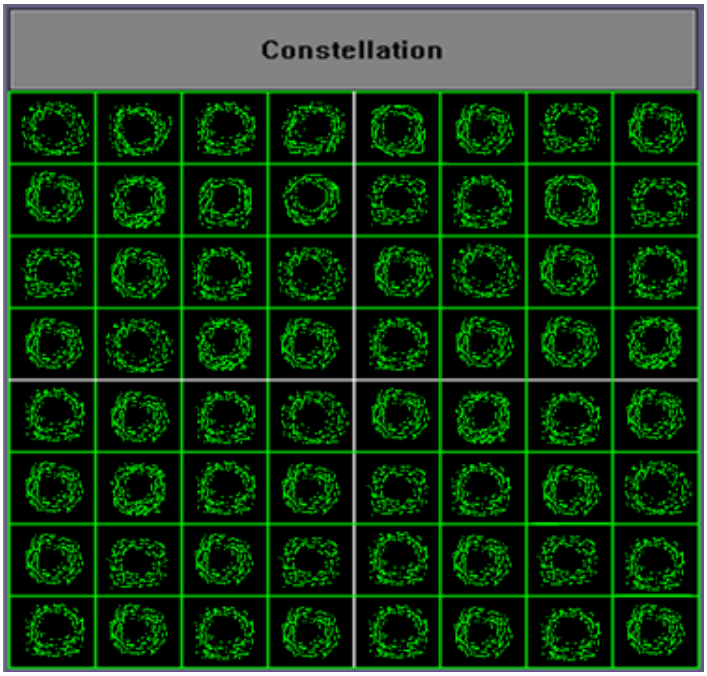
- **Broadband or system noise** - Causes symbol clusters to enlarge, which increases the probability of errors. An error occurs when the dot is pulled across a decision boundary.

System Noise - Incoherent Interference



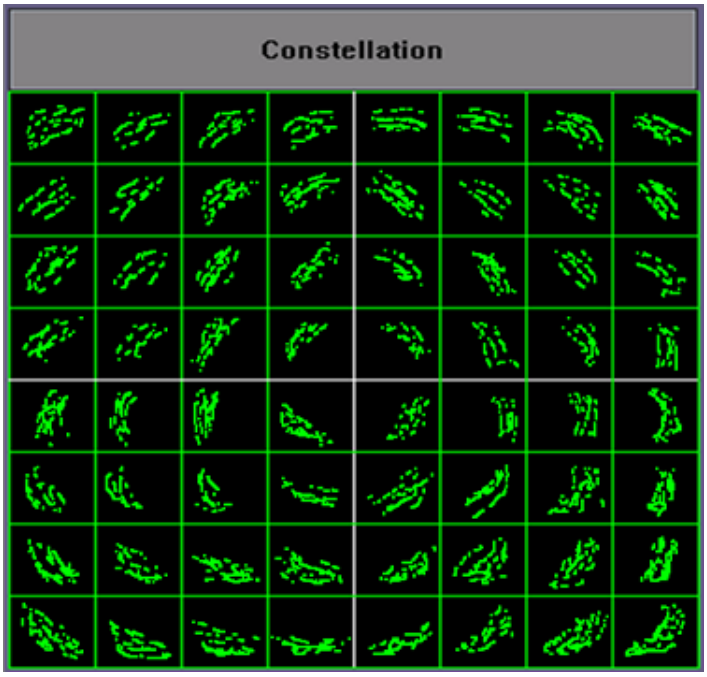
- **Coherent interference** - CSO/CTB, spurs or ingress produce symbol clusters with a hole in the center so they appear as "donuts". This can also be a result of laser clipping or sweep interference.

Coherent Interference



- **Phase noise** - Also known as Phase jitter in a QAM signal, it is caused by transponders in the transmission path or by the I/Q modulator. Phase jitter is a statistical quantity that affects the I and Q path equally. Phase noise causes the symbol clusters to appear as arcs, particularly those near the edges of the constellation. Phase noise can also result from faulty headend up/down converters.

Phase Noise



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7.1.4 Impairment Measurements

7.1.4.1 Table Mode

In addition to the standard digital carrier measurements, the following impairments are also measured with the optional Advanced Digital Measurement:

- Error Vector Magnitude (EVM) in %
  - Measurement of modulation quality of the transmitted signal before forward error correction.
  - Error Vector Magnitude = (maximum symbol magnitude / rms error magnitude) X 100%
- Maximum AC (maximum haystack amplitude change/variation)
- Carrier to Ingress
- Carrier to noise
- HUM in %
- Phase jitter in degrees
- Symbol Rate Error in ppm
- Frequency Error in ppm (deviation from nominal preset frequency)
- Peak to Peak Frequency Response
- Peak to Peak Group Delay

Impairment Table (Digital Carrier)

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7.1.4.2 Graph Mode

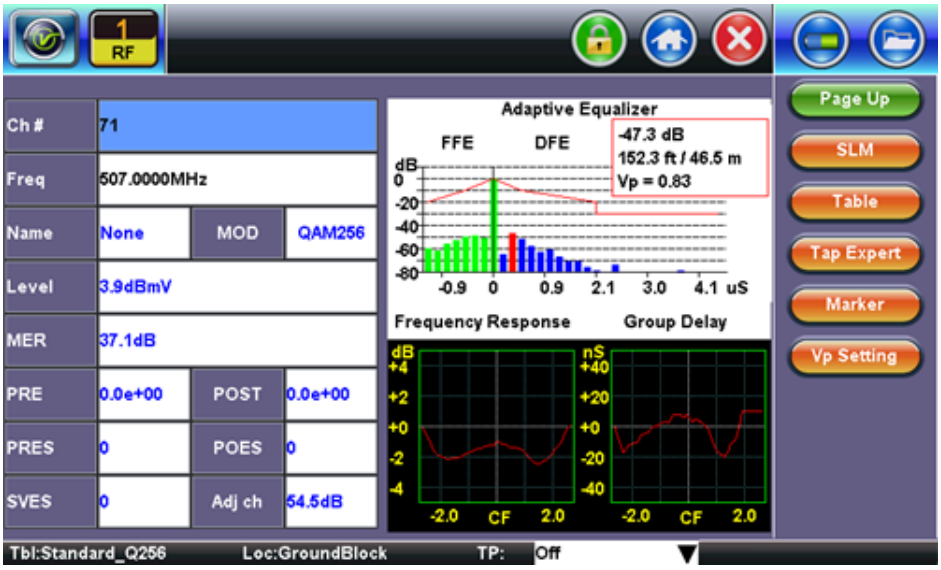
The graph mode displays the **Adaptive Equalizer Stress**. The adaptive equalizer graph is a useful tool for troubleshooting linear distortion.

Overview: Adaptive Equalization

Modern Cable Modems, Set-top-boxes and Cable Modem Termination Systems (CMTS) use advanced Adaptive Equalizer technology to compensate for complex in-channel frequency response impairments caused by micro-reflections, amplitude ripple and group delay occurring in the cable network. Signals in a cable system can arrive at the receiver before or after the desired signal. Signals normally arriving afterwards are either reflections or micro-reflections.

Rather than equalizing the entire upstream or downstream RF frequency spectrum, an adaptive equalizer adjusts its characteristics based on a single digitally modulated QAM carrier only as channel conditions change. This process maximizes or greatly improves the Modulation Error Ratio (MER) in the forward or reverse path.

Impairment Graph (Adaptive Equalizer)

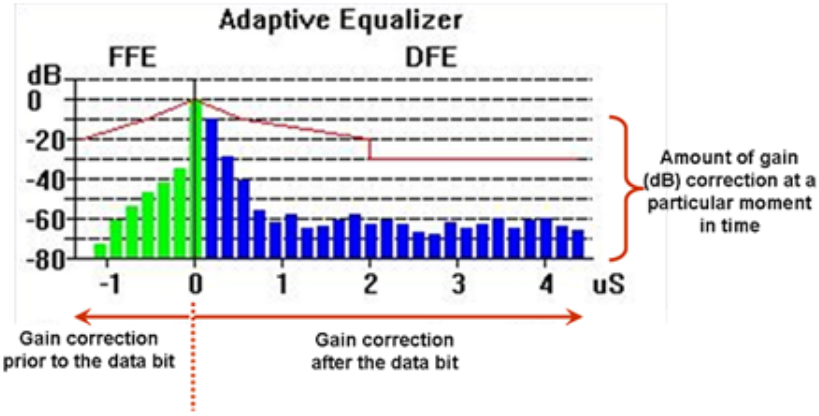


Adaptive Equalizer Measurement

The bar graph shows the performance of the Feed Forward Equalizer (FFE) and Decision Feedback Equalizer (DFE) circuitry.

- The vertical axis displays the level in decibels (dB), while the horizontal axis displays units of time typically relative to the adaptive equalizer tap spacing.
- Each bar displays a coefficient corresponding to the Feed-Forward Equalizer (FFE) and Decision Feedback Equalizer (DFE) taps.
- There are eight coefficients for the FFE and 24 coefficients for the DFE. The 8th coefficient, or the tallest vertical bar, is the incident signal (main signal path) and it is normally close to 0dB representing unity gain.
- If any bar appears above the average noise floor to the right of this incident signal, the problem is related to one or several micro-reflections.

Interpreting the Adaptive Equalizer Display



Note:

- The adaptive equalizer is like a frequency equalizer, however instead of changing the level at a specific frequency, it does it at a specific time.
- The specific time matches the time at which the reflection occurs - the gain is reduced only at this instant thus reducing the reflection.
- The maximum recommend correction is usually specified by the set top manufacturer and you should allow adequate margin for degradation.
- The taps on the horizontal axis are proportional to the symbol rate

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Equalized and Un-equalized MER measurements

Un-equalized MER is typically measured before the adaptive equalizer, and equalized MER is measured after the adaptive equalizer, but often this circuitry resides in the QAM receiver and cannot be disabled. So while the adaptive equalizer does a great job of improving the MER of a QAM signal, it makes troubleshooting marginal amplifiers, small ingress, CPD and related impairments a lot more difficult.

It is important to know how hard the adaptive equalizer is working to determine if there is any margin for system degradation. To solve this problem, the CX380's adaptive equalizer can be turned off, allowing a technician to easily identify, sectionalize and locate these difficult linear type distortion problems. Tap the function of "Equalizer On/Off" to enable or disable the adaptive equalizer.

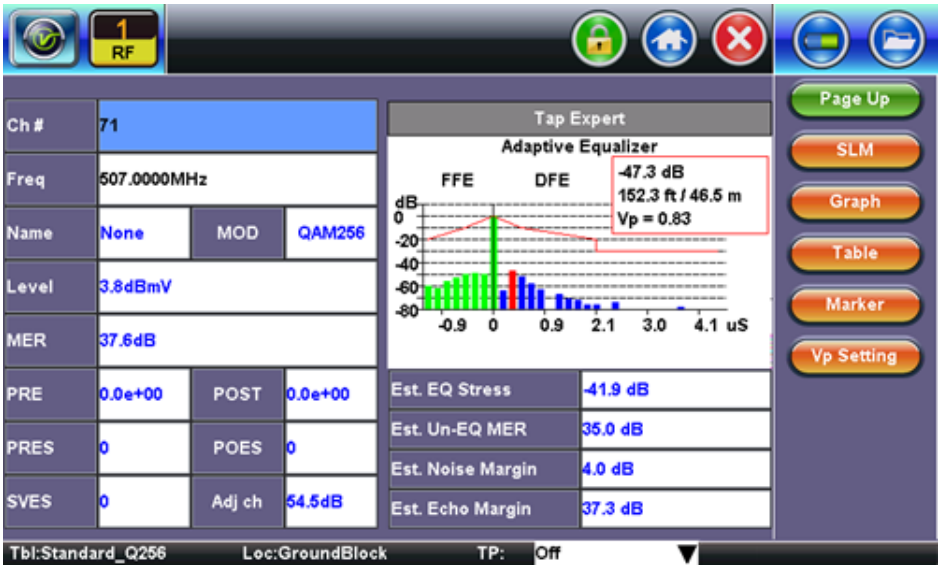
Tap Expert

By further analyzing the behavior of the equalizer taps, the following measurements can be performed:

- Estimated Equalizer Stress
- Estimated Un-equalized MER
- Estimated Noise Margin
- Estimated Echo margin

The measurement results provide an early indication that the system might have marginal performance, even though MER, pre-FEC errors and post-FEC errors are acceptable.

Tap Expert



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7.1.5 Timed Stats

For a Digital Channel, you can run a timed test, where key measurements are averaged over the designated test time. Press 'Timed Stats' and input the desired test duration. Press 'Start' to initiate the test.

Timed Stats

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7.2 Tilt Analysis

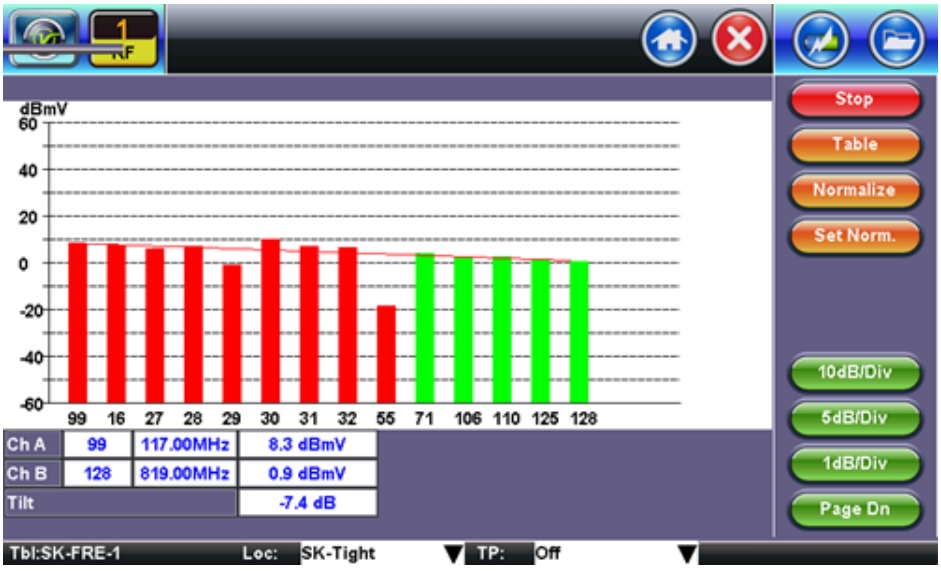
Overview:
Tilt measurement is used to check the channel levels at the lowest and highest frequencies because level variations across the frequency spectrum are indicative of distortion. Tilt measurement is also the most efficient tool for balancing distribution amplifiers. By tapping on the channel bars to select a channel then press the Enter key, the Tilt measurement will measure the two most recently selected channels.

Typically, the same analog and digital channels which have been recommended or defined for the Scan function should be used when performing Tilt measurements. Often, Tilt measurements are useful to identify excessive cable lengths at the customer premises that can cause high frequency roll off.

The CX380S-D3.1 measures up to 8 analog and 8 digital channels simultaneously. Normally, the tilt is measured from the lowest frequency channel to the highest frequency channel; however, the user can select any two channels to measure their tilt by tapping on the channel in the bar graph. The selected channel's bar graph will change to Yellow.

Press the ENTER key on the keypad to engage the selected channel.

Tilt



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7.3 System Scan

Overview:
Within seconds, all analog and digital channels at the service location are measured. The function provides a graphical overview of the entire channel plan according to the selected active channel table. It can provide fast visual confirmation or a snapshot of key analog and digital TV channels or DOCSIS carrier levels.

As a rule of thumb, analog carriers should be no more than 6 to 10dB higher compared to digital channels. DOCSIS channel levels should range between -10 to +10dBmV to allow for adequate margin at the cable modem.

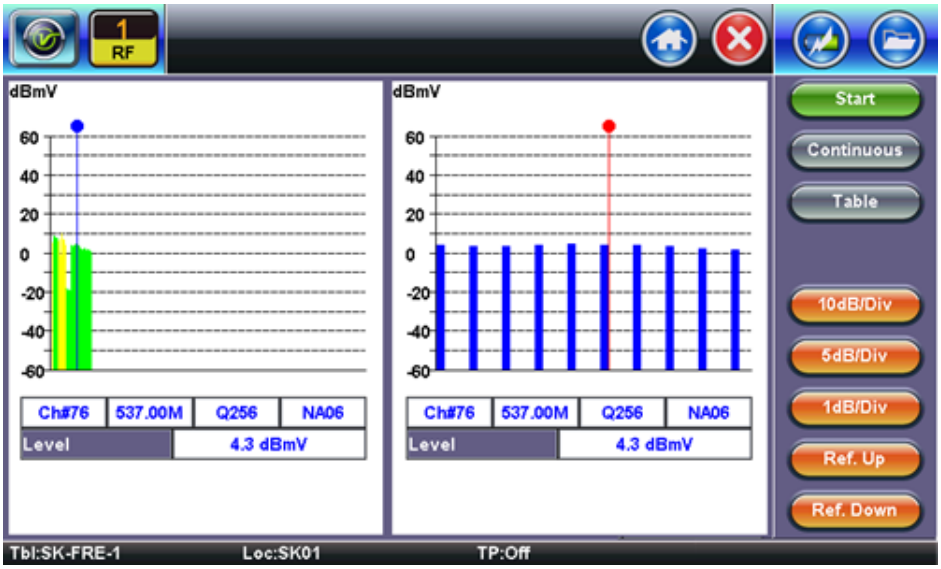
The system scan can be done continuously to capture any signal level variations in time by tapping the CONTINUOUS icon. In continuous scan mode, selecting MIN hold, MAX hold or MIN/MAX hold can be activated to record the highest and lowest signal level measured in time.

Analog Scan

The following measurements are performed for each analog channel:

- Video Power Level in dBmV/dBuV
- Audio1 Power Level in dBmV/dBuV
- V/A1 Ratio in dB

System Scan



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Digital Scan

The following measurements will be performed for each digital channel:

- QAM Power Level in dBmV

Once the test is completed or stopped by the user, a marker is available and can be placed on any of the measured channels. The measurements of the selected channel(s) are then displayed.

The System Scan display screen is split to two sections; left: all channel view, right: zoom view of nearby channels of the channel on the marker of the left screen.

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7.4 Spectrum Analysis

Overview:
The spectrum analyzer, like an oscilloscope, is a basic tool used for observing signals. While an oscilloscope provides a window into the time domain, the spectrum analyzer provides a window into the frequency domain. Spectrum analysis provides a convenient way to measure the amplitude of digitally modulated carriers and to troubleshoot ingress in the forward and reverse paths.

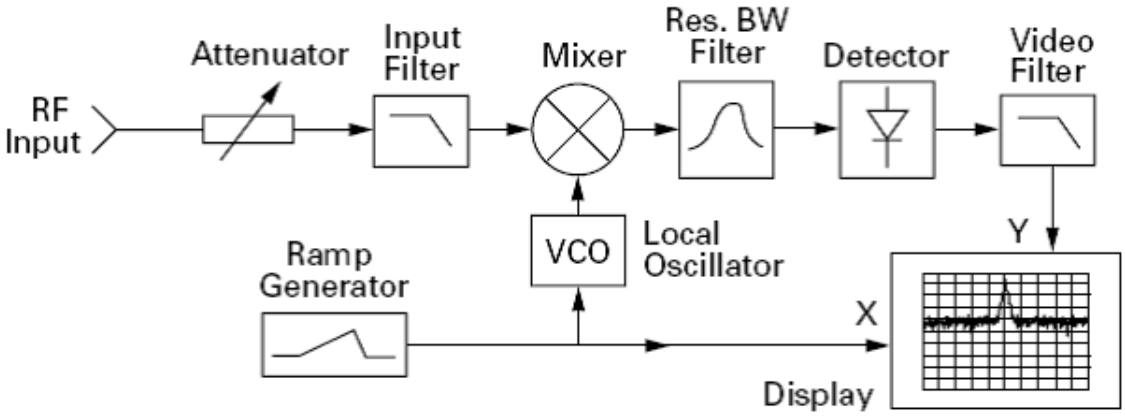
The following measurements and capabilities are possible:

- **Analog Channels**
  - Direct channel tuning and positioning of visual and audio carriers
  - Visual and audio carrier level and frequency measurement
  - Survey of system visual and aural carrier levels and frequencies
  - Depth of modulation measurement
  - Audio carrier FM deviation measurement
  - Visual carrier-to-noise measurement
  - In-channel response measurement
  - Hum/low-frequency disturbance measurement
  - Intermodulation distortion measurement (CTB and CSO)

- **Digital Channels:** (applicable to QAM, QPSK, and OFDM signals)
  - Average power
  - Adjacent channel leakage (ACL)
  - CSO and CTB
  - Direct channel tuning and positioning of digital signal
  - Survey of system digital channel levels
  - System frequency response

To understand the capabilities of the spectrum analyzer and the various elementary settings, it is important to have a basic understanding of how a spectrum analyzer operates. Referring to the block diagram below:

Simplified Spectrum Analyzer Block Diagram



1. The RF input signal first travels through the attenuator and the low-pass input filter where the attenuator limits the amplitude of the signal, while the filter eliminates undesirable frequencies.
2. After the input filter, the RF signal is mixed with another signal generated by a Voltage Controlled Oscillator (VCO) to produce an intermediate frequency. The frequency of the VCO is controlled by a repeating ramp generator, whose voltage also drives the horizontal axis of the display. As the frequency of the VCO changes, the intermediate frequency sweeps through the resolution bandwidth filter (IF filter), which is fixed in frequency.
3. A detector then measures the power level of the signal passing through the IF filter, producing a DC voltage that drives the vertical portion of the display. As the VCO sweeps through its frequency range, a trace is drawn across the screen. This trace shows the spectral content of the input signal within a selected range of frequencies.

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7.4.1 Setup

The following setup parameters are available:

- **Center Frequency (MHz) and Frequency Span (MHz)**
  - The two selections are independent of each other and made on two separate settings.
    - The center frequency selection sets the frequency of the center of the scale to the chosen value - normally where the signal to be monitored would be located. In this way, the main signal is in the center of the display and the frequencies on either side can be monitored.
    - The span selection is the extent of the frequency coverage that is to be viewed or monitored on the display. Any custom values can be entered. The display may show the default values of 2.4, 4.8, 7.2, and 9.6 MHz (for values of less than 9.6MHz), however, the screen displays two vertical purple lines representing the entered span's frequency

boundaries.

- **Start Frequency (MHz) and Stop Frequency (MHz)**
  The CX380S-D3.1 allows the entry of Start and Stop frequency in place of the CF and Span. The entry mode can be changed by tapping on the CF or START icon. The entry range is from 5MHz to 1000MHz.
- **Zero Span**
  - Zero Span mode is typically used for measuring the level variation of an analog channel. There are two ways to enter the Zero Span mode:
    - Select CF of an analog channel and enter 0Hz for the frequency span, or
    - Select Start and Stop frequencies to be the same as the CF of an analog channel.
  - The display can be set for Linear or Log mode.
- **Vertical scale (dB)**
  - Sets the logarithmic scale to 1, 2, 5, 7, or 10dB per division.
- **Resolution Bandwidth (kHz, MHz)**
  - Selectable filter sizes (10kHz, 30kHz, 100kHz, 300kHz, 1MHz)
  - Resolution bandwidth is the bandwidth of the IF filter, which determines the selectivity of the spectrum analyzer. A wide resolution bandwidth is required for wide sweeps, while a narrow filter is used for narrow sweeps.
  - The narrower the RBW setting, the better the frequency resolution; however, narrower filter settings require more measurement time
  - Wider filters are used when the display needs to be updated rapidly, or when wide modulation bandwidths are to be displayed.
- **Video Bandwidth (kHz, MHz)**
  - The video bandwidth filters enable a form of digital averaging which helps to reduce signal variations caused by noise. Video filtering, however, limits the speed at which the spectrum analyzer can scan.
  - Selectable filter sizes (10kHz, 100kHz, 1MHz)
- **Attenuation (dB)**
  - To ensure that the input stages of the analyzer are not overloaded, an RF attenuator is used. If input stages are overloaded, spurious signals may be generated within the instrument, resulting in possible false readings. However, if too much attenuation is inserted, additional gain is required in the later stages (IF gain) and the background noise level is increased, which can sometimes mask lower level signals. Thus, a careful choice of the relevant gain levels within the spectrum analyzer is needed to obtain optimum performance Selectable attenuations is from 0 to 50dB in 5dB increments.
- **Sweep Time (ms)**
  - The speed at which the analyzer scans the frequency span is important. The faster it scans the frequency range, the faster the measurement can be made. However, the scan rate or dwell time of the analyzer is limited by IF filter (RBW) and the video filter that may also be used to average the reading. These filters must have time to respond, otherwise signals will be missed and the measurements rendered useless. Nevertheless, it is still essential to keep the scan rate as high as is reasonably feasible to ensure that measurements are made as quickly as possible.
    - Selectable sweep times are 30, 50, 100, 150, 200, 250, 300 and 1000ms. For a larger span due to the amount of sampling points data to be taken, the sweep time will adjust automatically to a longer period.
- **Marker**
  - There are 4 markers available -- two verticals and two horizontal. They can be activated by tapping the MARKER function key.
  - Signal levels, frequencies and deltas are displayed with color coding.
  - To move a marker, tap on the Circle associated to each marker. For fine tuning of the marker, use Up, Down, Left, and Right arrow keys.
  - Vertical and horizontal markers can be paired and be moved together.
- **Search**
  - The Peak or Min or both in the measured span can be searched automatically. The search is updated per sweep.
  - Peak-Left and Peak-Right functions functions for Peak Search allow configurable peak level thresholds. A blue horizontal line appears on the screen when Peak Left (Pk-Pk Left) or Peak Right (Pk-Pk Right) is pressed, indicating the peak level threshold. This can be moved to the desired threshold by tapping on the dot at the end of the line and moving it.
- **Min/Max Hold**
  - Minimum, Maximum or both per sweep are detected and held at their location in the spectrum analysis mode.
  - The Min is shown in BLUE color and Max is in RED.
  - By tapping the UPDATE function key, the current spectrum, in YELLOW color can be shown together with the Min/Max or removed.
- **Profile**
  - For repeated use of the same spectrum analysis settings, user can tap on the PROFILE function key and save the current settings in a profile or recall a pre-stored setting for a list up to 20 profiles by name.
- **Auto Attenuation (AUTO ATTN.)**
  - Auto attenuation, upon activating, searches for the peak within the span and automatically set the attenuation such that the peak of the signal is placed at about 15dB to 20dB below the top of the display. Please note that auto attenuation will set the VScal (Vertical Scale) to 10dB by default.
- **Burst QAM**
  - Burst QAM mode is a unique feature in the CX380S-D3.1 family. The feature is useful for detecting and displaying the burst or transient QAM signal generated by the Cable Modems in the return path. The Burst QAM mode is similar to Peak Hold but only holds the peak for 5 consecutive scans for easy identifying of a Cable Modem channel in the return path.

The Burst QAM mode can be toggled on and off.

- **Pre-AMP**
  - The CX380S-D3.1 has a built-in pre-amplifier. This amplifier is useful of detecting the noise floor in a return path.
- **Peak Detector**
  - Can change the Peak Detector setting from 'Peak-Average' (default) to 'Positive-Peak'. 'Positive-Peak' is best suited for noise floor detection.
- **Span Power and Power Spectral Density**
  - This feature is available from the Spectrum Analysis Main Menu. Press "Page Dn" and select "Power ON".

Note: Dynamic Range

- CX380S-D3.1 has a dynamic range of 60dB with a display range of 70dB. If the received signal level is higher than the peak of the dynamic range, the RF receiver will be overdriven and results in unexpected spurious spikes on the spectrum display. It is recommended that should the peak of the signal is less than 5dB from the top of the display, increase of the attenuation becomes necessary until the peak of the signal is about 10dB below the top of the spectrum display. The full 60dB dynamic range upper and lower limits are shown as purple lines horizontally on screen.

Note: To optimize the Spectrum Analyzer for Noise Floor Detection take the following steps:

1. Go to Setup / Main Menu.

2. Set the 'SA Pre-AMP' setting to 'AUTO'. Thereafter, whenever you enter Spectrum Analysis, as soon as you change the ATTN setting to < 10 dB, the Pre-AMP will automatically turn ON.

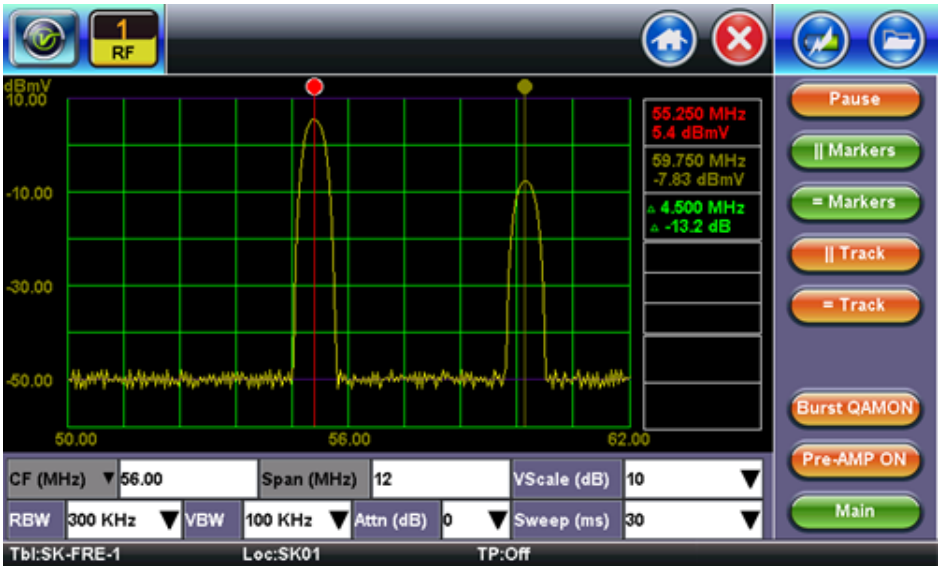
3. Set the 'SA Peak Detector' setting to 'AUTO'. Thereafter, the Peak Detector is always set to Positive-Peak.

To revert back to default settings, change both settings back to 'MANUAL'.

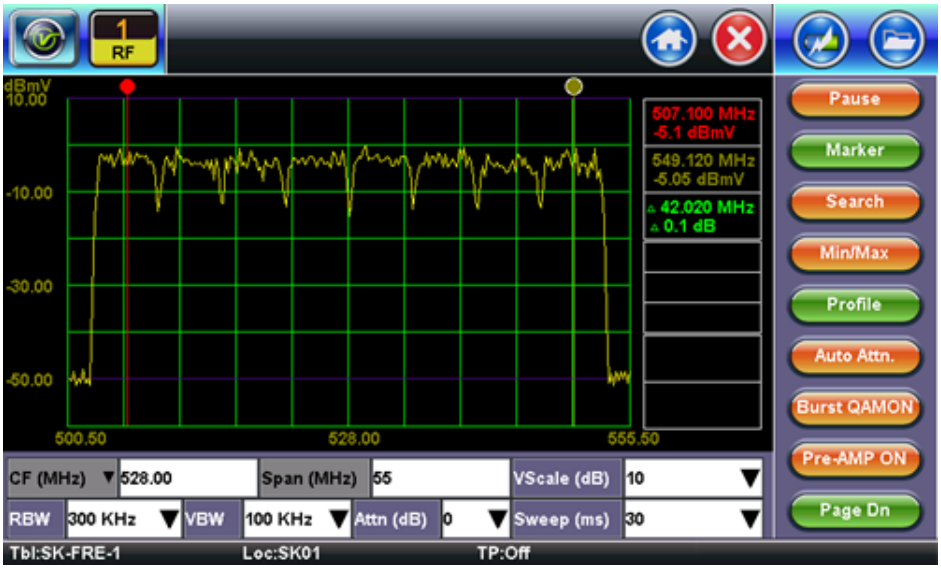
Spectrum Analysis - Setup Main Menu

Spectrum analysis is not overly complicated, but if you are not careful, it is very easy to make mistakes. The following overview provides simple guidelines to accurately measure the amplitude of analog and digitally modulated carriers.

Spectrum Analysis - Analog Signal



Spectrum Analysis - Digital Signal



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7.4.2 Amplitude Measurements

Overview:
Analog and digital carriers are very different in terms of the signal content and distribution of power over the channel and therefore need to be measured differently. Signal level meters that are designed to measure only analog carriers will not always measure digital carriers accurately.

Power is measured either as an absolute level or relative to another power level. Carrier levels are absolute measurements and are measured in power units, such as dBmV or dBuV. Relative power measurements are C/N, delta audio to video, CTB and CSO, and are always measured in dB.

- **Analog TV channel amplitude measurement**
  The DOCSIS RF Specification recommends that the average power of a downstream digitally modulated carrier be set 6dB to 10dB below what the amplitude of an analog TV channel on the same frequency would be. Before measuring or setting the amplitude of a digitally modulated carrier, first measure the amplitude of the cable network's analog TV channels.

- **Digital Carrier amplitude measurement**
  - On a digital carrier, the power is spread out more evenly over time and frequency compared to an analog carrier. To obtain an accurate representation of the power, you must measure the total power across the frequency band, not just at one narrow frequency the way an analog SLM measures level.
  - The 6/8MHz downstream QAM carrier is often referred to as the haystack because it resembles a pile of hay you would see on a farm. The haystack is a continuous MPEG bit stream. The idea is not to just measure the amplitude of the QAM signal,

but to measure the total power contained within the 6 or 8MHz carrier. This is similar to needing to measure the area within the signal (haystack) instead of its height only.
    - Using this example, the power has to be measured within one channel or within a specific frequency range. Use caution when viewing digital modulated signals because the signal level is dependent on the selected measurement bandwidth (resolution bandwidth).
    - Spectrum Analyzers typically do not have an IF or resolution bandwidth wide enough to measure a whole digital signal at once. To overcome this problem, the CX380S-D3.1 makes multiple measurements across the frequency range of the carrier. The powers of each of these measurements are summed up and the average power of the whole channel is calculated.

	**Note: Amplitude Measurements** Analog TV channel visual carrier amplitude and digitally modulated carrier average power are commonly measured in decibel millivolt (dBmV), a unit of power expressed in terms of voltage. Mathematically, dBmV = 20log (signal amplitude in millivolts/1 millivolt).

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7.4.3 Ingress Measurements

7.4.3.1 Forward Path Ingress

Overview:
Forward Path Ingress can be analyzed between 54 to 1000MHz (6MHz channel plan) or 108 to 1000MHz (8MHz channel plan).

Ingress noise is a term assigned by cable operators to describe any interference that is coupled into the forward or return path cable plant via an external source, and can be broadly categorized as follows:

- **Narrow band ingress:** The predominant coupling mechanism for ingress noise is a poorly shielded drop coaxial cable that acts more like an antenna than a drop cable. AM modulated carriers, amateur band and maritime radio transmission generate unwanted signal frequencies at varying amplitudes according to the propagation conditions.
- **Location specific ingress:** Electronic equipment in the subscriber premises can pass strong signal carriers back into the cable system, and these can interfere with reverse signals, such as cable modems.

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7.4.3.2 Reverse Path Ingress

Overview:
Historic video channel assignments limit the upstream frequencies between 5 - 42MHz (North America) and 5 - 65MHz (Europe). The upstream spectrum supporting return path connectivity is frequently impaired by ingress of interfering signals, such as Radio Citizen Band (CB) and other legitimate and non-legitimate RF emissions.

Reverse Ingress can be analyzed between 4 to 42MHz (6MHz channel plan) or 4 to 65MHz (8MHz channel plan).

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Return Path Outages

Return Path Noise and Ingress can be a result of:

- Stationary impairments
    - Thermal noise
    - Intermodulation Distortion (IMD)
    - Frequency response problems
- Transient impairments
    - RF Ingress
    - Impulse noise
    - Signal clipping
- Multiplicative impairments
    - Transient hum modulation
    - Intermittent connections

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Troubleshooting Techniques

1. The "divide and conquer" method normally works best. Establish the most distant point from the headend at which the signal is known to be good quality. Start midway between this point and the affected subscribers to locate the problem amplifier
2. Systematically check the signal level at the return path receiver test points in the headend or hub until the problem node is found

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Ingress Measurement Notes:
The spectrum analyzer's ability to measure low-level signals is limited by the noise generated inside the spectrum analyzer. The sensitivity required to measure low-level signals is determined by the measurement setup. The spectrum analyzer **Input Attenuator** and **Resolution Bandwidth** settings are the key factors that determine how small of a signal the spectrum analyzer can measure.

Input attenuator - When enabled, reduces the level of the signal at the input of the mixer to avoid compression, which can produce unwanted frequency products. An amplifier at the mixer's output will re-amplify the attenuated signal to keep the signal peak at the same point on the analyzer's display. However, in addition to amplifying the attenuated input signal, the noise present in the signal and analyzer is amplified as well. This has the undesired effect of raising the displayed noise level of the analyzer.

Resolution bandwidth - Affects how closely a small signal can be seen in the presence of a large one. By increasing the width of this filter, more noise energy is allowed to hit the envelope detector of the analyzer. This also has the effect of raising the displayed noise level of the analyzer.

Maximum sensitivity - For maximum sensitivity, both the input attenuator and resolution bandwidth settings must be minimized. If, after adjusting the attenuation and resolution bandwidth, an ingress signal is still near the noise, stability of the displayed trace can be improved by video filtering the display using the Video Bandwidth (VBW).

	**Note: Common Path Distortion (CPD)** Produced by poor contacts in the cable distribution network, these contacts create a diode or rectifier effect which produces potentially harmful 2nd and 3rd order Intermodulation Distortion (IMD) products or beats. These beats will occur every 6, 7 or 8MHz in the reverse path, depending on the channel plan used. Although the magnitude of these beats is small, they increase at a node when several reverse paths are combined.

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7.5 Cable Modem

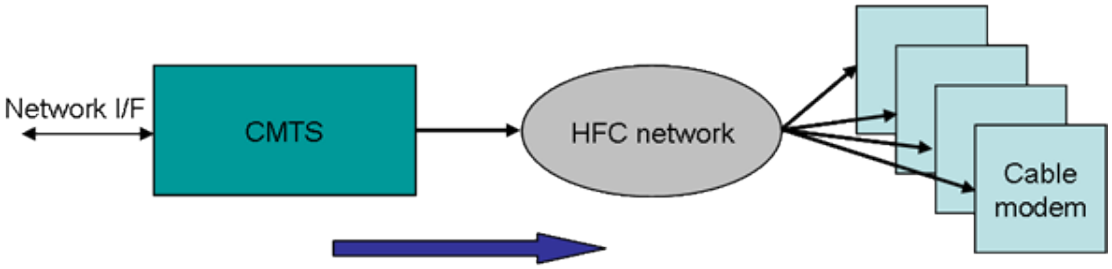
Overview:
Historically, CATV was a unidirectional medium designed to carry broadcast analog video channels to the maximum number of customers at the lowest possible cost. The DOCSIS interface specification basically enables the deployment of data-over-cable systems on a non-proprietary, multi-vendor, interoperable basis for transparent bidirectional transfer of Internet Protocol (IP) traffic between the cable system head end and customer locations over an all-coaxial or Hybrid-Fiber/Coax (HFC) cable network.

In its simplest form, the system consists of a Cable Modem Termination System (CMTS) located at the headend, a coaxial or HFC medium, and a Cable Modem (CM) located at the customer premises. In addition, DOCSIS defines physical, signalling and protocol layers to support interoperability and evolutionary feature capabilities to permit future value-added services.

The DOCSIS layers are briefly outlined as follows:

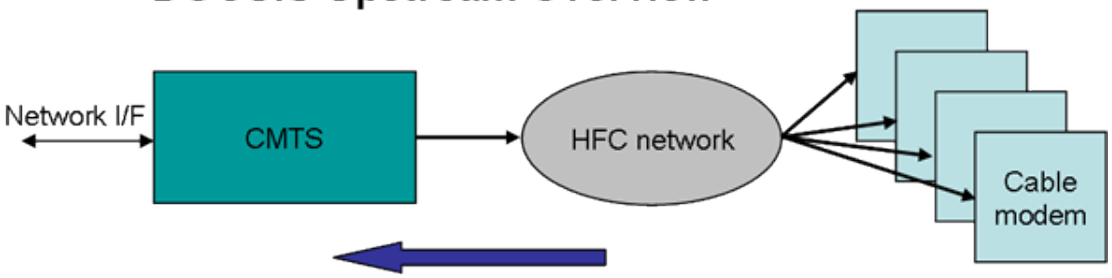
- IP network layer
- Data link layer comprising:
  - Logical Link Control (LLC) sublayer conforming to Ethernet standards
  - Link security sublayer for basic privacy, authorization, and authentication
  - Media Access Control (MAC) sublayer for operation supporting variable-length Protocol Data Units (PDU)
- Physical (PHY) layer comprising:
  - Downstream convergence layer conforming to MPEG-2 (Recommendation H.222.0)
  - Physical Media Dependent (PMD) sublayer for:
    - Downstream based on ITU-T Rec J.83 Annex B with either 64 or 256 Quadrature Amplitude Modulation (QAM), concatenation of Reed-Solomon and Trellis Forward Error Correction (FEC), in addition to variable-depth interleaving
    - Upstream employing Quadrature Phase Shift Keying (QPSK), 16, 64 or 128QAM, support for multiple symbol rates, cable modem controlled and programmable from the CMTS, frequency agility, fixed-frame and variable-length PDU formats, Time-Division Multiple Access (TDMA), programmable Reed-Solomon FEC and preambles, and capability to support future physical layer technologies.

DOCSIS Downstream Overview



- RF signal from CMTS to all Cable Modems (CM)
- Frequency range: 88 to 860 MHz (North America)
  108 to 862 MHz (Europe, Asia)
  DOCSIS 3.1: 108 to 1218 MHz
- Bandwidth: 6 MHz (North America)
  8 MHz (Europe, Asia)
- Modulation: 64QAM or 256QAM

DOCSIS Upstream Overview



- RF signal from CM to all CMTS
- Frequency range: 5 to 42 MHz (North America)
  5 to 65 MHz (Europe, Asia)
  DOCSIS 3.1: 5 to 85 MHz or 5 to 204 MHz
- Bandwidth: 3.2 MHz (DOCSIS 1.0 & 1.1)
  6.4 MHz (DOCSIS 2.0)
- Modulation: QPSK or 16QAM (DOCSIS 1.0 & 1.1)
  64QAM or 128QAM (DOCSIS 2.0)
- TDMA bursts controlled by CMTS

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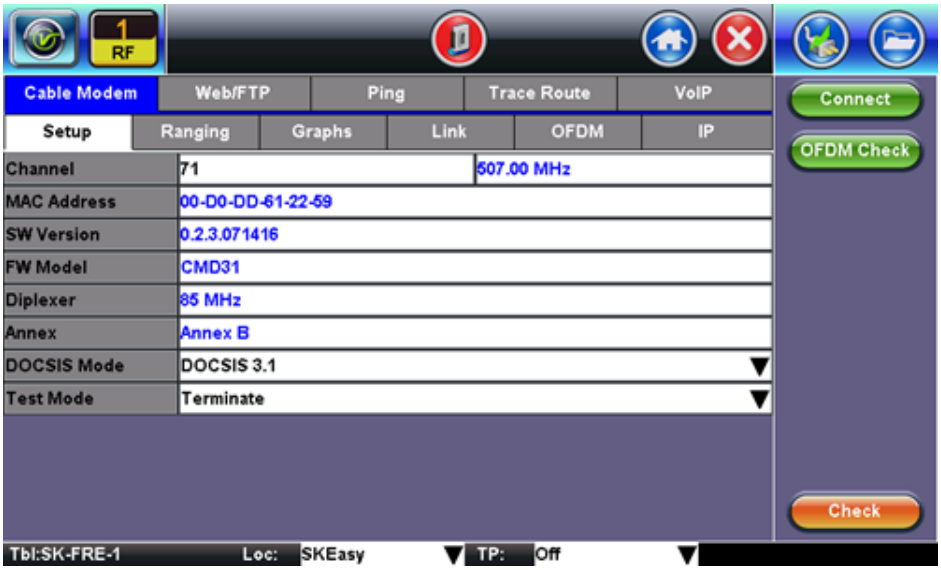
7.5.1 Setup

The CX380S-D3.1 offers a built-in DOCSIS 3.1 cable modem as an option. The built-in cable modem is able to range, register and connect with the headend CMTS to obtain the necessary parameters and a valid IP address on the network.

Launch the Cable Modem application to access the Setup screen.

Cable Modem Setup



Channel: input your system's primary DOCSIS channel

DOCSIS Mode:

- **DOCSIS 3.0:** for DOCSIS 3.0 systems, with up to 32x8 Channel Bonding support.
- **DOCSIS 3.1**: optional, for DOCSIS 3.1 / OFDM systems
  Note: *Legacy DOCSIS 2.0/1.x systems are not supported.*

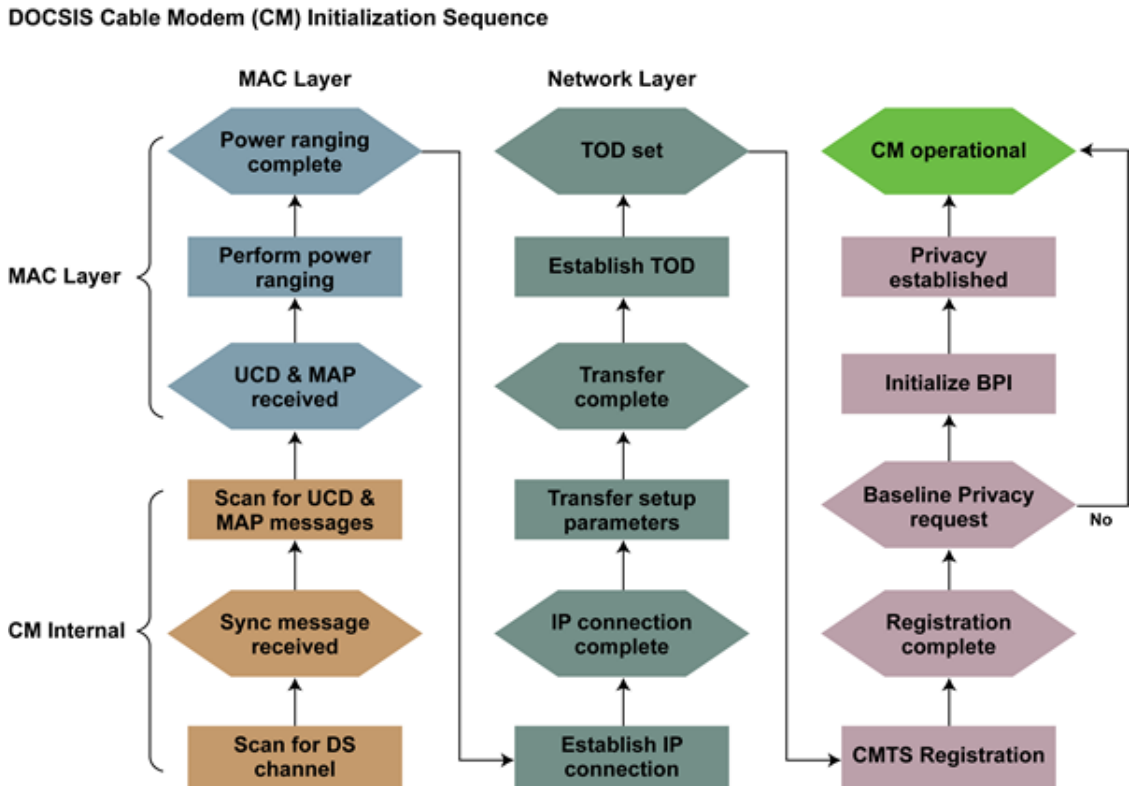
Test Mode:

- **Terminate:** terminate mode
- **Pass Through:** emulating a stand-alone Cable Modem. Once the Cable Modem goes online, you can connect a PC to the 10/100/1000 Ethernet test port at the top of the unit. The meter will automatically assign a Client IP address to the PC. Then with the PC, you can access the internet. This mode helps sectionalize and troubleshoot issues in the customer premises (e.g. replace the actual cable modem).
- **Always On:** terminate mode and also enables the Cable Modem to remain online when you exit from the Cable Modem. This allows you have online connectivity while using other features, such as Remote View and V300 R-Server access.

Once these settings are completed, press Connect. Once connect is pressed, the test set will go directly to the result page. Each step of the connection process is listed. As a step is performed, an "in progress" indicator informs the user of the current status.

After a step is completed, a Pass or Fail status is provided. If any one of the steps fails during the connection process, the cable modem will stop and declare a failed connection. At this point, the user can either choose to reset the test and try again, or go back to setup and verify the settings.

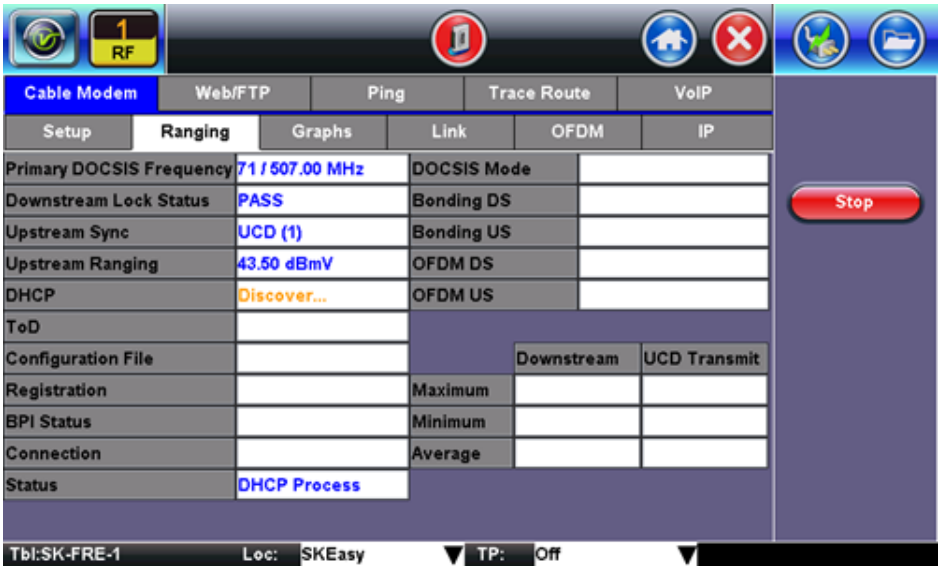
DOCSIS Cable Modem (CM) Initialization Sequence



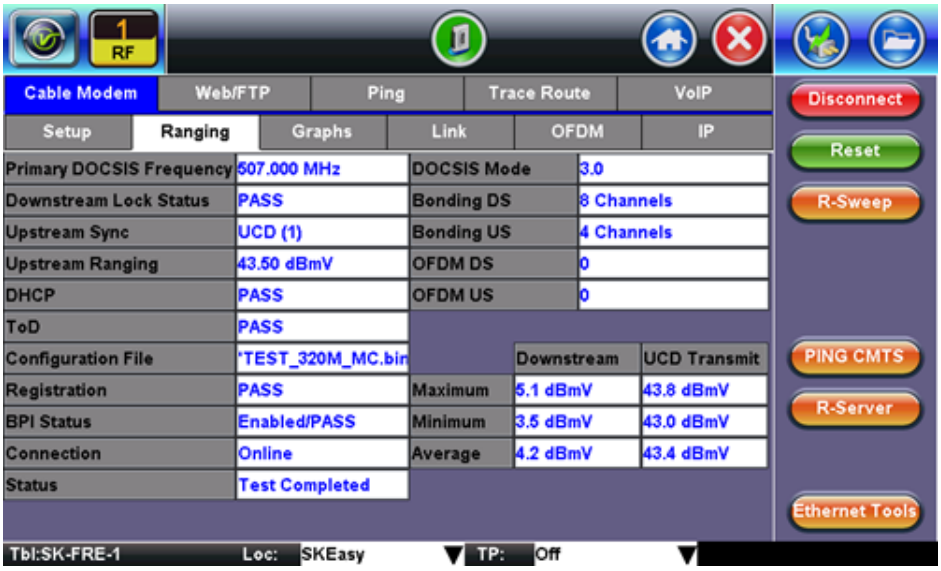
Cable Modem (CM) Connection Procedure and Training Sequence

1. CM scans the Downstream (DS) spectrum for a valid DOCSIS signal (either 64QAM or 256QAM). This can be a time consuming step if the CM is not on a channel.
2. CM demodulates the DOCSIS signal and looks for a SYNC message.
3. CMTS periodically broadcasts Upstream (US) Channel Descriptors (UCD) over the DS channel, from which a CM learns its assigned upstream operational frequency.
   The CM in turn scans for these UCD messages, which instructs the CM how to configure a burst profile (frequency, modulation, and burst parameters).
   The CM has now established both a US and a DS frequency.
4. CMTS periodically transmits US bandwidth allocation maps (MAP) in shared time slots in the DS direction. The CM looks for these MAP messages, which list the granted and contended Time Slots (TSs) for US communication.
5. CMTS assigns a temporary Service Identifier (SID) to the CM, which initiates a coarse power ranging and time synchronization process.
   The first Upstream burst that the CM sends is the initial maintenance - the CMTS responds with the Range-Response (RGN-RSP) message for frequency, power, and timing settings.
6. CMTS periodically sends keep-alive messages to verify link continuity between itself and all CM units in the same domain. When a CM receives its first keep-alive message, it reverts to a fine power ranging.
7. CM now forwards a bandwidth request to the CMTS, which in turn forwards a grant to the CM, permitting it to forward upstream information in allocated time slots.
8. CM now makes a DHCP discovery followed by a DHCP request. The CMTS forwards a DHCP acknowledgment from the DHCP server containing an IP address, a default gateway, the addresses of a TFTP and TOD server, and a TFTP configuration file name.
9. CM now initiates the TOD and TFTP process. From the TFTP server, the CM receives a configuration file containing QoS, security, applicable frequency assignments and any new software images.
10. CM forwards TFTP configuration file to the CMTS and initiates a registration request. If the configuration file is valid, the CMTS assigns the CM a permanent SID and registers the CM to online status.
11. Following registration, the CM optionally initiates the activation of the 56-bit DES encryption algorithm to provide security between the CMTS and itself over the cable plant.
12. CM is now operational and online.

Cable Modem Connection Process 1



Cable Modem, Ranging Tab, Online Status



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Server Connections

DOCSIS specifies that for a system to become functional and operational, the CMTS and CM must interface with the following mandatory servers:

- **Dynamic Host Configuration Protocol (DHCP) server** - Defined by RFC2181, it provides the IP addresses for both the CM and subsequent PC devices that follow.
- **Time of Day (TOD) server** - Defined by RFC868 for the purpose of time stamping operational system events.
- **Trivial File Transfer Protocol (TFTP) server** - Defined by RFC1350 for the purpose of registering and downloading CM configuration files for individual customer service. These configurations could include Quality of Service (QoS) parameters, Baseline Privacy Implementation (BPI), operating frequency assignments, the number of host devices, etc.

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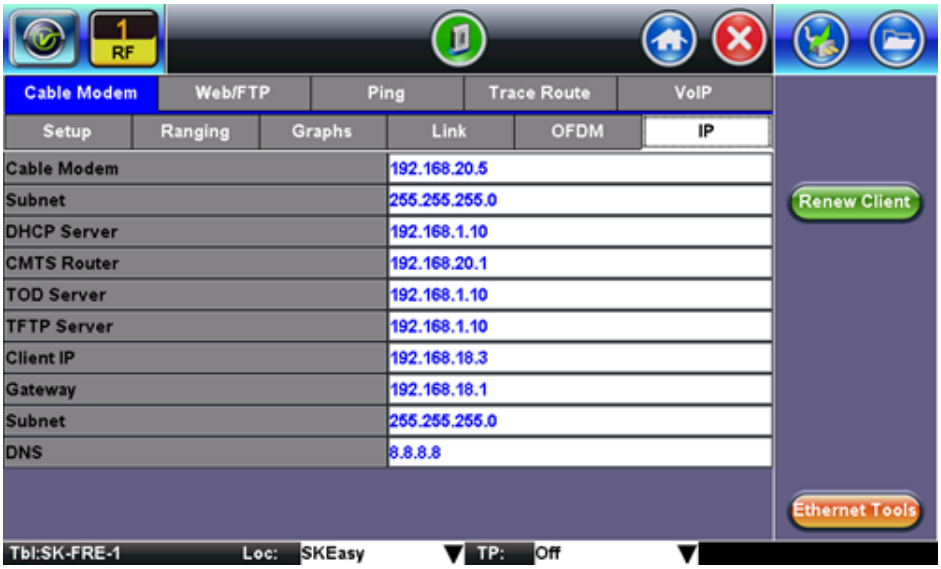
7.5.2 Cable Modem Results - DOCSIS 3.0

Ranging tab:
Provides information about ranging results, including channel bonding status, downstream power levels and UCD Transmit levels.

IP tab:
Once online, the user can access the IP results. This screen provides all the information related to the various IP addresses acquired or used during the connection process.

Cable Modem - IP Results



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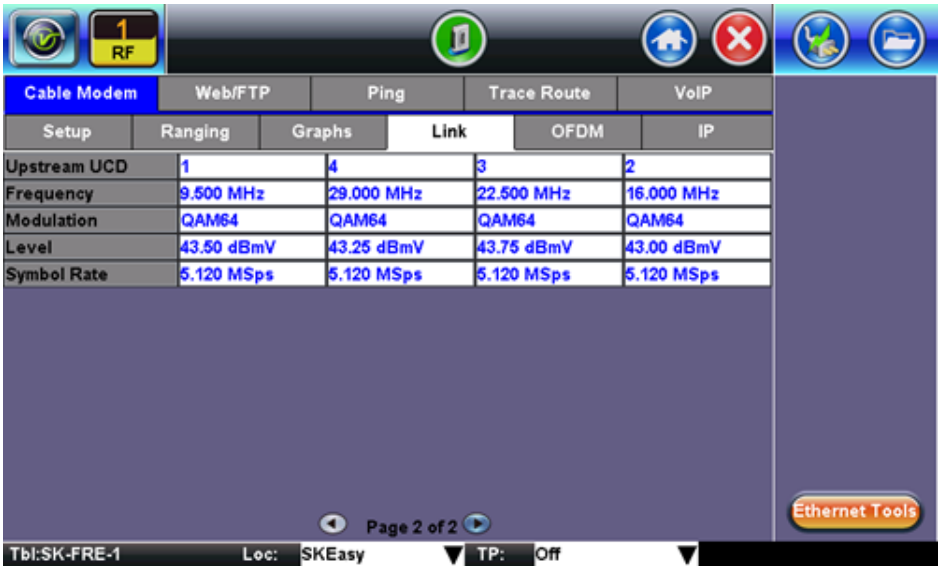
Link tab:
Provides information about the packets received, the downstream signal (frequency, modulation, level, MER) and about the upstream signal (frequency, level, modulation).

Cable Modem - Link Results (Downstream)

Cable Modem - Link Results (Upstream)



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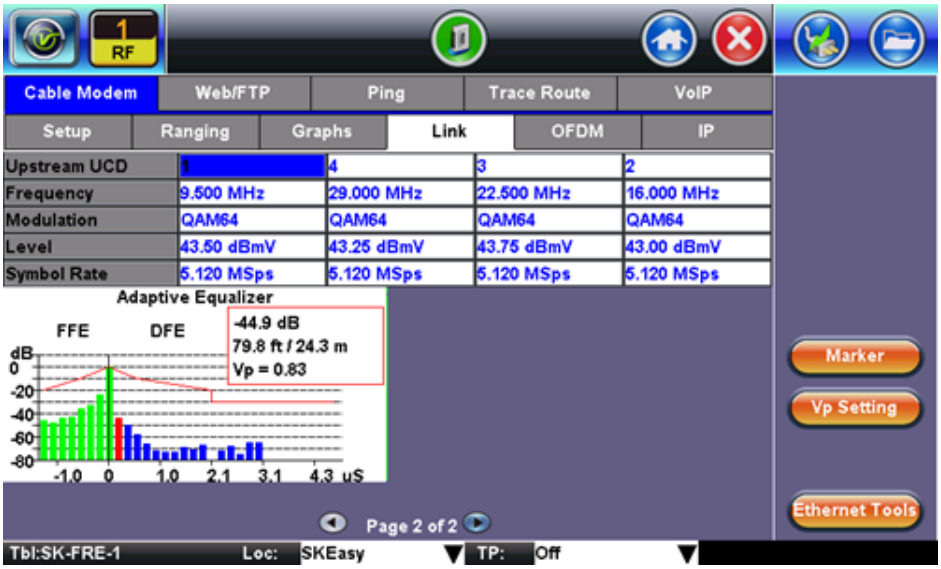
The Upstream channels provide Upstream Pre-Equalization information, which can be obtained by tapping on an Upstream UCD number.

Press the **Marker** button to highlight a specific pre-equalizer coefficient, for advanced troubleshooting information.

Cable Modem - Upstream Pre-Equalization Information



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Ping / Trace Route / VoIP / Web/ FTP tab:
The IP functions are similar to the ones described in IP Tools. ARPWiz is not supported on the Cable Modem interface.

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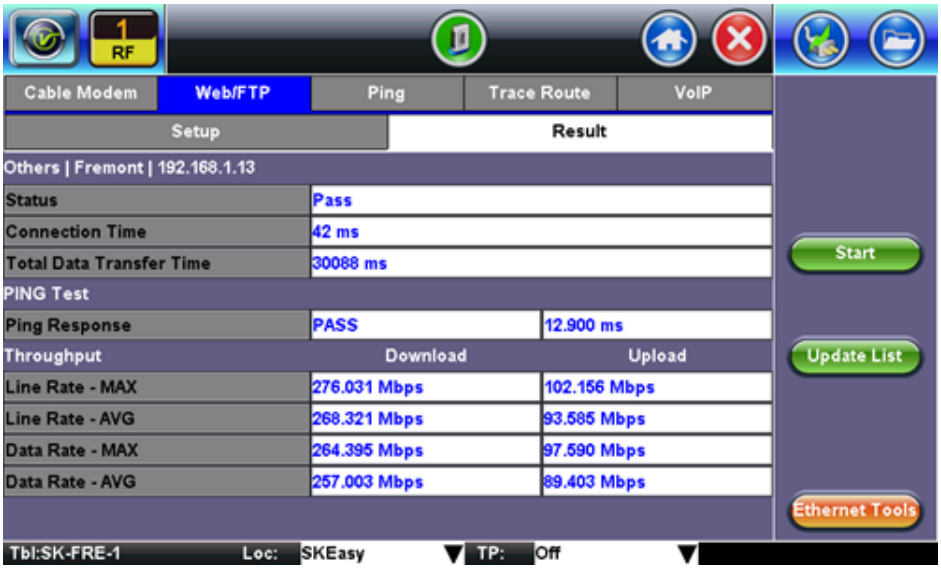
VeTest:
VeTest is a throughput test to an actual customer speed test server site.

In the **Web/FTP** tab, select **Mode** as 'VeTest'. Then, make appropriate selections for Provider and VeTest Server. If you cannot find the selections you are looking for, you can press **Update List** to check for the latest VeTest Server List site.
Note: The **Update List** feature requires the Cable Modem to be online.

Press **Start** to begin the test.

Cable Modem - VeTest



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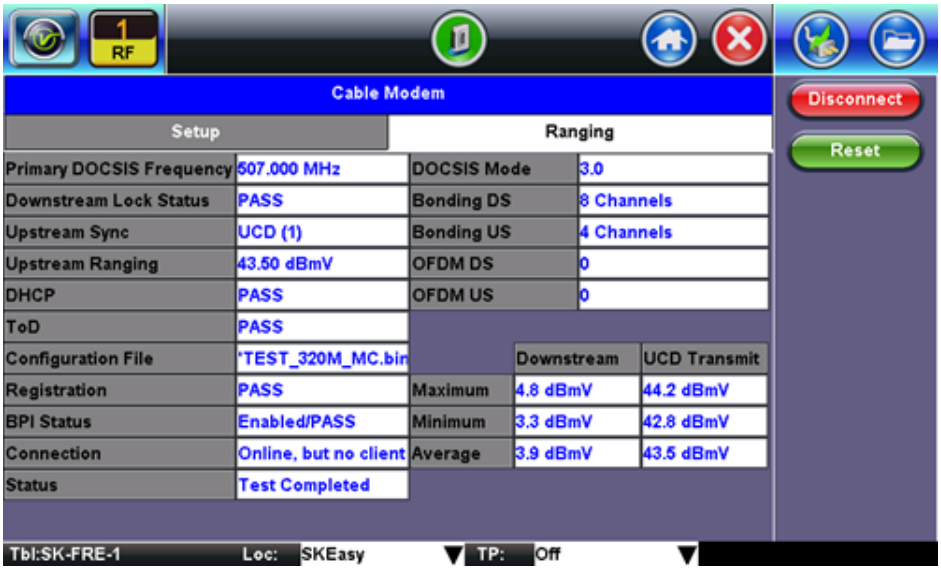
Pass Through tab:
Provides the ability to emulate a real cable modem. In the Setup screen, select Pass Through for the Test Mode and press Connect. Once the Cable Modem goes online, connect a PC to the meter's 10/100/1000T RJ45 port at the top of the unit. Traffic will pass through the meter, which functions like an actual cable modem.

Cable Modem - Pass Through



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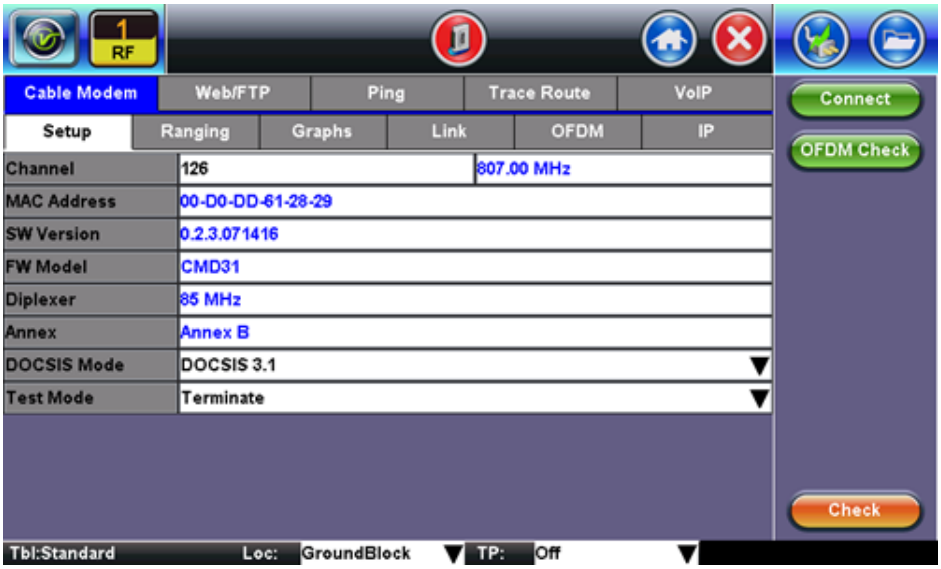
7.5.3 Cable Modem Results - DOCSIS 3.1/OFDM

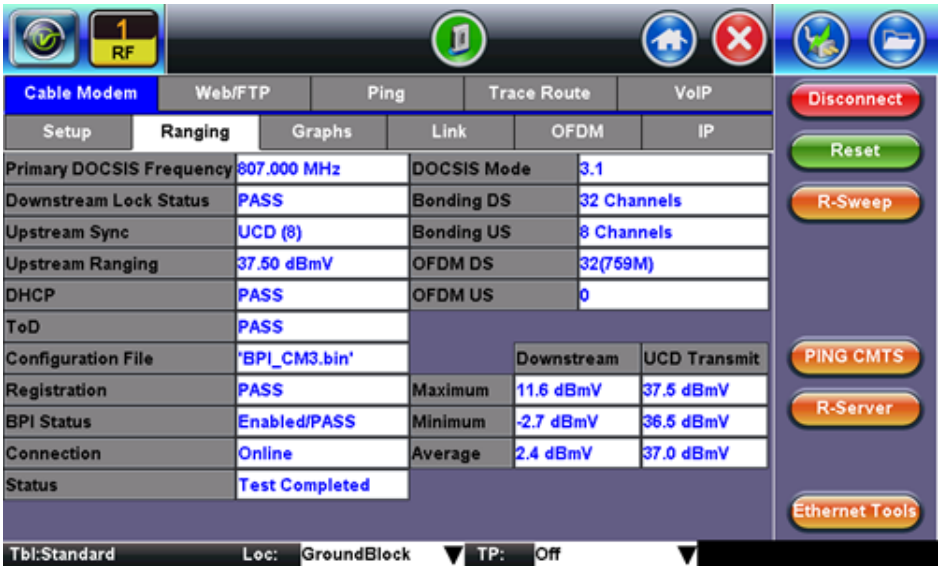
Setup for DOCSIS 3.1/OFDM Systems



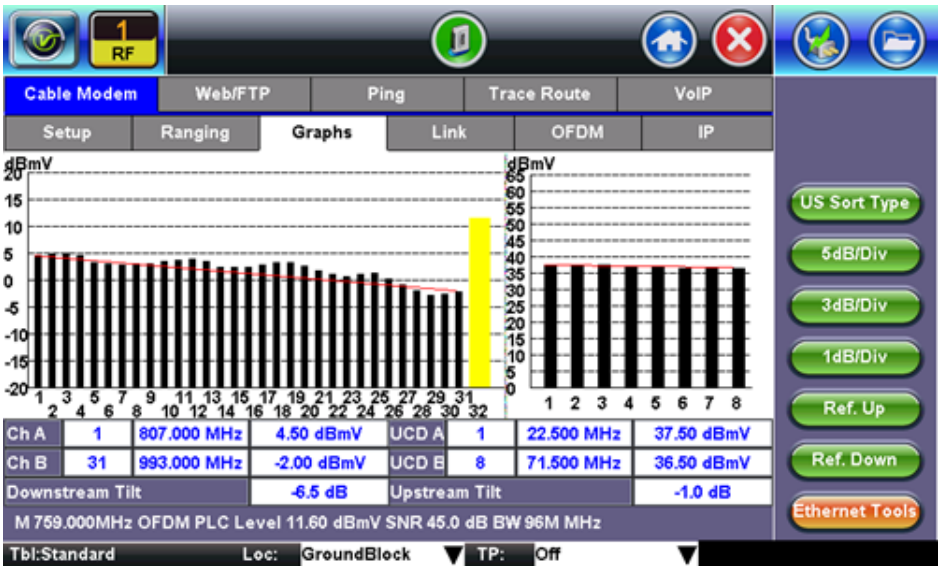
For testing with DOCSIS 3.1 systems, follow these steps.

1. For a system that contains both Single Carrier QAM (SC-QAM) and OFDM channels, enter the primary SC-QAM DOCSIS Channel number and press **Connect** to go online.

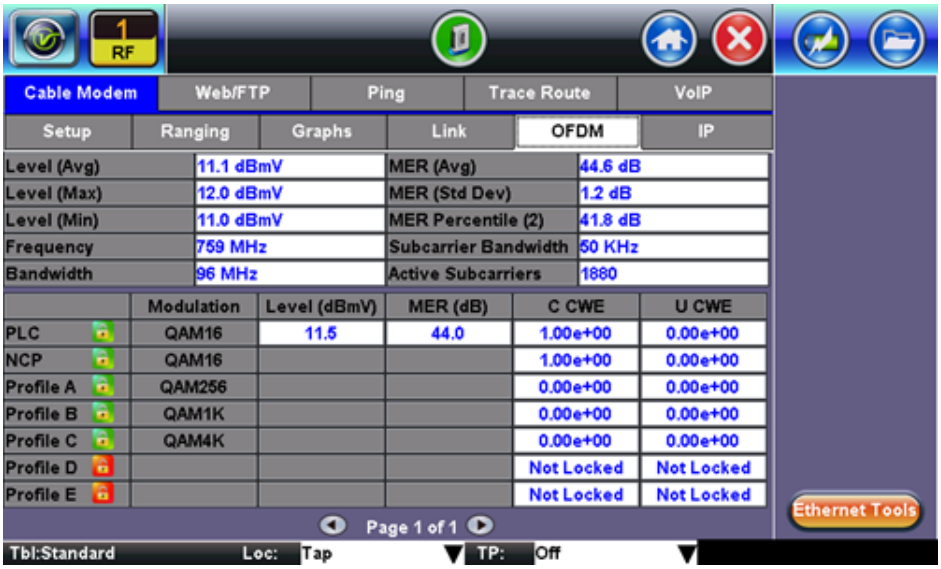
Ranging tab, Online Status in D3.1 Mode



Graphs tab, Online Status in D3.1 Mode



D3.1 OFDM Tab Results



OFDM Tab measurements:

- **Level**: reports Average, Maximum, and Minimum for the OFDM PLC.
- **Frequency**: Primary OFDM PLC Frequency

- **Bandwidth**: OFDM Channel Bandwidth
- **MER (Avg)**: Average MER for the Active OFDM Subcarriers
- **MER (Std Dev**): Standard Deviation for the Active OFDM Subcarriers
- **MER Percentile (2)**: the MER value for the worst 2% of all OFDM Subcarriers
- **Subcarrier Bandwidth**: bandwidth setting used for each OFDM Subcarrier
- **Active Subcarriers**: the number of active Subcarriers in the OFDM channel.
- **PLC**: Phy Link Channel
- **NCP**: Next Codeword Pointer
- **Modulation Profiles A, B, C, D, E**
- **C CWE**: Corrected Codeword Errors
- **U CWE**: Uncorrectable Codeword Errors

2. For a system that contains only OFDM channels, in the **Setup** tab, press **OFDM Check**. Enter the center frequency of the OFDM Phy Link Channel (PLC). Press **Connect**.

D3.1 OFDM Check Mode

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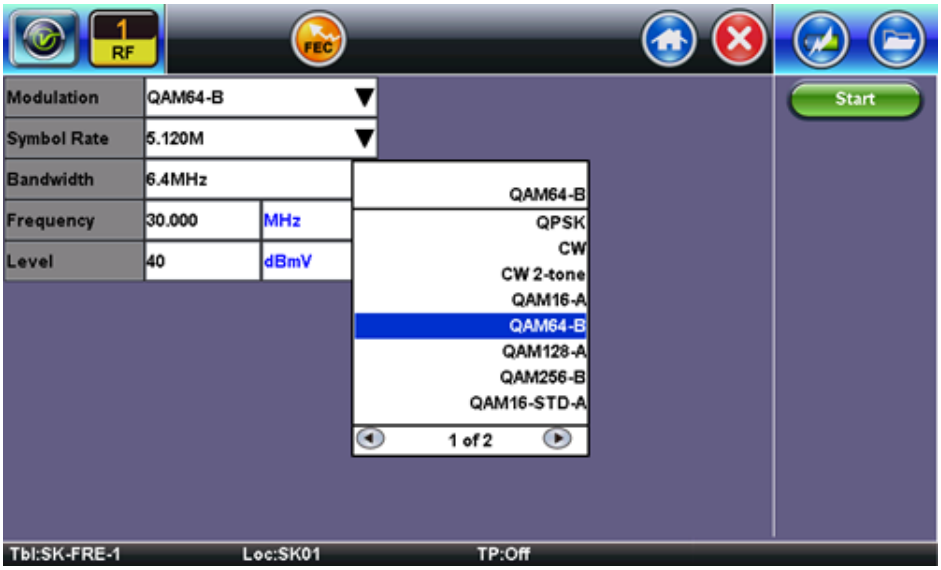
7.6 Upstream Signal Generator with FEC Correction (USG+FEC)

Overview:
The Upstream Signal Generator (USG) function generates a signal for upstream or return path testing.

- The USG + FEC option supports CW, CW 2-tone QPSK, QAM-16 Annex A, QAM-64 Annex B, QAM-128 Annex A and QAM-256 Annex B signal generation. QAM-16 STD Annex A, QAM-64 STD Annex A and QAM-128 STD Annex A are with ITU standard interleave (i & j) settings.
- The frequency is adjustable in the range of 5MHz to 65MHz.
- The level is adjustable over a dynamic range of 60dBuV to 120dBuV or 0dBmV to 60dBmV. When a digital modulation is selected, a symbol rate of 1.28Mbps, 2.56Mbps and 5.12Mbps with bandwidth of 1.6MHz, 3.2MHz and 6.4MHz respectively can be selected.
- The test set's USG+FEC option can continuously generate the selected signal after it is activated by selecting the LEAVE ON option upon exiting the USG+FEC menu. This allows a user to perform other measurements while the USG+FEC stays on.

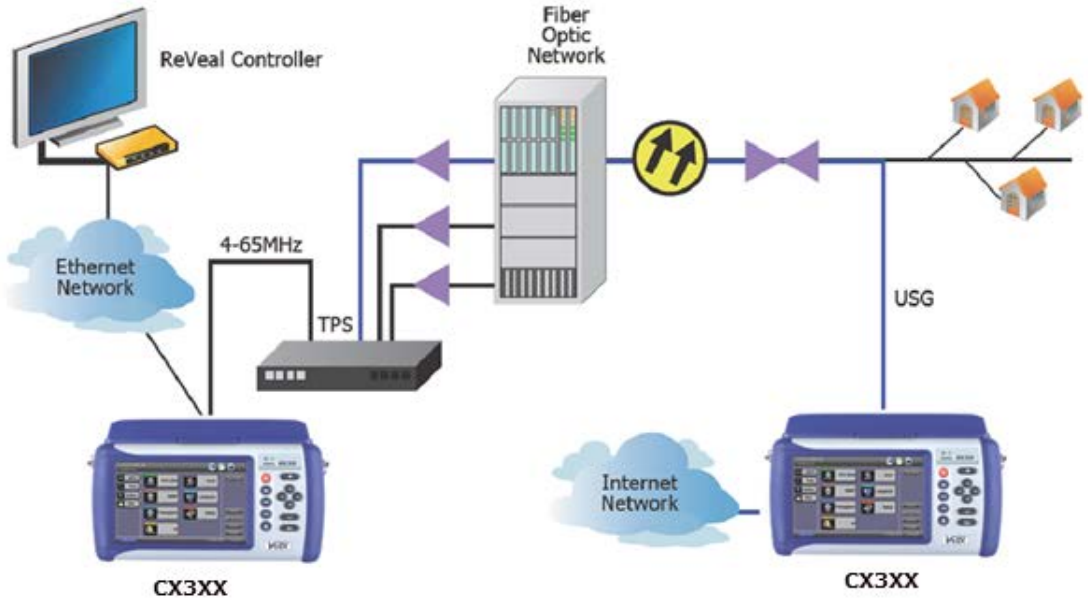
USG Setup



Note: Symbol Rate
The symbol rate is the gross bit rate, inclusive of channel coding overhead, divided by the number of bits transmitted in each symbol. Symbol rate is measured in symbols-per-second, hertz (Hz), or baud (Bd).

The USG function is a powerful application to check and validate the reverse path for DOCSIS cable modem operation. The USG is used in conjunction with the QAM analyzer option. See below.

Reverse Path Testing Using USG and QAM Analyzer Functions



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7.7 Installation Check

Overview:
This function performs measurements on user pre-defined channels. Up to 16 analog channels and/or 16 digital channels can be pre-programmed. OFDM - the Japanese standard channels can also be programmed (requires the OFDM option to be enabled). Each channel table has its own installation check settings. The user can modify these settings with ReVeal CX300 and load the updated configurations to the test set, or directly by changing the settings on the test set and save the new settings in the current channel table in use.

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7.7.1 Setup

The user can select to test Analog channels only, Digital channels only or both. OFDM channels can also be tested (requires OFDM option to be enabled).

Installation Check

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7.7.2 Results

During the test, a status indicator is displayed. Once completed, the yellow square is replaced by a green square if the measurements meet the location based thresholds, or a red square if the measurements fail to meet the location based thresholds. Once the measurements are completed, the user can display detailed information about each channel by tapping on the magnifying glass at the bottom right of the summary screen

The selected channels for the installation check test need to be active on the selected channel table. The installation check derives the pass and fail criteria by comparing the measured values to pre-selected thresholds (locations). If no parameter has been selected on the active location, a warning message will be displayed.

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Analog Channels

The following measurements are performed for each channel:

- Video Power Level in dBmV/dBuV
- Audio1 Power Level in dBmV/dBuV
- V/A1 Ratio in dB
- Audio2 Power Level in dBmV/dBuV
- Video/Audio2 Delta in dB
- Max Adjacent Channel Delta in dB

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Digital Channels

The following measurements are performed for each channel:

- QAM Power Level in dBmV
- MER in dB
- Pre-BER
- Post-BER
- Max Adjacent Channel Delta in dB

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7.8 Advanced Tools

Note: 1G / 10G Ethernet
The test set supports optional single port 1 Gigabit and 10 Gigabit Ethernet test features. For more information, see the *TX300s/TX320s User Manual* on www.veexinc.com.

Under the ADVANCED TOOLS menu, the following features are available:

- Return Path Analysis
- Sweep Operations
- MPEG Operations
- Remote Operation
- R-Server
- TPS Control
- More:
  - RP Balancing
  - HIP
  - Headend Check
  - FCC POP

Advanced Tools Menu

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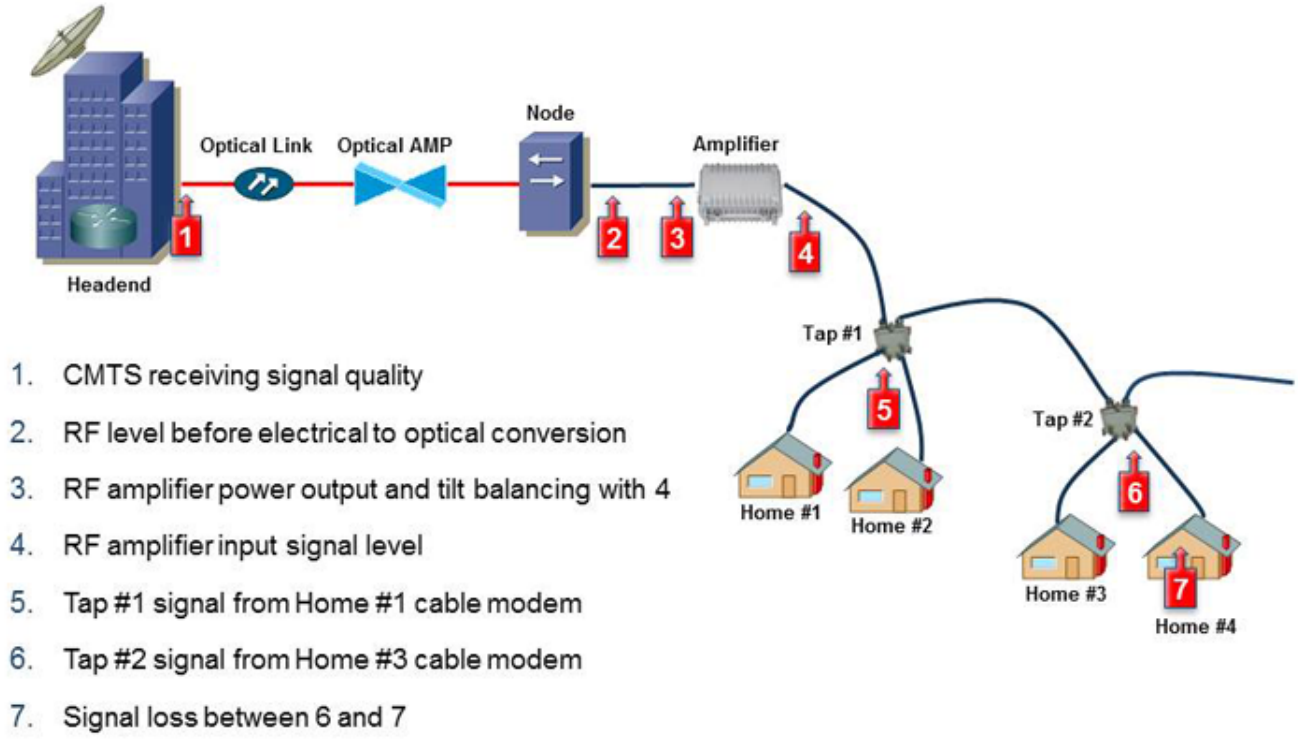
7.8.1 Return Path Analysis

Overview:
The Return Path refers to the path of the signals sent by cable modems at home to the CMTS located at the headend. Cable Modems on the same co-axial cable are "time sharing" the bandwidth from 5MHz to 42MHz or 5MHz to 65MHz.

HFC Test Points - Return Path



Operators increase Return Path bandwidth by using higher QAM64, 128, 256. Higher QAM introduces more noise sources affecting QAM64, 128 and 256. It becomes important to verify transmission quality with Return Path QAM analysis.

For Return Path QAM analysis, the upstream signal source must be FEC encoded in order for MER, Pre-FEC, Post-FEC and Constellation analysis. Generally, a VeEX CX series test unit with USG+FEC is required as the signal source.

To perform the Return Path QAM Analysis:

1. Press Return Path Analysis under the Advanced Tools menu on the home screen. Connect the test cable to the RF-IN test port.

2. Input test parameters: CF (Center Frequency), Symbol Rate, BW (Bandwidth), and MOD (Modulation) to match far end USG unit.

3. Press Start. Look for the QAM lock logo to transition to green and for measurements to begin.

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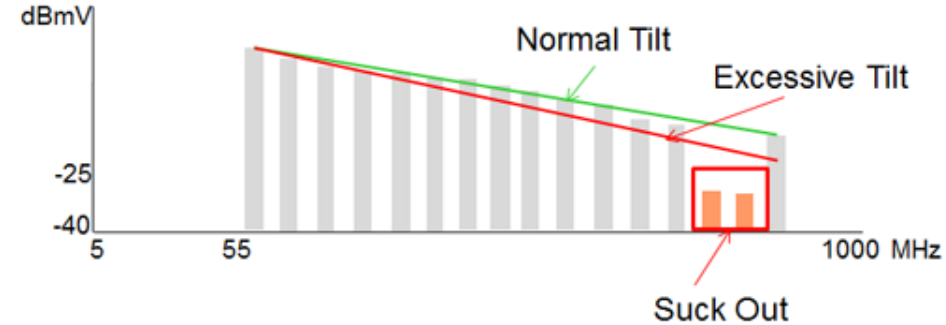
7.8.2 Sweep Operations

Overview:
Sweep is used to identify improper balance of amplifiers, tilts, or suck outs.

Tilt and Suck Out

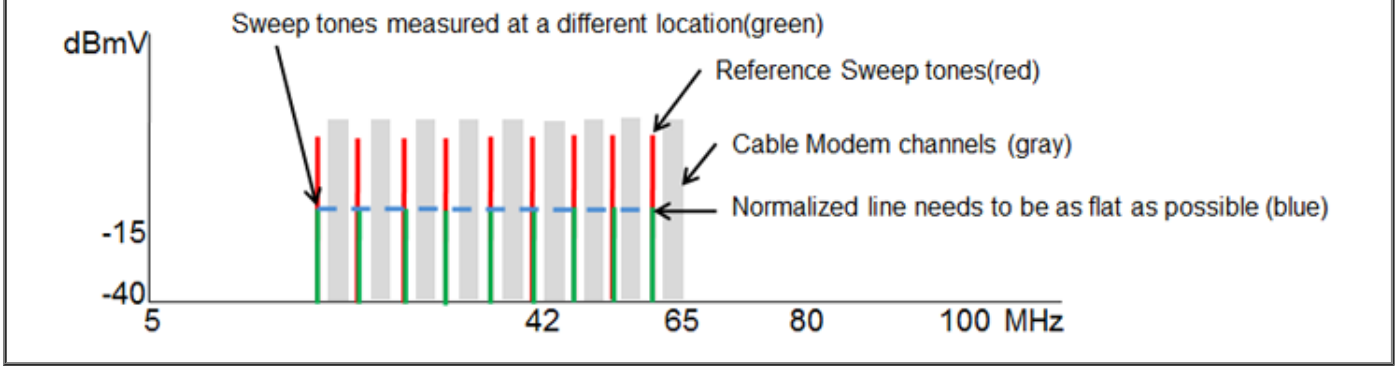


Starting from a drop point nearest to the signal source, for example, a Headend office, a Sweep operation measures the signal levels across the bandwidth with predefined check points in a Sweep table. The measurement is kept as a reference. Move the test set to the next drop point away from the first one, take the same measurement and compare with the reference measurement. Ideally, the signal of each check point should be relatively less or more, proportionate to the reference signal.

The following Sweep Operations are available under the Sweep Operations menu:

- **Return Path Sweep:** This function verifies the frequency response, tilt and proper operation of the amplifiers.
  Take a measurement by the sweep receiver in the Headend while sweep tones are inserted at point 2; the closest point to the Headend. Save this measurement as reference. Move and insert sweep tones at points 4, 5, 6, and 7, compare results and verify the frequency response and tilt at each point is relatively flat (refer to the graphic titled "HFC Test Points - Return Path" under Return Path Analysis section 7.8.1).

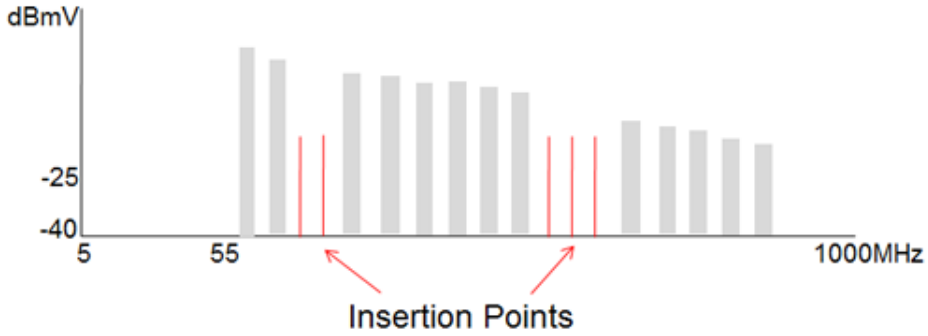
Return Path Sweep



The Return Path Sweep operation on CX380S-D3.1 depends on the test mode selection of either Controller or Responder, which can be selected under SETUP, Main Menu. The CX380S-D3.1 operates as a return path signal generator unit if Controller is selected, and a measurement unit if Responder is selected.

- **In Service Sweep:** This is a non service interrupting forward path sweep feature.
  In the Analog spectrum, sweep can be performed by inserting tones within the analog TV channels or un-used bands - a sweep tone generator is then required at the Headend. In an all-digital HFC system, tone insertion between channels is not possible, therefore In Service Sweep (ISS) is the preferred solution. ISS measures existing channels and makes a comparison.

Forward Path Sweep Insertion Points



The current channel table is used. The CX380S-D3.1 measures the in-service analog and digital channels to obtain the frequency response of the HFC networks.

- **Forward Path Sweep:** This function verifies the frequency response and proper operation of the amplifiers. It is a one person operation with Internet connection and requires Remote View and Sweep options on CX380.

- **In-Band Sweep:** CX380S-D3.1 also supports In-Band Sweep for Return Path and Forward Path. For In-Band Sweep, no separate connection is necessary. Communication between the 'Controller' unit and the 'Responder Unit is done via the same coaxial cable under test, using a proprietary in-band communication protocol.

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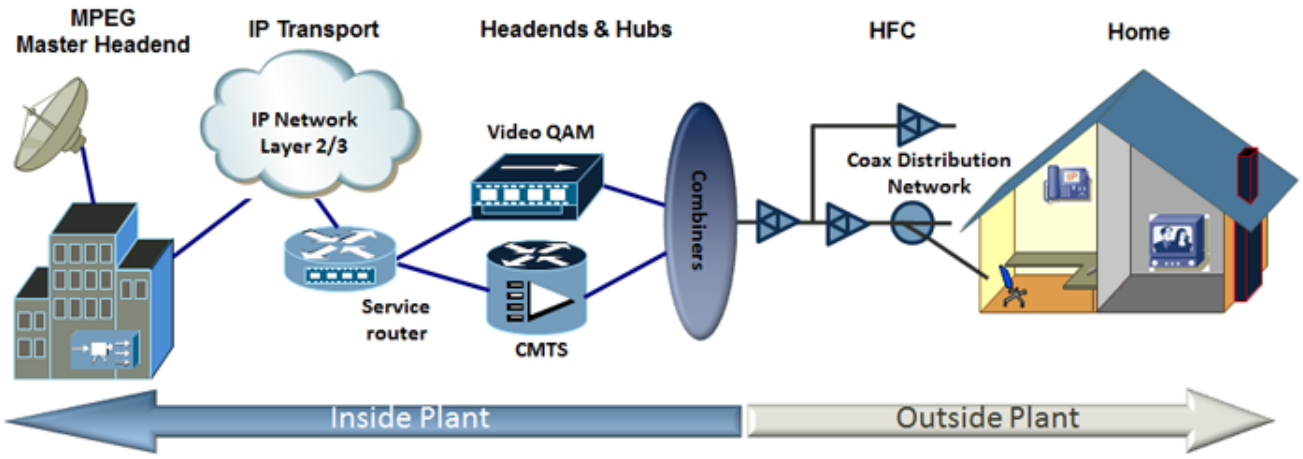
7.8.3 MPEG Operations

Overview:
MPEG-1/ MPEG-2 are digital video compression standards developed by Motion Pictures Expert Group. MPEG-1 video compression is based upon the same technique used in JPEG, but includes techniques for efficient coding of a video sequence. MPEG-2 is the current de facto standard, widely used in DVD and Digital TV. Ubiquity in hardware implies that it will be here for a long time. While MPEG-2 compression is widely adopted for SDTV broadcast applications, the newer H.264 compression standard is preferred for higher bandwidth HDTV signals. However, transition to HDTV has taken over 13 years and is ongoing, so MPEG-2 will continue for a while. Different profiles and levels in MPEG-2 allow for quality control.

Per the DVB-C standard, MPEG-2 video is usually transported from Master Headend over fiber using SONET/IP technologies that contain FEC or other error checking mechanisms. At regional Headends/Hub sites, the MPEG-2 is extracted, QAM modulated, IF unconverted and

inserted into 6/8MHz channels for transmission over the HFC network to customer STBs. The key impairments that can occur are caused by micro-reflections, non-linearity problems in the network, and interference from adjacent analog channels (due to higher power levels). MPEG-2 QoS testing will occur at the Master satellite Headend, or at any other point where the Service Information is changed, and before insertion into the coaxial plant.

MPEG Network



Test Challenges:
There is no single, simple test solution for MPEG. Terminology is new and confusing for those unfamiliar with digital video with terms such as Elementary Stream (ES), Packetized Elementary Stream (PES), Transport Stream (TS), Program-Specific Information (PSI), etc. The best known Test guideline is known as ETSI TR 101 290 Measurement guidelines for DVB systems. The ATSC has also recently introduced ATSC Recommended Practice: Transport Stream Verification A78.

Things to remember: Fix continuity problems first. Continuity errors create bogus alarms in other areas. Until the continuity problems are resolved, it will be very hard to determine if there are other problems in the stream. The PAT (Program Associate Table) is on PID 0x00. This is the first PID a decoder looks at – the MPEG 'Base PID'.

The CX380S-D3.1 can be optioned to perform MPEG analysis of a digital carrier that contains MPEG programs. The following functions are available under the MPEG Operations menu:

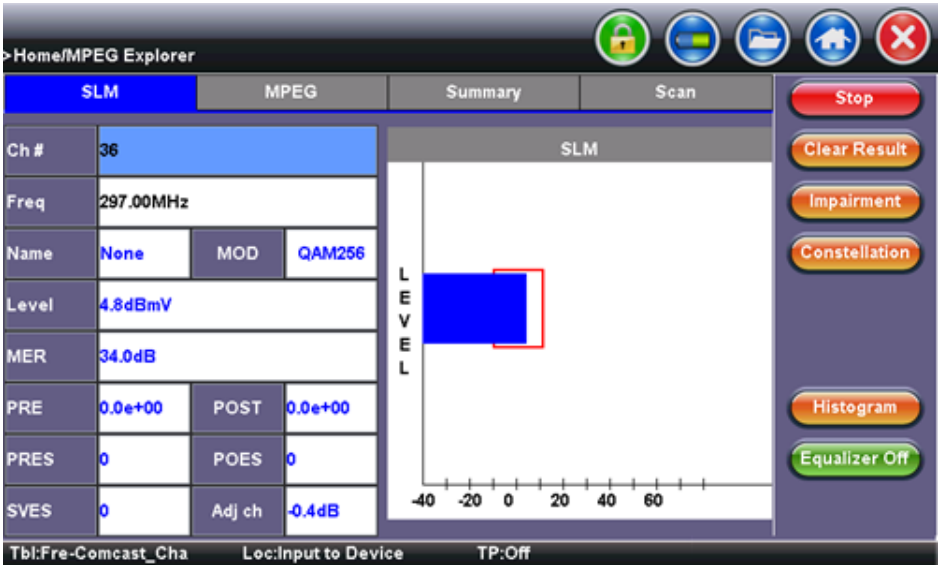
- **MPEG Explorer**: The MPEG Explorer provides a convenient and practical way to evaluate user quality of experience levels using objective test data. MOS scores provide a familiar, intuitive representation of picture, audio, and overall audiovisual quality. Metrics such as Relative MOS and VSTQ can be useful in accurately comparing video quality across different service types.

  MPEG Explorer metrics are grouped by:

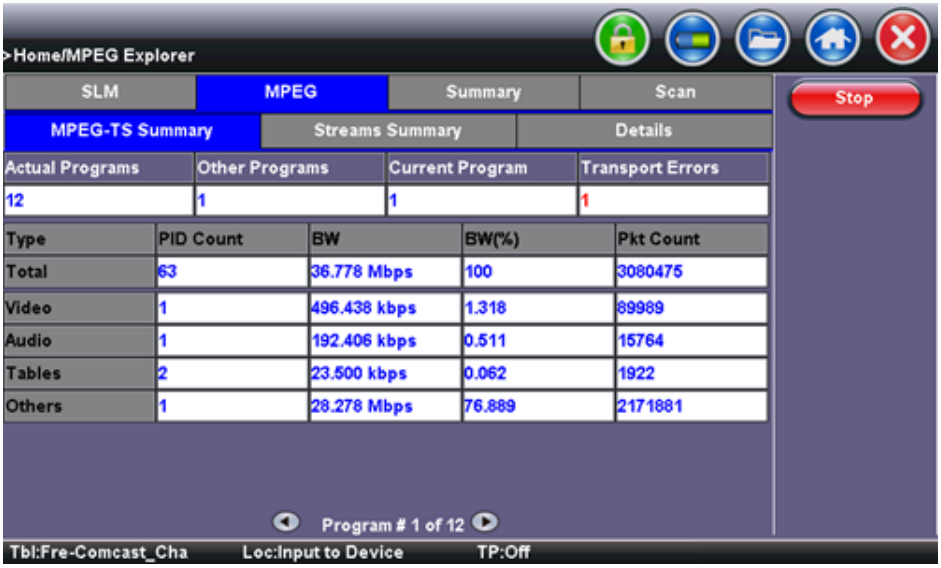
  - Video Stream Metrics - Relate to the encoded video stream, including image size, frame rate, GoP structure, etc.
  - Transmission Metrics - Relate to the performance of the IP network, UDP/TCP and RTP/MPEG Transport protocols

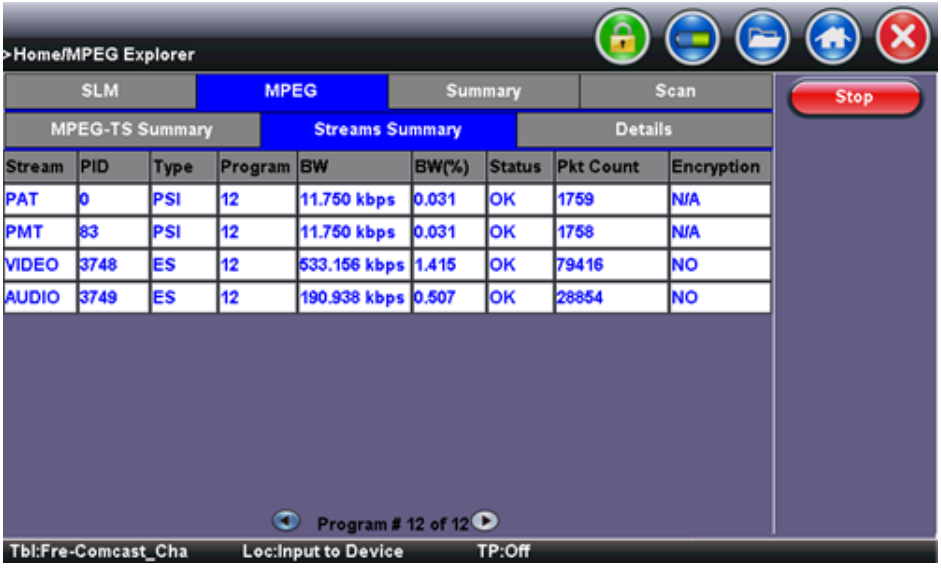
  The following functions are available under the MPEG Explorer:

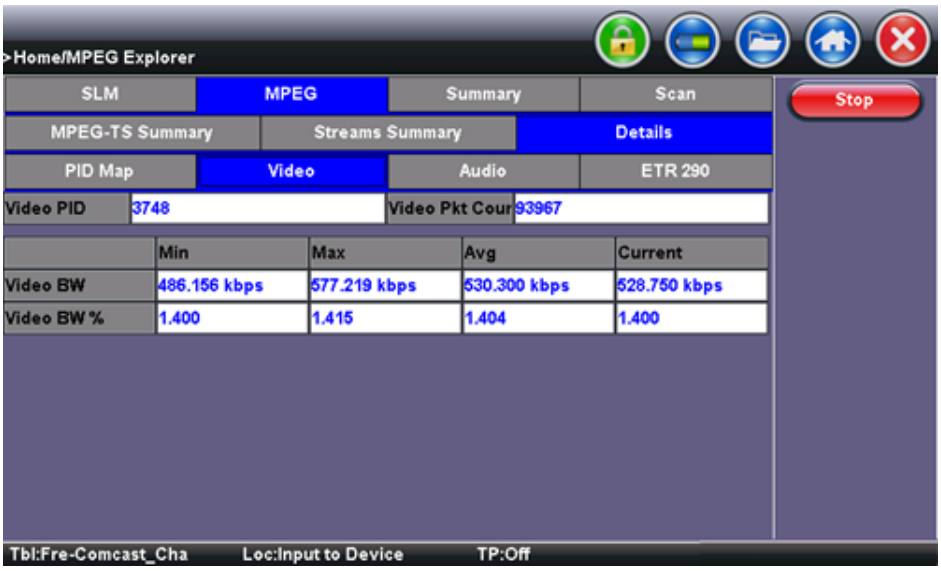
  - **SLM Measurements** - RF Domain
  - **MPEG**
  - **Summary**
  - **Scan - MPEG Channel Scan**



Always check signal level & quality of QAM carrier/s. Without a good strong signal, analysis of the MPEG stream may not yield any useful information. Check FEC counters and use Constellation diagram to identify problems. Disable/enable Equalizer to check QAM decoder performance, group delay and frequency response.







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7.8.4 Remote Operations

Overview:
Remote Operations allow fast spectrum analysis with high speed Internet communication that is not possible with the slow and old-style telemetry system. There is easy Internet connection through existing HFC network with built-in Cable Modem, USB WiFi adaptor, USB 3G mobile data card, or built-in 10/100-T Ethernet port. This function also offers powerful all-in-one features such as remote return path spectrum analysis, remote return path QAM analysis with integrated QAM generator supporting QAM16, 64, 128 and 256 modulations, remote return path multi-port ingress monitor, and remote return path alignment with integrated CW generator.

The following functions are available under the Remote Operations menu:

- **Remote View:** An optional feature to allow remote viewing of other VeEX CX devices.
- **IGM Scan Monitor:** To view a CX180R-IGM, the return path monitor system, current scanning spectrum.
- **Responder:** For configuring the unit as a Responder unit. This mode is used for Return Path Sweep and Remote View with a far end CX3XX configured as a Controller.

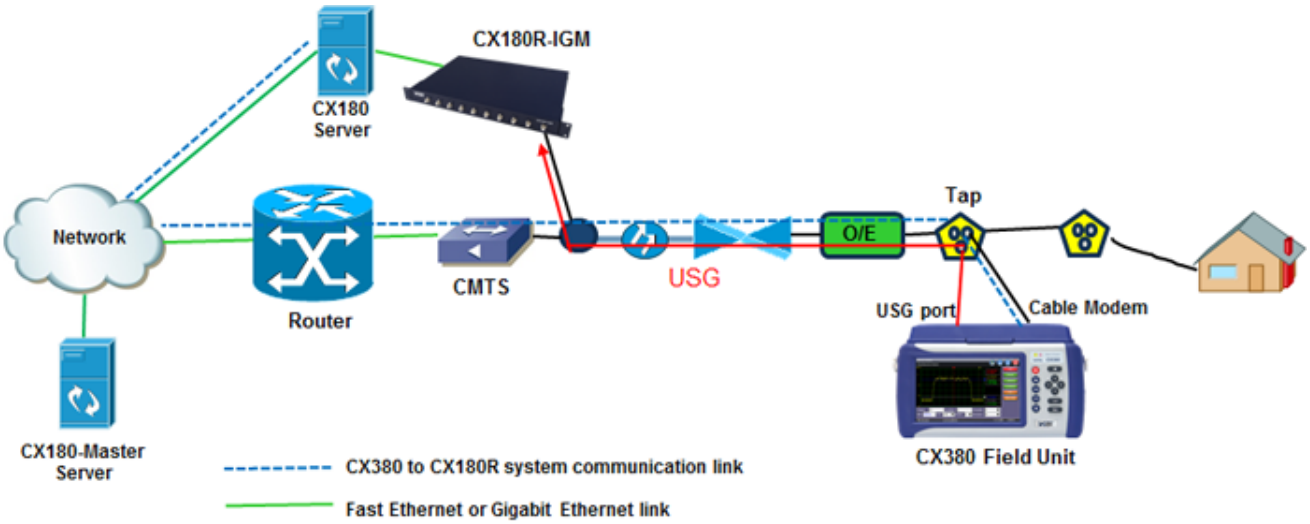
It is possible to conduct remote operations between CX380S-D3.1 field unit to CX180R system and from CX380S-D3.1 to another CX380.

For operations between CX380S-D3.1 field unit and CX180R:

The communication between these two units is done via Internet connection made through the following options:

- Built-in Cable Modem using existing HFC network (shown below)
- Data Card (3G mobile)
- WiFi hot spot
- 10/100-T network access
- Bluetooth via 3G mobile phone

CX380S-D3.1 to CX180R



Once the connection is established, the CX380S-D3.1 unit is able to do the following:

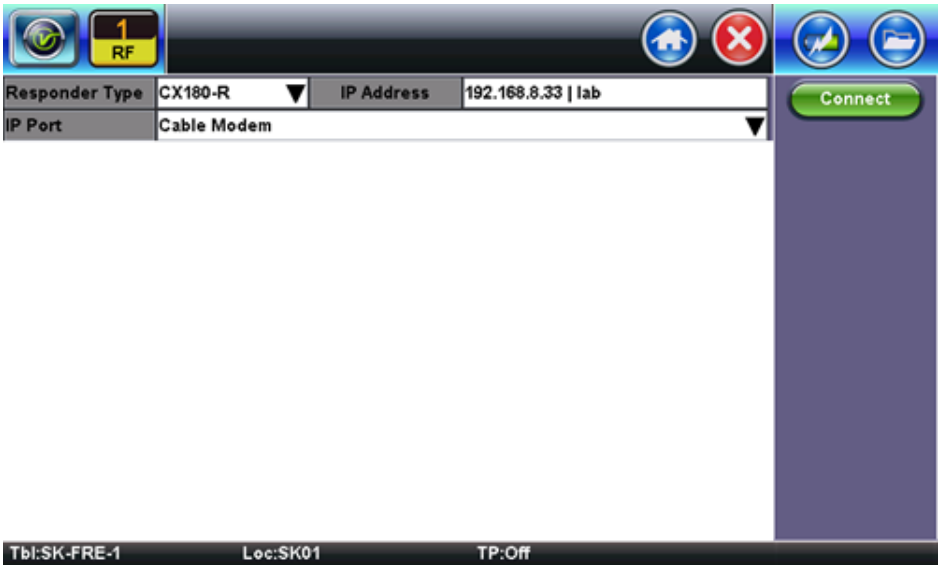
- Remotely monitors activities on all 10 nodes that are connected to a CX180R in IGM Scan Monitor mode.
- Remotely performs on-demand return path spectrum analysis
- Remotely performs on-demand testing of return path QAM analysis
- Remotely performs return path alignment with CW signal generated by USG in CX380

To set up connection through Remote View:

1. Under Advanced Tools, press Remote Operations. Then Press Remote View.

2. From the Remote View Setup page:

For Responder Type, select CX180R.
Select IP address of the CX180R-RPM system.
Enter the IP port to be used by the CX380.
Press **Connect**. Then, input the appropriate fields, such as 'Node ID' to connect to your CX180R-RPM System.



3. After CX180R-IGM connection is made, tap Exit to return to the Main Menu and start Return Path Analysis and Spectrum Analysis. To stop the Remote View session, return to the Remote View menu to disconnect.

USG Setup menu:

Enter the USG test parameters, then press 'Start.' Tabs are available on the USG home screen to allow quick access of Spectrum Analysis mode and Return Path Analysis mode.

To conduct Spectrum Analysis:

1. From the Home menu, enter Spectrum Analysis.

2. Port number for spectrum analysis can be changed from Port 1 to Port 10.

3. Tap USG+FEC to enter USG+FEC setup page.

4. Spectrum analysis bandwidth is from 5 to 65MHz. Spectrum data is sent from CX180R-IGM to CX380-Controller via Internet connection in real time.

To conduct Return Path QAM analysis:

QAM signal is normally generated by the CX380-Controller USG. Measurement is done by the CX180R-IGM and sent back to

CX380-Controller via Internet connection in real time.

Enter the CX180R-IGM port number to be used and then return to the USG+FEC menu.

For operations between CX380S-D3.1 and another CX380S-D3.1 unit:

Remotely control another CX380S-D3.1 in responder mode for the following:

- Spectrum Analysis
- Return Path QAM Analysis
- Return Path Alignment with CW signal generated by USG

1. Under the Setup/Main menu, select 'Controller' under Remote View Mode.

2. Under the Advanced Tools menu, press the Remote View tab.

3. On the Remote View Setup page:

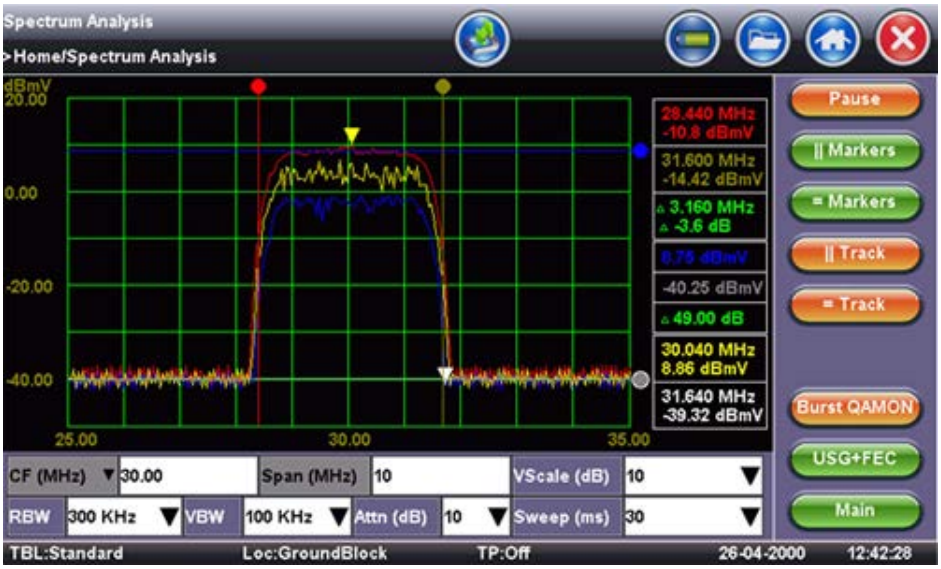
   - For Responder Type, select CX380
   - Edit or select CX380S-D3.1 Responder by IP address and name
   - Select the IP Port type
   - Press 'Connect' to start

4. After connection is successfully made, press 'Exit' to start the Remote View application. To stop Remote View, enter the Remote View menu and press 'Disconnect'.

To conduct Spectrum Analysis:

1. From the Home menu, enter Spectrum Analysis.

   Spectrum analysis can be from 5 to 1000MHz. The sample shown is the QAM signal generated by the CX380-Controller unit and measured by the CX380-Responder unit. Live spectrum traces are sent from the CX380-Responder and displayed by the CX380-Controller in real time via Internet connection. A shortcut to USG+FEC is available to allow quick access to the USG features.



To change USG signal type:

Shortcuts are available on Spectrum Analysis and Return Path Analysis screens to go to USG with FEC screen to make any changes in the set up.
Shortcuts to Spectrum Analysis and Return Path (RP) Analysis are also provided on the USG with FEC screen.

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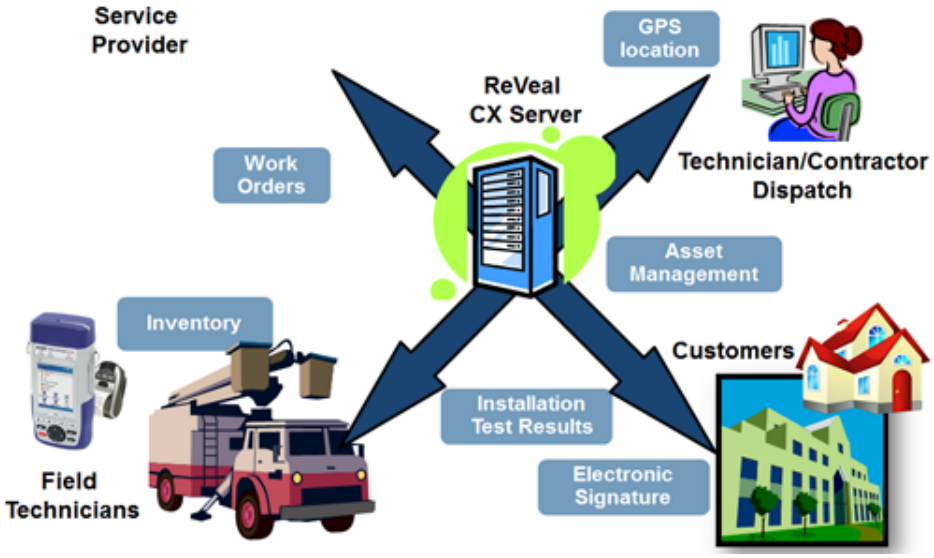
7.8.5 R300 Server

The R-Server function is an optional feature that allows the CX380S-D3.1 to communicate with the V300 R-Server for work force management.

The V300 R-Server offers the following capabilities:

- Works with VeEX CX field meters
- Convenient internet connection via WiFi, Ethernet, Cable Modem, USB 3G data modem, USB Bluetooth with mobile phone dialing
- Automatic test results upload after each install
- GPS job location mapping
- Daily, weekly, monthly statistical analysis of job, technician and/or contractor performance
- Billing generation and verification
- Work order dispatch
- Warehouse management
- Automatic channel table and firmware updates
- Theft prevention



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7.8.6 TPS Control

An optional feature that allows the CX380S-D3.1.1 to control external TPS (Test Point Selector or Matrix Switch) in order to access a node through the cascade of TPSs. It also allows re-use of already installed TPS matrix switches and enhances path test capability by replacing the out-of-date test unit.

Please note that an USB to Serial converter is needed and will be provided with this option.

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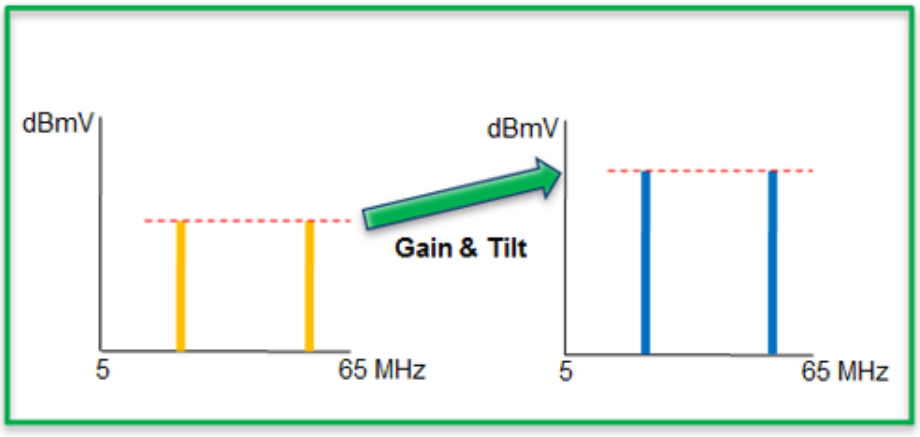
7.8.7 RP Balancing

This function allows one meter testing of a return path amplifier. This application requires the USG+FEC hardware option.

Both transmitter and receiver are in one unit. It sweeps entire return path band. The sweep steps and signal level are programmable. The operation is fast, real time, with high low tone adjustment.



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7.8.8 HIP, Home Installation Process

Contact Customer Care for more information about this feature.

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7.8.9 Headend Check

This optional features measures Analog and Digital channels as part of a single, detailed scan measurement. It tests all channels configured in the Channel Table.

Headend Check Setup

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7.8.10 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:

System Tests

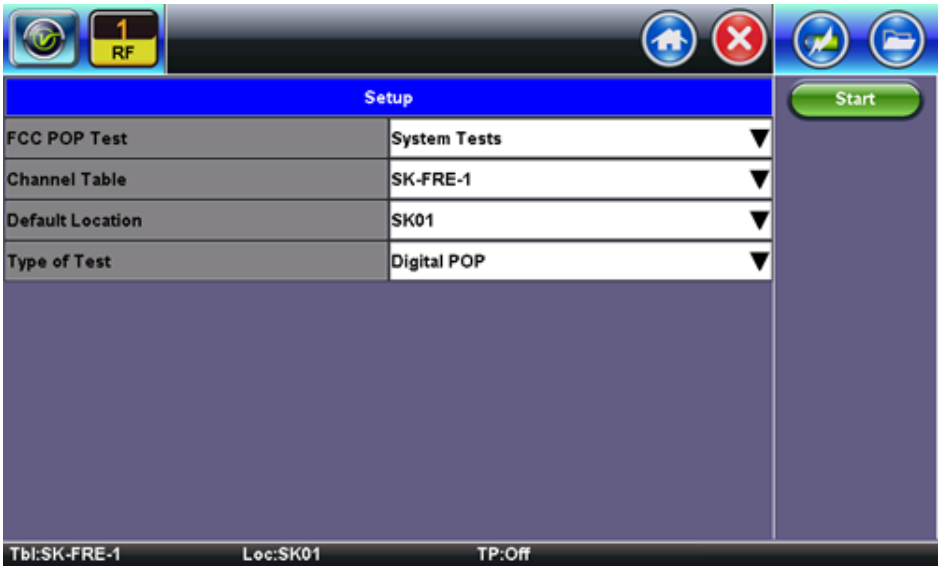
- Analog Levels: Video Level, Audio Level 1 & 2, Video/Audio Ratio 1 & 2, Max Adjacent Channel
- Digital Levels: Level, MER, Pre-BER, Post-BER, Adjacent Channel
- Digital POP: Level, MER, Pre-BER, Post-BER, Frequency Response, EQ Stress, Estimated Noise Margin (ENM), Error Vector Magnitude (EVM), Group Delay, Phase Jitter
- Analog Distortion: C/N, CSO, CTB, HUM
- ALL: test suite of all System Tests

24-Hour Test: Analog Video Levels

- Four tests are run in a 24-hour period, with an auto save of test results
- Measurements include Level, Max Variation of levels, and Max Adjacent Channel

Test Channels are based on a user configurable Channel Table. Standard test results are supported in both CSV and PDF Formats

FCC POP Setup



FCC POP Digital POP1

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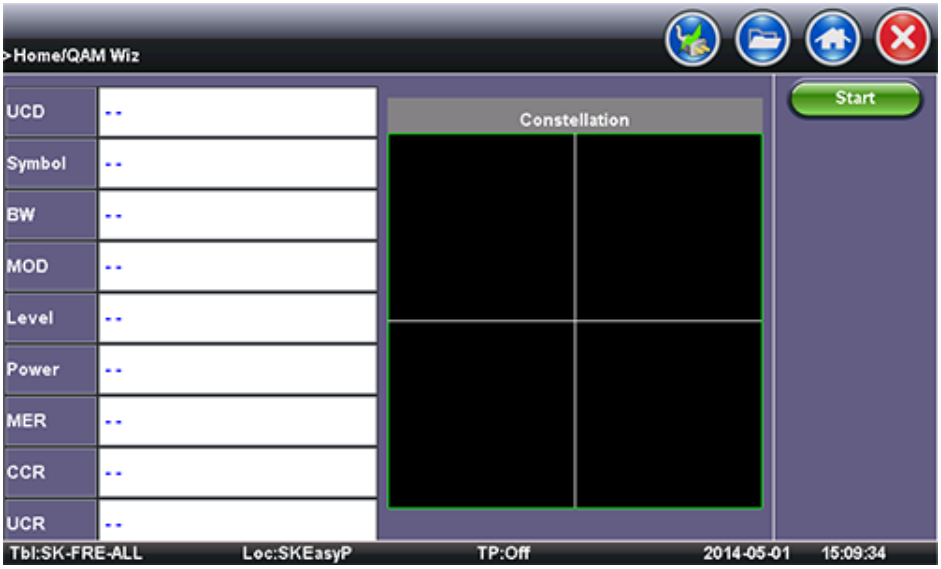
7.8.13 QAM Wiz DOCSIS Burst Demodulator

The optional QAM Wiz DOCSIS Burst Demodulator helps identify rogue Cable Modems that contribute harmful interference to the plant. QAM Wiz does the following:

- Captures all available Upstream Channel Descriptors provided by the CMTS from a specific downstream DOCSIS channel.
- For a selected UCD, captures and decodes burst Cable Modem signals.
- Assesses QAM health for the UCD by measuring Upstream MER, burst constellations and codeword error rates.
- Identifies associated Cable Modem MAC Addresses, which helps identify rogue Cable Modems.

Follow these steps to run a QAM Wiz test:
1. From the QAM Wiz Main Menu, press 'Start'

QAM Wiz Main Menu



2. Input the CMTS DOCSIS Channel number and press 'Apply'

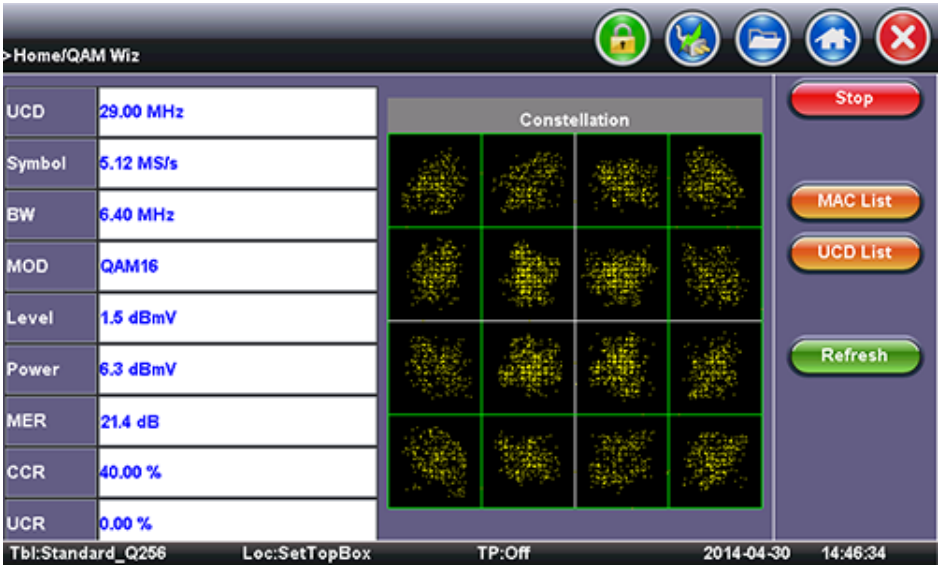
QAM Wiz - Channel Input

3. Select the desired UCD and press 'Analyze'

QAM Wiz - UCD

4. The Burst Demodulator may take up to one minute to display results. Typically within 30 seconds, various Upstream measurements will be displayed. Press the "MAC List" to view associated Cable Modem MAC Addresses.

MAC Addresses



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8.0 Tools

8.1 IP Tools

The 10/100BaseT management port is located on the right hand side of the unit. This port can be used to connect to the unit for management purposes (e.g., results retrieval, software upgrade, remote connectivity, etc).

You can access the management port configuration on the **Tools** > **IP Tools** menu.

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8.1.1 Setup

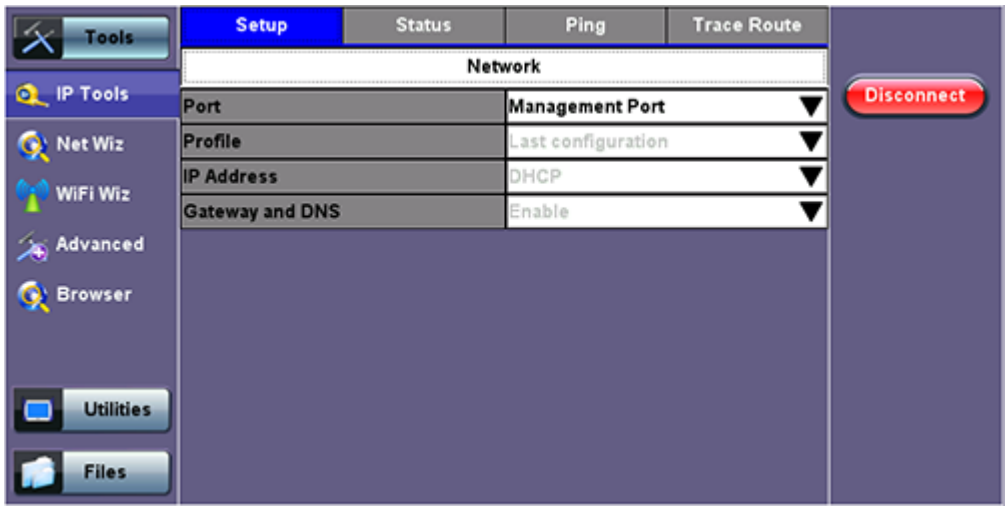
By default the IP configuration is set to DHCP and the unit will automatically attempt to connect.

For IP configuration, the following fields are required. Additional fields vary depending on Static or DHCP connection.

- **Port:** Select Management Port from the drop-down menu
- **Profile:** Default, Delete, Save, Save as..., Default, or Last configuration
- **IP Address:** Select from Static or DHCP
  - **Static:** If Static is selected, the user will manually enter the IP address parameters (local IP, Gateway IP and DNS server IP)
  - **DHCP:** If DHCP is selected, the unit will obtain IP address parameters from the DHCP server
- **Gateway and DNS:** Enable or Disable
  - **Enabled:** If enabled, enter the IPv4 address of the Gateway and DNS server in Static mode, or use the IP address provided by the DHCP server in DHCP mode
  - **Disabled:** If disabled, no Gateway or DNS server will be used for the tests

Enter all parameters then press **Connect** to start the test.

DHCP Setup



For **Static** type connection, these additional fields are required:

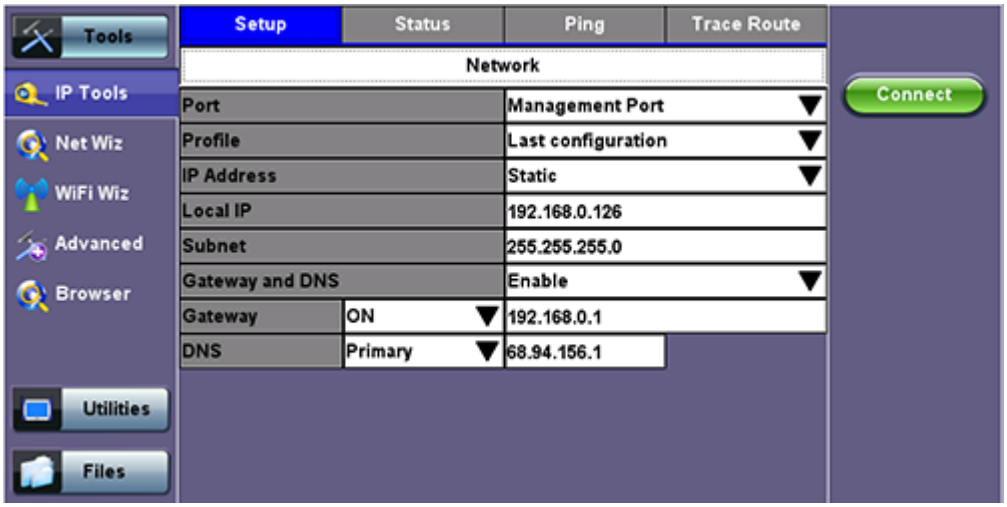
Static: The user is required to enter a Local IP, Gateway address (if Gateway and DNS are set to Enable), and Subnet. All Static fields can be filled by tapping on the section to access an alphanumeric keypad.

- **Local IP:** IPv4 address of the test set.

- **Subnet:** Enter the subnet mask.
- **Gateway and DNS:** Enable or Disable. If set to enable, Gateway and DNS fields become available.
  - **Gateway:** Off or On. IPv4 address of the network gateway.
  - **DNS:** Off, Primary, or Primary & Secondary. If set to Primary or Primary & Secondary, a DNS IP is required in order to use the URL as a destination.

Enter all parameters then press **Connect** to start the test.

Static Setup



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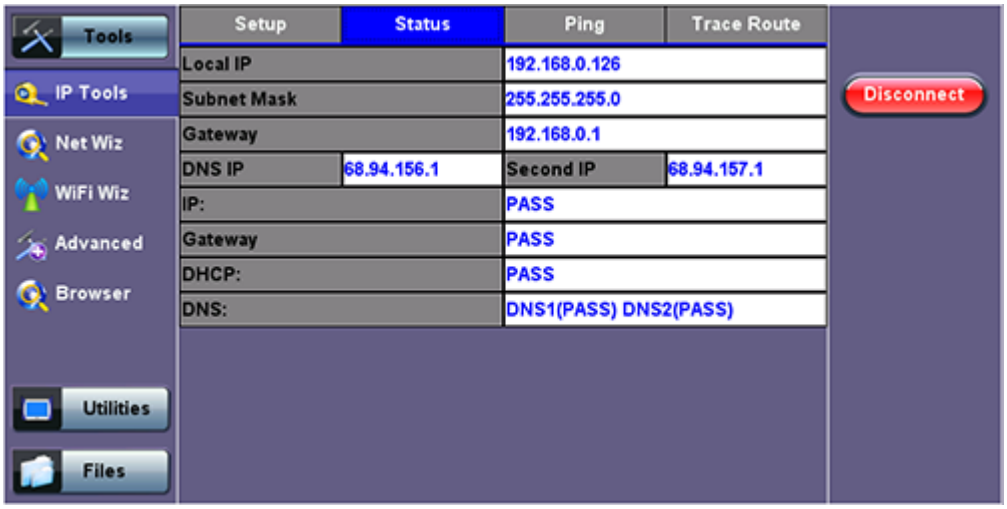
8.1.2 IP Connection Status

- Ensure the Status is PASS before continuing with any IP tests.
- If the connection fails, go back to the setup screen to verify that the parameters are entered correctly. Verify that the Ethernet cable is properly connected on the management port.
- **DHCP:** PASS indicates that an IP address has successfully been assigned.
- **IP:** PASS indicates that the IP address assigned has been verified to be unique in the network.
- **Gateway:** PASS indicates that the gateway IP address is valid.
- **DNS:** PASS indicates that the DNS IP address is valid.

IP Connection Status



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8.1.3 Ping

The Ping Result provides the number of Sent, Received, Unreach, Missing, and the Round Trip delay.

Ping Testing

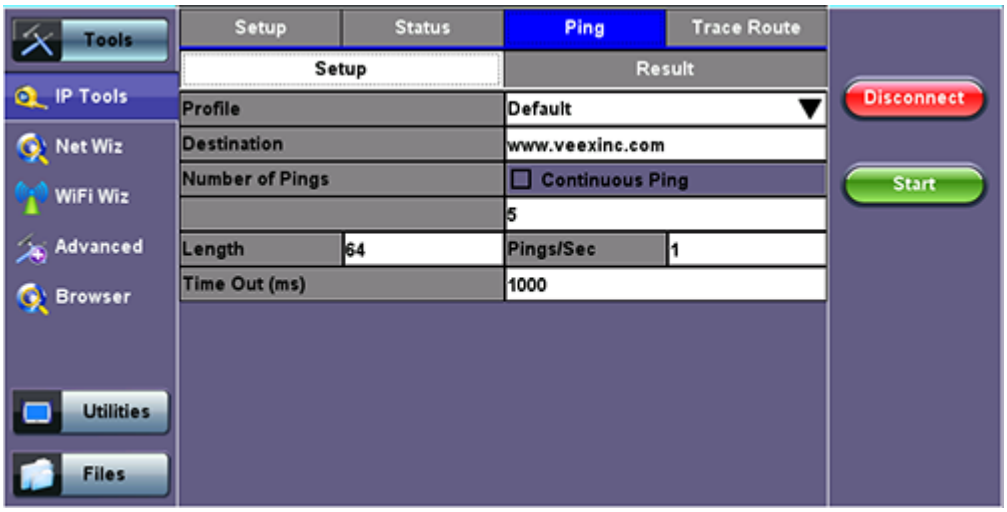
Ping is a popular computer network tool used to test whether a particular host is reachable across an IP network. A ping is performed by sending an echo request or ICMP (Internet Control Message Protocol) to the echo response replies.

Ping Setup

- **Profile:** Delete, Save, Save as..., or Default.
- **Destination:** Enter the destination IP address or URL to ping.
- **Number of Pings:** Press the field and use the alphanumeric keypad to enter the number of ping attempts that will be performed to reach the network device.
    - **Note**: If Continuous Ping is selected, the user is not required to enter the number of pings. The test set will continuously ping the target host until the user presses **Stop**.
- **Length:** Use the alphanumeric keypad to enter the length of the ICMP echo request packet transmitted.
- **Ping/Sec:** Use the alphanumeric keypad to enter the Ping repetition rate (Ping/second) up to 10 pings per second.
- **Time Out:** Time-to-Live (TTL) in milliseconds. Use the alphanumeric keypad to enter the maximum time allowed (in ms, up to 99999ms) between an ICMP ping and echo response.

Once the parameters are configured, press **Start** to begin the test.

Ping Setup



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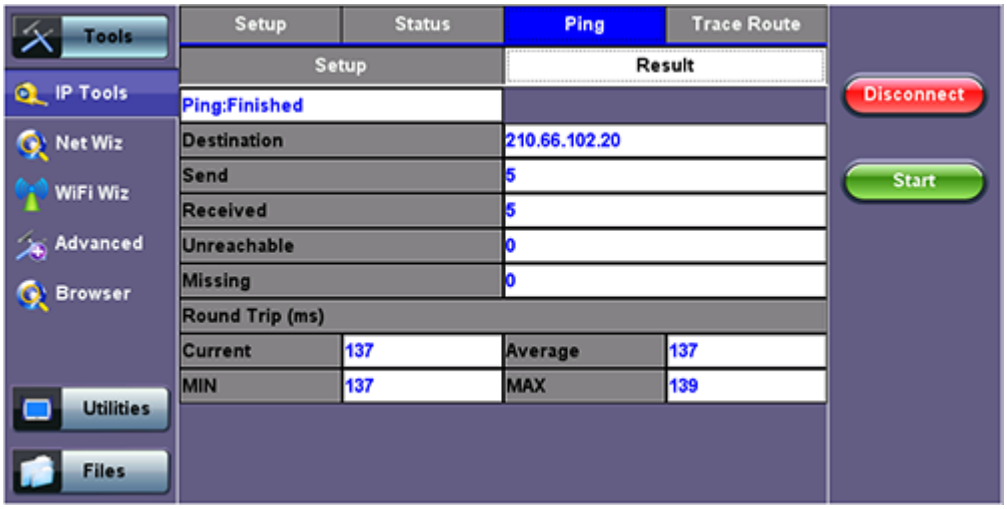
Ping Results

Pressing Ping will take you to the Result tab and start the Ping test.

- **Destination:** Indicates the destination IP address.
- **Ping status:** In Progress, PASS, or FAIL.
- **Sent, Received, Unreach, Missing:** Number of pings sent, received, unreached or missing. A Ping is counted missing if no response is received before timeout. A Ping is counted unreached if an echo response is received with host unreachable set.
- PING also estimates the round-trip time in milliseconds
    - **Current:** The current time for a Ping request to be answered.
    - **Average:** The average time recorded for a Ping request to be answered.
    - **Max:** The maximum time recorded for a Ping request to be answered.
    - **Min:** The minimum time recorded for a Ping request to be answered.

Ping Result



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8.1.4 Trace Route

Trace Route is a common method used to find the route to the destination IP address or URL. It is often used to identify routing problems and unreachable destinations. All the remote IP addresses and their response times are displayed indicating possible network congestion points.

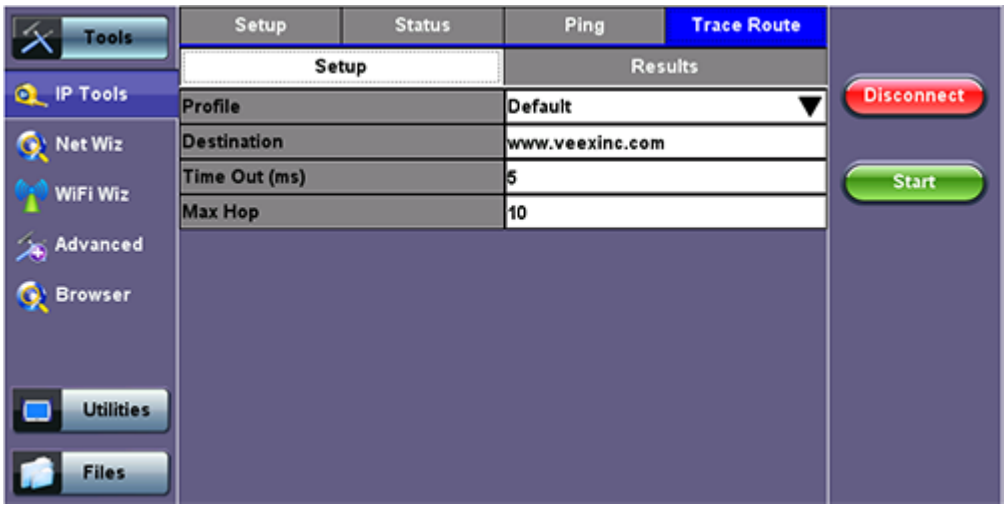
Trace Route setup tab:

The following setup selections are available:

- **Profile:** Delete, Save, Save as..., Default. Select Default to recall a trace route file or create a new test
- **Destination:** Enter the IP address or URL of the network device to be detected
- **Time Out:** Enter the maximum time allowed between an ICMP echo and response at each hop
- **Max Hop:** Enter the maximum number of network devices the packet is allowed to transit

Once the parameters are configured, press **Start** to begin the test.

Trace Route Setup



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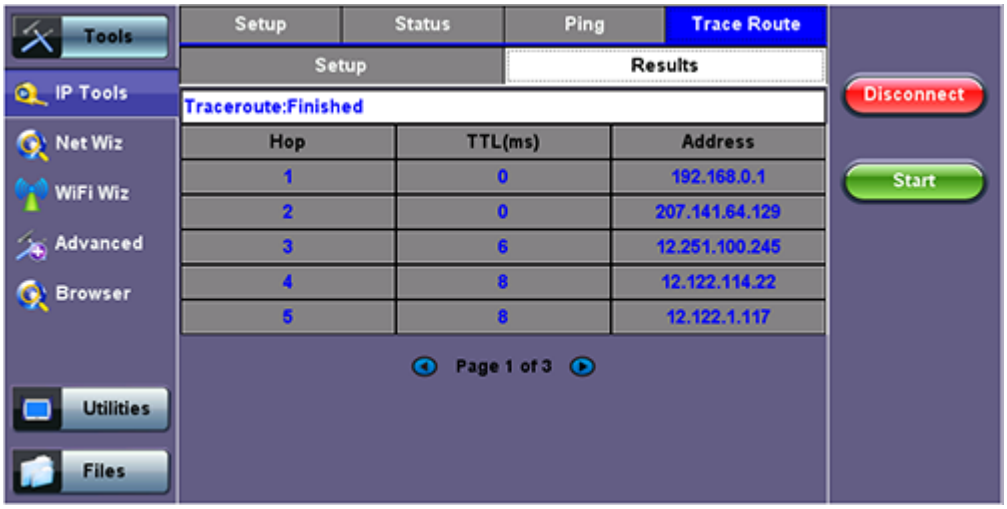
Trace Route results:

- **Hop:** Order of the routers on the route
- **TTL:** Time to reach each router on the route
- **Address:** Address of each router on the route

Note: If there is no response from a particular hop, an asterisk will be displayed.

Trace Route Result



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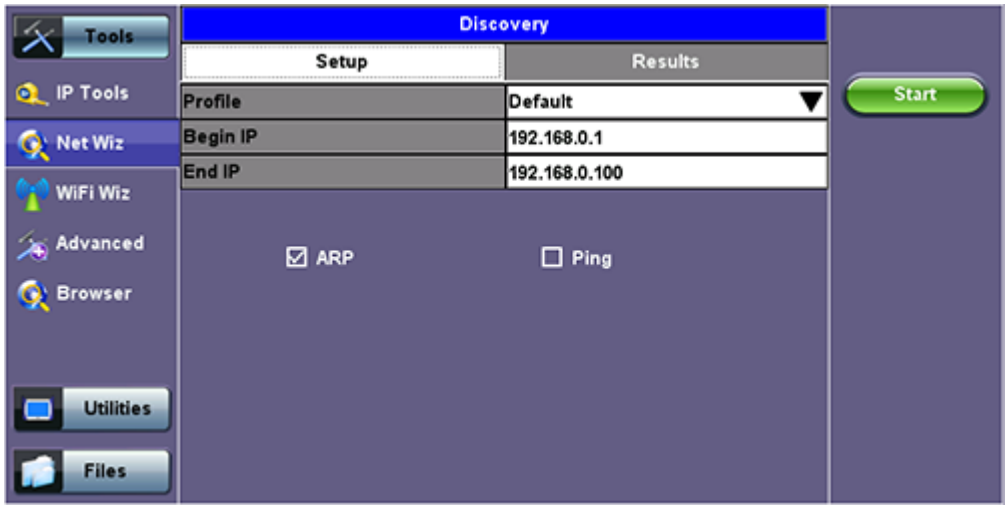
8.2 Net Wiz

Net Wiz verifies the status of each IP address in the user selected range, by using ARP (Address Resolution Protocol) and ICMP test.

8.2.1 Net Wiz Setup

- **Profile:** Drop-down selections are Default, Delete, Save, Save As...
- **Begin IP:** Set the start address for the desired IP range using the numeric keypad
- **End IP:** Set the end address for the desired IP range using the numeric keypad
- Select the test by placing a check mark in the corresponding box of any of the following: ARP, Ping

Net Wiz Setup



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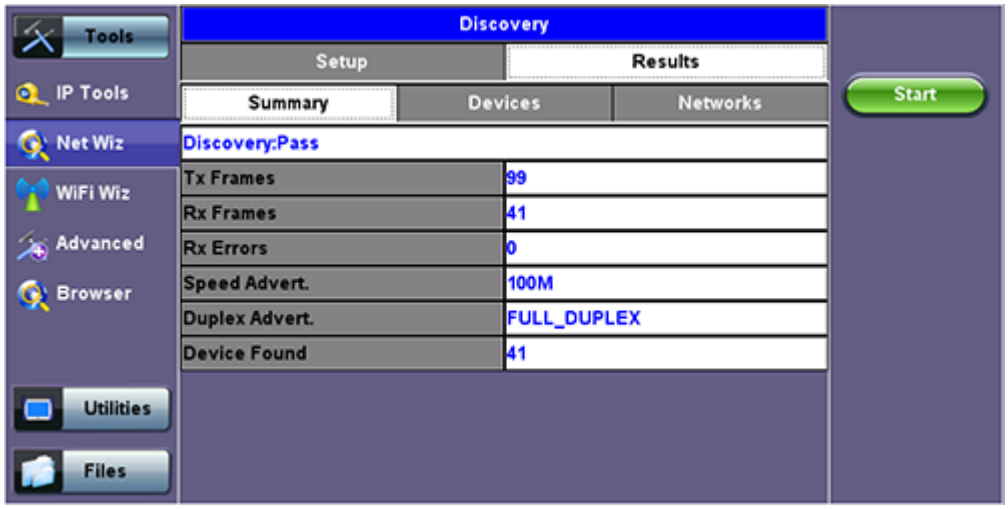
8.2.2 Net Wiz Results

Summary indicates the test status and reports:

- **TX/RX Frames:** Total number of TX (transmitted) and RX (received) frames
- **RX Errors:** Received frames in error
- **Speed Advert:** Speed advertised
- **Duplex Advert:** Duplex mode advertised
- Total number of Devices and Networks found

Net Wiz Results Summary

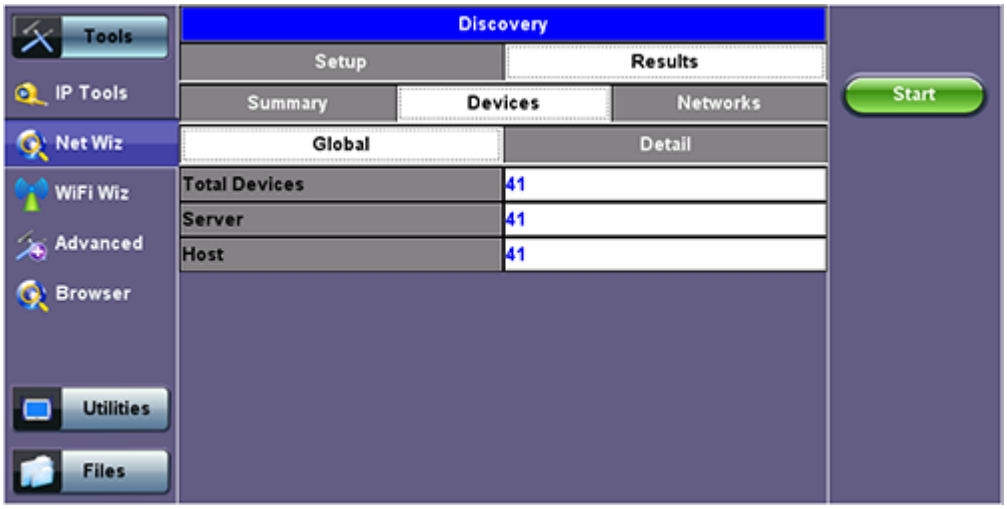


The **Devices** tab reports global and detailed device information.

Global reports:

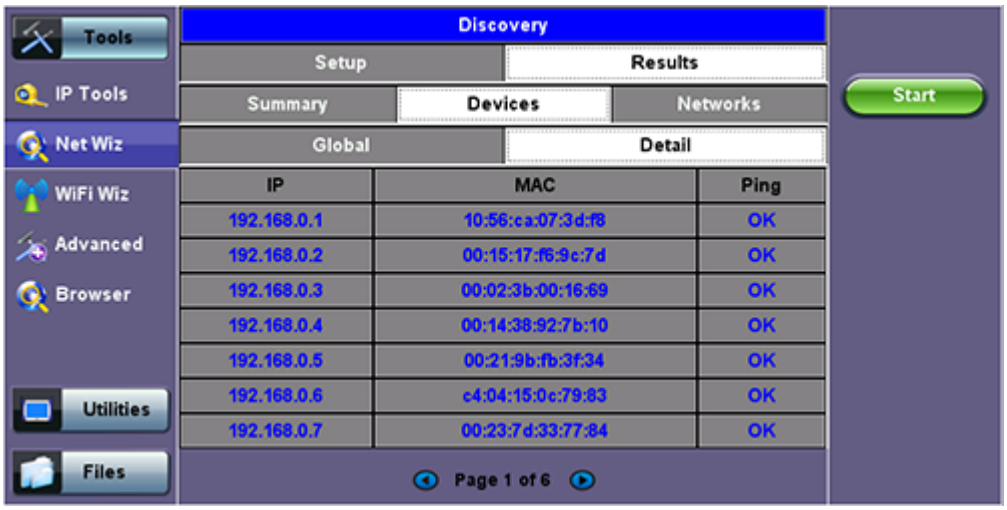
- Total number of devices found
- Number of devices (Routers, Servers, Hosts)

Net Wiz Results - Devices - Global



Detail displays the Attribute, MAC and IP Addresses, and Ping test results of each device discovered.

Net Wiz Results - Devices - Detail



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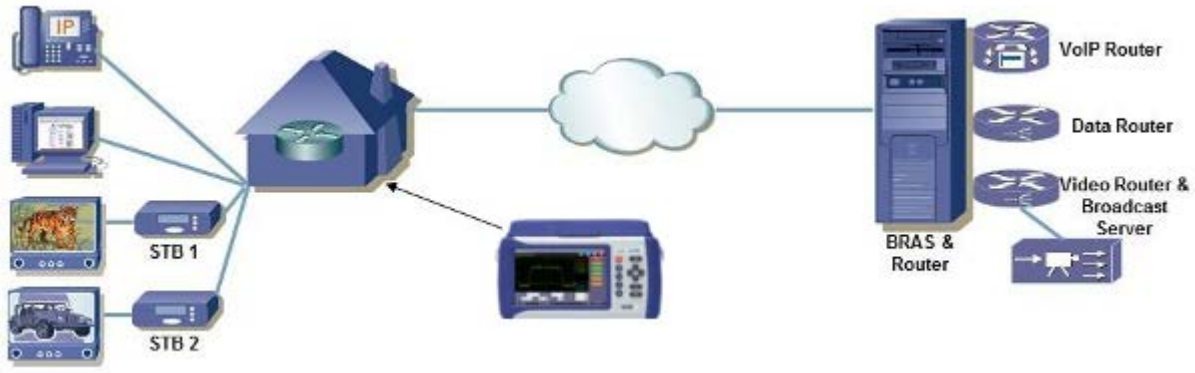
8.3 WiFi Wiz

This function allows you to test wireless WiFi 802.11a,b,g,n,ac networks (based on capabilities supported by Wifi USB adaptor provided by VeEX). A typical application is shown below.

Typical WiFi Wiz Application



The WiFi Wiz function supports:

- 802.11 a/b/g/n/ac standards (refer to WiFi USB adaptor provided by VeEX)
- WEP, WPA, WPA2 Encryption
- Scanning
- SSID broadcasting and report
- Signal Strength
- IP Connection and Ping Test

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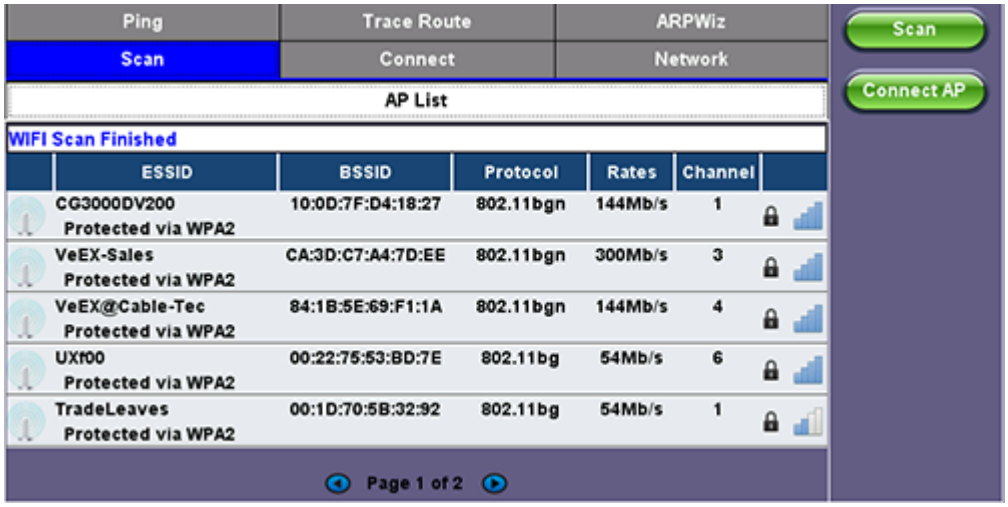
8.3.1 WiFi Procedure

- Plug the WiFi adaptor into the USB port. Allow at least 30-45 seconds for the unit to detect the wireless adaptor and for the software driver to load.
  - ***Note:*** *Products support USB wireless adaptors supplied by VeEX only and have the necessary software driver built into the test set.*
- Tap on the **Scan** tab once the test set has detected the wireless USB adaptor.

WiFi Wiz - AP List



AP List

The following information is displayed for each AP:

- SSID name of the AP
- BSSID (MAC address) of the AP
- 802.11 protocol version supported by the AP
- Max data rate supported by the AP
- AP's radio channel number
- Lock symbol indicates if security is set on the AP (WEP, WPA or WPA2).
  When the AP is unsecured, no lock symbol is displayed
- Signal strength of the AP

Select one of the Access Points (AP) to start a connection. If the AP is locked, a network key is required to complete the connection. The key can either be 10 characters or 26 characters.

- ***Note**: If the user enters the wrong network key, the test set will still connect to the Access Point, but will not be able to connect to the web or perform the Ping test.*

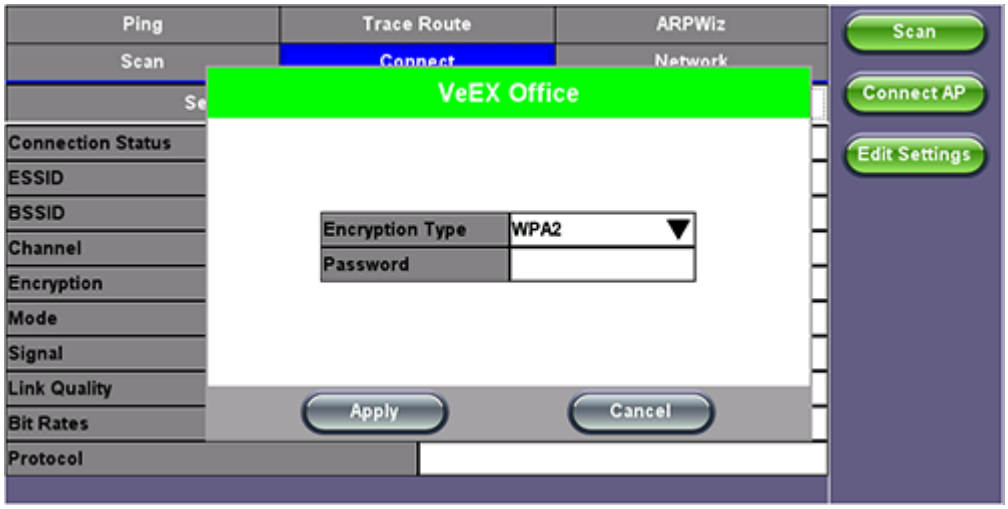
Once selected, an **Edit Settings** function key appears on the right hand side bar.

Tap on **Edit Settings** or **Connect AP** to change the Encryption Type and enter the WiFi Key.

- **Encryption Type:** Supported encryption types include WEP, WPA, and WPA2.
- **Key:** Security phrase or password necessary to access SSID and network. Tap the **Key** field to enter the AP password on the pop-up keypad.
  - ASCII formatting supported
  - The password/phrase can be hidden (**Global Settings** > **Show Password** > **Yes/No**)
  - ***Note**: Passwords are case sensitive.*

Hit **Apply** after selecting the Encryption Type and entering the Key. If the encryption menu was accessed via **Edit Settings**, press **Connect AP** to connect to the AP. If the encryption menu was accessed via **Connect AP**, the test set will automatically connect to the AP after hitting Apply.

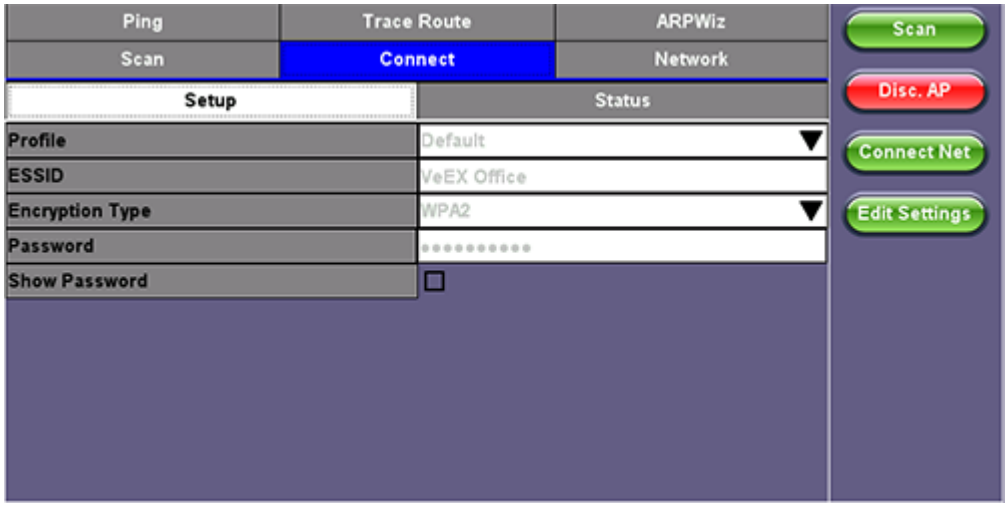
WiFi Wiz - AP Encryption Settings



Connect

The **Setup** Tab displays the Profile, ESSID, Encryption Type and Password.

WiFi Wiz Connection Setup

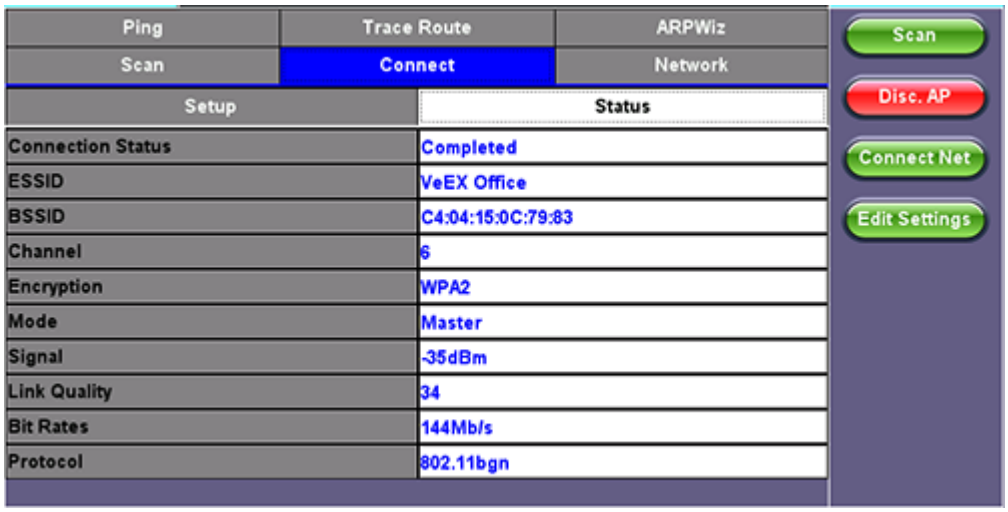


Status

The Status Tab displays the following information on the connection:

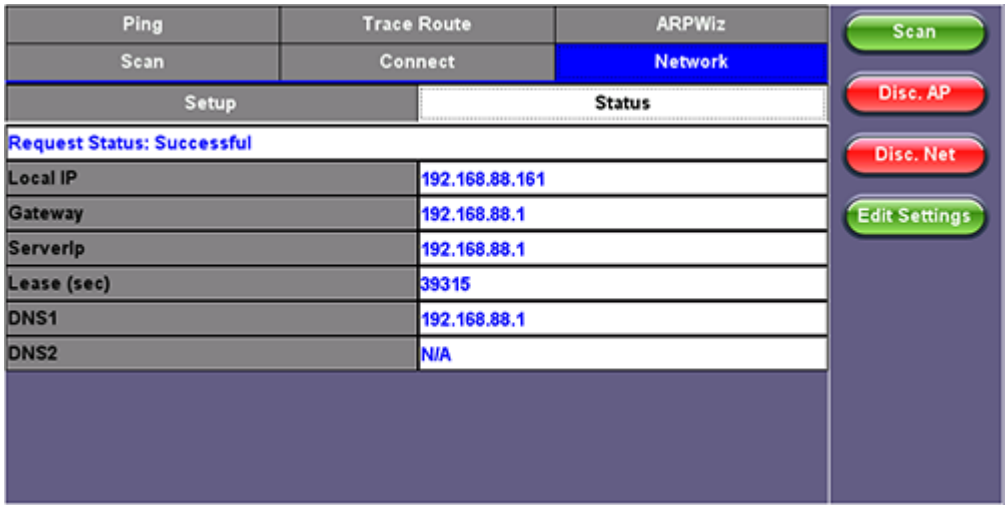
- **Connection Status**
- **ESSiD:** Name connected to
- **BSSiD:** MAC address of wireless router/device connected to
- **Channel:** WiFi Channel # connected to
- **Encryption:** Encryption type
- **Mode**
- **Signal:**
  - Radio signal level (dBm)
  - Link quality score
  - Max data rate
  - 802.11 protocols supported

WiFi Wiz Connection Status



After a successful connection to the Access Point press Connect IP to obtain an IP address and access the additional IP tests like Ping, Trace Route etc.

WiFi Wiz Connect IP



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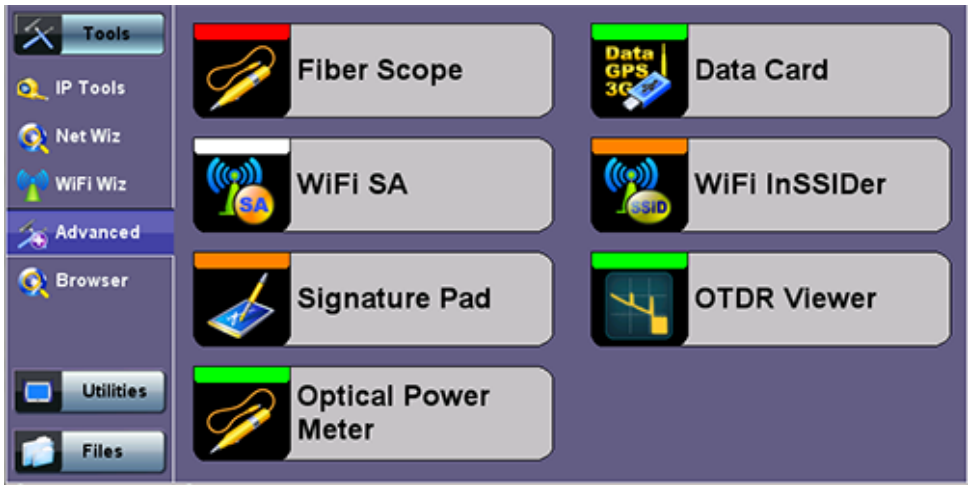
8.4 Advanced Tools

Advanced Tools



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8.4.1 Fiber Scope

The Fiber Scope Inspector is an ideal tool for checking fiber optic connectors for dirt and end face quality. The handheld probe design enables easy inspection of patch cords and difficult to reach bulkhead or patch panel connectors. Clear images are displayed on the V300 products for immediate analysis and can be saved for record keeping.

Fiber Scope

Key features include:

- Optical connector end face inspection
- Easy to change adaptor tips
- Multi mode and single mode fiber patch cords
- Sharp images displayed on VeEX V300 products
- Visual comparison mode of saved image

The ISO/IEC 14763-3 standard for Testing Optical Fiber Cabling specifies visual standards for connector end face inspection with a fiber microscope. The ISO-related standards and general industry practices recommend the following:

- Markings on the core or damage to the cladding close to the core are unacceptable
- Slight scratches and small pits on the cladding away from the core are, however, acceptable
- Cracks are not permitted in neither core nor cladding

Equipped with 400x magnification, the VeEX Fiber Scope Inspector is well suited for general installation and maintenance checks on both single mode and multi mode fiber types. Contamination or damage that cannot be viewed at this magnification is unlikely to impact practical connector performance; thus, it is an ideal tool for patch cord inspection, optical laboratory or field test applications.

Lightweight construction and the ergonomic positioning of the rotary focus dial enables one-handed operation and fast viewing, leaving one's hand free to move the connector under test as needed. Interchangeable screw-on adaptors are available for most modern

optical connectors, while the probe design blocks any hazardous infrared light from reaching the operator, resulting in completely eye-safe operation.

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8.4.1.1 Automatic Focus Detection and Analysis

In the past, fiber connector end-face inspection not only required a good Fiber Microscope (Fiber Scope), but certain amount of knowledge and hand-eye dexterity from the user. Results were prone to inconsistencies, subject to interpretation and PCs were required for post analysis against the criteria set forth by the IEC 61300-3-35 Sect 5.4 standard.
VeEX has made the task easier, faster and foolproof, with the introduction of its patent-pending revolutionary Automatic Focus Detection technology. Turning ordinary digital fiber scopes, like DI-1000, into accurate semi-automated inspection systems. All with the help of TX300S, FX300, RXT-1200 or SunLite OTDR test sets.

Instead of adding the extra complexity, fragility, cost, size and weight of other electromechanical focusing systems currently available in the market, VeEX's auto focus detection technology still relies on the incredible fast response and finesse of human hands, but leave the focus assessment, image capturing and analysis to the test set. Users could even try with their eyes closed and still achieve a perfectly focused image of the connector end-face in a few seconds. Moreover, users would still remain in control during non-trivial scenarios requiring the irreplaceable human dexterity and ingenuity.

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8.4.1.2 Main Advantages of Automatic Focus Detection

- Investment protection (no need to replace existing scopes, like DI-1000, with a more expensive ones)
- It's a simple software option upgrade to the test set
- Much faster focus, acquisition and analysis, compared to slow electro-mechanical auto-focusing scopes
- Robustness: Less moving parts and no internal motors makes a better choice for field applications
- No training necessary, yet get it right every time
- Smaller scope size
- Report generation (html and PDF)
- The test set detects when the image has reached optimal focus level, automatically freezes the picture, captures the image and runs the IEC 61300-3-35 analysis
- No need to move hands or press any buttons (movement and vibration are common causes of focus loss)
- No PC required for image acquisition or Pall/Fail analysis

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8.4.1.3 The Importance of Fiber Connector Inspection

Dirty or scratched connectors introduce loss, increase ORL and/or damage other connectors (Loss becomes more critical at higher data rates). End-face contamination is a leading cause of fiber link failures in data centers, corporate networks, MSOs and Telecom environments.

Fiber Inspection Scopes provide a magnified image of the fiber optics connector's End Face, focusing on the contact areas (prone to loss or damage by mating). Images, visual inspection and automated tools are often used to grade the health and cleanliness of connectors, after polishing or cleaning and before being used.

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8.4.1.4 Fiber Connectors and Test Gear Vulnerabilities

Opposed to the permanent or semi-permanent connections often found in network environments, "promiscuous" Test Equipment and their patch cords connect to multiple devices on a daily basis, increasing the chances to damage or get damaged. Extra care must be taken, not only to avoid potentially expensive damage, but to make sure that any tests and their results remain valid. Bad fiber or dirty/damaged connectors can result in false anomalies, defects or errors, even expensive repairs.

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8.4.1.5 About the DI-1000 Fiber Inspection Scope

- Digital Fiber Inspection Probe
- Native USB 2.0 (no adapters required, no image degradation)
- Compatible with existing UX400, TX300S, FX300, RXT-1200 and SunLite OTDR
- Precise and stable single-finger focus knob for one hand operation

- Blue light source for better contrast
- 400X magnification
- Interchangeable tips – Most commonly used tips are available (FC, SC, LC, ST, MTP, E2000, including PC, APC, 60° angled tips, among others)
- Compatible with VeEX test sets offering built-in Auto Focus-Detection & Analysis
- Ergonomic design

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8.4.1.6 Fiber Connector Inspection Setup

The Setup tab allows basic settings

File Prefix: String of alphanumeric characters to be appended at the beginning of the file name, every time the results are saved. For example Fiber0239-
Starting #: Every time a result is saved, this suffix number will automatically increment. Users can manually enter the initial value here.
Auto Freeze: This is amount of time the optional Auto Focus Detection feature will look for a stable in-focus image before automatically freezing the image and starting an analysis. Select Never, if manual capture or real-time analysis is desired. Auto freeze comes handy when both hands are tied (e.g. one holding the connector and the other holding the probe, or working on a pole)
Scope Mode: Use Local for USB fiber inspection scopes that directly attached to the test set. Use Remote if the probe is attached to a wireless transmitter using Wi-Fi connection.

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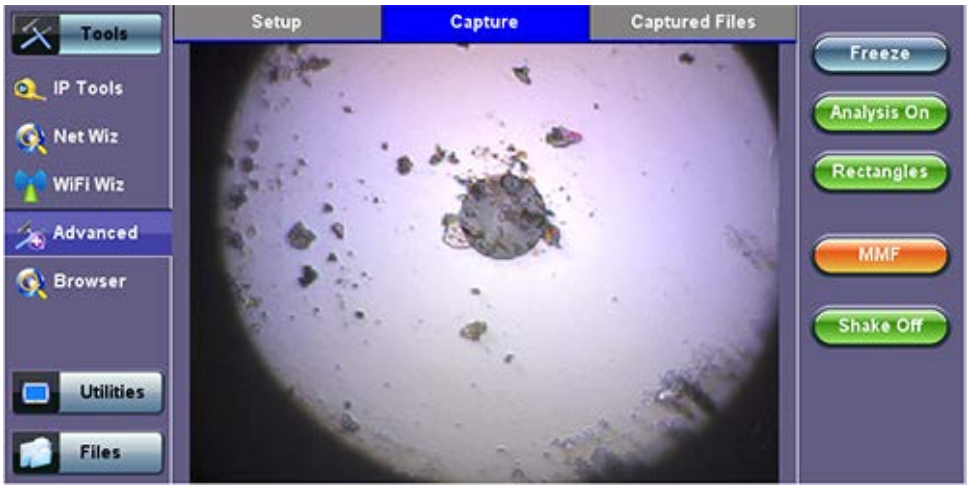
8.4.1.7 Capture Tab (View)

The Capture tab is the main user interface for the connectors' face inspection and analysis. It presents a real-time view of the connector's end face allowing users to align and focus.

Fiber Scope - Capture tab



Important! The soft buttons in the action bar (right side of the screen) do not indicate the current state or setting, they indicate the action that would take place if pressed. For example, if user taps on the "Analysis OFF" button, the analysis function is turned OFF and the button toggles to show "Analysis ON". These soft buttons should be interpreted as "Go to…"

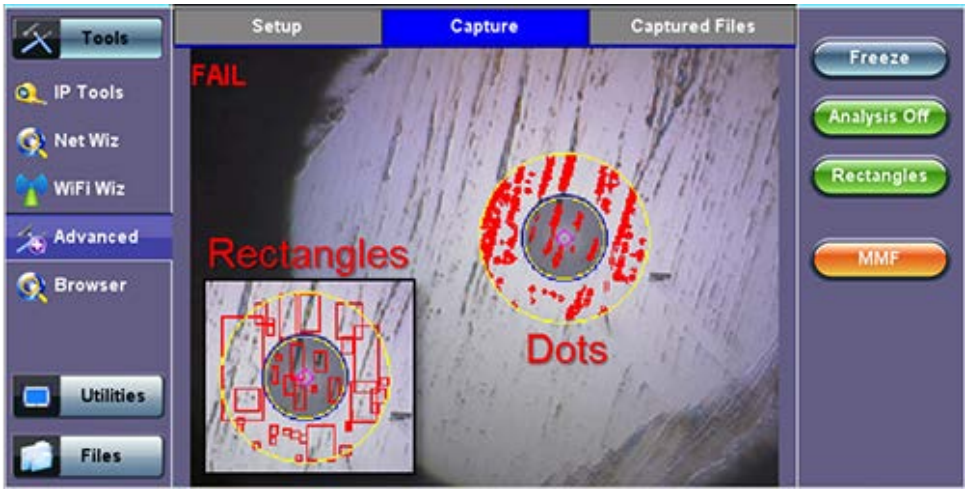
Freeze: Allows users to manually freeze the image in the desired view. If the optional Auto Focus Detection feature is enabled, the test set will automatically freeze the image when the image comes into focus. Once the image is frozen, users can tap on the image to save it.

Analysis ON/OFF: Turns the optional auto-analysis feature ON and OFF. If turned ON, the test set automatically analyzed the image in real time. If the markers get in the way of seeing the picture details, users can turn this feature OFF and perform manual analysis.

Dots/Rectangles: They are two ways of highlighting the different impurities found in the face of the connector. The dots tightly contour each individual anomaly, capturing its area. In some cases users may want to see impurities or scratches that are otherwise covered by the dots, so rectangles are used in this case to highlight the anomaly and still keep them visible. The selection between dots or rectangles does not affect the area calculation r the Pass/Fail results; they are just operator's choice.

Save: The Save button appears after freezing an image. I performs the same action as tapping on the screen to save the current

image. Use the >Utilities >Files function to View the report, export to PDF format and copy to USB.



MMF/SMF: Selects the type of connector/fiber to be analyzed and loads the correct Pass/Fail mask. Please note that the label in the button DOES NOT indicate the current mask type. It indicates that the mask would be changed to if activated.

Shake ON/OFF: Turning the Shake ON may help in situations when the image is not very stable, such as inspecting a female connector or bulkhead.

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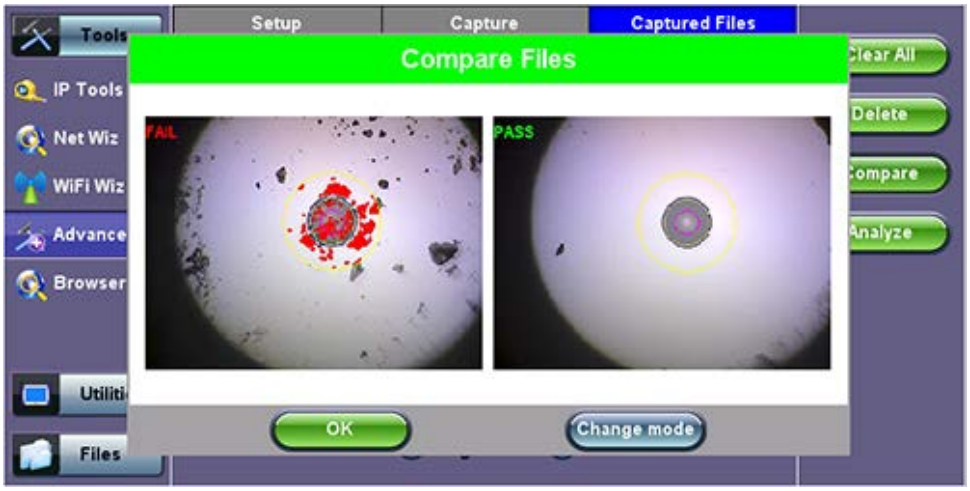
8.4.1.8 Captured Files Tab

This section of the user interface lists all the connectors' end face images that have been captured with the fiber inspection microscope. Users can and "Before" and "After" identifiers or remainders when comparing images before or after cleaning or polishing.

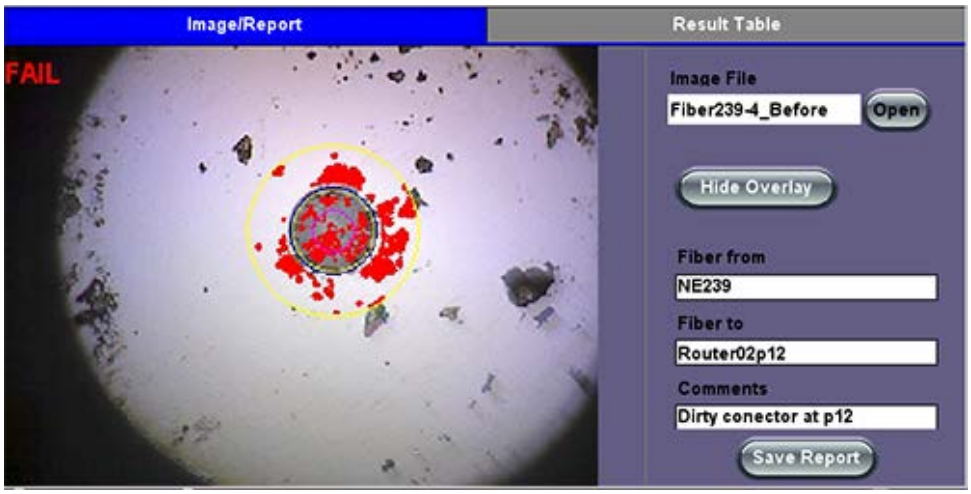
Clear All: Deletes all the image files in the Captured Files list

Delete: Deletes any selected files from the Captured Files list. Use the check-boxes to select

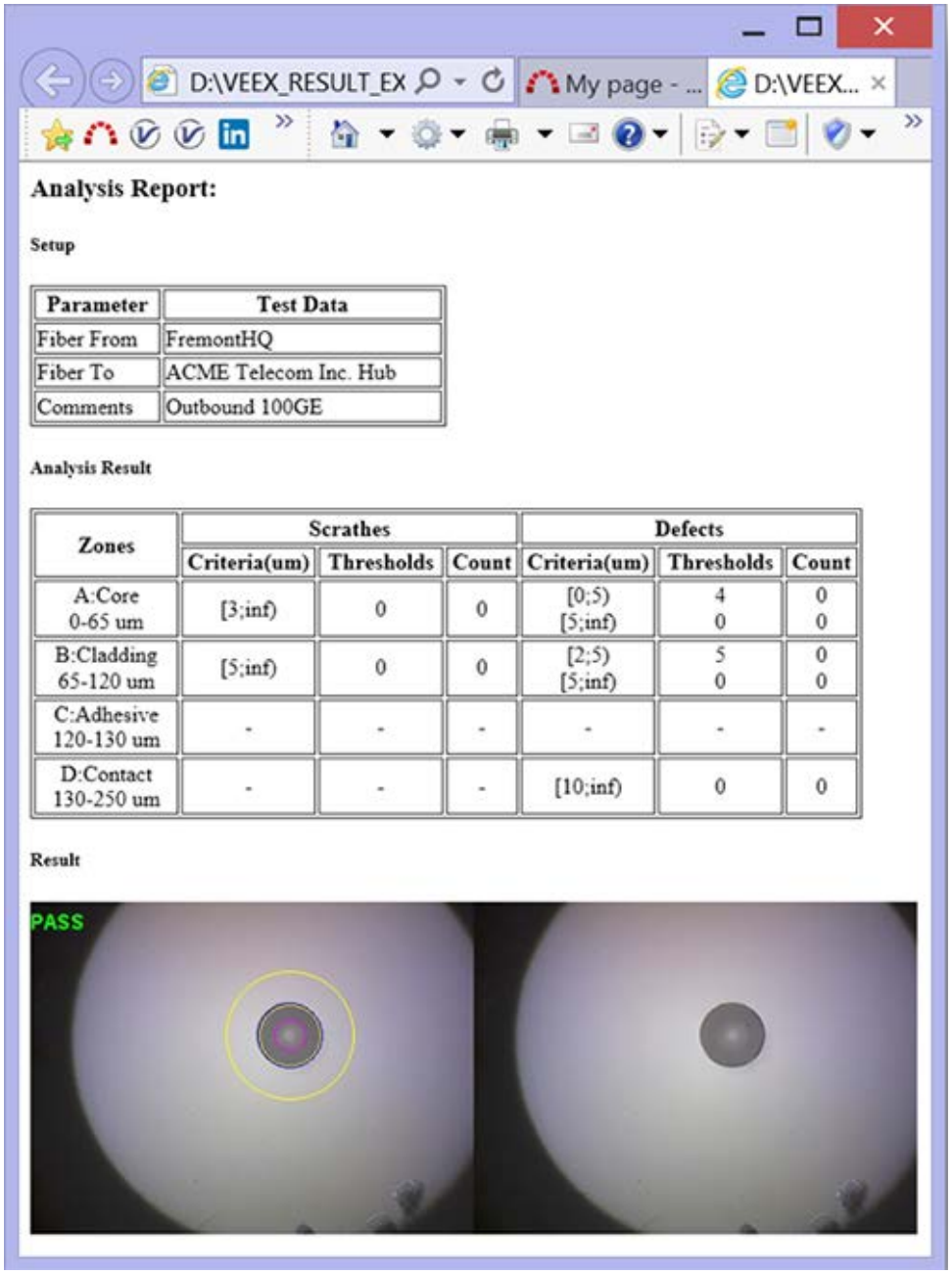
Compare: Compares two images, for example, ones taken before and after cleaning. Use the check-boxes to select any two image files and then tap on the Compare soft button. Use the Change Mode button on the comparison window to enable and disable the analysis overlay.



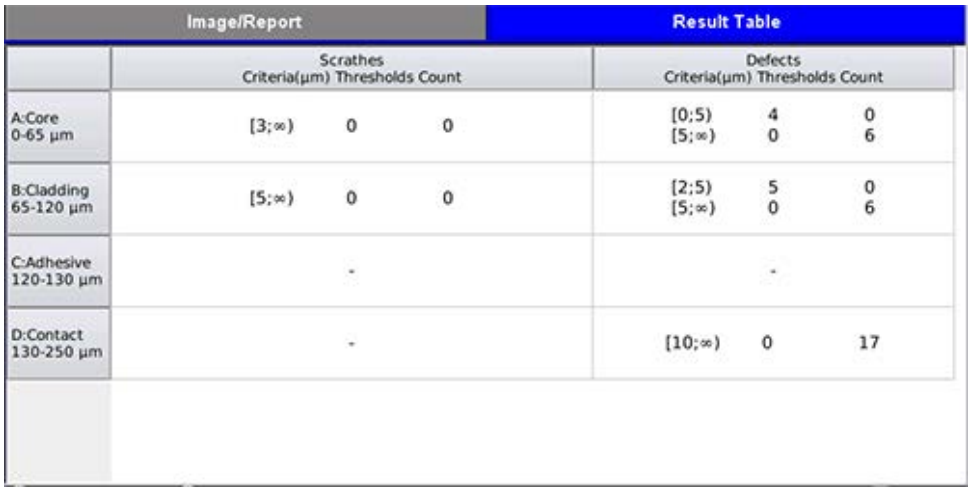
Analyze: This soft button opens a more detailed analysis and report generation. Use the check boxes to select the images to be analyzed



- **Image File:** shows the name of the picture currently being displayed. Use the Open button to navigate, select and load any other file.
- **Show/Hide Overlay:** Enables or disables the mask, anomalies identification and analysis.
- **Finer From/To:** User customizable labels to identify the fiber under test
- **Save Report:** Generates a full report including a table with measurements and images. Use the >Utilities >Files function to View the report, export to PDF format and copy to USB.



- **Results Table:** Shows the defects and scratches count by sizes and position, used for the evaluation of the Pass/Fail criteria, according to the IEC 61300-3-35 standard.



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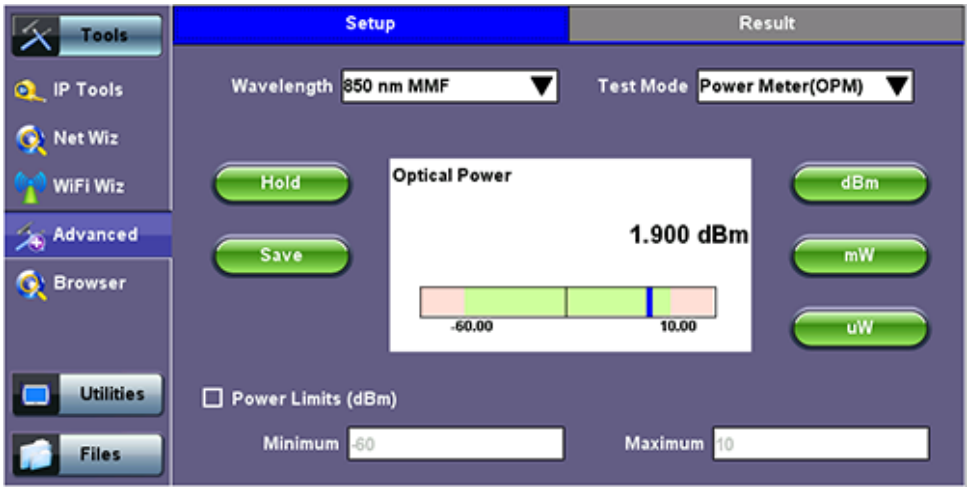
8.4.2 Optical Power Meter (OPM)

This function works in conjunction with Optical Power Meter dongles (USB), such the optional UPM-100.

Insert the OPM dongle to on of the test set's USB port before launching this application.



Optical Power and Loss Measurements

Wavelength: This pull-down menu provides a list of calibrated wavelengths to match the signal being measured.

Test Mode: Allows users to select between Power or Loss measurements.

- In Power Meter mode the test set presents the direct power readings, which are displayed in dBm, mW or uW units. Users can perform he conversions by using the button on the right side of the reading
- In Loss Meter mode the test set reports the difference in power readings between the Laser Source (LS) output being used and what is currently present at the connector after being attenuated by the fiber. The results are presented in dB. Loss meter requires to be referenced (calibrated) to the Laser Source output. You must connect the LS to the OPM dongle using a short patch cord and tap on the Reference button to record the 0dB point. Then that LS can be connected to the far-end of the fiber to measure the loss.

Hold: Freezes the last power or loss reading on the screen

Save: Records instantaneous power or loss readings in the Result's tab. This is useful when measuring multiple fibers or testing one fiber with multiple wavelengths. Up to 12 measurements can be logged in the Results tab. You must use the 1 button to save these results.

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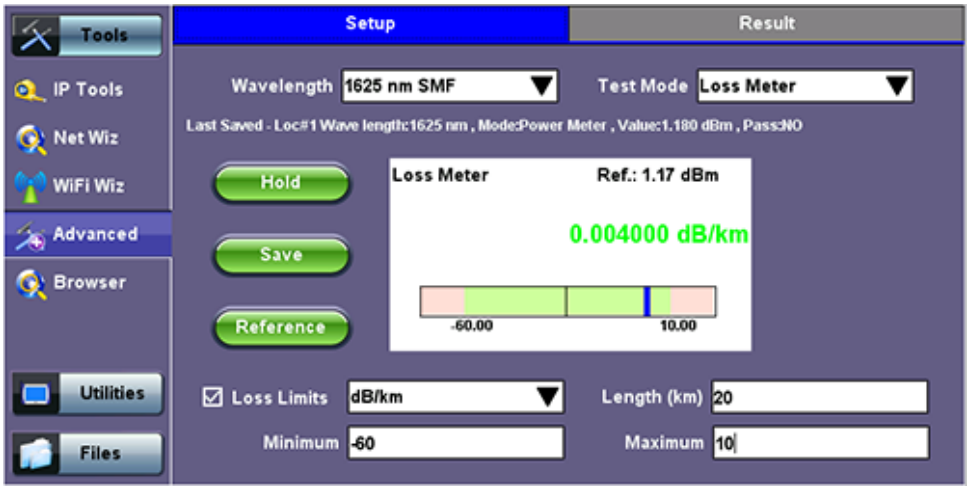
8.4.2.1 Setting Pass/Fail Limits

Whether measuring optical power or loss, there are always power input limits (saturation and Loss) or attenuation allowances that determine whether the fiber cable meets the requirements for the desired application or network elements.

Power Limits (dBm): When check-box is ticked, users can enter the Minimum and Maximum power levels allowed for the application (e.g. in line with the transceiver's dynamic range). If the power reading falls beyond those limits, the power measurement reading will turn red.

Loss Limits: Similar to power limits, user can set Minimum and Maximum amounts of optical power loss that are acceptable for the application or specified for the cable or installation. User can simply specify the total amount of attenuation in dB. Alternatively user can select the dB/km or dB/mi if the results are being compared against cable specifications. In this case, enter the length of the cable under test for the test set to make the conversion.



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8.4.3 WiFi Spectrum Analyzer

WiFi SA is a portable spectrum analyzer on a USB dongle that displays all RF activity in the WiFi bands (e.g.,s wireless networks, cordless phones, microwave ovens, Bluetooth devices, etc.). It offers the following capabilities:

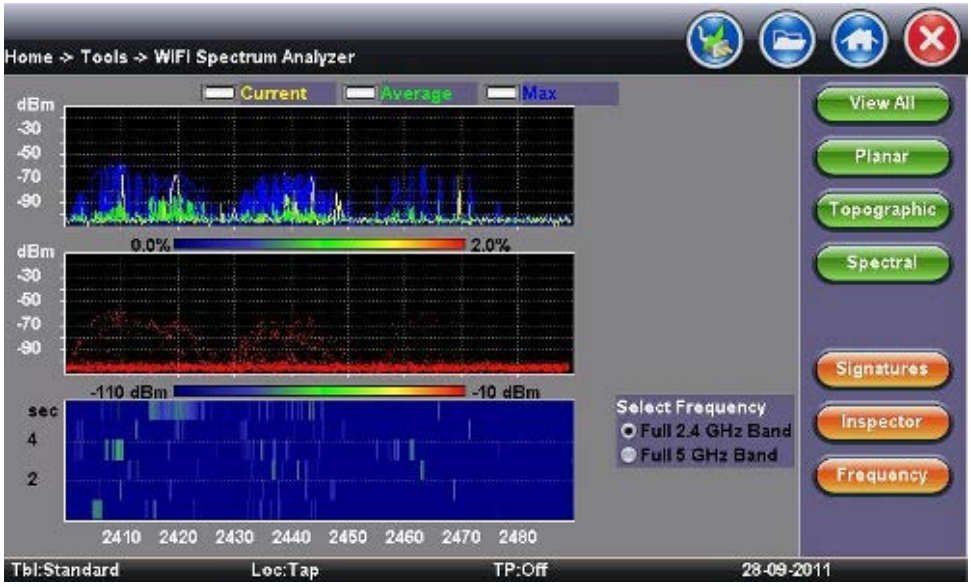
- Helps determine the best available WLAN channels quickly for optimal performance
- Helps to visualize and locate RF signals in the 2.4GHz and 5GHz spectrums
- Discover and remedy competing access points
- Optimize WLAN networks by locating and eliminating interference sources

WiFi SA Specifications

Parameter	2.4 GHz	5 GHz
Frequency range	2.4 to 2.495 GHz	5.15 to 5.85 GHz
Frequency resolution	26 kHz to 3 MHz	24 kHz to 3 MHz
Filter bandwidth	58 to 650 kHz	54 to 600 kHz
Antenna type	RP-SMA	
Amplitude range	-100 dBM to -6.5 dBM	
Amplitude resolution	0.5 dBM	

- Supports 802.11a/b/g/n networks
- Supports both 2.4 GHz and 5 GHz bands
- Equipped with RP-SMA antenna jack
  - Allows user to replace standard external Omni-directional antenna with a higher gain or directional antenna as needed
- The WiFi Analyzer is a compact and portable USB dongle that plugs into the USB 2.0 port of the V300 series
- The WiFi SA test application menu is located in the Tools/Advanced Tools menu

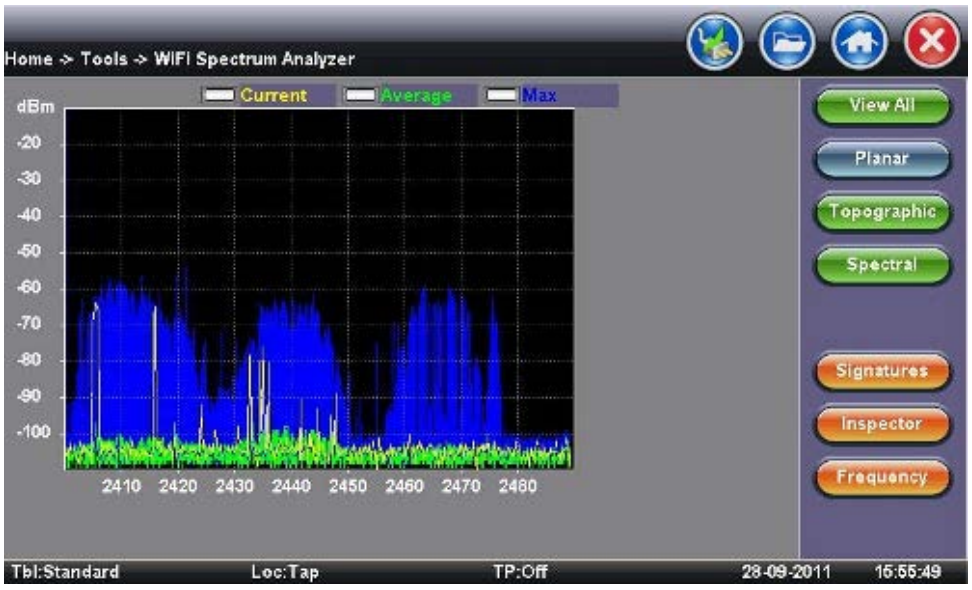
WiFi SA Display Summary **WiFi Analyzer USB dongle**



Display Summary

- **Planar view:** Reports current, average, and maximum signal amplitude for each wireless frequency
- **Topographic view:** Emphasizes which frequencies are the busiest across the entire spectrum
- **Spectral view:** Historical view of wireless spectrum use at a point in time

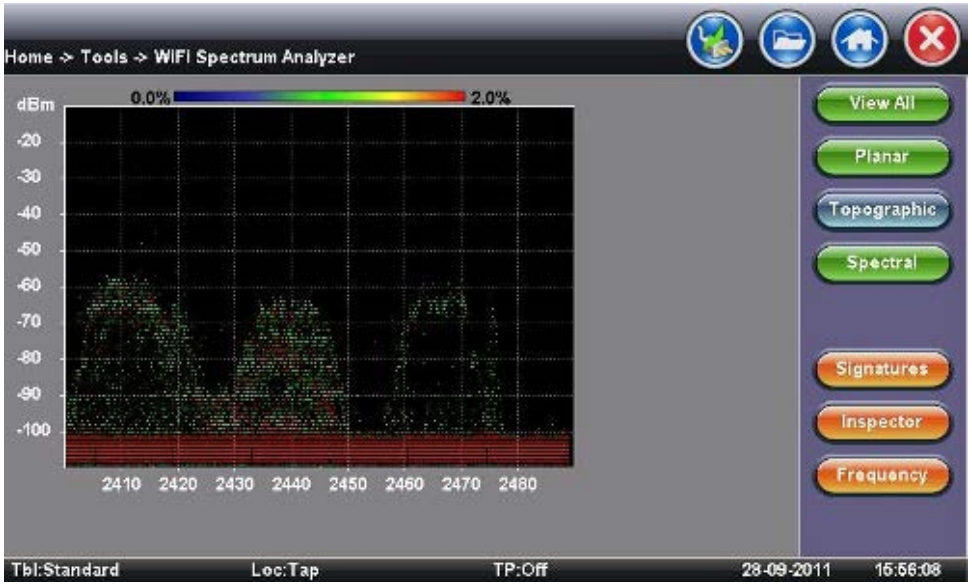
WiFi SA - Planar View



Planar View

- Traditional Spectrum Analyzer view with Max, Average, and Current results
- Displays RF activity in real time and tracks average and max values over a given period

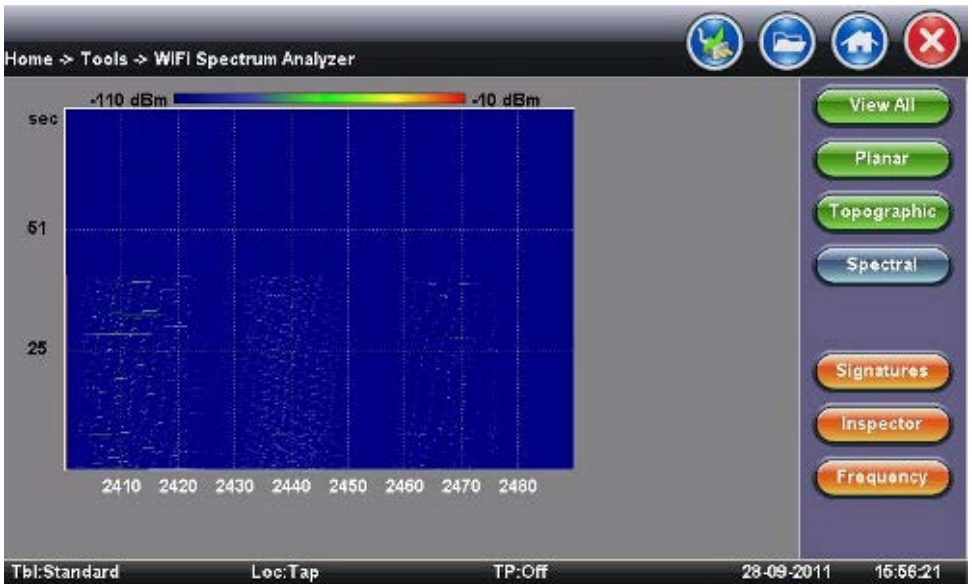
WiFi SA - Topographic View



Topographic View

- Similar to a density map - plots frequency versus amplitude
- Uses a special color scheme to assign colors to frequency amplitude points and to identify how often a particular coordinate is recorded
- Great resource for identifying devices with very low duty cycles
- Leaving it running will give a good indication of the typical local network conditions

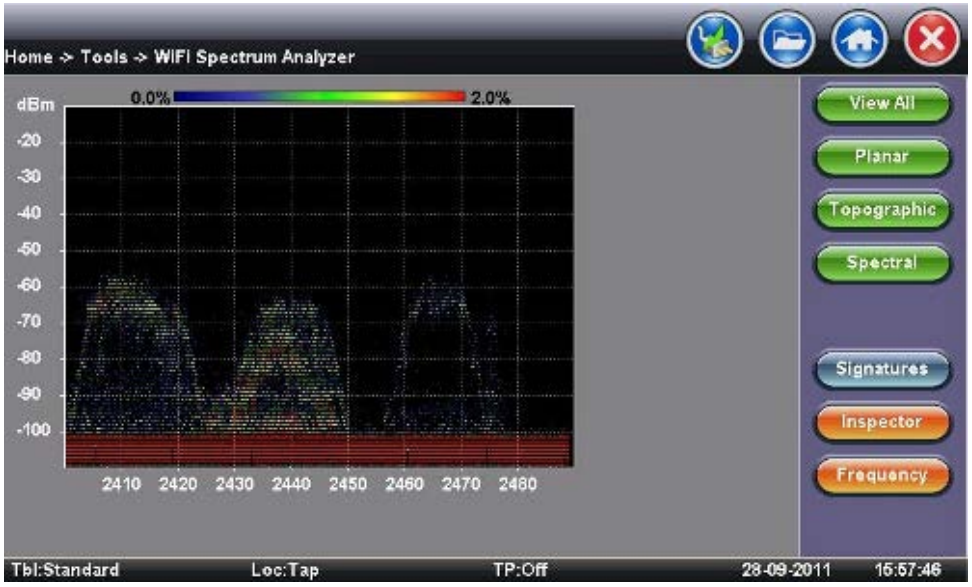
WiFi SA - Spectral View



Spectral View

- Waterfall type view across the whole band - graphs amplitude levels over time
- Uses color to pick out the relative signal strength at each point in time
- Great tool for troubleshooting intermittent problems, since it highlights devices that are perhaps emitting only short bursts of noise
    - For example - discover microwave oven in the kitchen interfering with WLAN

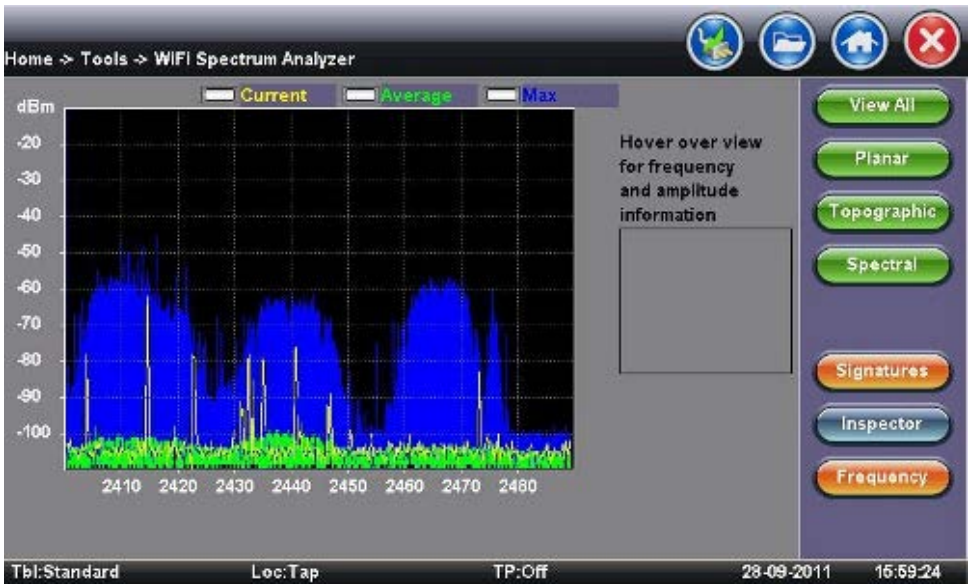
WiFi SA - Signatures



Signatures

- The Signatures button presets are available to identify unknown sources of RF activity (e.g., microwave oven)
- Select a device in the sidebar and click the pattern in the Topographic view to identify a device

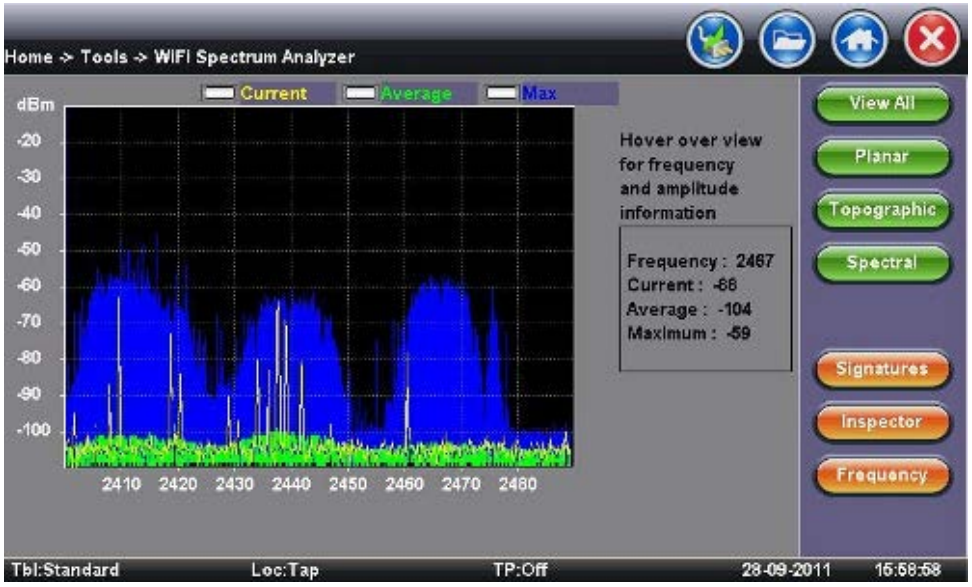
WiFi SA - Inspector



Inspector

- The Inspector button setup allows the user to measure the frequency of the RF activity or interference of interest
- When selected, a prompt and result box appears

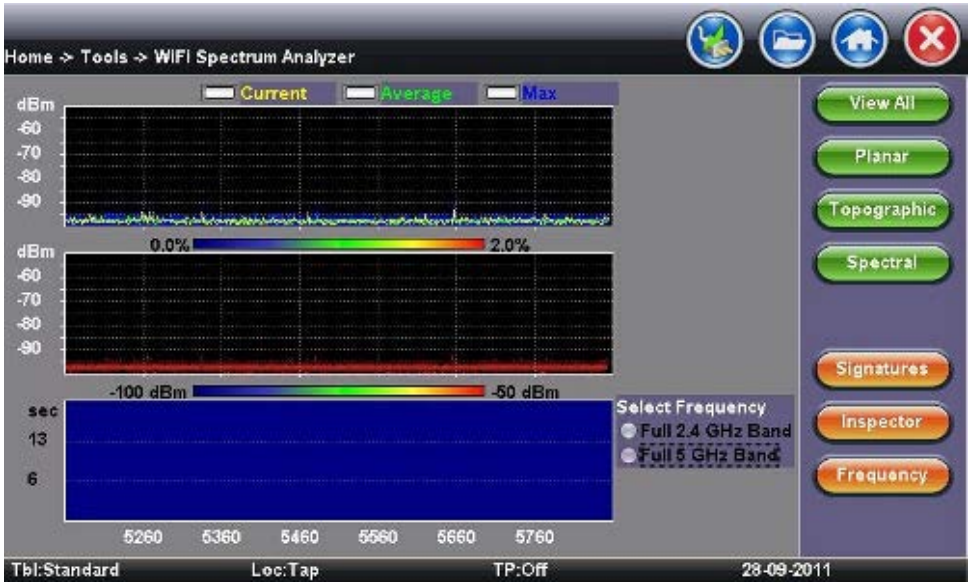
WiFi SA - Inspector - Result



Inspector Button - Result

- Identifies frequency and amplitude
- Current, Average, and Maximum amplitude values provide an indication of level fluctuation over measurement period

WiFi SA - Frequency



Frequency

- This button allows the user to select frequency band for testing

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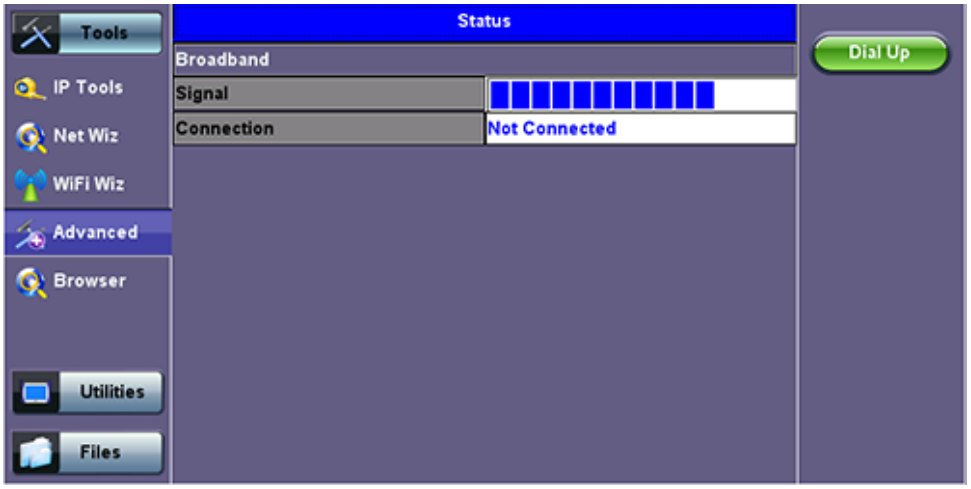
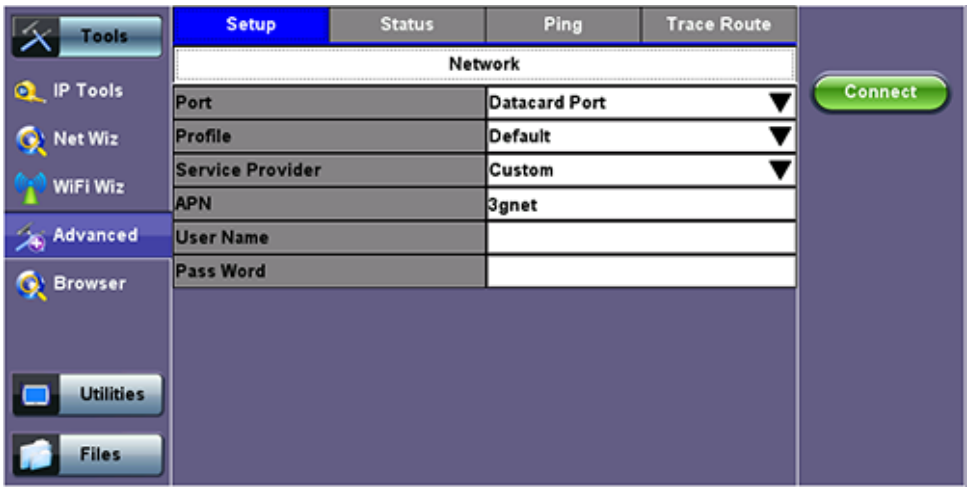
8.4.4 Data Card

To establish an IP connection using a data card, please make sure that the data card is connected on the USB port. Note that only datacards provided by VeEX are supported and have the driver necessary for connection. The **Data Card** icon, as shown below, will appear at the bottom of the screen.

Data Card - Setup

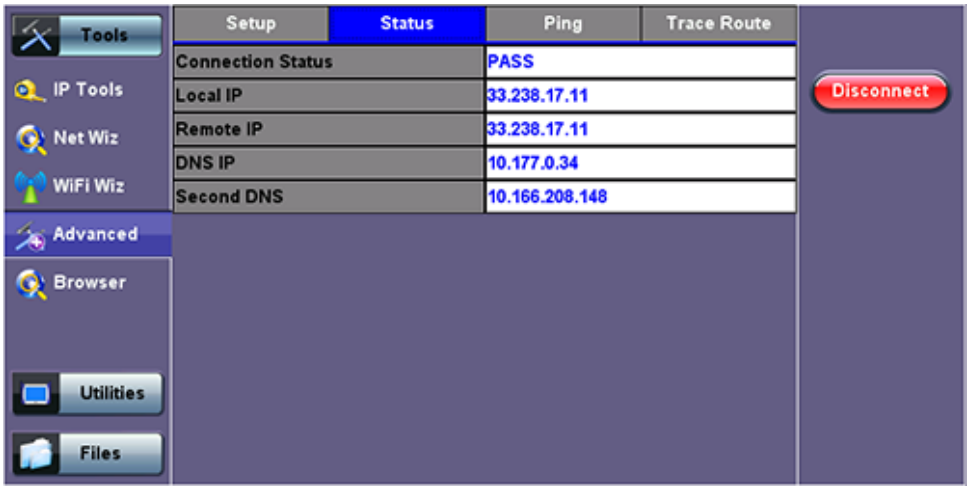


Press the **Dial Up** key.
In the IP Tools Setup menu, the Port will be displayed as "Datacard Port." The D for Data icon in the bar on the lower end of the screen will have a red cross to show that datacard is not connected - .
Select the **configuration parameters**, then press **Connect**.



Now that a connection has been established:

- The **D** for Data in the icon turns green .
- The connection details are displayed in the IP Tools Status tab (shown below)
- It will automatically reconnect if the test set is powered off/on and you are in a good reception area
- It will automatically reconnect if you enter a bad cell area and return to a good one



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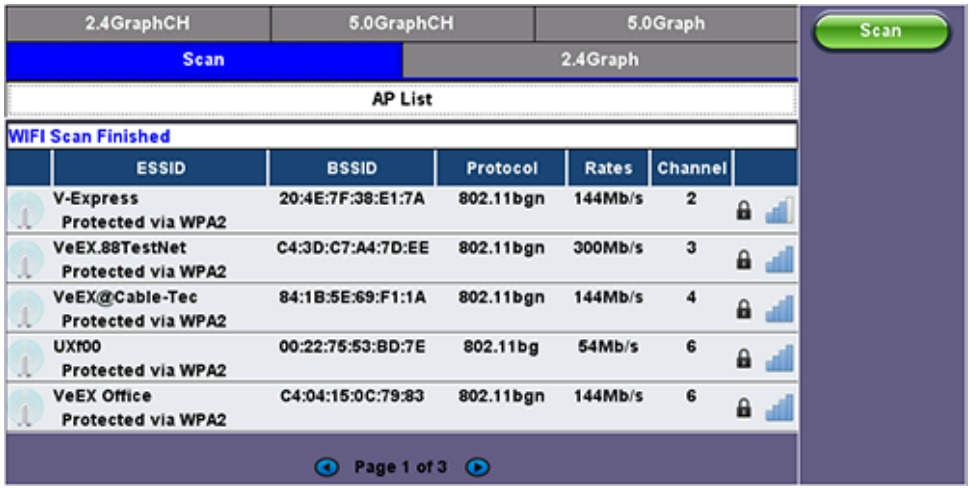
8.4.5 WiFi inSSIDer

WiFi inSSIDer Home



1. Plug the WiFi adaptor into the USB port. Allow at least 30-45 seconds for the unit to detect the wireless adaptor and for the software driver to load.

- ***Note:*** *Products support USB wireless adaptors supplied by VeEX only and have the necessary software driver built into the test set.*

The WiFi InSSider supports 2.4GHz and 5.0GHz Bands. The home screen has tabs to display test results for both frequency bands and also for graphical presentation of results for both.

2. Tap the Scan button on the right side of the screen.

After the scan is completed, the unit displays the list of access points (AP) detected in the 2.4 GHz and 5GHz bands.

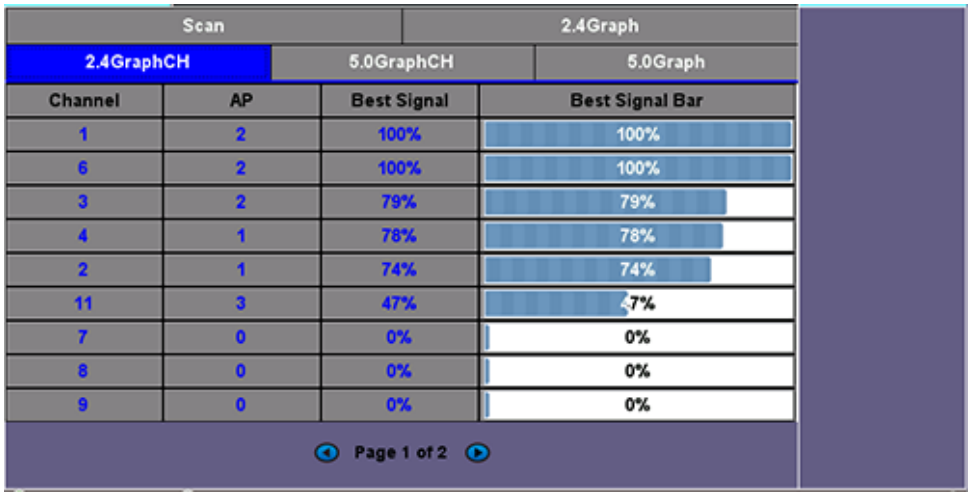
The following information is displayed for each AP:

- SSID name of the AP
- BSSID (MAC address) of the AP
- 802.11 protocol version supported by the AP
- Max data rate supported by the AP
- AP's radio channel number
- Lock symbol indicates if security is set on the AP (WEP, WPA or WPA2).
  When the AP is unsecured, no lock symbol is displayed
- Signal strength of the AP

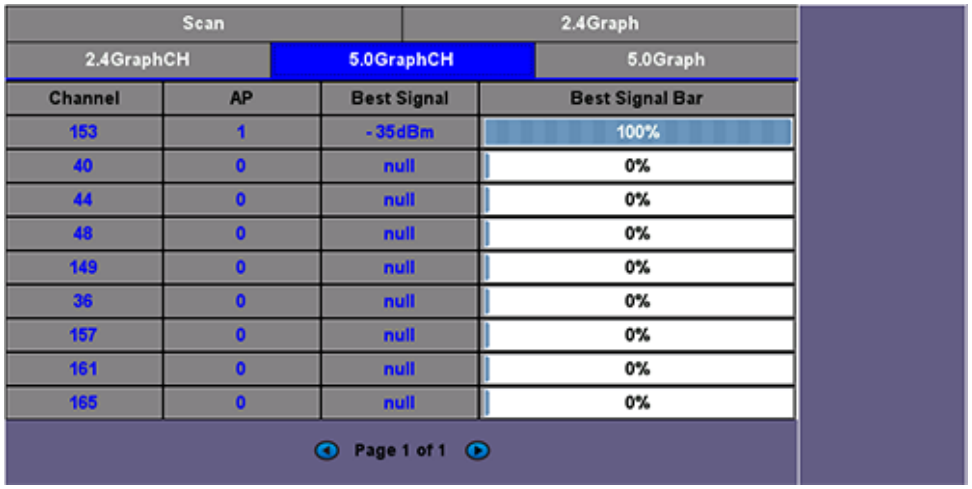
Access Points in the 5.0GHZ spectrum can only be displayed if the VeEX USB Wifi adapter supports 802.11a/n or 802.11 a/n/ac. Refer to the USB Wifi adapter specifications.

3. Use the 2.4GHz GraphCH and 5.0GraphCH tabs to view the number of Access Points detected for each channel in the 2.4GHz and 5GH bands and the strength of the strongest AP's signal for each channel.

2.4GHZ Channel

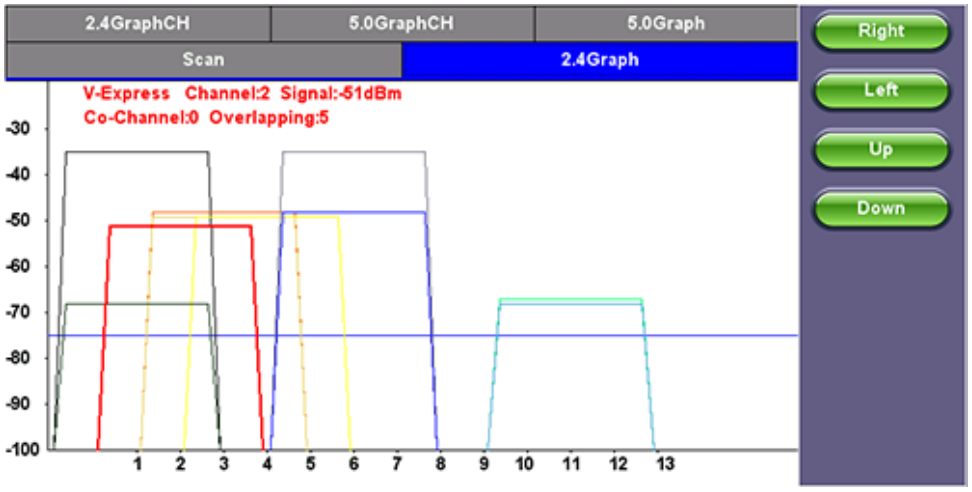


5GHZ Channel



4. Tap the Graph tab of the respective Channel to view the results in a graphical presentation.

Graph



Use the Right/Left/Up/Down function keys or the arrow keys on the unit's keypad to navigate the graph and get additional information for the access points. Detailed information for each Access Point includes:

- SSID: name of the AP
- AP's radio Channel number
- Signal strength (dBm)
- Number of co-channel: Number of APs using the same radio channel
- Number of Overlapping APs: Number of APs using channels whose frequency band overlaps with the AP.

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8.4.6 OTDR Viewer

This functionality allows the test platform to open and analyze standard OTDR .SOR files created by the TX300S-OTDR, RXT-4100 OTDR, FX300 OTDR or SunLite OTDR test sets. It can also be used to control the wireless OPX BOX OTDR via Bluetooth or USB connection, offering full-featured OTDR functionality.

Please refer to the OTDR manual for further details about its operation.

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8.5 Web Browser

A web browser is available in the >Utilities >Tools > Browser menu and can be used as a convenience (browse the web) or to quickly verify Internet connectivity.

The built in web browser uses the management port IP connection.

An active IP connection can be established either through Ethernet, WiFi or datacard ports.

The web browser defaults to VeEX's website. Use the Web browser's navigation bar to enter the name of the website you wish to reach.

Web Browser

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9.0 Utilities

9.1 Platform Settings

This section provides settings for the global parameters of the test set or platform (system settings).

Settings Menu

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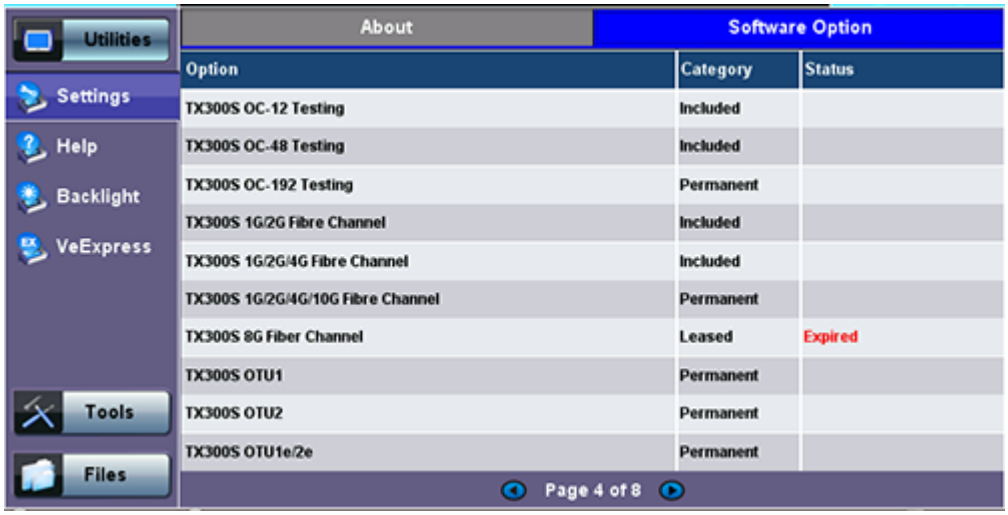
9.1.1 About

This section provides information about the software version, serial number, and MAC address of the management port of the unit, as well as a list of software licenses (optional test features) currently loaded in the test set.

Utility Settings - About

Utility Settings - About - Software Option



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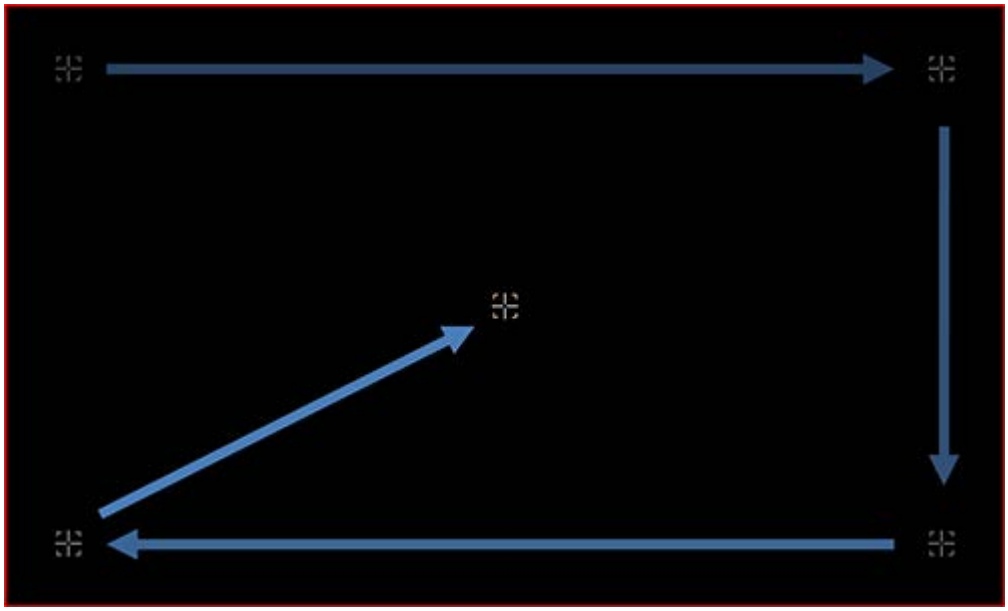
9.1.2 Screen Calibration

Go to this section to calibrate the touch screen.

Utility Settings - Screen Calibration



Follow the instructions and tap on the center of the five targets displayed at all four corners. A message displays when calibration is complete. If the touch screen is miscalibrated by mistake, please use the cursor and enter keys to start the calibration feature and repeat the procedure.

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9.1.3 Bluetooth

VeEX products support a micro USB Bluetooth adaptor offering wireless connectivity up to 10 meters (30 feet). Ultra compact and portable, the adaptor provides an untethered connection between the tester and other Bluetooth compatible devices such as a Notebook PC or cell phone, so the user can transfer test result files quickly and easily without having to hassle with memory sticks or Ethernet connections.

An overview of the application is shown below.

Bluetooth Adaptors - Compatibility

Not all Bluetooth adaptors on the market are supported by the V300 product series. Please use adaptors that have been tested and supplied by VeEX only to ensure compatibility and correct operation.

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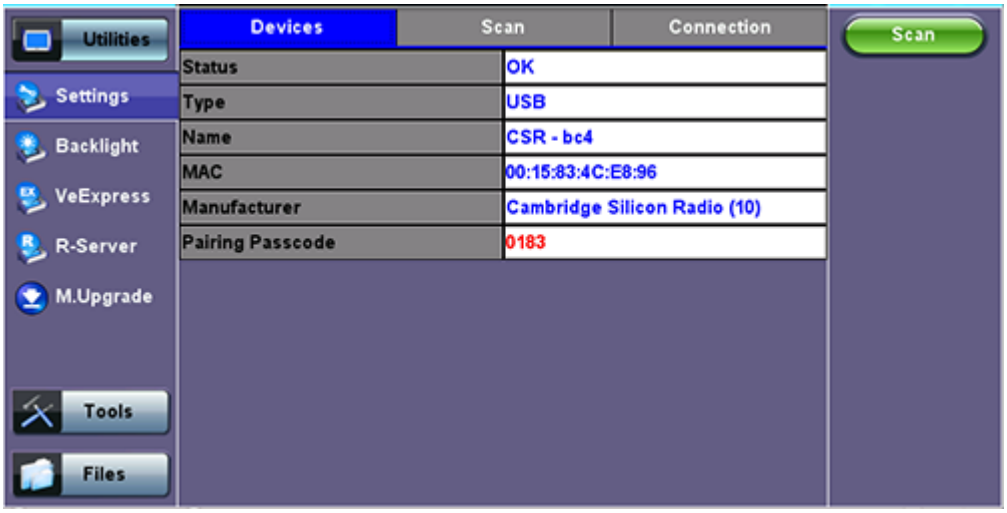
Bluetooth Setup

Insert the Bluetooth adaptor into the USB port on the side of unit. If you are using more than one USB device, use an external USB hub to connect additional devices. Once detected, a **Bluetooth** icon is displayed on screen.

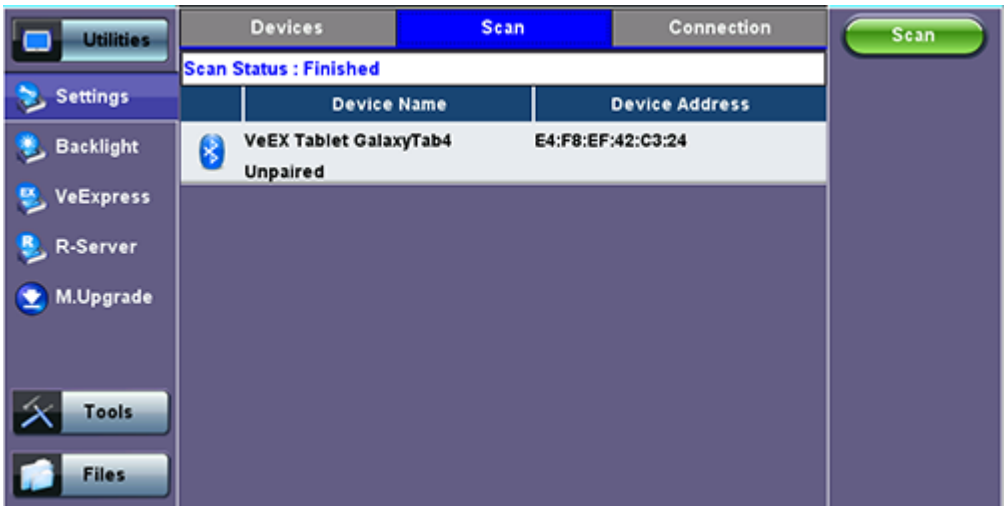
Devices

The test platform will automatically detect the Bluetooth adaptor once plugged into the USB port. Details of the Bluetooth adaptor will be displayed including the MAC address of the device and the last 4 digits of the serial # of the V300 test set. The last 4 digits of the V300 series test set will be the pairing code between the unit and the external device. Press the **Connection** tab to view the passcode.

Bluetooth - Devices Tab



Bluetooth - Devices Tab



Bluetooth - Connection - Passcode

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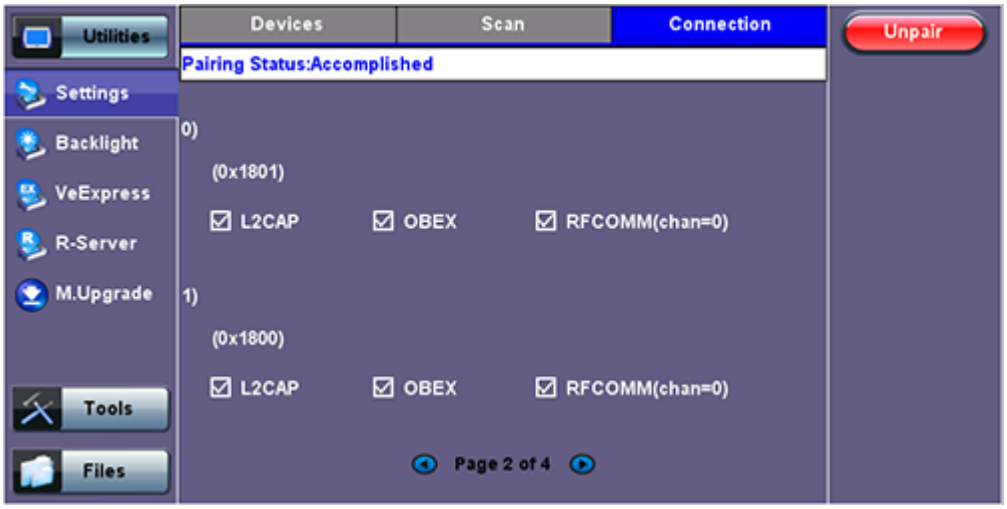
Setup

- Press **Scan** to check for available Bluetooth devices. Once scanning is complete, a list of discovered Bluetooth devices will be listed. Please ensure the peripheral device is set to **Discoverable** during Scanning and Pairing operation.
- Press **Pair BT** to begin the pairing process. During the pairing operation, you will be prompted to enter a code on the peripheral device (PC or Mobile Phone) in order to pair successfully. Enter the last 4 digits of the V300 serial number as shown in the **Connection** tab.
- Once paired, click the **Services** button at the bottom of the screen to check the service attributes. To upload test results

via Bluetooth and Mobile phone to a UMTS or 3G network, full data upload service will be required.

Bluetooth - Connection Established

Bluetooth - Connection Page 2



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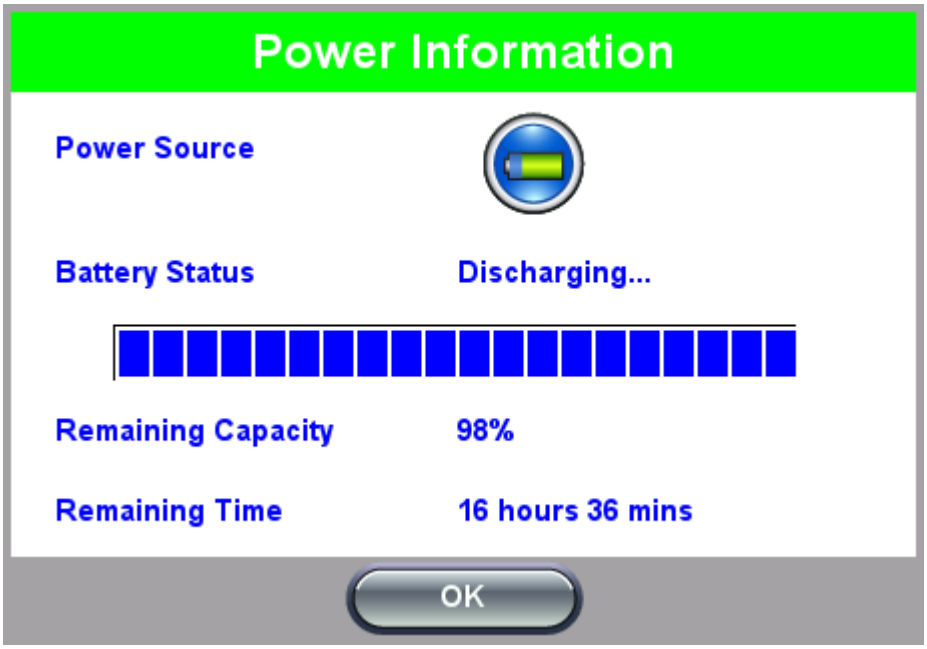
9.1.4 Power

This section provides information about current power source and information about the battery gauge. Tap on the battery icon, on the top bar, to bring battery charge and estimated autonomy information.

Utility Settings - Battery Power



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9.1.5 Backlight

This section provides backlight control of the unit.

Power: There are two settings -- one for Battery power and another for AC power.

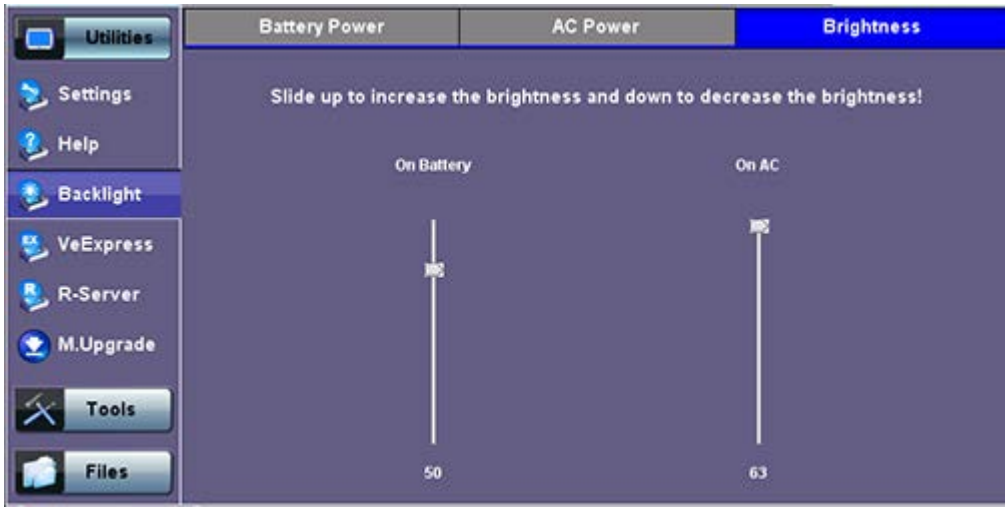
- The user has the option to select a timer to turn off the backlight if the unit is not in use. This function helps improve the battery autonomy and preserve LCD life
- To enable the timer, check "Turn off backlight if device is not used for" and with the drop-down menu, adjust the duration of the idle time before the backlight is turned off.
- Once the timer is active and the backlight turned off, any action on the test set (touch screen, keypad) will turn on the backlight again.

Backlight - Battery Power

Backlight - AC Power

Brightness: The user can select the brightness level for Battery and AC operation modes.

Backlight - Brightness



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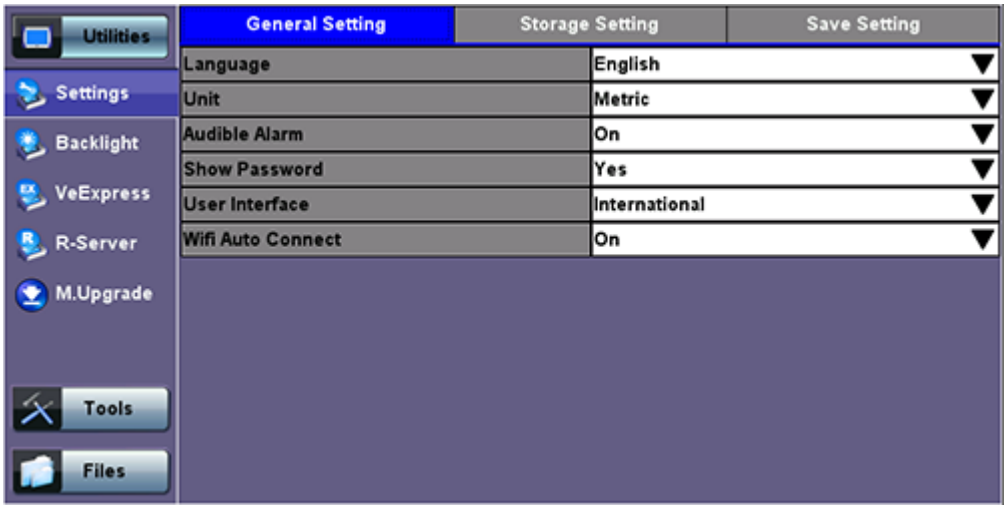
9.1.6 Global Settings

General Setting

- **Language:** An alternative language for the user interface
- **Units:** Measurement system (English - feet or Metric - meter)
- **Audible Alarm:** When enabled, the test set's buzzer will sound (beep) when alarms and errors are being detected.
- **Show Password:** Hides/unhides username and password information associated with FTP and related IP functions
- **User Interface:** The USA user interface version presents SONET/DSn application-oriented menus, while the International setting is more open to all settings.

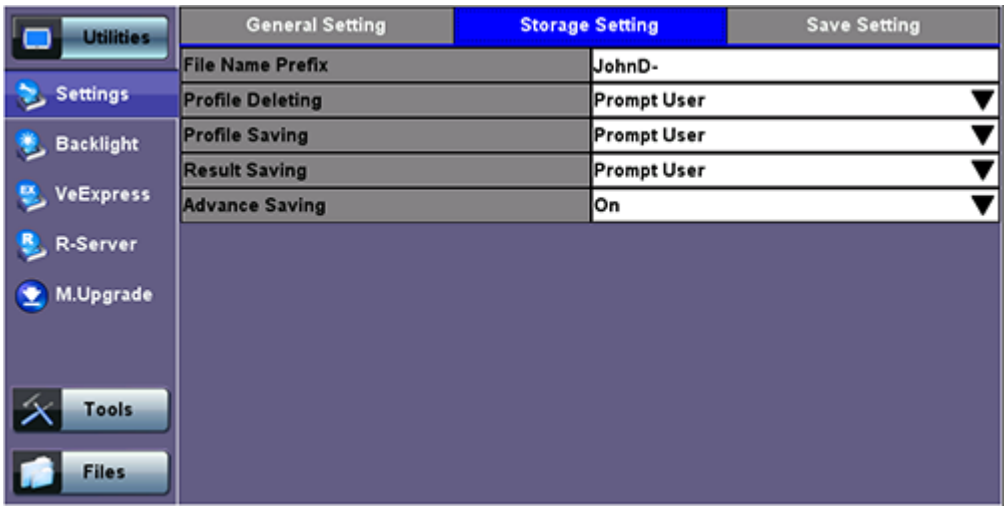
Utility Settings - General Setting



Storage Setting

- **File Name Prefix:** Tap on the box to enter the file name prefix using the pop up alphanumeric keypad
- **Profile Deleting:** Auto Delete or Prompt User
- **Profile Saving:** Auto Overwrite or Prompt User
- **Result Saving:** Manual or Prompt User
- **Advanced Saving:** On/Off. Allow users to add extra information to the results file to be uploaded to a centralized R300 Server. Requires Advanced Management Option.

Utility Settings - Storage Setting



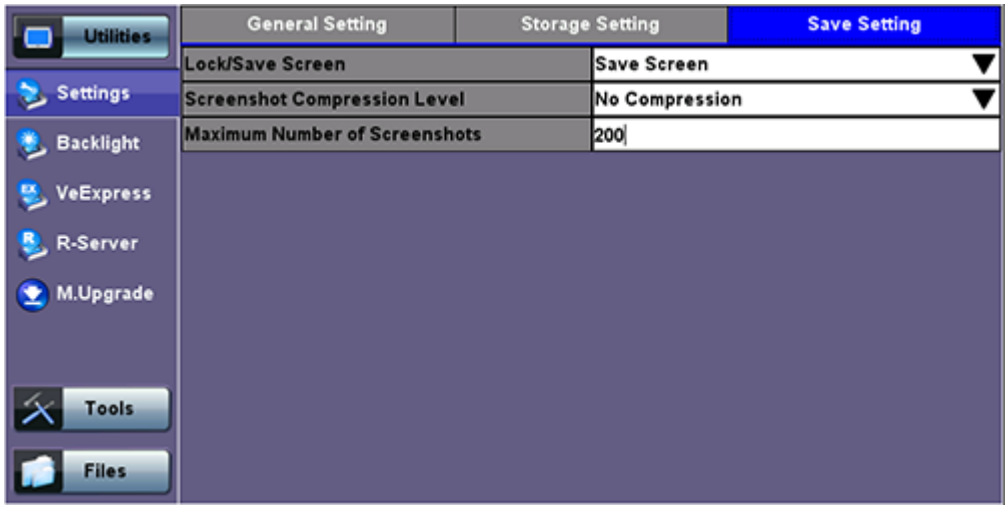
Save Screen Settings

Save Screen tab**:** Helps control the behavior of the Lock key on the keypad. The Lock key can be set to do the following:

- **Lock/Unlock** the unit's screen to prevent accidental interruption during a long term test.
- **Save Screen Shots:** The following configurations can also be done:
  - The compression level of the screen picture
  - Maximum number of screenshots that can be saved.

  Each time user presses the lock key from the key pad a screen shot will be saved in memory. The screen shots can be recovered under Files>Saved.

Utility Settings - Lock/Save Screen



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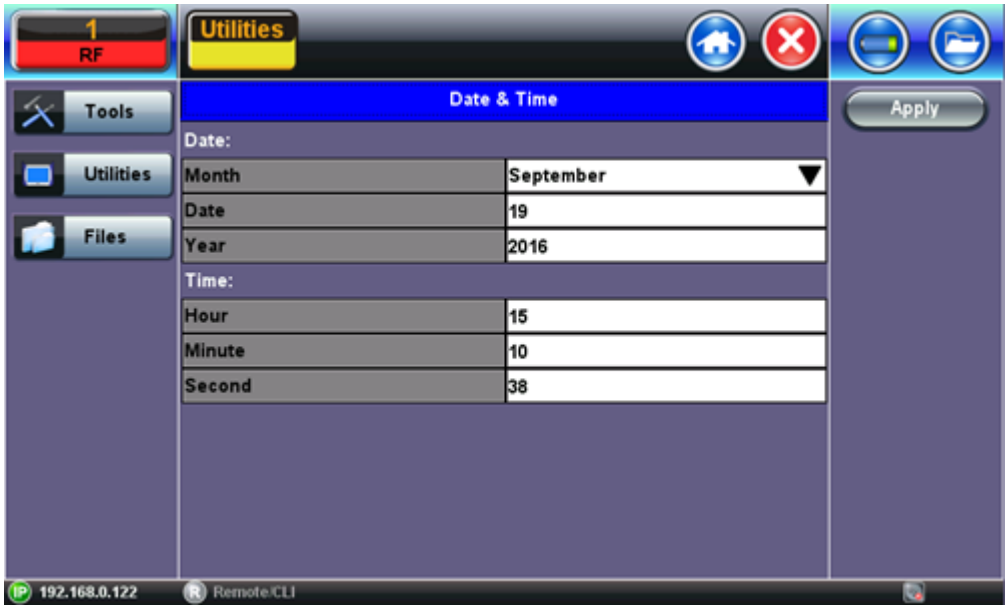
9.1.7 Date and Time

This screen allows the user to set the date and time. Daylight savings are automatically enabled in the utility.

Date Setup



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9.1.8 Remote Access

There are different ways to control or access the test set and the information it contains, from a local (LAN) or remote (WAN) connected PC:

- ReVeal PC software
- VNC Client

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ReVeal CX300

This VeEX application allows users to connect to the test set, using the platform's IP address. ReVeal intuitive user interface

offers the following functions:

- Test Profiles Management: Create, Edit, upload and download complex Ethernet and Fibre Channel test profiles (BERT, Throughput, RFC2544, Y1564 SAM, Scan, IP, Ping/Trace, Packet Capture, etc)
- Test Results Management: Download results from the test set, manage local test results (PC HDD), generate detailed test reports, export to CSV or PDF, and print.
- View software options, licenses, serial numbers, perform remote software updates

ReVeal is a Windows® application that can be downloaded free of charge from www.veexinc.com.

Users are able to connect remotely from a desktop PC via ReVeal tool software or through Remote Access on the test set. To proceed with remote access, make sure that remote control software is installed on the PC device. The user is able to configure the Profile, VNC Server Service, Web Service, VNC and Web passwords on the Remote Access page. Input the test set IP address and specified user password when prompted by the software to initiate Remote Access.

Go back to 9.1.8 Remote Access

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Remote access with VNC Server/Viewer:

The test set VNC service can be managed in >Utilities >Settings >More >Remote Access menu, to enable or disable the VNC server and assign remote access passwords.

- **Super User Password:** Allows remote VNC clients to view and control the user interface via mouse
- **Regular User Password:** Allows remote VNC users (guests) to view what's currently on the test set screen, but no interactions with the GUI are allowed.

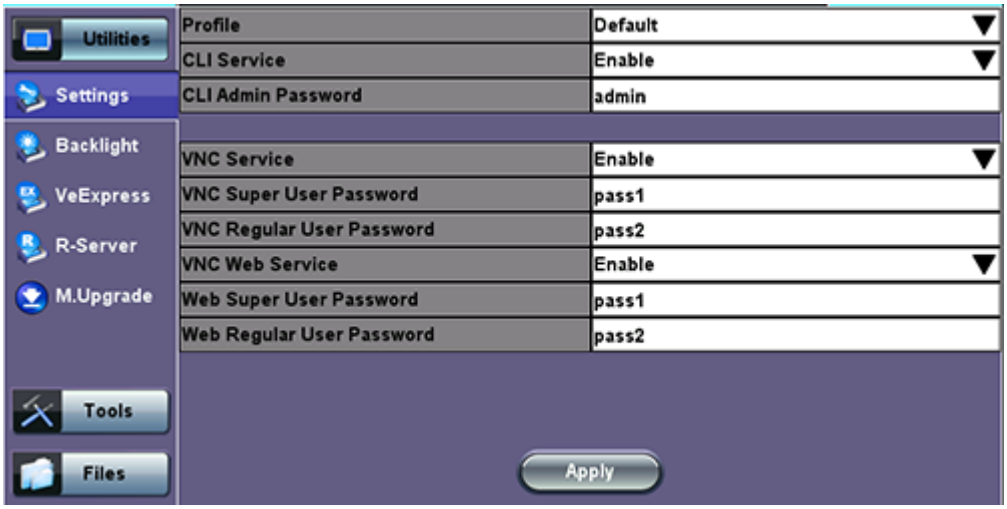
Although the test set VNC services allows multiple users to be connected simultaneously, it is a screen mirroring service, so all users would be seeing and interacting with the same GUI. Such feature can certainly be used for training purposes, but it is not recommended for multi-user or multi-test environments.

VNC clients, such as RealVNC®, are readily available for download for different platforms and form factors, including Windows®. Mac OS®, Linux, iOS, Android.

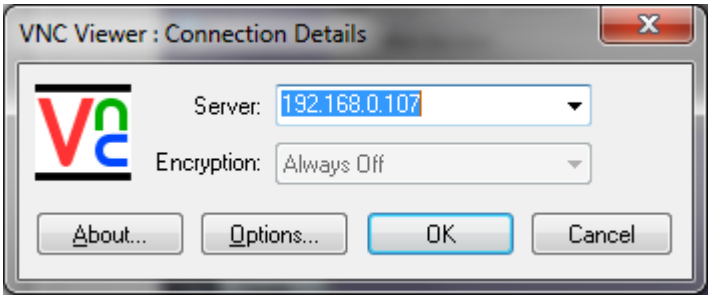
- **VNC Service:** Enable or disable the remote access to remote VNC clients running on PCs, Macs, tablets or smart phones.
- **VNC Super User Password:** Defines the password for users allowed to control the test set via standard VNC clients
- **VNC Regular User Password:** Defines the password given to users who are only allowed to view the test set current screen via standard VNC clients, but not make any changes to test or test set.

After configuring these settings in the Remote Access menu, run VNC on the PC. A message box will prompt the user to enter a Server number, which is the test set IP address. Enter the VNC Super/Regular password when prompted by the message box for a password.

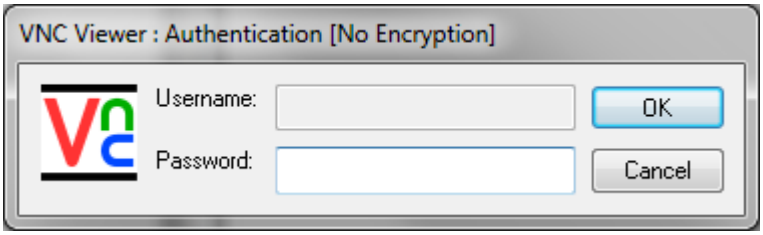
Remote Access



VNC Viewer - Enter Server Address



VNC Viewer - Password Prompt



[Go back to 9.1.8 Remote Access]

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10.0 File Management

V300 Style File Manager

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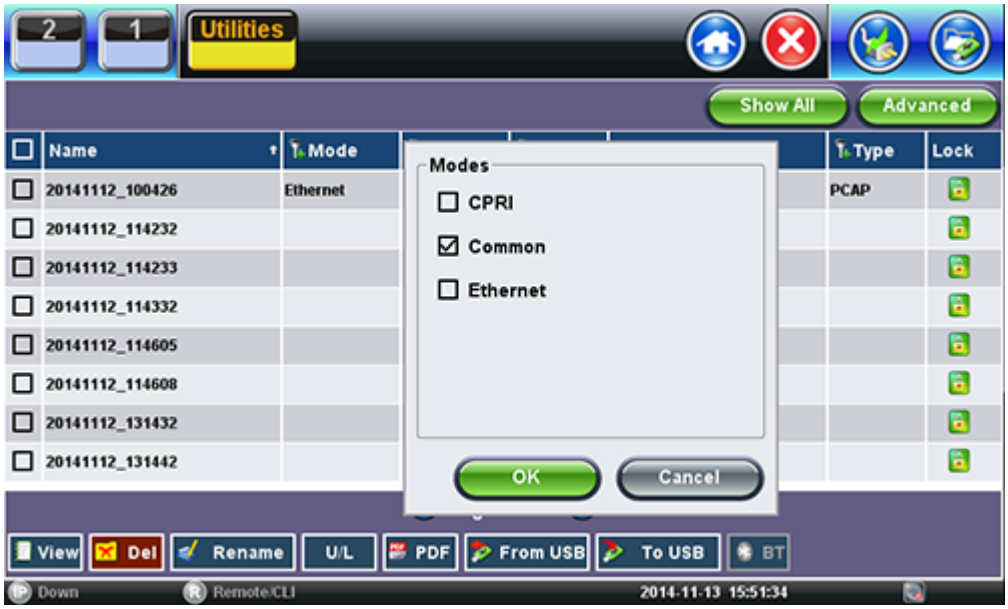
10.1 File Manager: Working with Saved Results, Profiles, Images

- From Utilities go to >Files >Saved
  - Displays all results stored in the test set
- Use the check box to select the desired files.
- Tap on any column header to sort by that specific parameter.
  - Tap again to change the sorting order
- The U/L button lock and unlock files to prevent accidental deletion.
- PDF button converts all selected files to PDF format
  - Requires FAT32 USB Memory stick

- Backup and Restore (USB Memory stick):
  - To USB copies all selected files to stick
  - From USB restores all files from the stick
- BT (Bluetooth®) File Transfer

    - Requires compatible USB dongle
- File Filters



    - Makes it easier to isolate desired types of results from all other test results stored in the test set
    - Reduces the number of pages displayed
- Activate Filters
    - Use the stylus to tap on the Y+ icon
    - Check mark the desired attributes
    - Filters parameters can be combined
- Reset Filters
    - Press the Show All button
- Sorting
    - Tap on a header to sort by that field's type, in ascending or descending order
    - Makes finding desired test Results or Reports even easier

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11.0 Setup - Main Menu

This menu contains CX380S-D3.1 related system operation and parameter settings:

- **Channel Table**
- **Default Location**
- **CM US Level Offset**
  - To adjust the Cable Modem Upstream Transmit levels to match a reference cable modem's measurements. Settable from -3.0 to +3.0 dB.
- **Unit**
  - To change the display unit between dBmV and dBuV.
- **TP Compensation**
  - To turn the Test Point (TP) compensation On or Off. User is able to edit and create, by name, of test point locations and the associated compensation value to be added to the level measurement results.
- **Table Lock**
  - To lock the channel table to prevent accidentally erasing of pre-stored channel tables.
- **Sweep table (RP)**
  - To edit and create return path sweep tables.
- **Tilt A&D Start Mode**
  - Choose whether the Tilt 'A&D Combined' mode starts in Graph or Table mode.
- **Spectrum Start Mode**
  - Select the default mode for Spectrum Analysis.
- **Analog C/N Offset**
  - Choose the offset frequency for the noise measurement. Settable from -1.00 MHz to + 2.50 MHz.
- **CSO/CTB offset**
  - Configure offset frequencies for Single Channel Analog CSO-1/-2/-3/-4 and CTB measurements.
- **In-Ch Freq response**
  - Configure test parameters for the Single Channel Analog In-Channel Frequency response measurement.
- **Co-ax Vp**
  - Currently not supported.
- **CM Always on**
  - Choose if the Cable Modem software should be pre-loaded after first powered on.
- **OFDM Table**
  - To create and edit OFDM channel table.
    Note: *The OFDM Table feature is applicable only for Japanese terrestrial OFDM features. It is not applicable for DOCSIS 3.1/OFDM.*
- **TPS Type**
  - Select the appropriate switch type.
- **Sweep Table (FP)**
  - To edit and create Forward Path Sweep tables for use with a CX180FS Forward Path Sweep system.
    Note*: This feature is currently not supporte*d.
- **SA Pre-AMP**
  - If set to AUTO, the Spectrum Analyzer will automatically turn on a Pre-AMP, making it optimized for Return Path ingress measurements.

- **SA Peak Detector**
  - If set to AUTO, the Spectrum Analyzer will automatically set the Peak Detector to Positive-Peak mode, making it optimized for Return Path ingress measurements.

Setup - Main Menu

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12.0 ReVeal Software

For more information on using the ReVeal CX300 software, refer to the ReVeal CX300 PC Software for CX300 series User Manual at www.veexinc.com.

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13.0 Warranty and Software

Warranty Period: The warranty period for hardware, software and firmware is one (1) year from the date of shipment to the customer. The warranty period for battery pack, LCD, LCD touch panel, LCD protective cover, and accessories (including, but not limited to patch cords, AC adaptor, SFP, USB adaptors, carrying case, carrying pouch) is limited to one (1) year.

Hardware Coverage: VeEX Inc. warrants hardware products against defects in materials and workmanship. During the warranty period, VeEX Inc. will, at its sole discretion, either

- Repair the products
- Replace hardware which prove to be defective

provided that the products that the customer elects to replace are returned to VeEX Inc. by the customer, along with Proof of Purchase, within thirty (30) days of the request by the customer, freight prepaid.

Software Coverage: VeEX Inc. warrants software and firmware materials against defects in materials and workmanship. During the warranty period, VeEX Inc. will, at its sole discretion, either

- Repair the products
- Replace software and/or firmware which prove to be defective

provided that the products that the customer elects to replace are returned to VeEX Inc. by the customer, along with proof of purchase, within thirty (30) days of the request by the customer, freight prepaid.

Additionally, during the warranty period, VeEX Inc. will provide, without charge to the customer, all fixes, patches and enhancements to the purchased software, firmware and software options. VeEX Inc. does not warrant that all software or firmware defects will be corrected. New enhancements attached to a software option require the option to be purchased (at the time of order or the time of upgrade) in order to benefit from such enhancements.

Limitations: The warranty is only for the benefit of the customer and not for the benefit of any subsequent purchaser or licensee of any merchandise (hardware, software, firmware and/or accessories).

Revoking the warranty: VeEX Inc. does not guarantee or warrant that the operation of the hardware, software or firmware will be uninterrupted or error-free. The warranty will not apply in any of the following cases:

- Improper or inadequate maintenance by the customer
- Damage due to software installed by the customer on the unit without prior authorization (written) from VeEX Inc.
- Unauthorized alteration or misuse
- Damage occurred from operating the unit outside of the environmental specifications for the product
- Improper installation by the customer

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14.0 Product Specifications

Note: Product Specifications
The most recent product specifications can be downloaded from the VeEX website.
For the most recent version, click here

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15.0 Certifications and Declarations

Declaration of Conformity

What is CE?

The CE marking is a mandatory European marking for certain product groups to indicate conformity with the essential health and safety requirements set out in European Directives. To permit the use of a CE mark on a product, proof that the item meets the relevant requirements must be documented.
Use of this logo implies that the the unit conforms to requirements of European Union and European Free Trade Association (EFTA). EN61010-1

For a copy of the CE Declaration of Conformity relating to VeEX products, please contact VeEX customer service.

ROHS Statement

What is RoHS?

RoHS is the acronym for Restriction of Hazardous Substances. Also known as Directive 2002/95/EC, it originated in the European Union and restricts the use of specific hazardous materials found in electrical and electronic products. All applicable products imported into the EU market after **July 1, 2006** must pass RoHS compliance.

Click here for ROHS Statement relating to VeEX products

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16.0 About VeEX

VeEX, Inc., the Verification EXperts, is an innovative designer and manufacturer of test and measurement solutions addressing numerous technologies. Global presence through a worldwide distribution channel provides uncompromised product support.

Visit us online at www.veexinc.com for latest updates and additional documentation.

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RoHS Compliance - FAQ

What is RoHS?
RoHS is the acronym for Restriction of Hazardous Substances. Also known as Directive 2002/95/EC, it originated in the European Union and restricts the use of specific hazardous materials found in electrical and electronic products. All applicable products imported into the EU market after **July 1, 2006** must pass RoHS compliance.

What are the restricted materials mandated under RoHS?
The substances banned under RoHS are lead (Pb), mercury (Hg), cadmium (Cd), hexavalent chromium (CrVI), polybrominated biphenyls (PBB) and polybrominated diphenyl ethers (PBDE).

Why is RoHS compliance important?
The restricted materials are hazardous to the environment and pollute landfills, and are dangerous in terms of occupational exposure during manufacturing and recycling.

How are products tested for RoHS compliance?
Portable RoHS analyzers, also known as X-ray fluorescence or XRF metal analyzers, are used for screening and verification of RoHS compliance.

Which companies are affected by the RoHS Directive?
Any business that sells applicable electronic products, sub-assemblies or components directly to EU countries, or sells to resellers, distributors or integrators that in turn sell products to EU countries, is impacted if they utilize any of the restricted materials.

What is WEEE?
WEEE is the acronym for Waste from Electrical and Electronic Equipment. WEEE, also known as Directive 2002/96/EC, mandates the treatment, recovery and recycling of electric and electronic equipment. All applicable products in the EU market after **August 13, 2006** must pass WEEE compliance and carry the "Wheelie Bin" sticker.

How are RoHS and WEEE Directives related?
WEEE compliance aims to encourage the design of electronic products with environmentally-safe recycling and recovery in mind. RoHS compliance dovetails into WEEE by reducing the amount of hazardous chemicals used in electronic manufacture.

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Annex IA of Directive 2002/96/EC (Categories)

1. Large household appliances
2. Small household appliances
3. IT and telecommunications equipment
4. Consumer equipment
5. Lighting equipment
6. Electrical and electronic tools (with the exception of large-scale stationary industrial tools)
7. Toys, leisure and sports equipment
8. Medical devices (with the exception of all implanted and infected products)
9. Monitoring and control instruments
10. Automatic dispensers

VeEX position and product status

Our quality and environmental policy is to limit and progressively eliminate the use of hazardous substances and chemicals in the design and manufacture of our products.

VeEX products are classified as Monitoring and Control Instruments under Article 2, Section (1), Category 9 of the WEEE 2002/96/EC Directive, and are therefore exempt to the RoHS requirements and restriction until 2010.

Furthermore, we are committed to abiding with EU country laws where the WEEE Directive is applicable. As such, VeEX products are being marked accordingly, reporting procedures are being observed and recycling programs are being implemented.

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