AT2500R

Series Analyzer

User's Manual

D07-00-067P Rev. A00

WARNING
Using the supplied equipment in a manner not specified by VeEX, Inc. may impair the protection provided by the equipment.

End of Life Recycling and Disposal Information
DO NOT dispose of Waste Electrical and Electronic Equipment (WEEE) as unsorted municipal waste. For proper disposal return the product to VeEX, Inc. Please contact our local offices or service centers for information on how to arrange the return and recycling of any of our products.

EC Directive on Waste Electrical and Electronic Equipment (WEEE)
The Waste Electrical and Electronic Equipment Directive aims to minimize the impact of the disposal of electrical and electronic equipment on the environment. It encourages and sets criteria for the collection, treatment, recycling, recovery, and disposal of waste electrical and electronic equipment.

Disclaimer: Contents subject to change without notice and are not guaranteed for accuracy.

AT2500R Table of Contents

1 Introduction

1.1 Welcome

The VeEX, Inc. AT2500R series analyzer (models R, Rv, RQ and RQv) is a 1.5 GHz portable, battery operated RF spectrum analyzer designed specifically for CATV applications. Functions include basic spectrum analysis, automated CATV tools for daily testing and preventative maintenance, QAM analysis, video demodulation test and analysis for locating faults or troubleshooting, Ethernet connectivity for real-time remote control capability, and FCC proof of performance testing.

The AT2500R series analyzer has a broad input range, high sensitivity and advanced circuit design characteristics that provide accurate and repeatable measurements in the headend, hub or in the field. Its front end incorporates a unique filtering capability with high/low pass, band selectable filters that prevent accidentally overloading the spectrum analyzer.

Testing options include one-button measuring of signal levels, with the appropriate correction factors for different modulation types, measurement of carrier-to-noise ratio, composite second and composite third order distortions as well as hum modulation, depth of modulation, time domain measurements for upstream bursty RF signal validation and QAM digital measurements such as MER, Pre/Post-FEC BER, group delay, and so on. An integrated frequency counter can measure any CW, AM, FM or television signal. The zero span mode includes a built-in AM/FM demodulator.

As a portable instrument, AT2500R can be used virtually anywhere to rapidly align any broadband RF network, while instantaneously monitoring system performance with documentation capability. Built-in preset measurement modes help automate tests and procedures on multiple frequencies or channels within minutes. All the results can be stored in non-volatile memory and later printed on a standard printer, either directly from the AT2500R or through your Ethernet network. Stored measurements may be downloaded to a PC with VeEX, Inc.'s file transfer and data management software that also allows measurement data to be exported directly into a preformatted FCC report or third party POP software.

The AT2500R series analyzer provides speed and accuracy when taking measurements and re-calibrates itself periodically or when it senses temperature variations and issues a warning for any out-of-calibration conditions. This automatic and continual verification against stored calibration curves ensures consistent and precise digital measurements, within the specified limits. It constantly monitors internal temperature as well as its battery level.

1.2 Safety Requirements

Important: Review the following safety precautions to avoid injury and prevent damage to this product or any product connected to it. To avoid potential hazards, use this product only as specified. Only qualified personnel should perform service procedures.

To avoid fire or personal injury:

1. Use the proper power cord specified for this product and certified for the country of use.
2. Ground the analyzer.

   Always use a three-pronged AC power cord (supplied with the analyzer) and insert only into a properly grounded three-pronged receptacle. Failure to ensure proper grounding may expose users to a shock hazard may damage the product and shall void the warranty.

Any attached equipment (customer supplied) must be grounded to the same protective ground as the AT2500.

3. Observe all terminal ratings. All signal connections made to the input port labeled RF IN (“F” connector) shall:
   - maintain proper ground continuity.
   - be stripped of any AC or DC component higher than the maximum RF input rating stated in the operating specifications.

At no time shall cable powering (higher than 90 VAC or VDC) be applied to the input port RF IN. This may cause damage to the unit and shall void the warranty.

   Consult the product manual for further ratings information before making connections to the product.
4. Replace batteries only with the proper type and rating specified, and respect terminals polarity connections.
5. Do not operate the unit with its covers removed.
6. Do not operate with suspected failures. If you suspect there is damage to this product, have it inspected by qualified service personnel.
7. Do not operate in an explosive atmosphere.
8. Do not operate outdoors without the portable protective case. Avoid direct rain on the AT2500.

1.3 Symbols and Terms

These terms and symbols may appear in this manual or on the product:

Warning:
Warning statements identify conditions or practices that could result in injury or loss of life.

Caution:
Caution statements identify conditions or practices that could result in damage to this product or other property. When this symbol appears on the product, refer to the manual.

Protective Ground:

(EARTH) Terminal

1.4 Model Designations for AT2500R Series

AT2500R Series Analyzer Model Designations:

R	Indicates “Portable” unit
RQ	Includes QAM Analyzer
Rv	Includes Video Demodulator
RQv	Includes both QAM Analyzer and Video Demodulator

1.5 Standard Measurement and Hardware Features

The following software and hardware features are standard on all AT2500R series analyzers.

AT2CATVPAK	CATV Measurement Functions. Includes carrier measurement, precision frequency counter, in-service Hum, CCN, CSO, CTB, In-channel Response, Depth of Modulation measurements, and digital channel power.
AT2TDM	Time domain measurement package for accurate level measurements of bursty signals.
AT2VIDOUT	Baseband NTSC video output.
Ethernet 10/100	RJ-45 port and integrated firmware for high-speed access and remote control.
High/Low pass filters	Integrated band-selectable filters for use in bandpass filter mode or single filter for high pass or low pass filter applications. Manual or automatic modes available.
A99026010	WinCom II Data Management Software. PC-based software compatible with the AT2500. Includes FCC report export capabilities. One license included with each analyzer purchase. Package includes disk and connection cables.

PSU2065 AC power supply adapter, with an input rating of 100-250 VAC, at 50/60 Hz.

The PSU2065 power supply with automatic switching connects to any wall outlet with the above rating. An adaptor for the connection may be required depending on the country where the AT2500R is used. The output is rated at 16 VDC, 4.06A. Certification complies with the following: UL1950, UL136791, CSA950, LR36665, CE TUV / IEC 1950.

The external power jack on the front panel, under the front door, can ONLY receive power from the provided PSU2065. Any attempts to power the AT2500R from an external power source other than the provided PSU2065 may result in poor operation or damage to your AT2500R series analyzer not covered under warranty. Using a power supply or charger with a different rating may damage the power supply/battery charger and the AT2500. Please contact VeEX, Inc. if you need to power the AT2500R from a source that is not already approved.

1.6 Available Options for AT2500R Series

1.6.1 Software Options

AT-WEB AT2500 WebRemote. One license per analyzer provides remote access for multiple (not simultaneous) users to both the spectral analysis and the digital testing functions of the analyzer. License code and RF Switch control (AT160x) included.

A99026021 WinRemote II Remote Control Spectrum Analyzer and QAM Digital Measurement Software. PC-based software compatible with the AT2500. One license per PC. Package includes disk, user manual and connection cables.

1.6.2 Warranty and Calibration Options

ATWx2 Calibration service for “x” years (3-year or 5-year programs available).

ATWx0 Extended warranty option for “x” years (additional 1 or 3 years for a 3-5 year total warranty).

1.6.3 Accessories

A90093030 Model BTA bucket truck adapter (OPTIONAL)

A91001280 AT2500R replacement high capacity battery 12V 7 A/h (Requires DBHCBAT) (STANDARD)

A65000909 Serial cable for PC connection DB-9 to DB-9 (STANDARD)

A99025600 Padded protective case for AT2500R (STANDARD)

1.7 Warranty Information

This VeEX, Inc. product is warranted against defects in materials and workmanship during its warranty period. The warranty period for this product is contained in the warranty page on http://www.sunrisetelecom.com. VeEX, Inc. agrees to repair or replace any assembly or component found to be defective under normal use during this period. The obligation under this warranty is limited solely to repairing or replacing the product that proves to be defective within the scope of the warranty when returned to the factory. This warranty does not apply under certain conditions, as set forth on the warranty page on http:/ www.sunrisetelecom.com. Please refer to the website for specific details.

THIS IS A LIMITED WARRANTY AND THE ONLY WARRANTY MADE BY VEEX, INC.. VEEX, INC. MAKES NO OTHER WARRANTY, REPRESEN- TATION OR CONDITION, EXPRESS OR IMPLIED, AND EXPRESSLY DISCLAIMS THE IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICU- LAR PURPOSE AND NON-INFRINGEMENT OF THIRD PARTY RIGHTS.

1.8 Receiving and Unpacking

The AT2500R series analyzer is carefully packed at the factory in a shipping container specially designed to prevent damage during transportation.

The original VeEX, Inc. shipping container and packing materials should be saved since they may be needed for long-term storage and for protecting the unit during transportation to the factory for calibration or repair.

1. Inspect the shipping container prior to accepting delivery. If any exterior damages are present, notify the transport carrier immediately. VeEX, Inc. is not responsible for damage caused during shipping.
2. Carefully open the shipping container without destroying it. Verify the contents of the package. Each container should have the following:
   - AT2500R series analyzer
   - PSU 2065 Power supply, 100-240 VAC, 16 VDC
   - User's Guide
   - WinCom II software package
   - Padded protective carrying case
   - Null Modem cable (for direct PC-to-analyzer serial connection)
   - Ethernet Crossover Cable (for direct PC-to-analyzer Ethernet connection)
3. Unpack the AT2500R and inspect it for damage.
4. Test the operability of the AT2500, using the procedure listed in *Section 1.10, "Initial Verification".* If you discover damage or operational defects, notify your VeEX, Inc. representative for instructions on how to proceed.

Caution: *If the equipment has to be returned to an authorized VeEX, Inc. service center, carefully repackage it in the original shipping container and then contact VeEX, Inc.'s customer service department to obtain a Return Materials Authorization (RMA) number and proper shipping instructions.*

1.9 Physical Location

The AT2500R series analyzer is intended for use indoors or in dry outdoor conditions.

The AT2500R series spectrum analyzer is equipped with 4 miniature low power consuming fan units, which are controlled by the system firmware. The fan units are activated once the factory set internal threshold temperature of the unit is exceeded. The fan units continue to run in order to sustain a regulated operating temperature.

Extended use (>2 hours) of the unit within its protective soft case is not recommended. This will reduce the fan's air flow, leading to moderate overheating and may cause some measurement inaccuracies, specifically in the QAM mode.

1.10 Electrical Connections

When connected to an external AC power source, the unit receives power both for normal operation and to charge its battery. When disconnected from an external AC source, the unit runs off of its internal battery. The green light over the power switch is on whenever the unit is operating.

The AT2500's internal battery has been fully cycled and charged at the factory before shipping. If the red light below the power switch is lit steadily, the battery is fully charged and the charger has switched to a trickle (float) charge. If the red light is lit blinking, the battery is charging.

1.11 Initial Verification

The AT2500R analyzer has been inspected and has passed all final operational and quality control tests prior to being carefully packed for shipment. The AT2500R should be activated as soon as possible after receipt to verify that it operates in accordance with the specifications listed in this manual.

The default settings when shipped from the factory are as follows:

Mode	Spectrum Analyzer
Span	Full span (5 MHz–1.5 GHz)
Resolution Bandwidth	1 MHz
Sweep Time	30 milliseconds
Amplitude	30 dB of input attenuation
Center Frequency	750 MHz

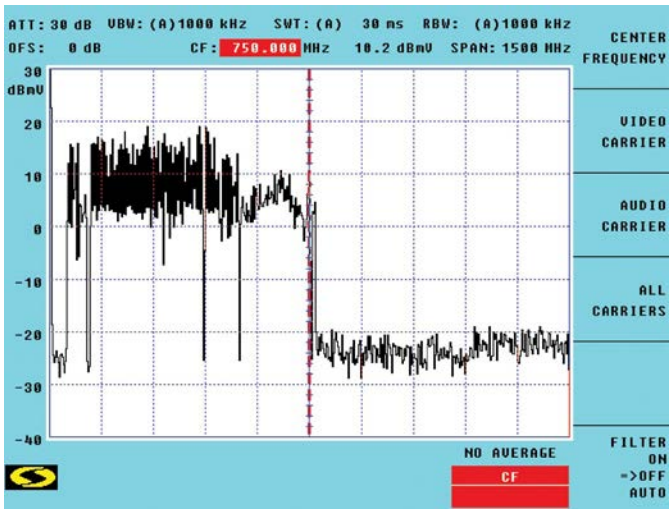


Figure 1-1: Spectrum Analyzer Default Instrument Settings

To check the operation of the spectrum analyzer, follow these steps:

1. Turn the unit on. The power switch is located on the front panel.
2. When the unit has passed its initial self-test and calibration, the spectrum analyzer screen appears with the default instrument settings (see above).
3. If the unit finds an error in the initial self-test, it displays error messages on the screen during the boot-up sequence.
4. If the main electronics pass the initial self-test but an RF error occurs during self-calibration, the AT2500R displays an “uncal” message below the VeEX, Inc. logo at the bottom left corner of the screen.

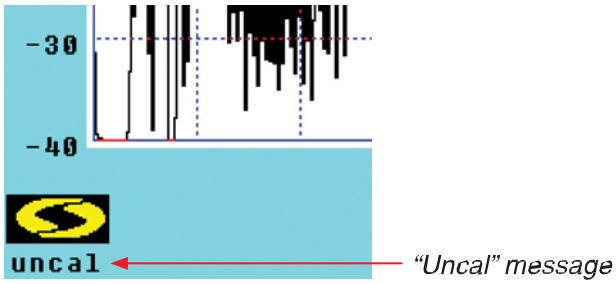


Figure 1-2: Uncalibrated Measurement

5. Press MENU to display the main menu options. Note the time, date, temperature and battery voltage readings at the top of the screen.
6. Apply a stable carrier wave (CW) RF signal of known frequency and level (for example, 40 MHz at +10 dBmV) to the AT2500’s input.
7. Using the rotary knob or arrow keys, select the FREQUENCY COUNTER icon from the main menu and press ENTER.
8. Tune to the desired frequency by pressing F1, then entering the center frequency, in megahertz, of the CW signal. Press ENTER.
9. Verify the accuracy of the frequency and level displayed. If the frequency and level are correct, the AT2500R is functioning normally.

2 Understanding the AT2500R

This section provides general information to help you become familiar with the front panel keys and the basic operation of the AT2500. It includes a detailed description of the front panel and an explanation on the use of standard features.

2.1 Automatic Calibration

The AT2500R automatically calibrates itself according to the current ambient temperature, and then monitors the temperature continuously, recalibrating as required. It is fully calibrated to traceable standards and includes calibration data in its non-volatile memory.

2.2 AT2500R Online Help

Context-sensitive help screens can be called up any time during the operation of the instrument.

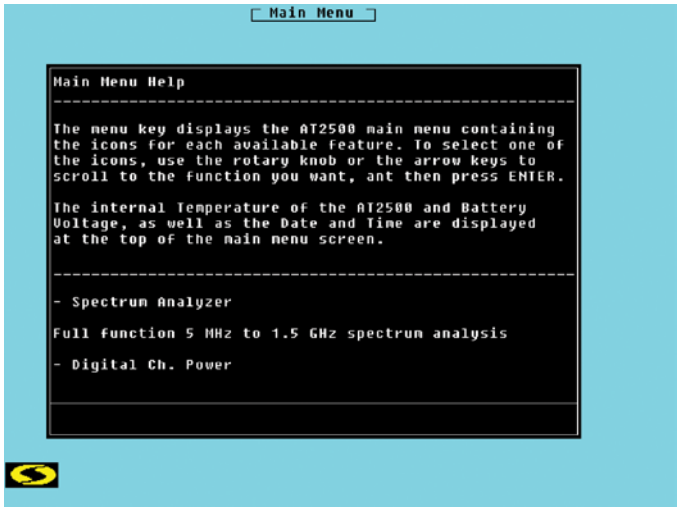


Figure 2-1: AT2500R Online Help

In all modes of operation, the help system is continuously available to assist the user with step-by-step instructions. The help system includes tips and reminders as well as detailed descriptions of each menu function.

To access the help system, press the **HELP** key. Use the rotary knob to scroll through the text line by line, or use the arrow keys to scroll page by page. Press **ENTER** to return to the start of the text, or press **ESC** to exit the help system and return to the previous mode of operation.

2.3 AT2500R User Interface

2.3.1 Front Panel

AT2500 RQv2

Figure 2-2: Front View of the AT2500RQv2

	Connector	Use	Type
①	**RF IN**	RF signal input	Female F type
②	**LPT1**	Parallel printer port	25-pin D type
③	**COM1**	RS-232 data port	9-pin D type
④	**NETWORK**	Ethernet communication port	RJ-45
⑤	**KEYBOARD**	External keyboard	PS2 type
⑥	**DC IN 16 V**	Power supply input	5-mm jack

AT2500 RQv3

Figure 2-3: Front View of the AT2500RQv3 with USB ports

	Connector	Use	Type
①	**RF IN**	RF signal input	Female F type
②	**COM1**	RS-232 data port	25-pin D type
③	**USB 1 & 2**	Printer and external keyboard	2 x USB A type
④	**NETWORK**	Ethernet communication port	RJ-45
⑤	**DC IN 16 V**	Power supply input	5-mm jack

2.3.2 Rear Panel

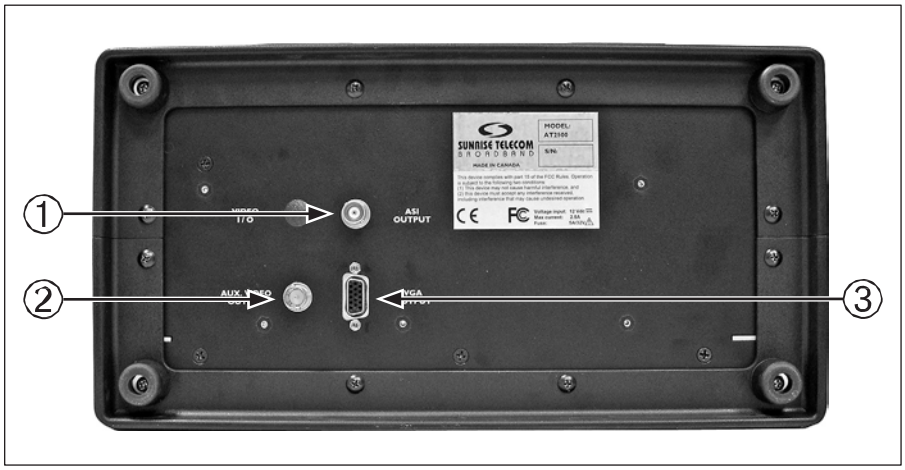


Figure 2-4: Rear View of the AT2500RQv2 & AT2500RQv3

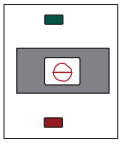
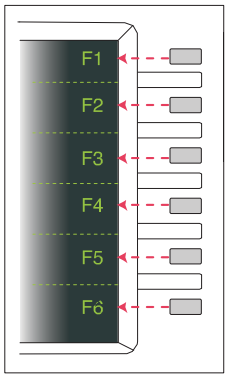
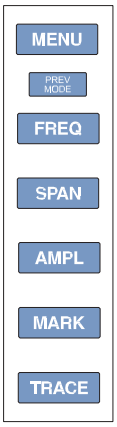
	Connector	Use	Type
1	**ASI OUTPUT (optional)**	Asynchronous Serial Interface transport stream output for MPEG transport stream	BNC
2	**AUX. VIDEO OUTPUT**	NTSC video display output	BNC
3	**VGA OUTPUT**	VGA monitor connector	15-pin D type

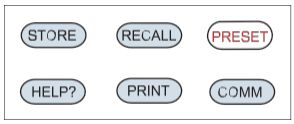
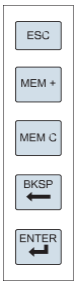
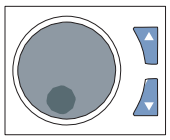
2.3.3 Push Buttons

The blue keys labeled MENU, FREQ, SPAN, AMPL, MARK and TRACE are the main function front panel keys that access menus containing various functions. Within the menus, the six push buttons arranged vertically along the right side of the display are used to select sub-menus. These unlabeled buttons are called softkey menus. Although the softkey function keys are not labeled, these keys are also known as **F1** (top key) to **F6** (bottom key).

The function for each softkey is displayed to the left of the button (right side of the screen). Note that the functions vary depending on the mode and menu, providing access to various options within the selected mode. Depending on the selected mode of operation, some of the softkeys may be shortcuts to other test modes.

All of the following keys are located on the front panel.

	AT2500R Key	External Keyboard Key	Description
	**Power**	**N/A**	Power switch used to turn the unit on or off. The green light indicates the unit is powered on and in use. The red light indicates the battery status: when this light is lit steadily, the battery is fully charged and the charging circuit is in trickle mode. If the red light is blinking, the unit is being charged from an external AC source.
	**F1 to F6**	**F1 to F6**	Six small black unlabeled keys on the right of the display, correspond to F1 to F6, from top to bottom. These six keys change functionality based on the current mode of operation. Each key's function appears correspondingly.
	**MENU**	**F7**	Displays the main menu screen that provides direct access to the various test options and setup functions.
	FREQ	**]**	Displays the softkey choices used to set the center frequency: enter a frequency directly (in MHz) or enter the video or audio channel number, as defined in the channel plan.
	SPAN	****	Displays the softkey choices used to set the span, resolution bandwidth (RBW), video bandwidth (VBW), sweep time (SWT) and signal trigger settings.
	AMPL	**[**	Displays the softkey choices used to set amplitude related parameters: attenuator, reference level, vertical scale and reference offset.
	MARK	**;**	Displays the softkey choices used to set the horizontal and vertical markers for indicating and/or measuring level and frequency references. Pressing the V2 marker softkey twice activates the noise marker (dB/Hz) function.
	TRACE	**'**	Displays the softkey choices used to choose signal-processing functions: digital average 1, digital average 2, peak hold or no average.
	Prev Mode	**F8**	Shortcut to the previous measurement mode and instrument settings.

	AT2500R Key	External Keyboard Key	Description
	**Store**	**Insert**	Displays the softkey choices used to store measurement records (up to 250) or instrument settings (up to 100).
	Recall	**Home**	Displays the softkey choices used to bring up saved settings and/or records.
	Preset	**Page Up**	Clears the current instrument settings and returns the unit to factory default settings.
	Help	**Delete**	Calls up context-sensitive help screens.
	Print	**End**	Prints an image of the current screen directly to most printers with a USB or parallel port. You may choose either an Epson compatible or an HP LaserJet compatible parallel printer driver in the setup parameters. The AT2500R does not work with all available printers on the market. Contact VeEX, Inc. for recommendations, or test compatibility before purchasing a particular printer.
	Comm	**Page Down**	Runs the built-in communications software for downloading and uploading files, using a standard RS-232C connection or an Ethernet connection.
	**Esc**	**Esc**	Returns to the previous menu selection.
	Mem+	**F9**	Adds a screen trace to volatile (temporary) memory. This feature may be used to compare a live trace with a captured trace in volatile memory. To save a trace in non-volatile memory, use the STORE key.
	Mem C	**F10**	Clears the trace data currently in volatile memory, and clears a recalled trace from the screen display.
	BKSP	**Backspace**	Backspace key. When pressed within a keyboard command, it deletes or corrects preceding characters.
	Enter	**Enter**	Confirms commands or saves entries.
	**Arrow keys**	**Arrow keys** ↑ ← ↓ →	The arrow keys and rotary knob move items up and down or left and right, depending on the context. Used for incremental change of values such as center frequency, reference level, and marker position. The arrow keys provide a greater incremental change than the rotary knob (by a factor of 10) in any given mode.

	AT2500R Key	External Keyboard Key	Description
	**Keypad**	**0 to 9** **A to Z** **+ - , #** **Space Bar**	Used to enter alphanumeric data, spaces and symbols. If an entry from the numeric keypad does not coincide with an allowed function value, the analyzer defaults to the nearest allowable value. To type letters, release and press the same key again within a second, until the proper character appears. Wait until the AT2500R accepts the keystroke and moves the cursor to the next slot, before pressing another key.

2.4 Main Menu Software Functions

The MENU key displays the AT2500R main menu containing the icons for each available feature. To select one of the icons, use the rotary knob or the arrow keys to scroll to the function you want, and then press ENTER.

The top line of the screen shows the external temperature, in degrees Celsius or Fahrenheit depending on user preferences. It also shows the battery voltage and the current date and time.

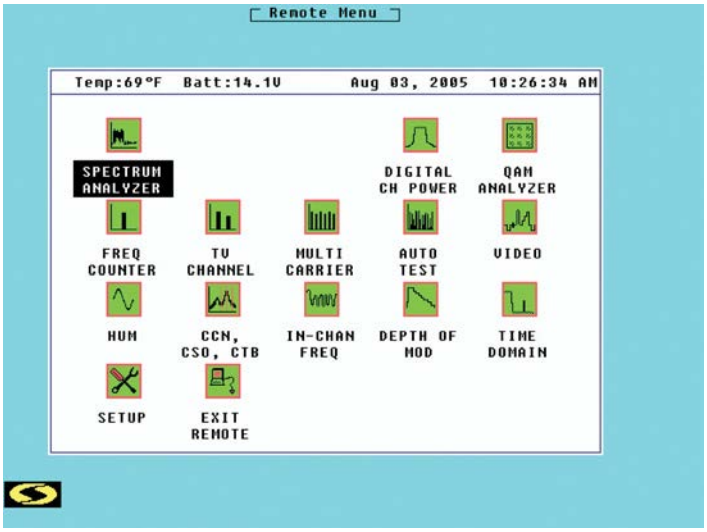


Figure 2-5: Main Menu Icons

2.4.1 Standard Functions and Icons

Spectrum Analyzer
Full function 5 MHz to 1.5 GHz spectrum analysis

Digital Ch. Power
Measures the average RF power of digitally modulated carriers such as 16, 64 and 256 QAM or RF spectrum bandwidth by setting the center frequency and measurement bandwidth.

QAM Analyzer
The built-in QAM demodulator measures in-service 16/64/256 QAM digital signals. It displays the QAM constellation with zoom capabilities, adaptive equalizer taps, in-channel flatness, group delay, pre- and post-bit error rate (BER), modulation error ratio (MER), error vector magnitude (EVM), errored seconds and severely errored seconds. Also provides QAM impairment analysis (QIA).

Freq. Counter
Measures the selected center frequency, with ±0.75 dB level accuracy and 1-PPM frequency accuracy.

TV Channel
Measures the selected TV channel (visual and aural carriers), with the same accuracy as the frequency counter.

Multi-Carrier
Scans up to six user-specified reference carriers. Markers may be used in this mode to measure deltas in level. View RF amplifier tilt (slope) and gain, to make adjustments to the amplifier and to view the results in real time.

Auto Test
Measures tagged channels in the active channel plan, with the same accuracy as the frequency counter. Measures 80 analog channels (video and audio carriers) in less than a minute.

Video
Takes baseband video measurements such as differential gain and phase, chrominance/luminance delay and gain, depth of modulation linearity, signal-to-noise (S/N) weighted or unweighted. Includes choice of waveform monitor or vectorscope display.

Hum
Measures hum modulation distortion. Results are shown in peak-to-peak percent and dBc (decibels below carrier level).

CCN, CSO, CTB
Provides test options for three parameters: CCN, CTB and CSO. Tests are performed separately or simultaneously combined. Can also perform all 3 measurements in gated, non-intrusive test modes without service interruptions.

In-Channel Freq.
Measures in-channel frequency response in-service using a ghost canceling reference signal, video sweep or a CATV multiburst test signal in the VITS lines of a video channel.

Depth of Mod.
Measures the video depth of modulation as a percentage in both graphical and numeric format. A white reference test signal transmitted on the VITS of program video provides a standard for calibrating the video depth of modulation.

Time Domain
Measures burst levels, signal-to-noise (S/N) and total channel power of upstream DOCSIS channels, with faster horizontal sweep times than in the spectrum analyzer's zero span mode.

Setup
Displays the AT2500's model number, operating software version, serial number and installed options. Allows the user to configure operational parameters, color setup, channel plans and configure remote mode operation.

Remote Mode/ Exit Remote
Enables or exits the AT2500's remote mode, which is used to download or upload records, configuration files (channel plans, colors etc.) between a PC and the AT2500. Remote mode also enables remote control of the AT2500 through software such as WinCom II, WinRemote II, or realWORX.

3 Basic AT2500R Functions

3.1 Default Instrument Settings

The light gray key with the red lettering **PRESET** resets the AT2500R to factory default settings.

The AT2500's factory-set default state is Spectrum Analyzer with the following settings:

- Full span (1500 MHz)
- Center frequency set to 750 MHz
- Resolution bandwidth of 1 MHz
- Sweep time of 30 ms
- 30 dB of input attenuation

3.2 Storing and Recalling Measurement Records or Instrument Settings

Measurements, traces and instrument settings are stored as records in non-volatile memory for later viewing, printing or transferring to a computer. The AT2500R can store up to 250 measurement records and 100 instrument settings. You can then select any record from the Recall Records or Recall Settings directory listing when needed.

If you are storing records and instrument settings for your proof-of-performance or FCC testing and compliance documentation, you must include all pertinent information about the test equipment used for the measurements. This means that certain information for the AT2500 must be entered in order to output the correct reports. See Chapter 9, "WinCom II" for instructions. The VeEX, Inc. report headers include the model and serial number, last factory cali- bration date of the instrument as well as basic information such as date, time, temperature, company name and user name. If you are using VeEX, Inc.'s WinCom II data management software, you can export your stored traces from the analyzer to your PC. From WinCom II, the measurement results can then be exported directly into either:

- A VeEX, Inc. preformatted Excel Macro FCC POP report, using a .CSV file format, or
- a .TSD file on your PC, that is then imported into POP Family ware (see Chapter 9 for instructions)

For FCC exports, it is important that the site ID be entered in a specific format in order for the software to recognize formatting and populate the proper cells.

3.2.1 Storing Measurement Records

You can store up to 250 different measurement records in the AT2500's memory. To save a measurement record:

1. Press the **STORE** key on front panel and then press **Store Records (F1)**.
2. Type in a unique filename (up to 16 characters), and then press **ENTER**.
3. If desired, edit the site ID (up to 8 characters), and then press **ENTER**.
4. If desired, enter a comment (up to 40 characters) and press **ENTER**. You can also leave this field blank. Press **ENTER** again to save the record.

Each record is automatically saved with the extension .XML and contains:

- the name and comment fields
- the mode (such as spectrum analyzer) and front panel settings
- the time and date
- the actual trace or information on screen at the time of capture

3.2.2 Storing Settings

You can store up to 100 different instrument configurations in the AT2500. Before storing the setup, instrument settings such as span, attenuator settings, bandwidth adjustment as well as the frequency or channel position must be set in advance.

To store the settings:

1. Press the **STORE** key on the front panel, then press **Store Settings (F2**).
2. Type in a unique filename (up to 16 characters), then press **ENTER**.
3. If desired, edit the site ID (up to 8 characters), then press **ENTER**.
4. If desired, enter a comment (up to 40 characters), then press **ENTER**. You can also leave this field blank. Press **ENTER** again to save the record.

   Each stored setting contains:

   - name and comment fields
   - mode (such as spectrum analyzer) and the front panel settings
   - time and date

3.2.3 Recalling Stored Records

Stored records are linked to the analyzer mode in use. In order to recall one of these records, the analyzer must be in the same mode as that of the test record. There are several ways to return to a particular mode. For example, you can:

- select an icon from the main menu;
- select a softkey shortcut (if available);
- use the **ESC** or **PREV MODE** key.

To access stored records:

1. Once the analyzer is in the correct mode, press **RECALL** on the front panel, then select **Recall Records (F1)** to display the list of records.
2. Using the rotary knob or arrow keys, highlight the record you want to recall. You can now view or superimpose the trace over the live signal:
   - To superimpose the trace, press **ENTER**.
   - To view (display on screen) the content of a record on screen before recalling it, press **Display Item (F1**). From this view, you can recall and superimpose the record over a live trace by pressing **ENTER**. To return to the list of saved records, press **File Manager (F1)**.

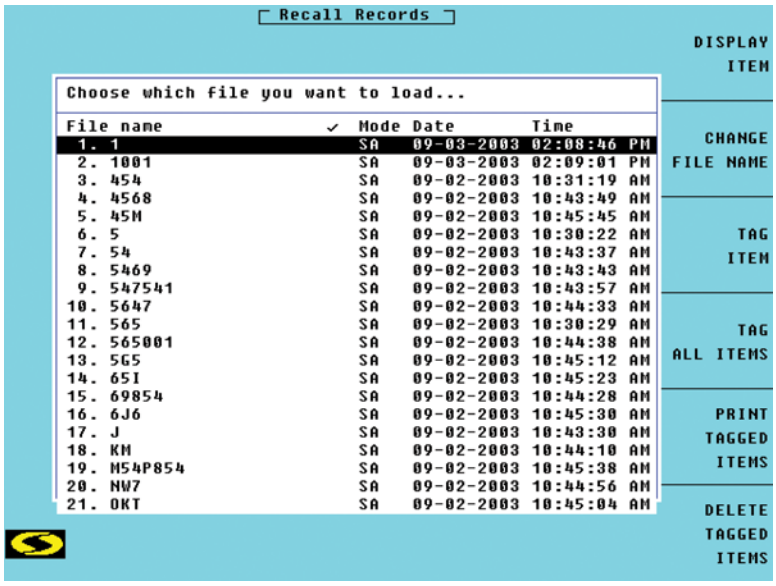


Figure 3-1: Recalling Stored Records

3.2.4 Recalling Stored Settings

To recall a particular test setup:

1. Press **RECALL**, then select **Recall Settings (F2)**.
2. Using the rotary knob or arrow keys, highlight the settings you want to recall. You can now view or immediately recall the setup:
   - To recall the setup immediately, press **ENTER**.
   - To view the content of the setup, press **Display Item (F1)**. To apply the viewed setup, press **ENTER**. To return to the list of saved settings, press **File Manager (F1)**.

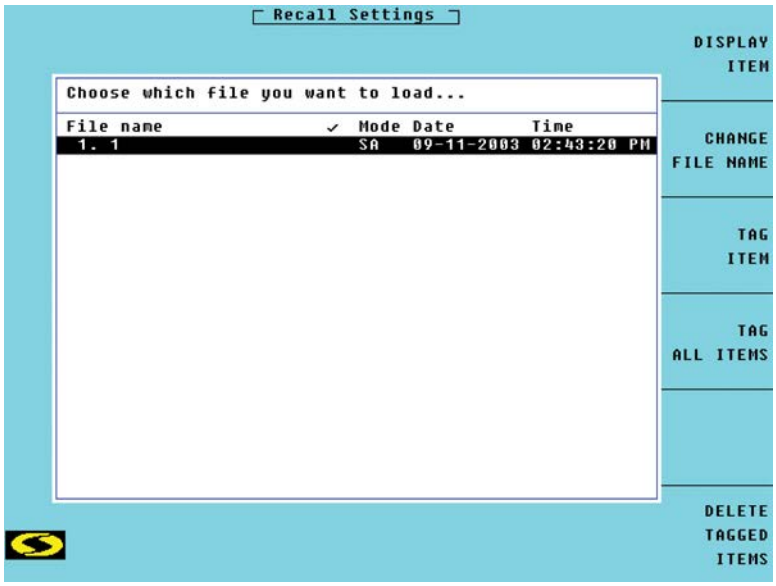


Figure 3-2: Selecting a Stored Settings File

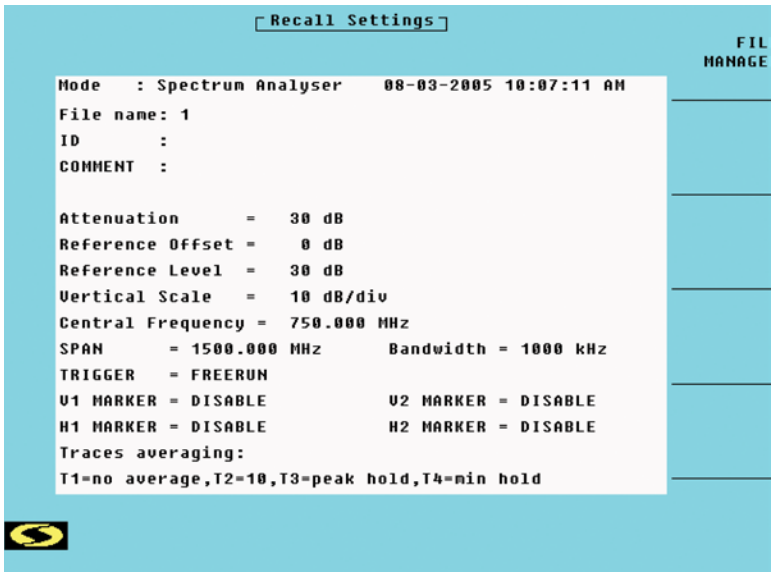


Figure 3-3: Displaying the Parameters in a Stored Settings File

3.2.5 Superimposing a Record on a Live Trace

With the AT2500, you can recall a stored trace and superimpose it on a live trace for comparison. The superimposed trace appears in a specific color on the screen.

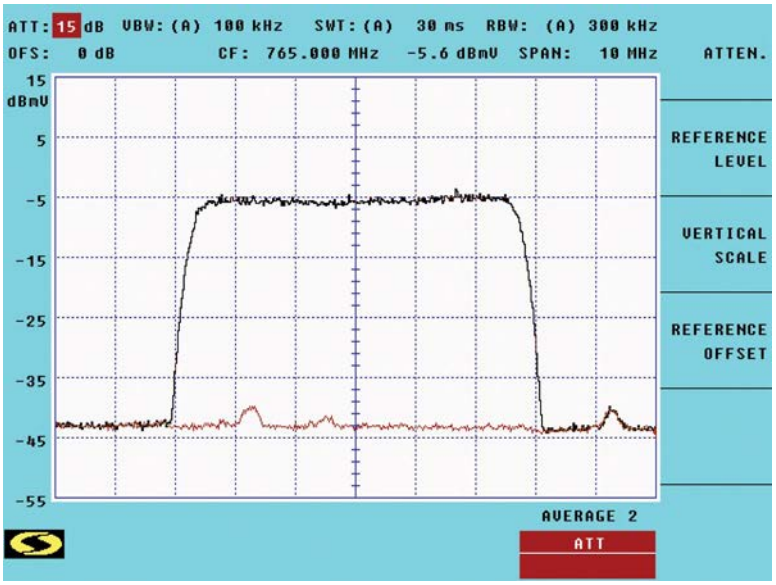


Figure 3-4: Superimposing a Trace on a Live Display

To superimpose a trace:

1. Press **RECALL** on the front panel, then press **RECALL RECORDS (F1)**.
2. Using either the rotary knob or arrow keys, scroll through the records and highlight the record. Press **ENTER** to superimpose the trace on the current live trace.
3. To clear the superimposed trace, press the **MEM C** key on front panel.

3.2.6 Freezing a Live Trace

With the AT2500, you can capture a single trace on screen in order to compare it with traces the analyzer is acquiring.

To capture a live trace:

- To capture a live trace, press the **MEM+** key on the front panel. The static trace appears in a specific color on the screen, along with newly acquired traces.
- To clear a captured trace, press the **MEM C** key on front panel.

Any traces captured with the **MEM+** key are not stored with the saved records. The captured traces are stored in the AT2500's volatile memory. Once the captured trace is cleared with the **MEM C** key, it cannot be recalled. To store a trace in non-volatile memory, use the **STORE** key instead of the **MEM+** key.

3.2.7 Erasing Records and Settings

The AT2500R can store 250 measurement records and 100 analyzer settings. Once this limit has been reached, the storage mechanism operates on a first in-first out (FIFO) basis. As new measurements or settings are stored, the oldest ones are overwritten so that the total number of measurements and settings is still 250 and 100 respectively.

To avoid losing older records, download the stored data to a PC regularly or erase stored records and instrument settings that are no longer needed. See *Section 3.4, "Data Communications"* for more information on connecting a PC to the AT2500. Note that the AT2500R must be in remote mode either by pressing the **COMM** button or by selecting the REMOTE icon.

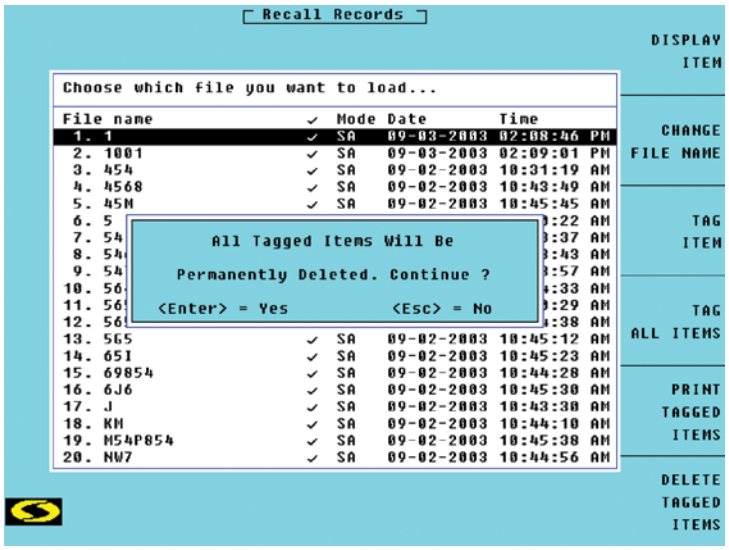


Figure 3-5: Erasing Tagged Records

To delete records:

1. First tag the records you want to delete, using one of the following methods:
   - to delete only a few records, use the rotary knob to scroll through the records on the current page. To view records on undisplayed pages, use the arrow keys. Tag the highlighted record by selecting **TAG ITEM (F3)**.
   - to delete all records, select **TAG ALL ITEMS (F4)**.

2. Once the records are tagged, select **F6 DELETE TAGGED ITEMS**. At the prompt, press **ENTER** to continue or **ESC** to cancel the operation. At the second prompt press **ENTER** to permanently delete all tagged items or **ESC** to cancel the operation.

3.3 Printing Reports and Screens

The newest version of the analyzer, the AT2500RQv3 has replaced the parallel printer port and PS2 keyboard port with two A type USB ports. The AT2500R supports several different makes of printer through its USB ports. When using a USB printer the AT2500R automatically selects the correct printer driver.

If you are using an AT2500RQv1 or AT2500RQ2, the parallel port supports two printer drivers:

- a standard Epson compatible driver, which works well with most types of dot matrix and ink jet printers
- a driver emulating the HP LaserJet standard for laser printers

The most common ink jet printers generally work well with the AT2500R. However, your printer may not be 100% compatible with the AT2500R. If you do need to purchase a printer for your analyzer, we recommend you contact your VeEX, Inc. representative or save a few traces in your analyzer and bring it to the store with you to try it before making your purchase.

3.3.1 Setting up the Printer

To connect the AT2500R to a compatible USB printer

1. Turn on both the AT2500 and the printer.
2. Use a standard USB cable to connect the printer to the AT2500 using either of the two USB ports on the front panel. These ports are located behind the drop down door on the unit's front panel. Some printers may not be compatible.

To connect the AT2500**R** to a compatible parallel printer

1. Use a standard printer cable with 25-pin connectors. Run this cable between the printer and the AT2500's 25-pin port labeled LPT1. This port is located behind the drop down door on the unit's front panel. Some printers may not be compatible.
2. From the main menu, select the SETUP icon and choose the appropriate printer driver. See *Section 3.5.1, "Choosing General Operating Parameters"* for complete instructions.

3.3.2 Printing a Screen

Individual screens can be printed out from the current display once the printer has been set up (see *Section 3.3.1, "Setting up the Printer"*).

To print the screen, press the **PRINT** key. An error message appears if there are any problems either with the printer configuration or cable connection. If a message does appear (see *Figure 3-6*), make sure that the printer cable is connected and that the appropriate printer driver is selected.

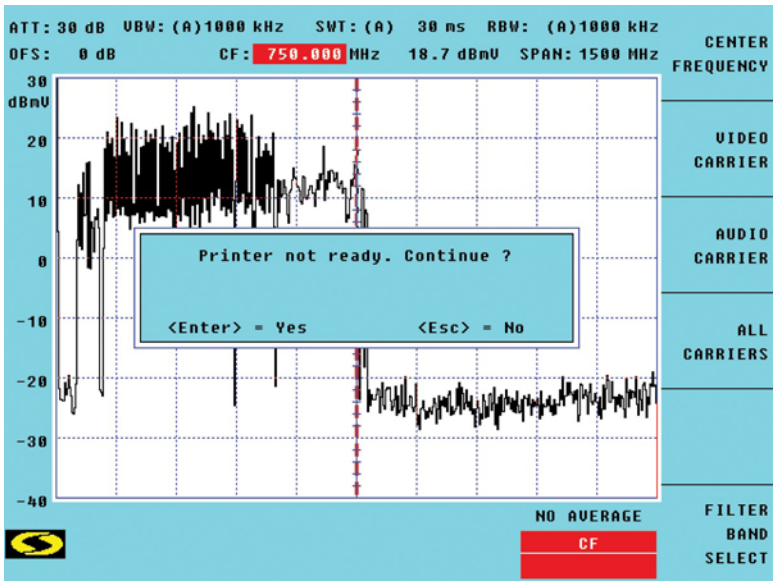


Figure 3-6: Printing Errors

3.3.3 Printing Multiple Records

Multiple screens can be printed out from the stored records once the printer has been set up (see *Section 3.3.1, "Setting up the Printer"*).

To select and print multiple stored records:

1. Press **RECALL** on the front panel, then press **F1 RECALL RECORDS**.
2. Using the rotary knob or the arrow keys to scroll through the records, highlight the records you want to print, then tag the highlighted record by selecting **F3 TAG ITEM**.
   - To view records on undisplayed pages, use the arrow keys.
   - To tag all records, select **F4 Tag All Items**.
3. Once the records are tagged, select **F5 PRINT TAGGED ITEMS**. An error message appears if there are any problems either with the printer configuration or cable connection. If a message does appear (*see Figure 3-6*), make sure that the appropriate printer driver is selected.

The VeEX, Inc. report headers include the model and serial number, last fac- tory calibration date of the instrument as well as general information such as date, time, temperature, company name and user name.

3.4 Data Communications

The AT2500R supports a connection to a PC or other device in several ways:

- a direct serial link for RS-232 communications
- a telephone modem link for RS-232 communications
- an Ethernet connection for TCP/IP communications over a LAN

The first two connection types require the use of the AT2500's 9-pin D type connector labeled COM1 on the front panel, behind the drop down door. If you connect your PC directly to the AT2500, you must use a **null modem cable**. Note that the AT2500R must be in remote mode either by pressing the **COMM** button or by selecting the **REMOTE** icon.

You must install VeEX, Inc.'s WinCom II (see Chapter 9) or WinRemote II software on your PC and run the program in order to established communications with the AT2500.

This manual covers the AT2500 functions and operation only. Please refer to the documentation accompanying the VeEX, Inc. software for more informa- tion on using serial communications.

3.4.1 Connecting the AT2500R to a LAN

The AT2500R supports an Ethernet 10Base-T connection to a local area network (LAN) via the RJ-45 network connector on the front panel. You can assign a static IP address to the AT2500, or you can let the AT2500R obtain a network assigned IP address from a DHCP server. Contact your system administrator if you are unsure of the IP settings you should use.

Other settings may affect a remote connection. In the user parameters (see *Section 3.5.1, "Choosing General Operating Parameters")*, make sure that the system type is set to "SERVER".

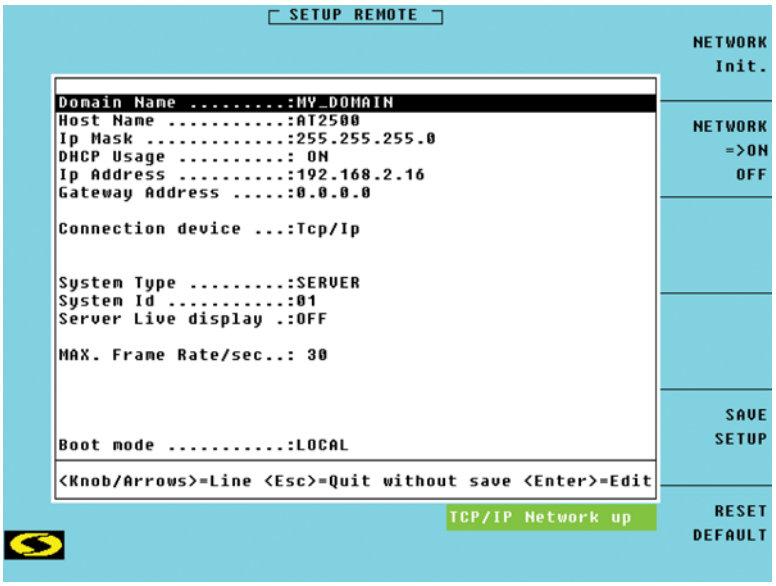


Figure 3-7: Setting up a LAN Connection

To set up a network connection

1. Connect the AT2500R to your network using a straight-through standard CAT-5 Ethernet cable, or directly to your PC using an Ethernet crossover cable.
2. On the AT2500, choose the **SETUP** icon from the main menu, and then select **F5 Remote Setup**.
3. Scroll to the **Connection Device** field, and press **ENTER** to select TCP/IP.
4. Using the rotary knob, scroll to the **DHCP Usage** field and select one of the following:
   - "ON" if you want the AT2500R to obtain an IP address automatically on your network

     If the analyzer was not connected with an Ethernet cable to the local network where an IP can be acquired, a message appears on screen in a red box indicating that the TCP/IP network is down. This means the network setup has not been applied. Connect your analyzer with an Ethernet cable to your network where an IP address can be assigned automatically, complete the network setup (see step 5) and then press **F1** Network Init to initialize the connection. If successful, the message "TCP/IP Network Up" appears in a green box.

   - "OFF" if you want to manually configure the AT2500's IP address. If there is no DHCP server available to assign addresses, you can manually assign an IP address to the AT2500. For a direct Ethernet connection with a crossover cable, choose OFF and manually configure the IP addresses of the AT2500R and your PC.
5. Using the rotary knob, select the TCP/IP communication parameters:
   - Domain Name
   - Host Name
   - IP Mask
   - DHCP Usage ("OFF" for manual IP assignment)
   - IP Address (only if you selected OFF in step 4)
   - Gateway Address

   If devices in your network do not use a gateway, you must configure the AT2500's IP address so that its base address matches your network.

The AT2500R does not support Host Name identification on a TCP/IP network. The AT2500R must be identified by the IP address. Care should also be taken when using DHCP to ensure that the lease time on an IP address is long enough for your application.

6. Using the rotary knob, select the client/server parameters:
   - system type (CLIENT or SERVER; use SERVER to access the AT2500R by remote)
   - system ID (used by remote software such as WinCom II or WinRemote II to recognize the connection from the PC to the analyzer. Must be set to the same ID as your software)
   - server ID (only if you selected CLIENT as the system type)
   - server live display

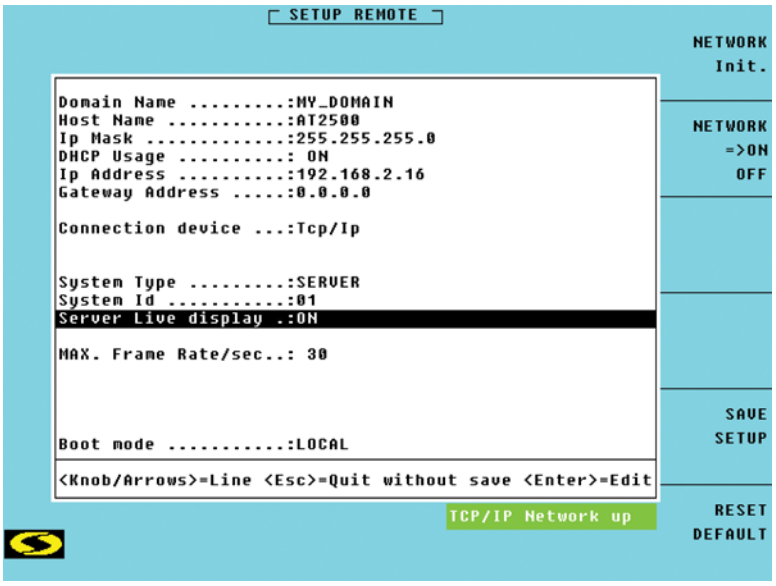


Figure 3-8: Activating the Server Live Display for Broadband Switches

7. Set the frame rate at which the AT2500R sends traces in remote mode. Choose a value from 1 to 30 frames per second.
8. Press **F1 Network Init** in order for the new IP address to take effect. If the network connection is valid, the message “TCP/IP Network Up” appears on screen in a green box.
9. Press **F5 Save Setup** to store the new communication parameters and then press **ESC** to return to the main menu.
10. From the main menu, select the **REMOTE MODE** icon. If the text below the icon says “EXIT REMOTE” you are in remote mode and can continue to the next step. If it says “REMOTE MODE”, position the cursor on the icon and press **ENTER**. The text at the top of the screen should now indicate “Remote Menu”.
11. Scroll to the Spectrum Analyzer icon and press **ENTER**. You should see a blank spectrum display with “Remote Spectrum Mode” in the upper left corner of the spectrum area, or you may see a “Remote Spectrum” window box in the middle of the screen if you selected “On” or “Off” in the Server Live Display setting in the Setup Remote page.

The AT2500R is now ready to be controlled remotely via a LAN.

3.4.2 Connecting a PC Directly to the AT2500

Pressing the **COMM** key configures the AT2500R as a file server. This allows a program such as WinCom II to access the contents of the non-volatile memory as if it were a disk drive on a PC. It also allows a program such as WebRemote to take control of the AT2500 by remote. Note that you must put the AT2500 in remote mode either by pressing the **COMM** button or by selecting the **REMOTE** icon.

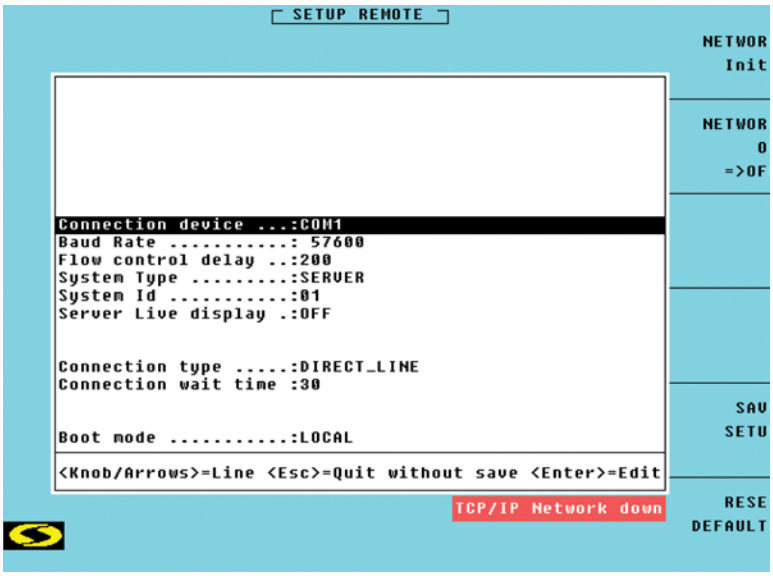


Figure 3-9: Setting up an RS-232 Connection

1. Connect a PC to the AT2500's COM1 port using a standard null modem cable or crossover Ethernet cable. These cables are included in the VeEX, Inc. software packages.

   For a direct Ethernet connection, your PC and the AT2500R must have IP addresses within the same range to allow communication. Refer to *Section 3.4.1 "Connecting the AT2500 to a LAN"* and follow the instructions in steps 4 and 5 for manually configuring an IP address on the AT2500. Refer to your Windows documentation to set up your IP address on your PC.

2. On your PC, set up the communication parameters (baud rate, data bits, parity, etc.) so that they match the settings on the analyzer before attempting communications. The maximum baud rate for serial communication is 115,200 baud.
3. On the AT2500, choose the **SETUP** icon from the main menu, and then select **F5 Remote Setup**.
4. Using the rotary knob, scroll to **Connection Device**, and press **ENTER** to select COM1.
5. Using the rotary knob, select the communication parameters:
   - baud rate (115200 baud recommended)
   - flow control delay
6. Using the rotary knob, select the client/server parameters:
   - system type (use Server to access the AT2500 by remote)
   - system ID (used by software such as WinCom II or Win Remote to recognize the connection from the PC to the analyzer. Must be set to the same ID as your software.)
   - server ID (only if you selected Client as the system type)
7. Press **F5 Save Setup** to store the new communication parameters and then press **ESC** to return to the main menu.
8. To use WinCom II with the AT2500, select the **REMOTE MODE** icon from the main menu. If the icon reads EXIT REMOTE you are in remote mode and can continue to the next step. If it says REMOTE MODE, position the cursor on the icon and press **ENTER**. The text at the top of the screen should now indicate "Remote Menu".

9. Scroll to the Spectrum Analyzer icon and press **ENTER.**
10. Once the transfer is complete, press **ESC** to access the main menu, and then select the **EXIT REMOTE** icon to return the AT2500 to its normal mode of operation.

3.4.3 Configuring the AT2500R Remote Mode

You can use the AT2500R through a computer if you have set up the remote function, either by pressing the **COMM** button or by selecting the **REMOTE** icon.

On the AT2500, choose the SETUP icon from the main menu, and then select F5 Remote Setup. You can now choose the method you want to use to communicate with your analyzer for data management or remote control. See *Section 3.4, "Data Communications*" for instructions on setting up an RS-232 or Ethernet connection.

Once the remote setup is complete, the settings are stored in the AT2500. You need to activate remote mode if you are using a remote application such as WinCom II or WinRemote II. For further instructions, see *Section 3.4.5, "Transferring AT2500 User Files with WinCom II*" or *Section 3.4.6, "Using WinRemote II with the AT2500".*

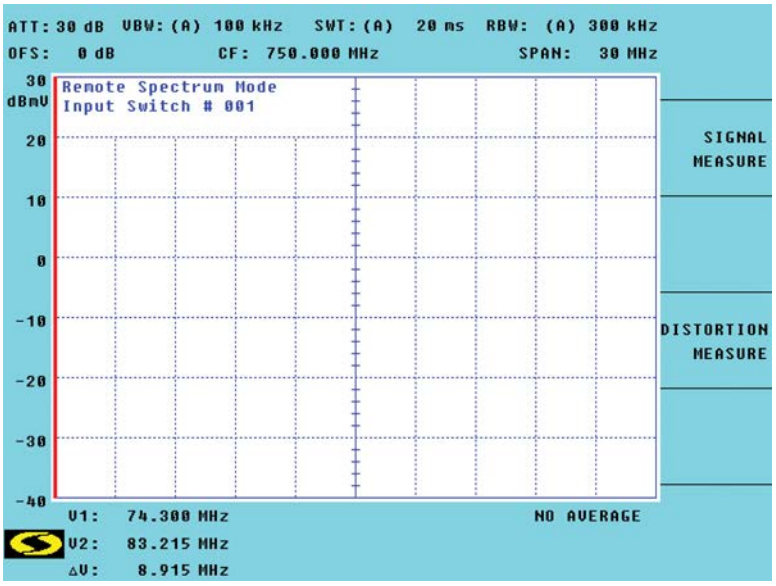


Figure 3-10: Activating Remote Mode

3.4.4 Upgrading Firmware

WinCom II includes a simple utility for upgrading the AT2500R firmware. If you are upgrading an AT2500H with a parallel port, the file extension of the firmware file has an extension of .TAR.GZ. If you are upgrading an AT2500H with a USB port, the file extension of the firmware file has an extension of .RUN. Your channel plan is still in memory, but it may not be selected as the default plan.

All stored measurements and settings are also kept in memory. As a precaution, **download** the stored data from the AT2500R every time you upgrade or update the firmware to avoid the possibility of losing data due to the incompatibility of a given parameter. See *Section 3.4, "Data Communications" f*or more information on connecting a PC to the AT2500. Note that the AT2500R must be in remote mode either by pressing the **COMM** button or by selecting the **REMOTE** icon.

To upgrade the AT2500:

1. Make sure you have the appropriate firmware. VeEX, Inc. provides update files on disk, or they can be downloaded from the website at www.sunrisetelecom.com. You must have a password in order to download files from the web site. Contact VeEX, Inc.'s customer support department to obtain a password. (See *Section 11.2, "Technical Support")*
2. Press the **COMM** key on the AT2500's front panel to put the unit in communication mode.
3. Run the WinCom II software and establish communication with the AT2500. See *Section 3.4.1* or *3.4.2* for instructions on setting up a direct or LAN connection.
4. Select Upgrade Firmware from the WinCom II communications menu. Using the dialog box, select the firmware file. The firmware file has the extension ".RUN" if the AT2500R has USB ports or the extension .TAR.GZ if the AT2500R has a parallel printer port.
5. Double-click on the file to start the upgrade procedure.
6. Once the file transfer is complete, WinCom II will attempt to reconnect to the AT2500. It may take several minutes for the new firmware to load in the AT2500, in which case the reconnect attempt will time out. You are not required to reconnect to the AT2500R to complete the upgrade so you can cancel the process and confirm the upgrade directly on the analyzer.
7. Remember to set up your user parameters (see *Section 3.5.1, "Choosing General Operating Parameters"*).

3.4.5 Transferring AT2500 User Files with WinCOM II

Use the VeEX, Inc. WinCOM II data manager software to retrieve individual records or a set of records. In order to retrieve records from the AT2500, you must establish a communication connection with the AT2500. See *Section 3.4.1* or *3.4.2* for instructions on setting up a direct or LAN connection. See *Section 3.4, "Data Communications" f*or more information on connecting a PC to the AT2500. Note that in order to use WinCOM II, the AT2500 must be in remote mode either by pressing the **COMM** button or by selecting the **REMOTE** icon.

The information that you record about your measurement traces includes date, time, instrument serial number, user name, company name, temperature, instrument calibration date and so on.

The following directories contain saved files on the AT2500. All files are saved under the user-defined file name, with the appropriate extension (see below).

Channel Plans	Channel plans for NTSC, PAL or other television standards. Format ".ACP" (proprietary binary format)
Color Settings	Customized color settings used on the AT2500HM analyzer. Format ".CLR" (proprietary binary format)
Parameter File	User preferences on the AT2500HM analyzer. Format ".PRM" (proprietary binary format)
QAM Normalization	Stored QAM Normalization files. Format ".XML"

Settings Records Stored instrument setups. Using the same settings files on multiple units make consistent measurements. Note that to recall a setup, you must be in the appropriate mode for that setup. Format ".XML"

Switch Configuration User preferences of external switches. Format ".SWT" (proprietary binary format)

Trace Records Stored measurement records and traces. Note that to recall a trace, you must be in the same mode that you were in when the trace was captured. Format ".XML"

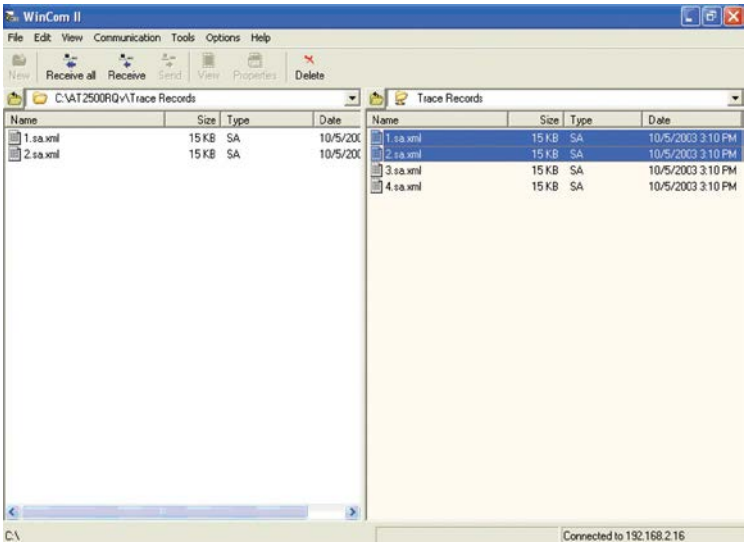


Figure 3-11: Copying User Files

For complete information on WinCom II, see *Section 9, "WinCom II"*.

3.4.6 Using WinRemote II with the AT2500

The VeEX, Inc. WinRemote II software provides remote control access to AT2500 spectrum analyzers. It offers full control of the spectrum analyzer functions such as center frequency, span, resolution bandwidth settings and so on. Note that to use WinRemote II, the AT2500 must be in remote mode either by pressing the **COMM** button or by selecting the **REMOTE** icon.

WinRemote II's functions and menus are similar to the menus of the AT2500R spectrum analyzer insofar as possible. WinRemote II includes capabilities for storing and viewing recorded traces, and can also export the measurement data to the Windows clipboard (in BMP format). Data you have collected can be printed through WinRemote II.

Depending on the quality of your Ethernet link, real-time screen refresh on your PC is typical at 25 frames per second (fps). You can set the frame rate in the remote setup menu (see *Section 3.4.1, "Connecting the AT2500 to a LAN"*).

WinRemote II can also tap into a bank of VeEX, Inc. RF test point selectors such as the AT1601M, so that you can select up to 256 different test points remotely. Switches from other vendors are compatible with the AT2500. Contact your local

VeEX, Inc. representative for further details. Note that the switches can only be controlled through the AT2500's RS-232 COM port.

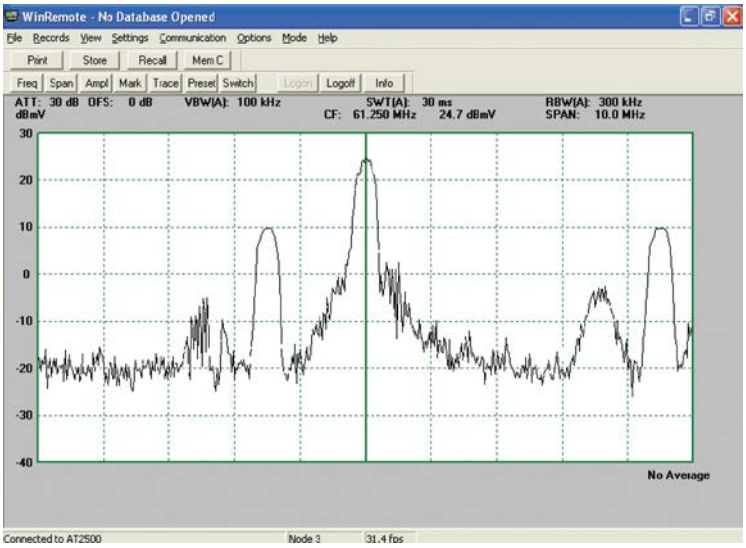


Figure 3-12: Using WinRemote II with the AT2500

In addition WinRemote II offers control of the unit's QAM analyzer measurement functions, such as digital channel power, constellation view, statistical graph view, and adaptive equalizer display. Functions and menus are similar to the menus of the AT2500R QAM analyzer insofar as possible.

The AT2500R can acquire data for QAM statistics over a period as long as 60 minutes. With a remote connection, this period can be extended to up to 7 days.

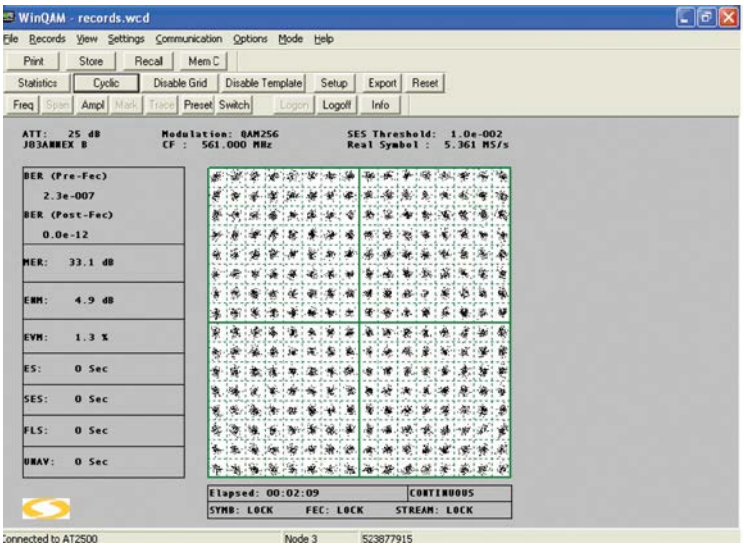


Figure 3-13: QAM measurement function using WinRemote II

3.5 Setting up the AT2500R Preferences

The AT2500's initial settings can be customized according to individual user requirements. To display the setup screen (Figure 3-14), press **MENU**, then select the **SETUP** icon.

The Setup screen displays important information about your AT2500**,** such as model and serial numbers, software version, calibration date and time. It also shows all installed options and indicates which options are enabled for use locally or remotely on your analyzer. Note that some features might appear that are available as separate options for legacy products. Additional information includes certain user preferences such as the active channel plan and the active color setting.

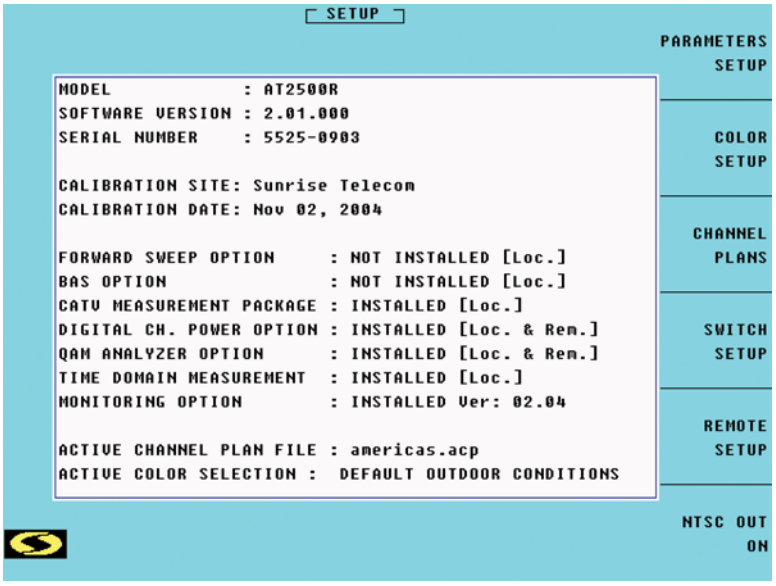


Figure 3-14: Setup Screen

From the Setup screen, select one of the following keys to customize a specific item:

F1 PARAMETERS: Select global parameters for the AT2500. These parameters are independent of the user and mode.
F2 COLORS: Define custom color schemes.
F3 CHANNEL PLANS: Edit channel line-ups for each headend.
F4 SWITCH SETUP: Set up a test point switch.
F5 REMOTE SETUP: Configure the AT2500's COM port or Ethernet port for remote communication.
F6 NTSC OUT ON/OFF: Toggle the NTSC output on or off.

3.5.1 Choosing General Operating Parameters

The Parameter screen displays global parameters set on the AT2500R such as LCD power down delay and power off delay, beep on/off preferences as well as the current date format.

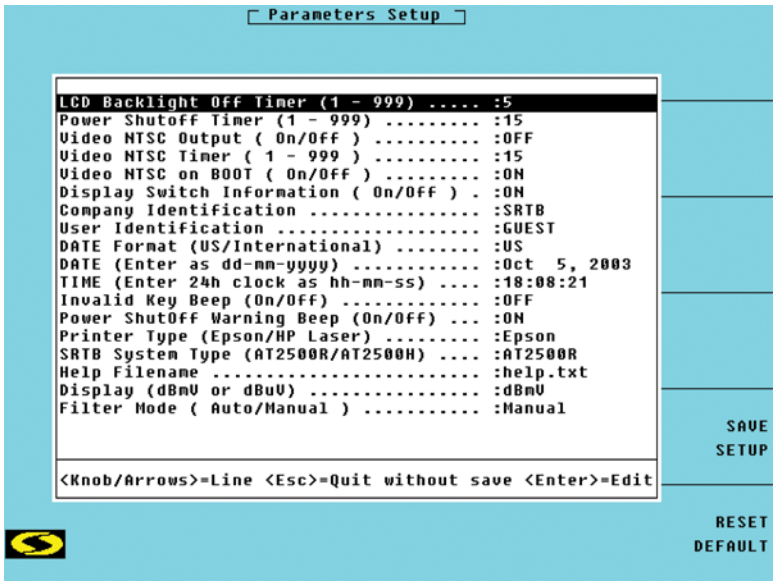


Figure 3-15: Parameter Setup Screen

To change any of the parameters, scroll through the menu using the rotary knob. When a parameter is highlighted, press **ENTER** to make changes. Once you have finished editing all the parameters, select **F5 SAVE SETUP** to store the new values.

LCD Backlight Off Timer

Set the LCD screen's power down delay time in minutes. The LCD power down feature conserves battery power. You may continue to operate the unit by pressing any key or rotating the knob in either direction, thus restarting the countdown. Enter 999 to disable the feature.
Default value: 5 minutes

Power Off Timer

Set the power off delay in minutes. This feature helps conserve battery charge by powering off the AT2500R when not in use. All active settings are saved at the time of power off so that when the unit is powered on again, the settings are exactly the same as when it was powered off. You may continue to operate the unit by pressing any key or rotating the knob in either direction, thus restarting the countdown. Enter 999 to disable the feature.
Default value: 15 minutes

Video NTSC Output (On/Off)

Toggle On or Off the Video NTSC output.
Default value: Off

Video NTSC Timer

Set Video NTSC output off delay time in minutes.
Default value: 15 minutes

Video NTSC on Boot (On/Off)

Set Video NTSC output in the ON position when unit starts up (boots).
Default value: On

Display Switch Information (On/Off)

For remote control applications which use a test point switch controlled by the AT2500. Provides a live view onscreen according to the switch position.
Default value: On

Company Identification	Enter your company name in alphanumeric characters via the keypad. Maximum 30 characters.
User Identification	Enter your user name in alphanumeric characters via the keypad. Maximum 30 characters.
Date Format	Toggle between International and US date and time format. Depending on the selection of US or International settings, the temperature in the main menu will display in degrees Celsius (international) or Fahrenheit (US). Also displays the time in 24-hour (international) or 12-hour (US) format. **Default value: US**
Date	Set the current date on internal clock/calendar in the format MM-DD-YYYY.
Time	Set the current time on internal clock/calendar in the format HHMMSS. Use the 24-hour clock (e.g. 1:00 pm is 13:00). The time displays on a 12-hour clock if you select US date format.
Invalid Key Beep (On/Off)	Toggle on or off a warning beep when an invalid key is pressed. **Default value: Off**
Power Off Beep (On/Off)	Toggle on or off a warning beep when the timer initiates the shutdown process. **Default value: On**
Printer Type (Epson/Hp) (AT2500RQv2 with parallel port only)	Toggle between an Epson compatible printer driver (for dot matrix and inkjet printers) and a HP LaserJet printer driver. The printer drivers embedded in your AT2500R contain a minimal command set in order to increase efficiency and save on disk space. The most common ink jet printers on the market generally work well with the AT2500. However, your printer may not be 100% compatible with the AT2500. If you do need to purchase a printer for your analyzer, we recommend you save a few traces in your analyzer and bring it to the store with you to try it before making your purchase. **Default value: Epson**
SRTB System Type (AT2500R/AT2500H)	Lets you select the type of unit. For the AT2500 “R” series, choose AT2500R. **Default value: AT2500H**
Help Filename	File loaded into the AT2500 containing the help text. **Default value: help.txt**
Display (dBmV or dBuV)	Toggle between dBmV and dBuV **Default value: dBmV**
Filter Mode (Auto/Manual)	Toggle between automatic and manual filter selection. In order to always use the automatic filtering function, set this field to Auto. To always use the user-defined filtering option, set this field to Manual. Filter settings are then restored at reboot. **Default value: Manual**

3.5.2 Defining Custom Screen Colors

The AT2500R has a color TFT active matrix LCD screen display. Unlike CRT displays, this type of LCD panel remains in focus when displaying fine detail with a screen resolution of 640 x 480 pixels. The recessed polarized screen can be viewed clearly in direct sunlight when you select the default color scheme for outdoor conditions.

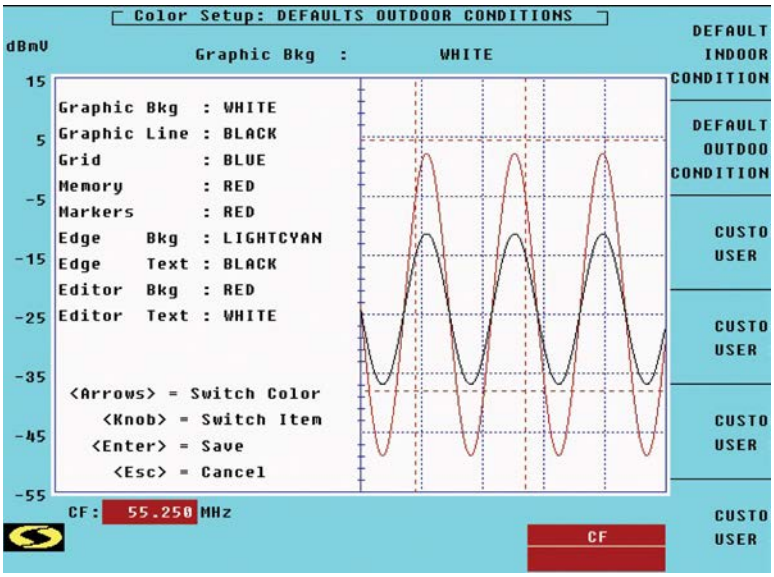


Figure 3-16: Color Setup Screen

To set up custom colors:

1. First select which user is using the custom color scheme. You can create up to four custom user color settings by pressing **USER 1 (F3)** to **USER 4 (F6)**.
2. Use the rotary knob to select the item that you want to edit. The nine editable screen components are: Graphic Background, Graphic Line, Grid, Memory, Markers, Edge Background, Edge Text, Editor Background and Editor Text. Select an item, and then use the arrow keys to select the color.
3. Once you have chosen a color for all of the items, press **ENTER** to save and exit color setup mode. To exit without saving, press **ESC** and then **ENTER** at the prompt, or **ESC** to remain in color setup mode until you are ready to save the setup and exit.

3.5.3 Setting up a Channel Plan

The Channel Plan includes a directory of several channel plan files that you can edit and customize.

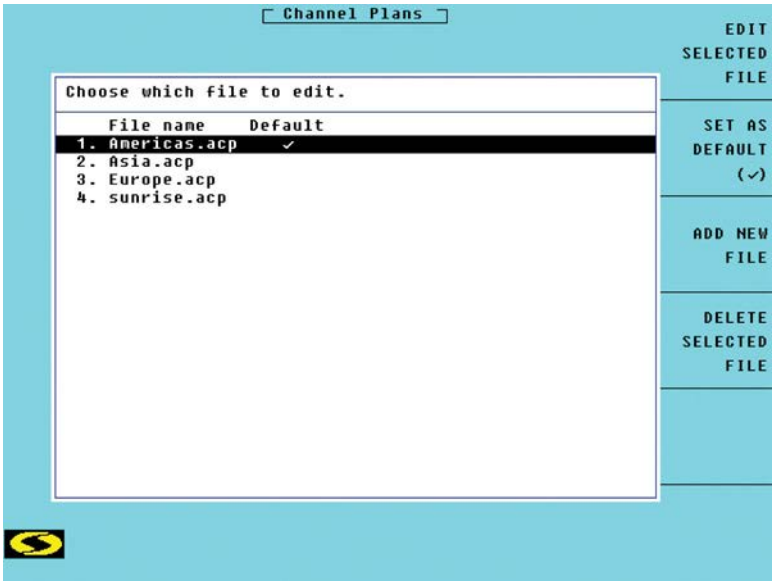


Figure 3-17: Channel Plan File Menu

Managing Channel Plan Files

From the Channel Plan directory screen, you can also edit, add, set as default or delete a channel plan file. Highlight a channel plan file and then select one of the following keys:

Softkey	Action
F1 EDIT SELECTE › FILE	Opens a new menu with options for editing a file. You can also highlight a file and press **ENTER** to access this menu.
F2 SET AS DEFAULT	Selects (or deselects) a default file. A checkmark appears next to the default channel plan file used during tests.
F3 ADD NEW FILE	Creates a new channel plan file.
F4 DELETE SELECTED FILE	Erases a channel plan file from the AT2500.

If you selected **F1** EDIT SELECTED FILE from the channel plan directory, you can now edit a particular plan within the file. Highlight a channel plan, and select one of the following keys:

Softkey	Action
F1 EDIT SELECTED PLAN	Opens a new menu with options for editing a plan. You can also highlight a plan and press **ENTER** to access this menu.

Softkey	Action
F2 SET AS DEFAULT	Selects (or deselects) a default plan. A checkmark appears next to the default channel plan used during tests
F3 ADD NEW PLAN	Creates a new channel plan. You must enter a name for the plan.
F4 DELETE SELECTED PLAN	Erases a channel plan from the selected file.
F5 CHOOSE ANOTHER FILE	Returns to the previous menu so you can select a different file.
F6 SAVE PLANS TO FILE	Saves edited plan or new plan to the channel plan file.

Editing or Adding a Channel Plan

The channel plan menu provides a summary of the channels in the selected plan, such as the position, type, frequency and a selection of VITS parameters. These parameters indicate where particular test signals are for the CATV tests available. If a checkmark appears in the TEST column, then the channel is included in the automatic tests (autotest).

In addition to standard TV or digital channels, the channel line-up can also include leakage detector pilot signals or data carriers. It may be easier to edit an existing channel plan, by adding or deleting some channels and editing other channels as required (see below, **DUPLICATE CURRENT PLAN AS (F2)**).

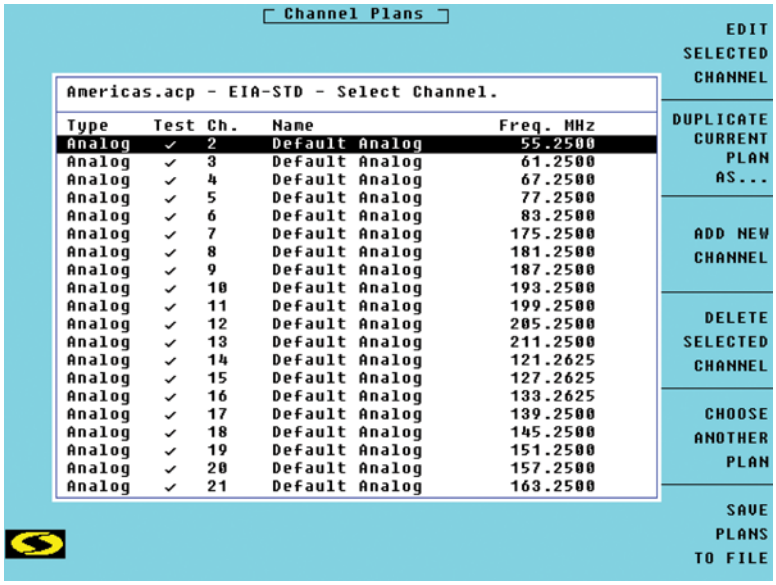


Figure 3-18: Adding or Editing a Channel Plan

If you selected **EDIT SELECTED PLAN (F2)** from the channel plan file, you can edit a particular channel, save the entire plan under another name (duplicate), add and remove channels, etc. Choose one of the following options:

Softkey	Action
F1 EDIT SELECTED CHANNEL	Opens a new menu with options for editing a channel. You can also highlight a channel and press **ENTER** to access this menu.
F2 DUPLICATE CURRENT PLAN AS	Saves the current plan under a new name. You must enter a name. This is the recommended method for defining a channel plan. You can then edit the individual channels (see above) as required.
F3 ADD NEW CHANNEL	Creates a new channel that is added to the line-up.
F4 DELETE SELECTED CHANNEL	Erases a channel from the line-up.
F5 CHOOSE ANOTHER PLAN	Return to the previous menu so you can select a different plan.
F6 SAVE PLANS TO FILE	Saves the edited plan or new plan to the channel plan file.

Select **EDIT SELECTED CHANNEL (F1)** again from the channel plan menu. You can now edit the channel's parameters. Using the rotary knob, highlight each parameter and press **ENTER** to edit it. Depending on the parameter, you may be able to toggle between accepted values using the **ENTER** key, or you may be able to enter your own values using the alphanumeric keypad. The list of parameters is context-sensitive: for example, if you are defining a digital channel, only options for digital channels appear in the list.

Field	Data Range	Default value
Number	4 digit alphanumeric	
Name	20 digit alphanumeric	
Type	Analog, Digital, Other	Analog
Test	Checkmark/no checkmark	No checkmark

Once you select the type (analog, digital or other) the remaining fields vary as shown in the following pages.

FOR ANALOG CHANNELS (TYPE=ANALOG)

Field	Data Range	Default value
Fwdrev	Forward, Reverse	Forward
Video carrier freq	5 to 1500 MHz	55.25
Audio carrier freq offset	4 to 8 MHz	4.5
Audio carrier2 freq offset	4 to 8 MHz	0
Audio carrier2 bw	0 to 2 MHz	0
Audio 2 type	None, FM, Digital	None
Channel width lower	-2 to -1 MHz	-1.25
Channel width upper	4 to 6.75 MHz	4.75

Field	Data Range	Default value
Modulation	NTSC-M, PAL-B, PAL-G/H, PAL-I, PAL-M, PAL-N, SECAM-B, SECAM-G/H, SECAM-K/L, Unknown	NTSC-M
Scrambling	None, Vertical, Horizontal	None
Hum measure in auto test	Checkmark/no checkmark	No Checkmark
Hum	CW, Video	Video
Hum freq	50, 60 Hz	60
CCN measure in auto test	Checkmark/no checkmark	No Checkmark
CCN gated line	7 to 35	15
CCN gated field	Field 1, Field 2, Both	Field 1
CCN freq. offset	-9.99 to 9.99	2
Video noise bw	4 to 6 MHz	4
CTB gated line	7 to 35	15
CTB gated field	Field 1, Field 2, Both	Field 1
CTB freq. offset	-9.99 to 9.99	0
CSO gated line	7 to 35	15
CSO gate field	Field 1, Field 2, Both	Field 1
CSO freq. off low1 tag	Checkmark/no checkmark	No Checkmark
CSO freq. off low1 value	-9.99 to 0 MHz	-1.25
CSO freq. off low2 tag	Checkmark/no checkmark	Checkmark
CSO freq. off low2 value	-9.99 to 0 MHz	-0.75
CSO freq. off up1 tag	Checkmark/no checkmark	Checkmark
CSO freq. off up1value	0 to 9.99 MHz	0.75
CSO freq. off up2 tag	Checkmark/no checkmark	Checkmark
CSO freq. off up2 value	0 to 9.99 MHz	1.25
IRC line	7 to 35	19
IRC field	Field 1, Field 2	Field 1
IRC signal type	Multiburst, GCR, Cable sweep, sinx/x	Multiburst
IRC freq. 1	.5 to 5 MHz	0.5
IRC freq. 2	.5 to 5 MHz	1.25
IRC freq. 3	.5 to 5 MHz	2.0
IRC freq. 4	.5 to 5 MHz	3.0
IRC freq. 5	.5 to 5 MHz	3.6
DOM measure in auto test	Checkmark/no checkmark	No Checkmark

Field	Data Range	Default value
DOM line	7 to 35	17
DOM field	Field 1, Field 2	Field 1
DOM signal type	Multiburst, NTC-7, Composite TX	Multiburst
Video diff gain/phase line	7 to 35	17
Video diff gain/phase field	Field 1, Field 2	Field 1
Video diff gain/phase sig. type	NTC-7, Composite TX, Full line 5 steps, Full line 10 steps, Full line ramp	NTC-7
Video YC line	7 to 35	17
Video YC field	Field 1, Field 2	Field 1
Video YC signal type	NTC-7, Composite TX, Sin square pulse & bar	NTC-7
Video SN line	7 to 35	17
Video SN field	Field 1, Field 2	Field 1
Video SN signal type	NTC-7, Composite TX, Sin square pulse & bar	NTC-7

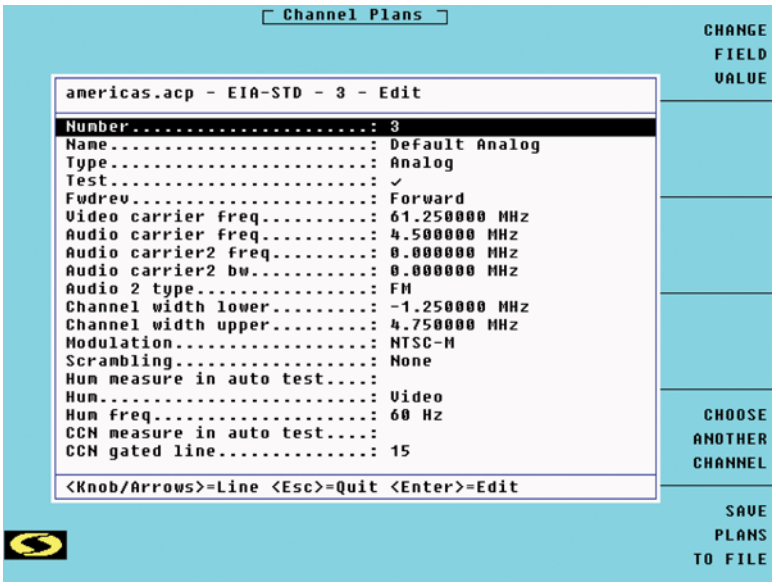


Figure 3-19: Analog Channel Setup

FOR DIGITAL CHANNELS (TYPE=DIGITAL)

Field	Data Range	Default value
Fwdrev	Forward, Reverse	Forward
Center freq	5 to 1500 MHz	555
Channel width	1 to 10 MHz	6
Modulation	QAM64, QAM256	QAM64
Symbol rate	5 - 7 MS/s	5.056941
Polarity type	Auto, Normal, Reverse	Normal
J83 annex	A,B,C,upstream QAM16, None	B

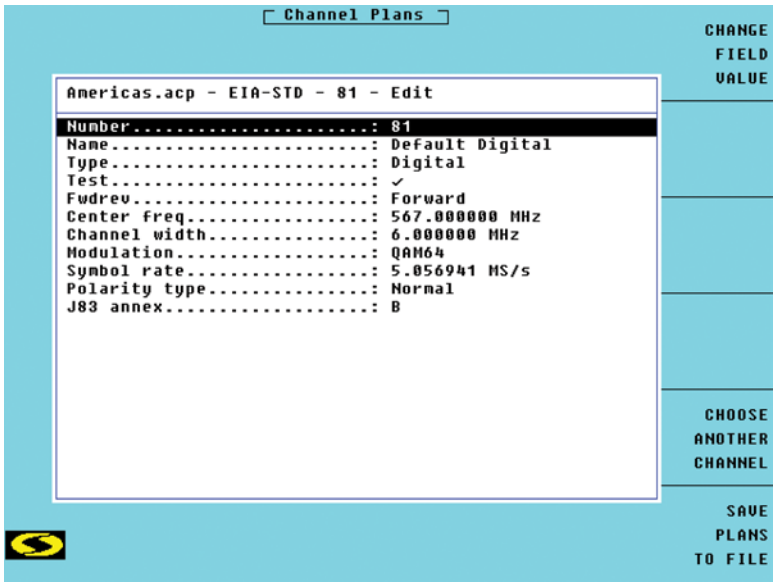


Figure 3-20: Digital Channel Setup

FOR OTHER CHANNELS (TYPE=OTHER):

Field	Data Range	Default value
Fwd/rev	Forward, Reverse	Forward
Center freq	5 to 1500 MHz	88.1
Channel width	0.1 to 10 MHz	0.2
Modulation	QPSK, FSK, BPSK, CW, VSB-AM, FM, CDMA, Unknown, QAM16, QAM32	FM
Symbol rate	0 to 99999999 S/s	0
Burst	Burst, Continuous	Continuous
TDMA length	0 to 999999 ms	0
TDMA repeat rate	0 to 999999 ms	0

Once you have made all necessary changes, press **F6** SAVE PLANS TO FILE to record your changes.

3.5.4 Setting up Remote Switches

The AT2500 can control broadband switches such as the VeEX, Inc. AT1600 and the Electroline Test Point Selector. Switches from other vendors may also be compatible with the AT2500. Contact your VeEX, Inc. representative for more information. (See *Section 11.2, "Technical Support".*) The AT2500 can only control the switches on its serial COM port.

To set up remote switches, go to the setup screen (*Figure 3-14*) and press **SWITCH SETUP (F4)**. Use the rotary knob to highlight a field and then edit its value. The default values are shown in the following table:

Field	Range	Default
Serial Port (COM1–COM4)	COM1, COM2	COM2
Baud Rate (2400–115200)	2400, 9600, 14400, 19200, 38400, 57600, 115200	This value varies according to switch type.
Switch Type	No Switch, Sunrise, Elect. TPS, Custom 1, QEC SRR	No Switch
Total number of RPTP (1.256)	1 to 256	16
Master Group Start	1 to 65535	1

Press **F5** to save the setup.

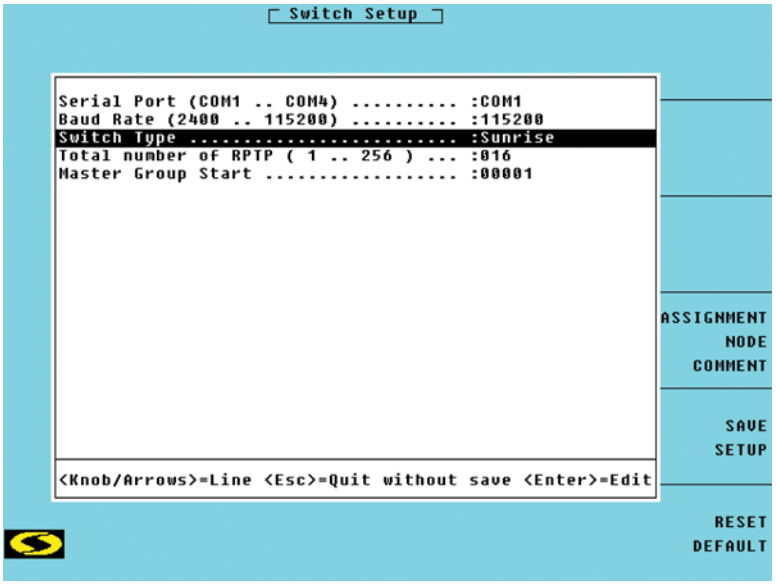


Figure 3-21: Remote Switch Setup

3.5.5 Activating the NTSC Output

The AT2500R includes a baseband NTSC signal representative of the actual spectrum analyzer screen display. This NTSC signal can be sent to a TV or a channel modulator.

On the AT2500, choose the SETUP icon from the main menu, and then select **F6** NTSC OUT ON/OFF. You can now toggle between an active (ON) or inactive (OFF) NTSC output.

This feature can also be enabled or disabled through the general preferences menu. See *Section 3.5.1, “Choosing General Operating Parameters”.*

4 Using the Spectrum Analyzer Functions

The Spectrum Analyzer Module is a standard feature on models R, Rv, RQ and RQv of the AT2500 series analyzers. This module offers full signal analysis functionality over the 5 MHz to 1.5 GHz range. This chapter covers all spectrum analyzer functions accessed through the Spectrum Analyzer icon and the Frequency Counter icon on the main menu. For additional features used to test cable TV signals, see Chapter 5, “CATVPAK Automated CATV Measurements”.

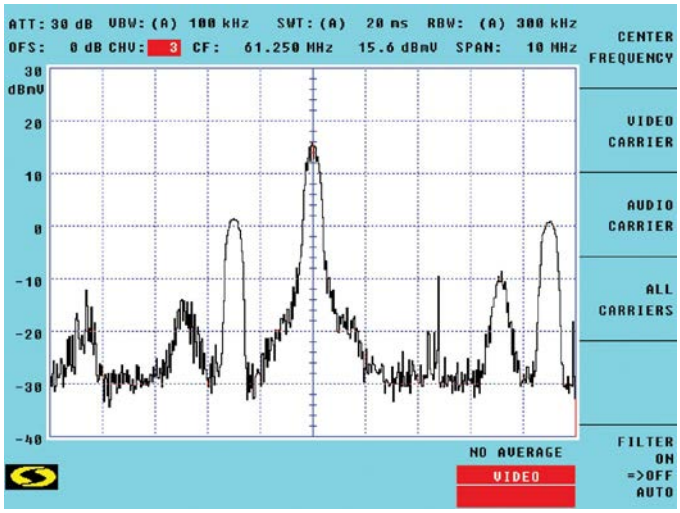


Figure 4-1: Spectrum Analyzer Screen

4.1 Spectrum Analyzer Menus

To access the spectrum analyzer functions, return to the main menu and select the **SPECTRUM ANALYZER** icon. Once in this mode, use the five main menu keys listed below to access softkey control menus. Press **ESC** to bring up a secondary softkey menu of modes that can be directly accessed using the same softkeys.

Button	Softkey Menus	Button	Softkey Menus
FREQ	**F1** Center Frequency **F2** Video Carrier **F3** Audio Carrier **F3** All Carriers **F6** Filter On, Off, Auto	**AMPL**	**F1** Atten. **F2** Reference Level **F3** Vertical Scale **F4** Reference Offset
SPAN	**F1** Max Span **F2** Zero Span **F3** Resolution Bandwidth **F4** Sweep Time **F5** Video Bandwidth **F6** Free Run, Pwr Line, TV Frame	**MARK**	**F1** V1 Marker **F2** V2 Marker/Noise **F3** H1 Marker **F4** H2 Marker F**5** V1 > CF **F6** V2 > CF
TRACE	**F1** No Average **F2** Average 1 **F3** Average 2 **F4** Peak Hold		

4.2 Spectrum Analyzer Instrument Settings

4.2.1 Tuning to a Frequency

The **FREQ** button calls up the frequency tuning functions of the AT2500R spectrum analyzer. The frequency tuning functions are automatically called up whenever accessing a mode that may require tuning.

The frequency tuning functions offer four ways to select a frequency:

F1 CENTER FREQUENCY. Enter a center frequency value in MHz either through the keypad or by using the rotary knob and arrow keys.

F2 VIDEO CARRIER. Enter a TV channel reference (as per the active channel plan) to automatically tune to the frequency that coincides with the video of the channel.

F3 AUDIO CARRIER. Enter a TV channel reference (as per the active channel plan) to automatically tune to the frequency that coincides with the audio of the channel.

F4 ALL CARRIERS. Select from additional carriers programmed in the channel plan such as FM radio, and alignment carriers.

Press **ENTER** to confirm your selection.

4.2.2 Using the Filters

The frequency tuning functions include an option for activating filters.

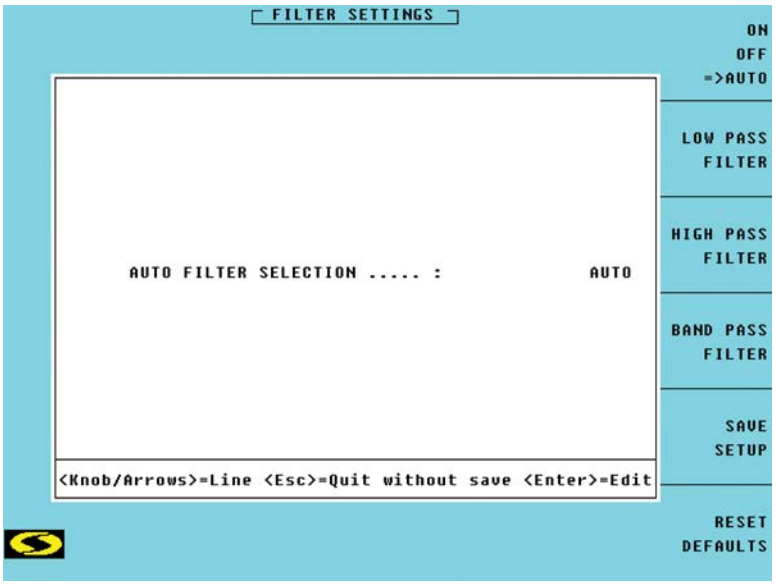


Figure 4-2: Using the Filters

VeEX, Inc. recommends the use of filters in automatic mode for most measurements.

To activate a filter:

1. Press **FREQ** to access the frequency tuning functions.
2. Press **F6** FILTER ON, OFF, AUTO to access the filter menus.

3. Press **F1** and select ON. An arrow symbol appears next to the active choice. If you select OFF or AUTO, you can skip to step 6.
4. Select the softkey that corresponds to the type of filter you want to use:
   - **F2** LOW PASS FILTER. Choose from one of the 7 cutoff frequencies: 45, 88, 174, 280, 370, 460, or 550 MHz.
   - **F3** HIGH PASS FILTER. Choose from one of the 7 cutoff frequencies: 35, 78, 164, 270, 360, 450, or 540 MHz.
   - **F4** BAND PASS FILTER. Select a combination of low and high pass filters.
5. Press **ENTER** or use the arrow keys to scroll through the choices within each filter type.
6. Once you have made your choice, press **F5** SAVE SETUP to activate the filter and return to the spectrum analyzer. To cancel your changes, press **F6** RESET DEFAULTS to use the default filter settings.

When the filters are turned on, the minimum attenuator value is 5 dB.

The appearance of an "S" symbol at the bottom left of the screen above the VeEX, Inc. logo indicates Saturation (i.e. an overload condition on the analyzer). Attenuation and/or span adjustments should be made to reduce the overall input power into the analyzer. Once the appropriate adjustments are made, the "S" symbol will disappear.

For more information on using filters, see the VeEX, Inc. application note *"Proper Alignment of Tunable Bandpass Filters for Noise and Distortion Testing"*, on our website: www.sunrisetelecom.com.

4.2.3 Setting the Span

The **SPAN** button calls up the span-related functions. Frequency spans are variable from a maximum span of 1500 MHz to a minimum span of 100 kHz. Zero span mode is also available.

To set the span:

1. Press **SPAN** to access the span functions.
2. By default, you are prompted to enter a value in MHz and press **ENTER**. The rotary knob and the arrow key also increment the span settings.

Span	Rotary Knob Increments	Arrow Key Increments
<10 MHz	0.1 MHz	1 MHz
10-100 MHz	1 MHz	10 MHz
>100 MHz	10 MHz	100 MHz

You may also choose one of the softkey shortcuts:

- press **F1** MAX SPAN to set the AT2500 to its full 1-1500 MHz span or
- press **F2** ZERO SPAN to access the AT2500's built-in AM/FM demodulator.

Aural Signals

To detect aural signals in zero span mode, tune to a specific frequency and activate the audio demodulator by pressing **F2** LOG AM FM. Toggle between log scale, AM detector with percent of modulation scale and FM detector with deviation scale in kHz. To adjust the audio volume, select **F3** Volume and use the arrow keys or rotary knob.

For more information on the hum, depth of modulation and frequency response options that are available in zero span mode, see *Section 5.5, "Distortion Measurements".*

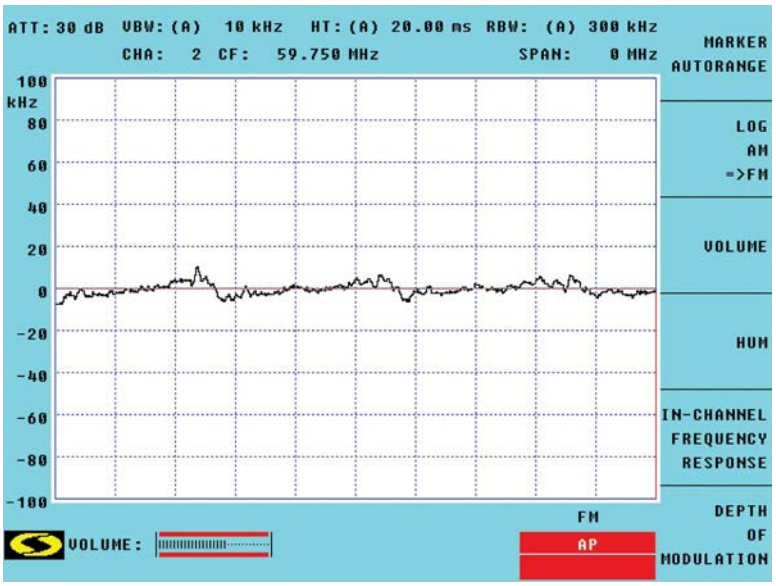


Figure 4-3: Zero Span Mode

4.2.4 Setting the Resolution Bandwidth, Sweep Time and Video Bandwidth

The AT2500's intermediate frequency (IF) filters affect the way signals appear on the display. As the filter bandwidth changes (resolution bandwidth), the width of the displayed response also changes. The wider a filter is, the wider the signal appears on the screen. One way to determine if the resolution bandwidth (RBW) is set wide enough to respond fully to the input signal is to increase the filter and watch until the amplitude no longer increases.

Span affects the RBW and video bandwidth (VBW) settings. For viewing a TV channel, the RBW and VBW should be set to 300 kHz and 100 kHz respectively, or wider if the span is greater than 10 MHz.

By default, the AT2500 automatically adjusts the RBW, the sweep time and the VBW according to the span selected (autocoupled). In automatic mode, the letter (A) appears in the display at the top of the screen, next to each of the three parameters. The letter (M) is displayed next to the parameter to indicate that it has been changed manually. To reset the parameter to its automatic value, press its softkey again.

If you manually change the RBW, VBW and SWT settings to values that are incompatible for an accurate measurement, an "uncal" message appears below the VeEX, Inc. logo at the bottom left of the screen.

Span

To set up the resolution bandwidth, sweep time and video bandwidth, press **SPAN** and select values for the following:

F3 RESOLUTION BANDWIDTH. Selects the IF filter setting for a measurement. To change the bandwidth manually, press **F3** and use the arrow key to select one of the accepted values. The horizontal time and the video bandwidth adjust automatically to the appropriate values for the bandwidth selected. The letter (M) is displayed next to the resolution bandwidth parameter to indicate that it has been changed manually. If desired, press **F3** again to reset the resolution bandwidth to its automatic value.

Accepted values: 10, 30, 300 or 1000 kHz.

F4 SWEEP TIME. Selects a sweep time in milliseconds (ms), either via the keypad or by using the arrow keys. If the sweep time is too slow for the bandwidth, the message “uncal” appears to indicate that insufficient data is available to display the waveform properly.

In order to display an accurate measurement, sweep time is automatically set to a value that is inversely proportional to the square of the resolution bandwidth. Press **F4** again to reset the sweep time to its automatic value.

Accepted values: 2, 4, 10, 20, 30*, 50, 100, 200, 500, 1000, 2000, and 5000 ms.

*Note that 30 ms sweep time is only available with spans of 1000 MHz or more.

F5 VIDEO BANDWIDTH. Selects a video bandwidth in kilohertz (kHz), either via the keypad or by using the arrow keys.

Accepted values: 10, 100 or 1000 kHz.

Examples

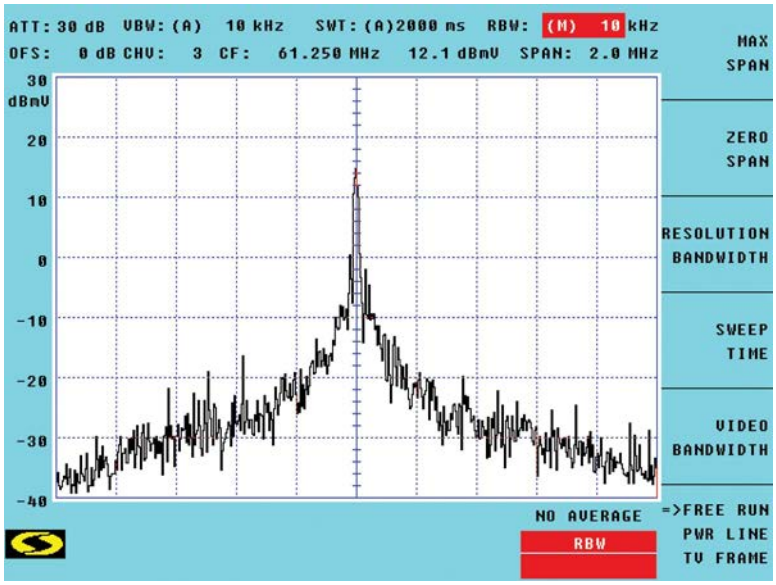


Figure 4-4: Signal Measurement with RBW of 10 kHz

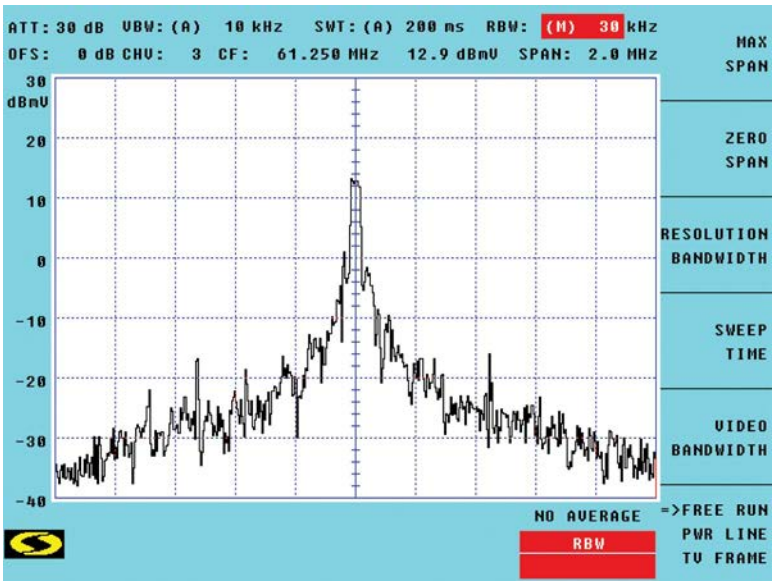


Figure 4-5: Signal Measurement with RBW of 30 kHz

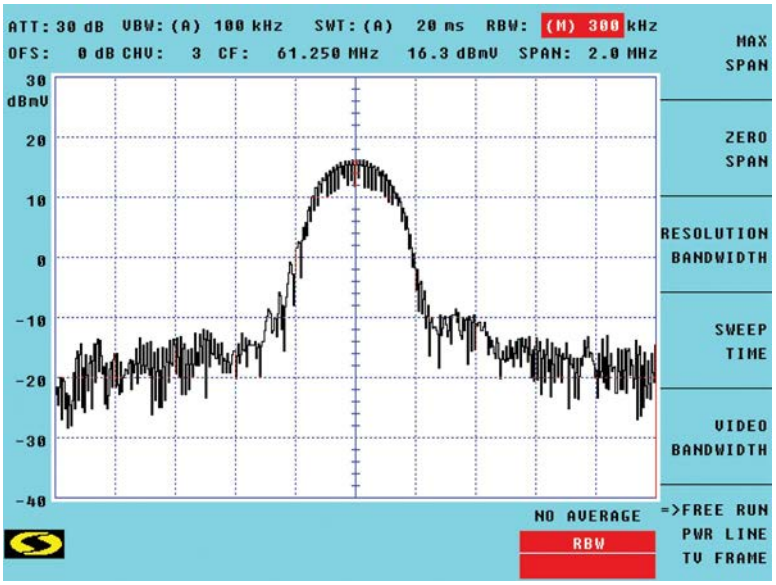


Figure 4-6: Signal Measurement with RBW of 300 kHz

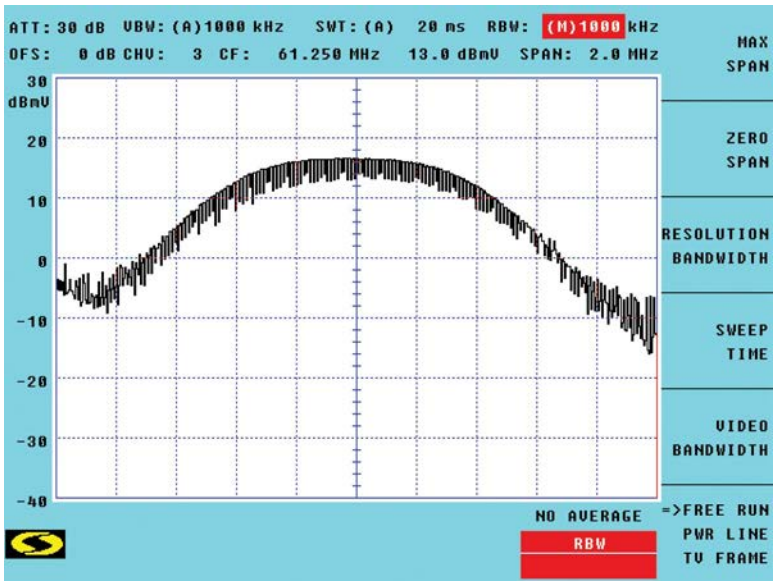


Figure 4-7: Signal Measurement with RBW of 1000 kHz

4.2.5 Setting the Amplitude

To set up the amplitude, select values for the following:

F1 ATTENUATOR. Adjusts the variable 65 dB attenuator. Select input attenuation by increasing or decreasing in steps of 5 dB.

F2 REFERENCE LEVEL. Sets top of the screen reference level in steps of 1 dB.

F3 VERTICAL SCALE. Selects one of vertical scale options:10 dB, 5 dB or 2 dB/div.

F4 REFERENCE OFFSET. Sets reference level offset value from -40 to +40 dB. All level readings will automatically be compensated. This function is useful when working with amplifiers or other equipment that have test points. All that has to be done for test point (TP) compensation is to enter the value of that TP.

4.2.6 Multiple Trace Display

The AT2500 displays 500 data points per trace, and can display up to four traces simultaneously. Each trace is displayed in a different color that has been pre-selected to maximize the contrast with the background color, and the other traces.

For **indoor conditions** the trace colors are as follows:

Trace 1: Yellow	Trace 2: Blue	Trace 3: Pink	Trace 4: Green

For **outdoor conditions** the trace colors are as follows:

Trace 1: Black	Trace 2: Blue	Trace 3: Pink	Trace 4: Green

Press **TRACE** to access the signal processing choices, and select one of the following options:

F1 NO AVERAGE. With this method, the AT2500's averaging function is off. Data appears as it is captured.

F2 AVERAGE 1…50. The AT2500 displays the average value of the user selected number of captured traces. The user selects a value between 1 and 50.

When the AVERAGE 1…50 function key is pressed (**F2**), a prompt for the number of averages will appear as AVG LENGTH on the bottom right hand portion of the screen. The number selected between 1 and 50 inclusive, will be retained if one exits the spectrum analyzer mode and later returns.

F3 DETECT. The AT2500 selects between positive, negative, or sample detector mode.

F4 PEAK HOLD. The AT2500 displays the highest value for each data point. MIN HOLD. The AT2500 displays the lowest value for each data point.

F5 TRACE. Toggles trace on/off.

F6 TRACE. Selects the specified trace number to edit. Trace is 1, 2, 3 or 4.

The default settings for Traces 1 through 4 are shown below.

TRACE	AVERAGE	DETECTOR	PEAK HOLD / MIN HOLD	TRACE ON/OFF
1	No Average	Positive	OFF	ON
2	Average=10	Sample	OFF	OFF
3	No Average	Positive	PEAK HOLD	OFF
4	No Average	Negative	MIN HOLD	OFF

Figure 4-8 below shows how four traces turned on simultaneously may appear on the screen.

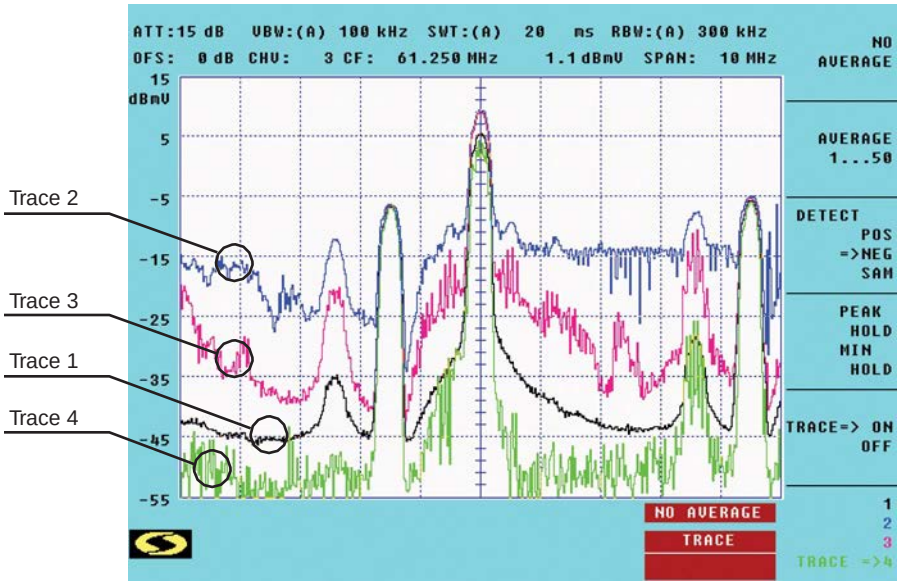


Figure 4-8: Multiple Trace Display

When two or more traces are superimposed on each other, different color combinations may appear. To differentiate one trace from another will require different settings to be applied to the traces. Traces may alternatively be turned on and off as required to view only the traces of interest. This will help in minimizing the activity on the screen. Pressing the **PRESET** *button or turning the unit on and off will reset the traces to their default values.*

4.2.7 Using the Markers (Vertical, Horizontal, and Tilt)

Two vertical markers and two horizontal markers can be used to set level and frequency references. The vertical V1 and V2 markers indicate the frequency and respective level. When viewing multiple traces, you can select the trace for which the vertical markers will be applied. In addition to the horizontal and vertical markers, the AT2500R series analyzer includes a tilt marker, which assists cable operators in assessing and aligning their cable systems.

Vertical Marker Menus

F1 MKR V1. Indicates which trace the first marker will function on. The five options are 1, 2, 3, 4, or no arrow (off). The default is no arrow (off). The color of the vertical marker V1 is the same as the trace against which it is applied.

F2 MKR V2. Indicates which trace the second marker will function on. The 5 options are 1, 2, 3, 4, or no arrow (off). The default is no arrow (off). The color of the vertical marker V2 is the same as the trace against which it is applied.

F3 MKR V2. Selects V2 as a level or noise marker.

F4 V2 mode. Indicates V2 mode of operation with three options FREE, DELTA, and TRACK. The FREE option is the normal operation, where V2 can be moved independently of V1. The DELTA option allows the user to lock V2 to V1 at a specific frequency delta or offset so that both markers move together. The TRACK option locks V2 to V1 at whatever offset is currently set

F5 PEAK. Changes to peak search menus. Turns on V1 and searches to positive peak.

F6 MORE 1/3. Goes to the horizontal markers screen (2/3).

Peak Search Marker Menus

F1 PEAK. Toggles between Positive or Negative peak search. The arrow indicates current mode. If V1 is off, turns V1 on. Default is Positive, but will remember last used setting.

F2 NEXT PEAK. Finds next highest/lowest peak on the screen.

F3 NEXT PEAK RIGHT. Finds next peak to the right.

F4 NEXT PEAK LEFT. Finds next peak to the left.

F5 V1=>CF. Tunes center frequency to vertical marker 1.

F6 V2=>CF. Tunes center frequency to vertical marker 2.

Figure 4-9 below shows the first of three marker menus. The measurements shown are for the V1 and V2 markers applied to the second trace of a multiple trace display.

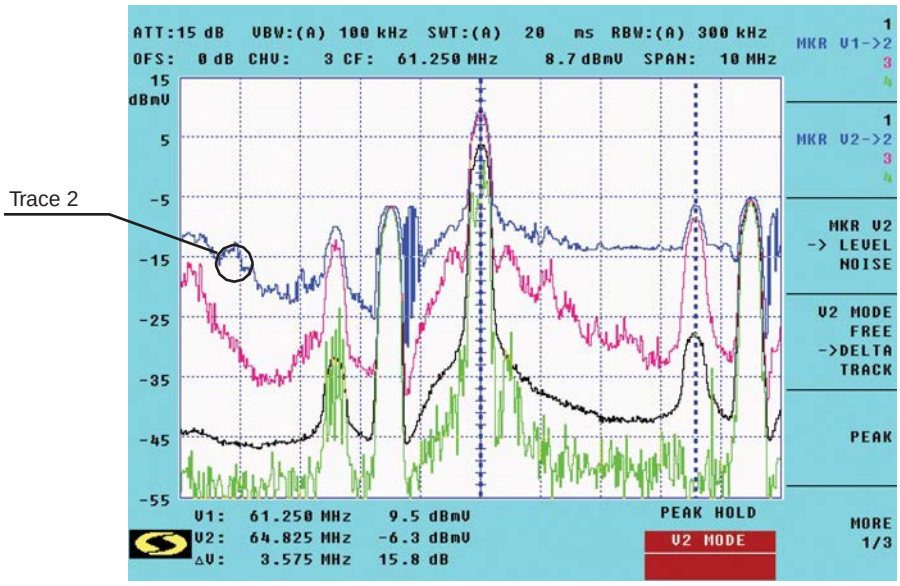


Figure 4-9: Vertical Marker Menu

Figure 4-10 below shows the peak search menu as chosen from within the vertical marker menu. By pressing **NEXT PEAK (F2)**, the next highest peak on the screen is selected. The frequency and associated level is displayed below, and represented via the marker. The marker is moved as per the menu item selections.

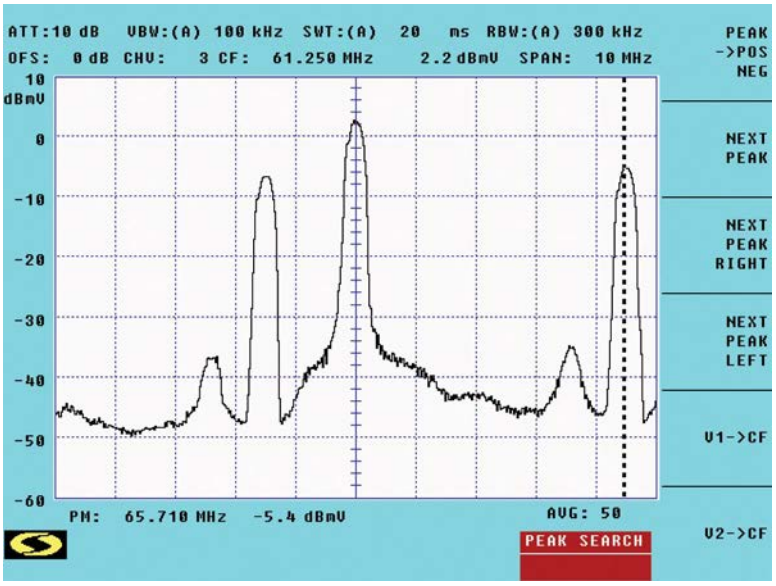


Figure 4-10: Peak Search Marker Menu

To set the vertical markers:

1. Press **MARK** to call up the marker menu, then choose one of the following options:
   F1 V1 MARKER. Sets vertical marker 1 to trace 1. Press **F1** in succession to scroll through the multiple traces if they are active.
   F2 V2 MARKER. Sets vertical marker 2 to trace 1. Press **F2** in succession to scroll through the multiple traces if they are active.
2. Select **F3** to operate V2 as a level or noise marker.
3. Select **F4** to operate V2 in either the FREE, DELTA or TRACK modes of operation.
4. Use the arrow keys or the rotary knob to position the marker(s). Marker values will remain current until new data is entered.
5. To automatically tune the center frequency to vertical marker 1 or vertical marker 2 proceed to step 7, as these menu options are found in the horizontal marker menu.
6. Press **ESC** to exit the marker menu and go back to the previous menu, or to proceed to the horizontal marker menu, go to step 7.
7. Press **F6** to enter the horizontal marker menu.

Horizontal Marker Menus

F1 MKR H1. Sets the first horizontal marker (H1).
F2 MKR H2. Sets the second horizontal marker (H2).
F3 (UNUSED)
F4 V1=>CF. Tunes center frequency to vertical marker 1.
F5 V2=>CF. Tunes center frequency to vertical marker 2.
F6 MORE 2/3. Goes to the tilt markers screen (3/3).

Figure 4-11 below shows the second of the three marker menus. The measurements shown are for a typical multiple trace display where vertical and horizontal markers are activated.

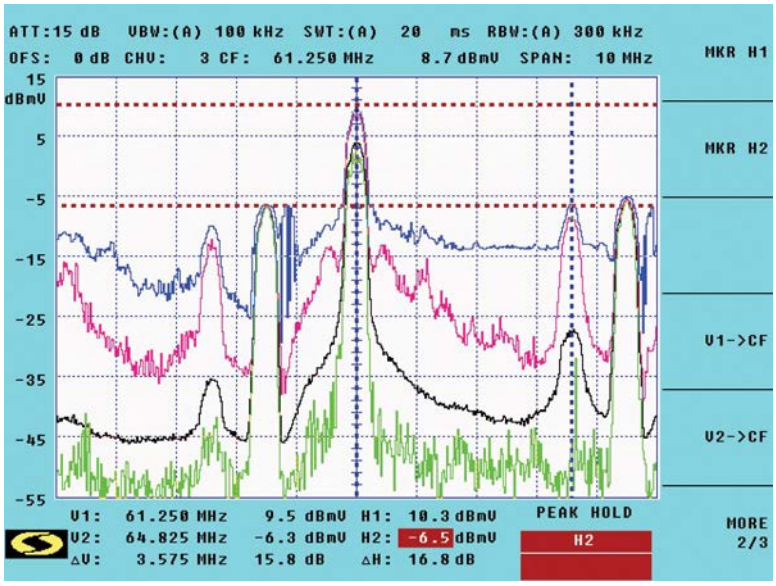


Figure 4-11: Horizontal Marker Menu

To Set the Horizontal Markers:

1. Press **MARK** to call up the vertical marker menu, then press **F6** once to enter the horizontal marker menu.
2. Press **F1** to activate horizontal marker H1.
3. Press **F2** to activate horizontal marker H2.
4. Use the arrow keys or the rotary knob to position the H1 and H2 markers as required.
5. Press **ESC** to exit the horizontal marker menu.

Tilt Marker Menus

F1 TILT MKR. Activates the tilt marker on or off.
F2 TILT MKR LOW FREQUENCY. Sets the low frequency reference value.
F3 TILT MKR LOW FREQUENCY LEVEL. Sets the level (in dBmV) of the low frequency reference value.
F4 TilT MKR HIGH FREQUENCY. Sets the high frequency reference value.
F5 TILT. Sets the Tilt by using keypad or wheel/arrow combination to adjust the slope.
F6 MORE 3/3. Goes to the vertical marker menu (1/3)

Figure 4-12 below shows the tilt marker menu. The display highlights the spectrum between a specified low and high frequency range and a specified tilt.

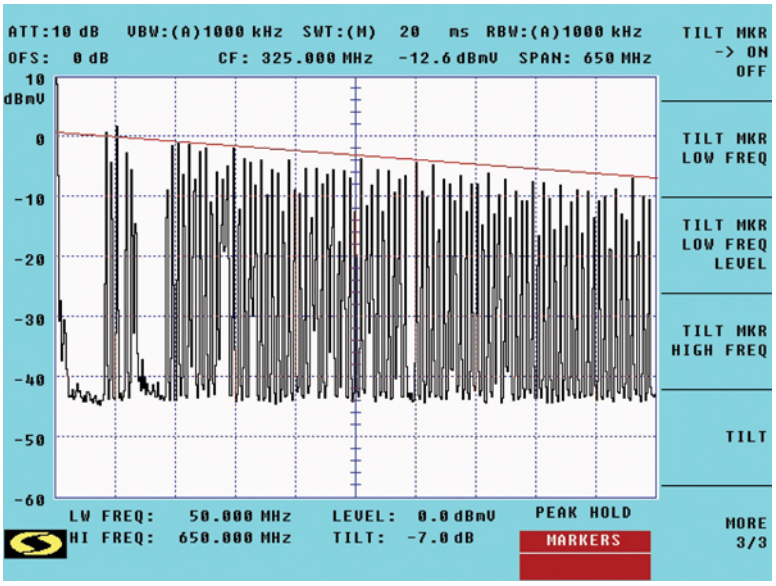


Figure 4-12: Tilt Marker Adjustment Menu

To set the tilt marker:

1. Press **MARK** to call up the vertical marker menu, then press **F6** twice to enter the tilt marker menu. (Or once to enter the tilt marker menu via the horizontal marker menu).
2. Press **F1** to activate the tilt marker from the default off position to the on position.
3. Press **F2** to set the low frequency reference value.
4. Press **F3** to set the low frequency level (in dBmV) reference value.

5. Press **F4** to set the high frequency reference value.
6. Press **F5** to set the desired tilt level (in dB) reference value.
7. Press **ESC** to escape the tilt marker menu or **F6** to return back to the vertical marker menu.

4.2.8 Selecting the Sweep Method

Press **SPAN** to access the sweep mode choices, then press **F6** to select one of the modes. An arrow symbol appears next to the active mode:

Free Run	In this mode, the AT2500 continually scans and retraces the signal. The scan-retrace cycle repeats indefinitely.
Pwr Line	In this mode**,** the AT2500 scan-retrace cycle repeats at the power line frequency, which is 60 Hz or 50 Hz depending on how the channel is defined in the channel plan.
TV Frame	In this mode, the scan's starting time repeats at the video frame rate, which is 29.97 Hz or 25 Hz depending on how the channel is defined in the channel plan.

The Pwr Line and TV Frame modes "freeze" the spectrum analyzer trace and display activity related to power line applications or TV signals.

4.3 Using the Frequency Counter

The frequency counter measures frequencies and levels accurately for CW carriers, AM, FM or TV channels. The counter displays frequency with a 10 Hz resolution.

Accuracy is provided through the stable 1-PPM reference time base. For example, the accuracy when reading a frequency of 100 MHz is 100 x 1, which is equivalent to 100 Hz.

To access the frequency counter, return to the main menu and select the **FREQ. COUNTER** icon. The AT2500 always initiates an auto calibration sequence before entering this mode for maximal accuracy.

See *Section 4.2, "Spectrum Analyzer Instrument Settings"* for information on selecting a frequency to be measured.

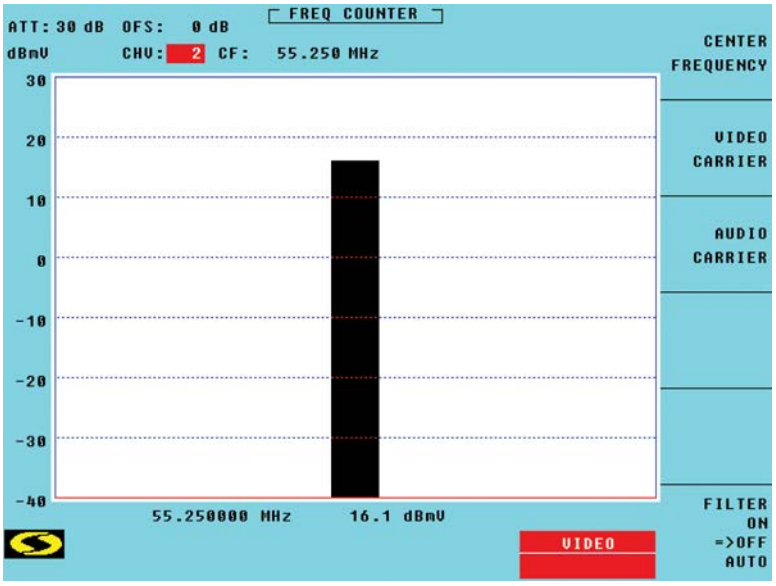


Figure 4-13: Frequency Counter Menu

5 CATVPAK–Automated CATV Measurements

The CATVPAK is a standard feature on models R, Rv, RQ and RQv of the AT2500 series analyzers. It includes the following test functions:

- Digital Channel Power
- TV Channel
- Multi-Carrier
- Auto Test
- Hum
- CCN, CSO, CTB
- In-Channel Frequency Response
- Depth of Modulation

5.1 Digital Channel Power

The AT2500R analyzer measures digital channel power by averaging the sum of power level acquisitions across the desired measurement bandwidth.

To measure digital channel power:

1. Select the **DIGITAL CH POWER** icon from the main menu.
2. Tune to the desired center frequency or channel to be measured. To do so, either:
   - press **FREQ** and then use **F1** or **F2** to set the frequency. Press **ESC** to return to Digital Channel Power mode ***OR***
   - press **F3** to access the spectrum analyzer, then press **F1** to set the center frequency of the channel to be measured. Press **PREV MODE** to return to the digital channel power function.
3. Press **F1** to set the bandwidth of the channel to be measured. The default bandwidth is 6 MHz.
4. Press **F6** MEASURE to initiate the automatic measurement. The AT2500 automatically adds the power levels it reads at each acquisition point under the curve. The number of acquisition points and the width of the RBW filter used depend on the bandwidth you selected in step 3. The AT2500 applies averaging and corrections to the measurement, and displays in the channel power in dBmV and the equivalent dBm values.

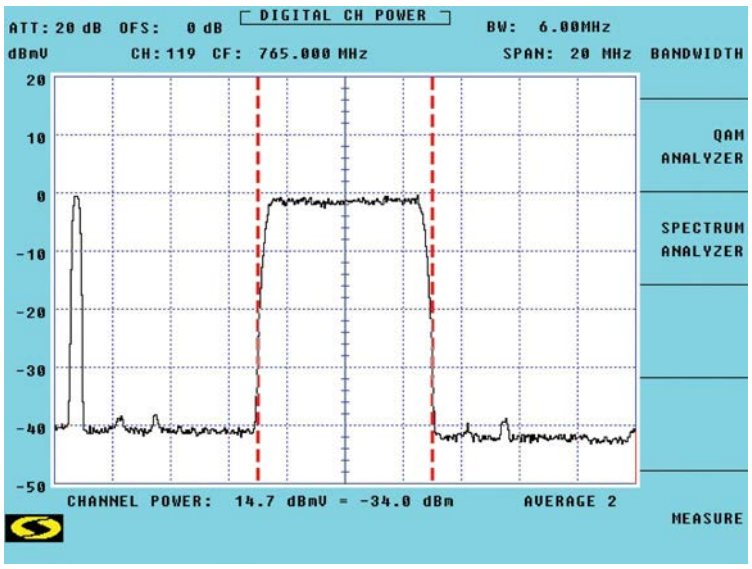


Figure 5-1: Digital channel power screen

5.2 Frequencies and Levels

5.2.1 TV Channel Mode

Use TV Channel mode to measure modulated video and audio carriers as well as 4.5 MHz intercarrier spacing with a 10 Hz display resolution.

To measure a TV channel:

1. Select the **TV CHANNEL** icon from the main menu.
2. Press the **FREQ** key on the front panel.
3. Tune to the desired frequency or TV channel by selecting one of the four soft-keys:
   F1 CENTER FREQ. Enter a frequency in megahertz.
   F2 VIDEO CARRIER. Enter a channel number.
   F3 AUDIO CARRIER. Enter an audio carrier.
4. The AT2500 begins reading the visual or aural levels and frequencies. The results appear at the bottom of the screen along with the delta values.

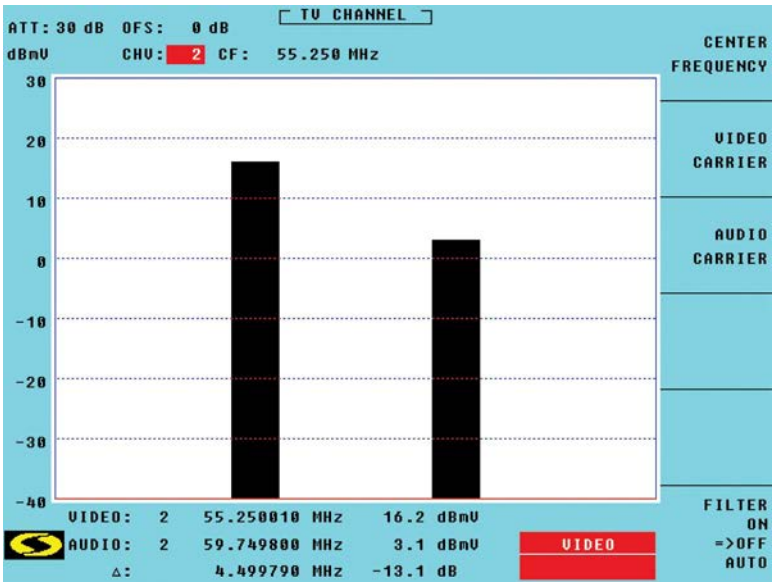


Figure 5-2: TV Channel Mode

5.2.2 Multi-carrier Mode

Use Multi-carrier mode to simultaneously measure the level of up to 6 carrier frequencies or TV channel frequencies.

To measure multiple carriers:

1. Select the **MULTI-CARRIER** icon from the main menu.
2. Press the **FREQ** key on the front panel.
3. Choose the frequency by selecting one of the four softkeys:
   F1 CENTER FREQ. Enter a frequency in megahertz.
   F2 VIDEO CARRIER. Enter a channel number.
   F3 AUDIO CARRIER. Enter an audio carrier.
   F4 ALL CARRIERS. Enter a channel number for other types of carriers.
4. Program the frequency for each of the bars in the display. When you first access this screen, the bar on the left has a marker through it to indicate that it is active and ready to be programmed. To switch between the display bars, press **F5** Switch Position and continue programming the rest of the display bars.
5. Press the **ESC** key to exit programming mode and to begin reading the levels of the six carriers.

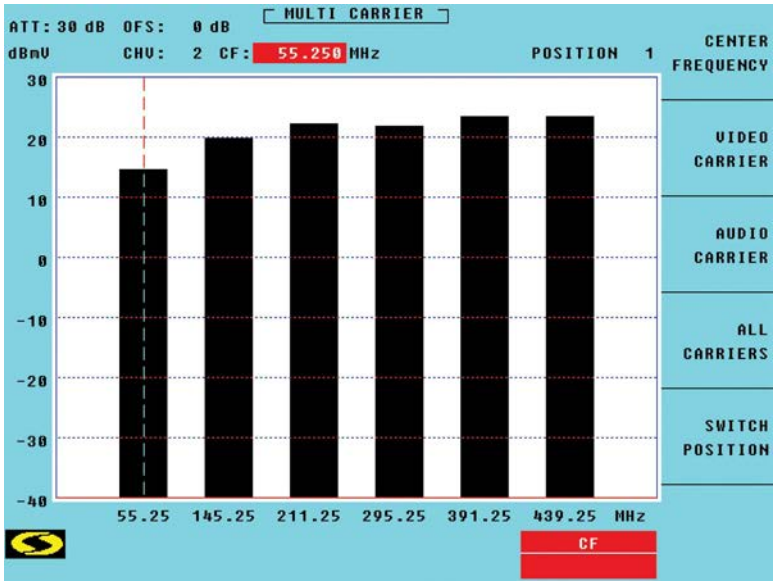


Figure 5-3: Multi-carrier Mode

5.2.3 Autotest

Use the Autotest function to test all tagged channels and frequencies in the active channel plan automatically. Please see *Section 3.5.3, "Setting up a Channel Plan"* to select an active channel plan and tag the channels you want to include in the automatic test.

An entire headend can be scanned and measured within a minute, with level accuracy of ± 0.75 dB and a frequency accuracy of 1 PPM or 10 Hz.

In addition to the level and frequency measurements, the AT2500 can also perform Hum, CCN, and Depth of Modulation tests on user selected channels. Within the channel plan, the user selects all or specific channels on which some or all three of the additional tests will be performed. In each case, the parameters specific to each of the measurements will be as prescribed by the user in the channel plan.

Note that the carrier sweep option can be used to evaluate frequency response, but does not offer the same accuracy in frequency response as a true sweep test.

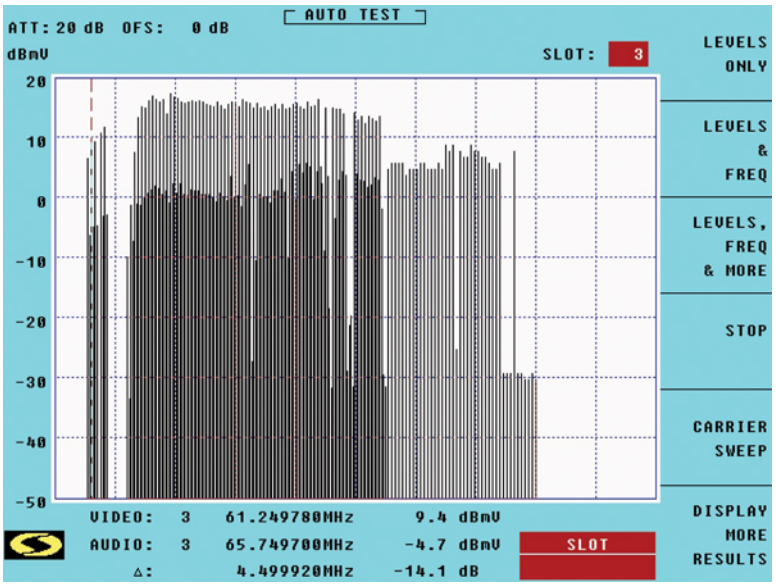


Figure 5-4: Autotest Mode

To automatically test tagged channels:

1. To perform an autotest on levels only, or levels and frequencies, proceed to step 3. If one or any of the following measurements (i.e. Hum, CCN, Depth of Modulation) are required as part of the autotest, go to step 2.
2. Change the field values for each channel within the channel plan by referring to *Section 3.5.3, "Setting up a Channel Plan"* prior to initiating an autotest. The field values are described as follows:
   - Hum measure in auto test *(field must be checked on to be tested)*
   - CCN measure in auto test *(field must be checked on to be tested)*
   - DOM measure in auto test *(field must be checked on to be tested)*

*When selecting the type of test in step 4, **LEVELS, FREQ & MORE (F3)** must be selected to ensure the chosen parameters are measured. Depending on the number of channels selected for which the additional tests will be performed, measurement times may vary and may take on the order of several minutes to complete.*

3. Select the **AUTOTEST** icon from the main menu.
4. Select the type of test:
   F1 LEVELS ONLY
   F2 LEVELS AND FREQUENCIES
   F3 LEVELS, FREQUENCIES, & MORE
   F5 CARRIER SWEEP
5. To stop the test, press **STOP (F4)**. Use the rotary knob or arrow keys to view the measurements. The measurements can be stored for later viewing or printing.
6. To review the measured Hum, CCN, and DOM parameters press **F6**.

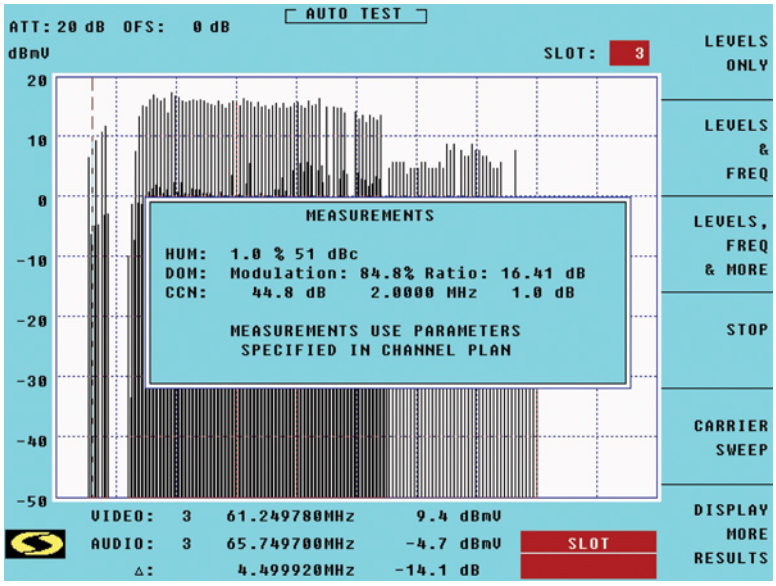


Figure 5-5: Autotest with Levels, Frequencies and More Results

5.3 Distortion Measurements

The AT2500's software routines for measuring CATV distortions are designed for optimal performance and follow all NCTA Recommended Practices for Measurements on Cable Television Systems. To further enhance distortion measurement capabilities, the AT2500 series analyzers all have a built in pre-amp for better sensitivity. In addition, the AT2500 series analyzer includes built-in high/low pass, band selectable filters that can be programmed to work together as bandpass filters that avoid input overloading and distortion or disruption of measurement results.

There are two main ways to access distortion measure mode.

- From the main menu (press **MENU** on the front panel), select the **HUM** icon or CCN, CSO, CTB icon ***OR***
- If you are already in spectrum analyzer mode, press **ESC** and then select **F4** DISTORTION MEASURE.

5.3.1 Hum Modulation Measurement

To access hum measurement mode:

1. Select the **HUM** icon from the main menu.
2. Tune to the carrier frequency or TV channel that you want to test. To do so, press the **FREQ** key on the front panel, and then use the keypad to enter the channel, or press **F1** Center Frequency. The AT2500 automatically sets the attenuator before performing the test. If necessary, you can manually set the input attenuator to view the carrier on screen.
3. Press **ESC** to return to the Hum menu.
4. Identify the type of signal you are testing. To do so, press **SIG. TYPE (F4)** to select either carrier wave (CW unmodulated carrier) or video (modulated carrier). An arrow appears before the active selection. The AT2500 automatically adjusts the instrument settings and sequences the test.

You can now view the real-time hum measurements in dBc (decibels below reference carrier) and in percentage.

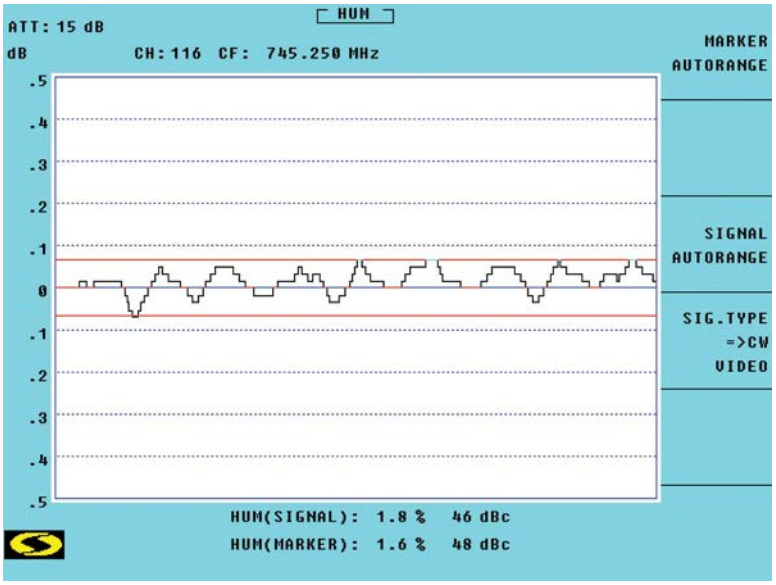


Figure 5-6: Hum Modulation Measurement

For more information on hum measurements, see the VeEX, Inc. application note *"HUM Measurements with the AT2000 Spectrum Analyzer"*, on our website: www.sunrisetelecom.com.

5.3.2 CCN, CSO and CTB measurements

Minimum carrier level for CCN measurements is 5 dBmV and 0 dBmV for CSO and CTB measurements to ensure the most accurate results. Although the AT2500's internal filters can handle higher signal power, insufficient signal levels reduce the accuracy of the measurement.

To access the CCN, CSO and CTB test menu:

1. Select the CCN, CSO, CTB icon from the main menu, or press **ESC** if you are already in the Spectrum Analyzer mode, then select **Distortion Measure (F4)** and press **CCN, CSO or CTB (F2).** You are now in the distortion menu.

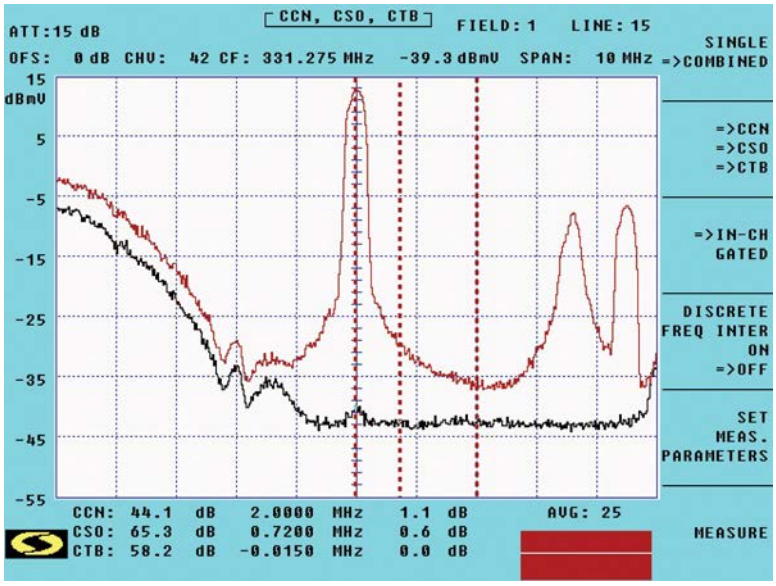


Figure 5-7: Distortion Measurements Menu and Results Screen

2. Select single or combined mode by pressing **F1** to mark your choice. An arrow symbol appears next to your selection.
   - Single mode measures the carrier for the selected parameter only. Use single mode when you want to measure only one specific parameter.
   - Combined mode takes all the measurements required for the CCN, CSO and CTB test parameters. You can store the combined measurements as one record file. Typically, the combined method is only used when the carrier (CW or video) is shut down completely or if the gated method is used.

3. Select the in-channel or gated test method by pressing **F3** to mark your choice. An arrow symbol appears next to your selection.
   - In-channel requires the removal of either the carrier (typically for CTB measurements) or its modulating signal (typically for CSO or CCN) at the system headend. The AT2500 prompts you through the measurement steps.
   - Gated is a non-intrusive method that measures the channel noise of a selected line during the vertical blanking period of the video signal. The gated method does not require the removal of the RF carrier or modulation of the channel under test. However, you need to take into account test conditions in order to ensure accuracy. Possible causes of poor accuracy include a noisy quiet line selected for the gated test.

     To avoid this problem, use a quiet line inserter. Quiet line inserters only allow for accurate measurement of CSO or CCN. For gated combined or gated CTB only measurements, use a line remover to shut down the carrier during the vertical interval. This is the only way to measure CTB accurately while service is still active. Please refer to the VeEX, Inc. application note, *"Making Composite Triple Beat Measurements Using the AT2000 Spectrum Analyzer"*, on our website at www.sunrisetelecom.com.

4. Set the Discrete Frequency Interference (DFI) to either ON or OFF by pressing F4. When the setting is set to on, the user will observe higher acquisition times, as more measuring points are being imposed across the whole band.

CAUTION: *In order to avoid overloading the front-end input and causing the analyzer to generate internal distortions, please ensure that the internal filters are set to the "auto" position.*

Depending on the frequency selected for the distortion tests, the analyzer automatically selects the closest low-pass filter below and the closest high-pass filter above the selected frequency. This combination acts as a bandpass filter and thus reduces the total power entering the analyzer to a non-overload condition. This ensures that the measurement results indicate the analyzer measurement and not distortions the analyzer could have generated internally.

Minimum carrier levels for CCN measurements is 5 dBmV and 0 dBmV for CSO or CTB to ensure the most accurate results. Although the AT2500's internal filters can handle excessive signal power, insufficient signal levels reduce the accuracy of the measurement.

5. Press **F5** SET MEAS. PARAMETERS to access the setup measurement window. Use the rotary knob to select a parameter, and choose a value for each type of measurement. Note that there are values already saved in the channel plan. By default, the AT2500 uses the saved values. However, you can use the softkey to change the settings for this test. The changes are not stored in the channel plan and are erased from memory once the AT2500 is powered off. To make permanent changes, use the channel plan editor.

GATED TESTS

Field Select	At the specified center frequency or channel, sets the analyzer to the correct video signal field where the test signal is expected to be found. Press **ENTER** to choose field 1 or 2.
Line Select	At the specified center frequency or channel, sets the analyzer to the correct video signal line where the test signal is to be found. Choose a line from 7 to 35.

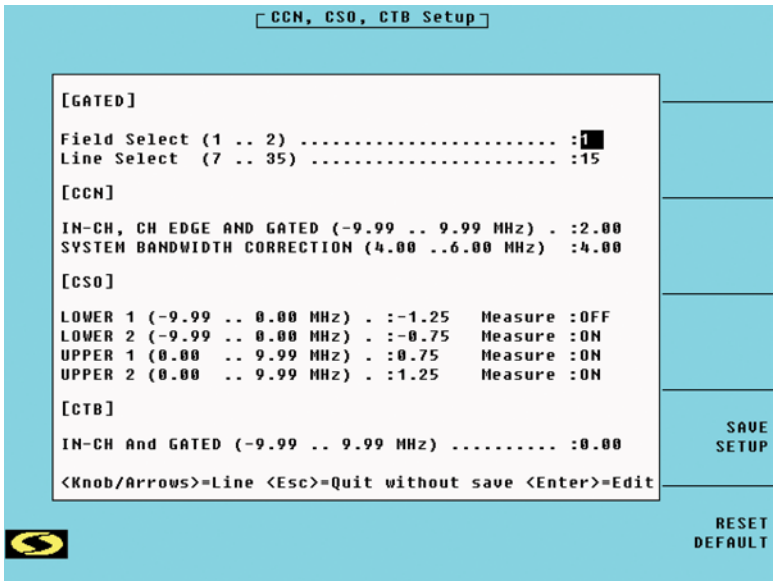


Figure 5-8: Distortion Measurement Setup

CCN TESTS

In-ch or gated	Sets frequency offset from video carrier for noise correction measurement. Accepted values: -9.99 to 9.999 MHz Typical value 2 MHz
System Bandwidth correction	Noise bandwidth correction applied to the noise measurement algorithm in CCN measurement. Accepted values: 4.00 to 6.000 MHz. Typical value 4 MHz

CSO TESTS

Lower 1*	Accepted values: -9.99 to 0.00 MHz Typical value -1.25
Lower 2*	Accepted values: -9.99 to 0.00 MHz Typical value -0.75
Upper 1*	Accepted values: 0.00 to -9.99 MHz Typical value +0.75
Upper 2*	Accepted values: 0.00 to -9.99 MHz Typical value +1.25

* For each of these parameters, indicate whether you want to measure the value. Toggle the “Measure” field on or off.

CTB TESTS

In-ch and gated	Accepted values: -9.99 to 9.999 MHz Typical value 0.00

6. When the changes have been made, press **F5** to save the setup.

7. Press **F6** to begin the measurement. The results at the bottom of the screen include:
   - the measured ratio (CCN, CSO or CTB, depending on selection) in dB
   - the frequency in MHz
   - the noise-near-noise (or beat-near-noise) correction factor used in the calculation

Figure 5-9 below shows a measurement taken with the Discrete Frequency Interference (DFI) turned on and subsequently turning on of the movable marker to observe other potential beat products in the channel. The DFI marker is added to the screen and its associated measurement results is shown on the bottom. The user scans the channel via the arrow keys or the rotary knob to position the marker.

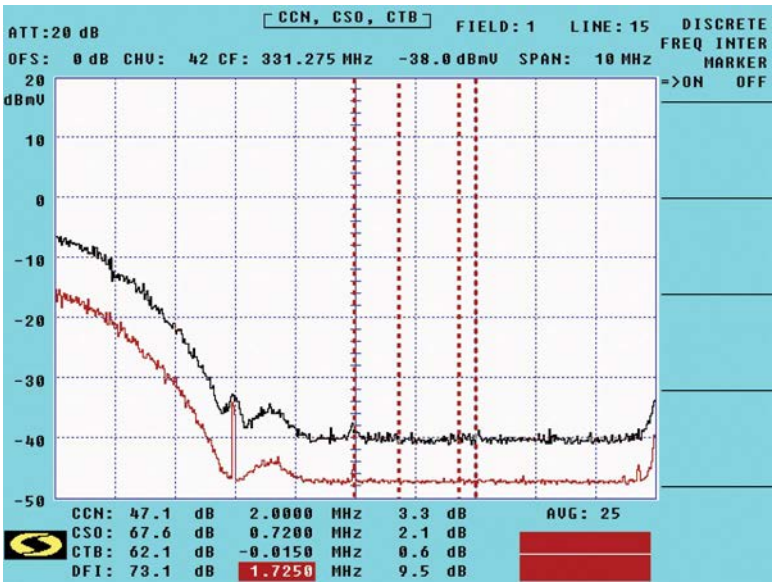


Figure 5-9: Combined Distortion Measurement with DFI on and Marker "ON"

5.4 In-Channel Frequency Response

The in-channel frequency response can be made with a vertical interval test signal (VITS). The required test signal for proper measurement include any of the following:

- Multiburst
- Ghost canceling carrier (GCR)
- Wide band sweep

For ghost canceling carrier and wide band sweep signals, it is not necessary to set up the multiburst packet frequencies. If a cable multiburst is used, however, make sure that the analyzer multiburst packet frequencies match the test signal frequencies. Failure to set up the multiburst packet frequencies may produce faulty measurement results since the AT2500 does not scan for these frequencies. An FCC multiburst is only valid for broadcasters and is not supported by the AT2500 series analyzer.

To measure in-channel frequency response:

1. Select the **IN-CHANNEL FREQ.** icon from the main menu.

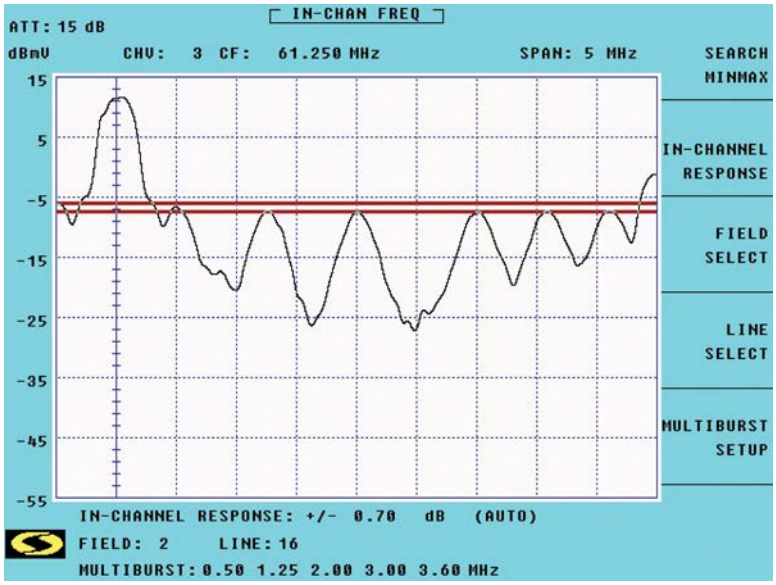


Figure 5-10: In-Channel Frequency Response

2. The AT2500 starts the test automatically based on the values saved in the channel plan. However, you can use the softkeys to change the settings for this test. The changes are not stored in the channel plan and are erased from memory once the AT2500 is powered off. To make permanent changes, use the channel plan editor. To adjust the AT2500's settings:

   F3 FIELD SELECT. At the specified center frequency or channel, press **ENTER** to set the analyzer to the correct video signal field (1 or 2) where the test signal is expected to be found.

   F4 LINE SELECT. At the specified center frequency or channel, press ENTER to set the analyzer to the correct video signal line (from 7 to 35) where the test signal is expected to be found.

   F5 MULTI-BURST SETUP. Define up to five multiburst packet frequencies based on the test signal parameters.

3. To begin the test with the new settings, press **F2** IN-CHANNEL RESPONSE.
4. At the end of the test, press **F1** SEARCH MIN/MAX to position the horizontal markers to find the peak and valley points and indicate the response figure in +/- dB.

5.5 Depth of Modulation

Depth of modulation is measured as the percentage of the total amplitude change of the carrier, as the signal progresses from sync tip to peak white. You can measure depth of modulation on a TV channel with a vertical interval test signal (VITS). A test signal transmitted on the VITS of program video provides a reference to calibrate the video depth of modulation.

To measure depth of modulation:

1. Select the **DEPTH OF MOD** icon from the main menu.
2. The channel's field and line settings are already saved in the channel plan. By default, the AT2500 uses the saved values. However, you can use the softkeys to change the settings for this test. The changes are not stored in the channel plan and are erased from memory once the AT2500 is powered off. To make permanent changes, use the channel plan editor. Select the test signal as follows:

   F3 FIELD SELECT. At the specified center frequency or channel, press **ENTER** to set the analyzer to the correct video signal field (1 or 2) where the test signal is expected to be found.

   F4 LINE SELECT. At the specified center frequency or channel, press **ENTER** to set the analyzer to the correct video signal line (from 7 to 35) where the test signal is expected to be found.

   The video depth of modulation appears at the bottom of the screen as a percent of modulation. The graticule shows the same data in graphical format.

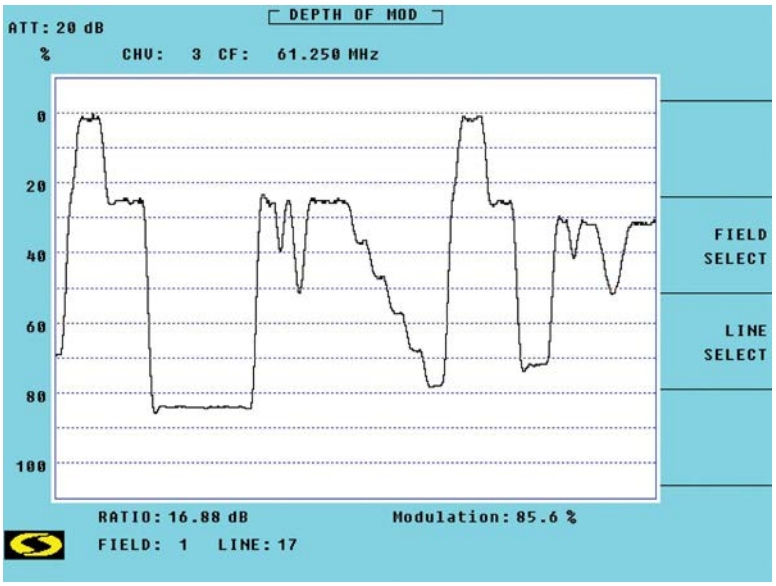


Figure 5-11: Depth of Modulation

6 Time Domain Measurements

The Time Domain Module (TDM) is a standard feature on models R, Rv, RQ and RQv of the AT2500 series analyzers.

This module is useful for observing burst levels, signal-to-noise (S/N) and total channel power of upstream DOCSIS channels. It allows faster horizontal sweep times than the zero span mode available with the standard spectrum analyzer module included with all AT2500 series analyzers.

To access the Time Domain Module, return to the main menu and select the **TIME DOMAIN** icon.

6.1 Setting up the Display

If you have not already tuned to the frequency you want to observe, press **F3** SPECTRUM ANALYZER. This key provides a shortcut to the spectrum analyzer functions so that you can set up the center frequency.

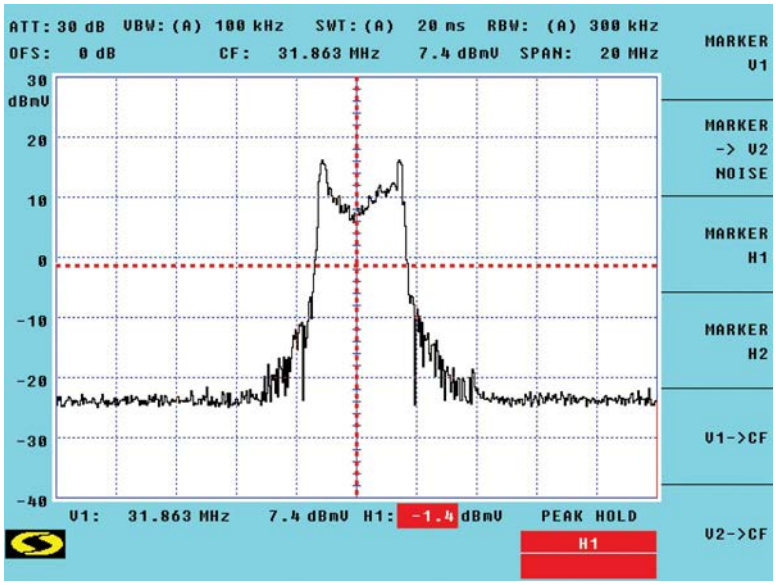


Figure 6-1: Setting up the Center Frequency and Markers

Tip: *If you are measuring DOCSIS cable modem bursts, you can obtain more information on setting up the analyzer for accurate peak level measurements from the application note "Upstream DOCSIS Signals" on our website at www.sunrisetelecom.com.*

1. Press **PREV MODE** to return to the Time Domain Module.
2. Use the following softkey menus to set up the display.

   F6 TEXT TOP MIDDLE BOTTOM. Press **F6** to scroll through the choices for text display: top, middle or bottom.

   F1 SIGNAL BANDWIDTH (BW) CORRECTION. Enter a signal bandwidth correction figure in megahertz (MHz) and press **ENTER**.

   Accepted values: from 0.30 to 9.94 MHz, in steps of 0.05 MHz.

F2 NOISE BANDWIDTH (BW) CORRECTION. Press **F2** to toggle this feature on or off. When active, this feature applies the AT2500's internal correction factor to the noise bandwidth. Noise measurements are available when the vertical markers are used and vertical marker 2 (V2) is set to Noise.

The above softkey menus as well as the shortcut to Spectrum Analyzer mode are available when you call up the Time Domain module, or when you switch between the Spectrum Analyzer and Time Domain modes (toggle **PREV MODE** key).

The analyzer is now ready to trigger on the signal. See *Section 6.2*.

6.2 Setting up the Time and Trigger Functions

Press **SPAN** to access the time and trigger functions. The first three softkey menus provide manual control of resolution bandwidth, horizontal time and video bandwidth. The fourth key provides access to a series of menus for selecting trigger parameters such as the level, holdoff and delay.

6.2.1 Resolution Bandwidth, Horizontal Time and Video Bandwidth

By default, the AT2500 automatically adjusts the resolution bandwidth, the horizontal time and the video bandwidth according to the span selected in the spectrum analyzer screens.

- In automatic mode, the letter (A) appears in the display at the top of the screen, next to each of the three parameters. You can, however, adjust these parameters manually depending on the data you want to view.
- The letter (M) appears next to the parameter to indicate that it has been changed manually. To reset the parameter to its automatic value, press its softkey again (F3, F4 or F5).

Use the following keys to adjust the measurement parameters:

F3 RESOLUTION BANDWIDTH. To change the bandwidth manually, press F3 and use the arrow key to select one of the accepted values. The horizontal time and the video bandwidth adjust automatically to the appropriate values for the bandwidth selected.

Accepted values: 10, 30, 300 or 1000 kHz.

F4 HORIZONTAL TIME. Press **F4** to select a sweep time in milliseconds (ms), either via the keypad or by using the arrow keys. If the horizontal time is too long for the bandwidth, the message "Undersampling" appears to indicate that insufficient data is available to display the waveform properly.

Accepted values: 0.05, 0.10, 0.20, 0.50, 1.00, 2.00, 5.00, 10.00, 20.00, 50.00, 100.00, 200.00, 500.00 ms

F5 VIDEO BANDWIDTH. Press **F5** to select a video bandwidth in kilohertz (kHz), either via the keypad or by using the arrow keys.

Accepted values: 10, 100 or 1000 kHz.

6.2.2 Triggering on a Signal

Press **F6** Trigger to display the menus for setting up the trigger level, holdoff and delay. You can also change the horizontal time from this menu.

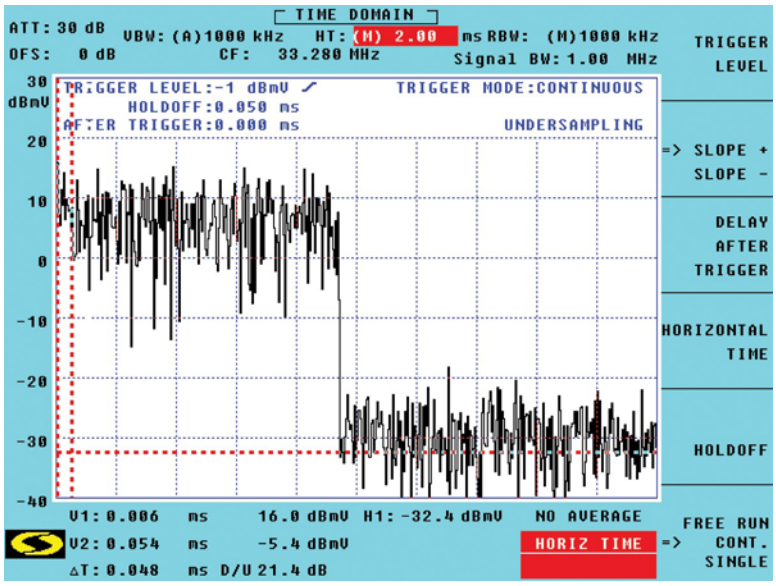


Figure 6-2: Triggering on a Signal

The following softkey menus appear once you press **F6**:

F1 TRIGGER LEVEL. Selects the amplitude for triggering on a signal. Use the keypad or the arrow key to choose the level. The trigger level is usually set at the vertical midpoint of the waveform. Adjust as necessary to obtain a stable display.

Accepted values: 1 dB steps over the 70 dB dynamic range.

F2 SLOPE + SLOPE –. Toggles between a trigger on the positive or negative slope of the waveform (rising edge or falling edge). A diagonal symbol appears to indicate which slope has been selected. When rising to the right, the AT2500 triggers on the positive slope or rising edge of the burst and will position the rising edge of the burst completely on the left of the screen; when falling to the right, the AT2500 triggers on the negative slope or falling edge of the burst.

F3 DELAY AFTER TRIGGER. Selects the delay that the AT2500 waits after triggering to capture and display the waveform on the screen. This allows you to trigger on one signal and view another portion of the signal (usually at a lower level) that appears later. On precisely repetitive signals, it allows triggering on one burst and so that it can be viewed before the next one occurs.

Accepted values: 0.001 to 100.000 ms in steps of 0.001 ms.

F4 HORIZONTAL TIME. Selects a horizontal time in milliseconds (ms). Use either the keypad or the arrow keys. If the horizontal time is too long for the bandwidth, the message "Undersampling" appears to indicate that insufficient data is available to display the waveform properly.

Accepted values: 0.05, 0.10, 0.20, 0.50, 1.00, 2.00, 5.00, 10.00, 20.00, 50.00, 100.00, 200.00, 500.00 ms

F5 HOLDOFF. Selects the delay that the AT2500 waits before triggering again. Adding a holdoff can help differentiate a given data event from a series of similar events.

Accepted values: 0.050 to 700.000 ms in steps of 0.001 ms.

F6 FREE RUN, CONT, SINGLE. Scrolls through the trigger mode choices (free run, continuous and single). In free run mode, the AT2500 continuously captures data without triggering. In continuous mode, the AT2500 automatically repeats its trigger-arm acquisition cycle. In single mode, press ENTER to re-arm for another single acquisition.

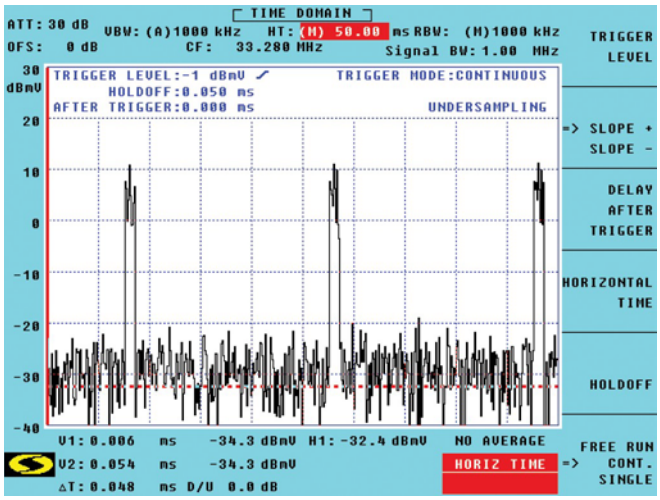


Figure 6-3: Adjusting the Horizontal Time

6.2.3 Zooming in on a Signal

The zoom feature automatically sets the horizontal time, based on the selected portion of the signal. To select a portion of the signal, you must first position the vertical markers.

To zoom in on a signal:

1. Press **MARK** to display the marker menu.
2. Set the two vertical markers to frame a portion of the signal:
   - Press **F1** to set the first vertical marker (V1) and enter the time either via the keypad or by using the arrow keys.
   - Press **F2** to select the second vertical marker. The arrow symbol should appear next to V2. Enter the time for the second marker, either via the keypad or by using the arrow keys.

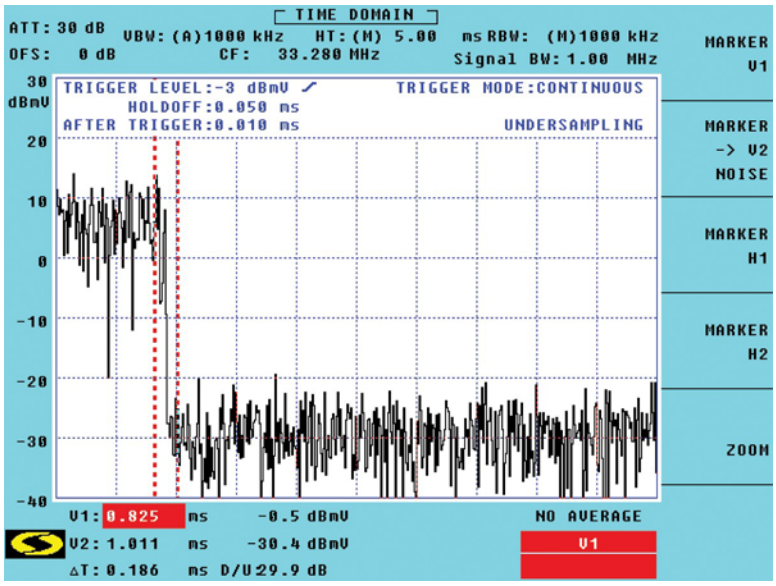


Figure 6-4: Setting the Markers for Zooming

3. Once you have positioned markers V1 and V2, press ESC then press **F5** Zoom to view the selected portion of the signal in greater detail. Note that if you leave the markers at their default values (beginning and end of horizontal time period), then pressing **F5** Zoom sets the display to the fastest horizontal time the analyzer can fit in the display window based on the time spacing between the two vertical markers.

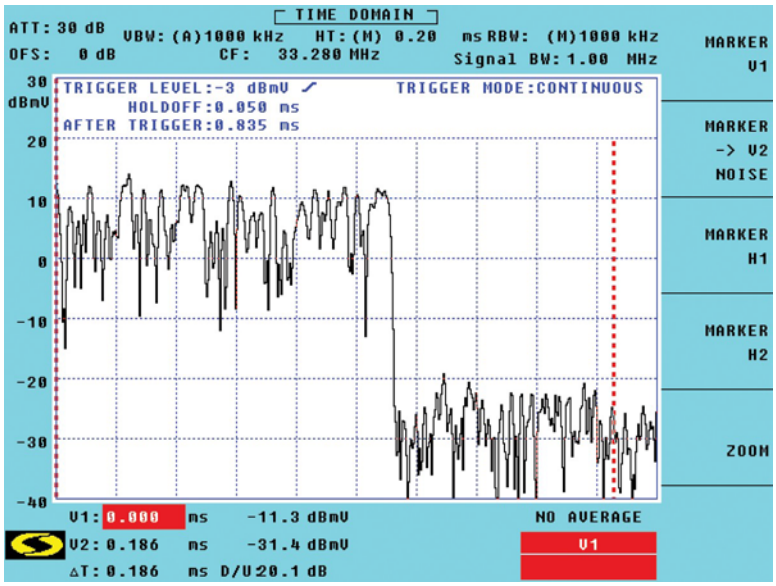


Figure 6-5: Zooming in on a Signal

7 Video Measurements

The Video Module is a standard feature on models Rv and RQv of the AT2500 series analyzers.

This module is useful for detecting signal distortions based on specific NTSC analog signal quality parameters. The AT2500 measures various parameters, using the test signals inserted in the video signal's vertical interval. The following measurements can be made with the Video module, depending on the test signal selected:

- Differential gain and phase
- Y/C luminance chrominance delay and gain
- Depth of modulation
- Modulation linearity
- Signal to noise

There are two main modes of operation:

- a waveform monitor for measuring time parameters and amplitude of the signal's luminance and chrominance, etc. and;
- a vectorscope view for quality control of video chrominance using the color bar test signal.

To access the Video Module, return to the main menu and select the **VIDEO** icon. The AT2500 uses an automatic attenuator when in Video mode.

7.1 Setting up the Test Parameters

7.1.1 Basic Setup

Whether you are using the waveform monitor or the vectorscope display, there are several shared functions that can be accessed from either mode.

The following keys and menus are used to set up the general testing parameters:

FREQ Calls up softkey options for tuning to a frequency that contains a test signal. Choose **F1** CENTER FREQUENCY or **F2** VIDEO. Also includes menu for high, low and bandpass filter activation: **F6** FILTER ON-OFF-AUTO.

SPAN Calls up softkey options for selecting the test signal: **F2** FIELD and **F3** LINE.

F1 WAVEFORM/VECTORSC. Selects an operating mode. An arrow symbol appears next to the active choice. To switch modes once you are in a particular operating mode, press **ESC** to return to this menu.

F3 SPECTRUM ANALYZER. This shortcut takes you to Spectrum Analyzer mode.

F5 SET MEAS. PARAMETERS. Opens a screen for defining the test signal type and measurement setup. See *Section 7.1.2*.

F6 MEASURE. Initiates a measurement based on the current setup.

7.1.2 Measurement Parameters

To access the measurement parameter setup screen, press **F5** SET MEAS. PARAMETERS (available from the waveform monitor or the vectorscope display).

This screen allows you to choose a test signal and set up its parameters. It also lets you identify which performance measurements are to be made with the signal. The following table lists the relevant tests based on the selected test signal:

Test Signal	Typical Uses
Stairstep and ramp	Differential gain and phase. The stairstep test signal can also measure modulation linearity.
Color bars	Amplitude and phase measurements
Pulse and bar	Amplitude and phase response and distortion measurements. Modulated pulse part measures Y/C delay and gain.
Sine-squared	Y/C luminance-chrominance delay and gain.
Composite (NTC-7)	Same uses as for bar, pulse and stairstep. Use with a multiburst signal for complete testing.
Multiburst	Frequency response. In Video mode, the AT2500 tests the response of the baseband-demodulated video. Use the In-channel Frequency response module to test RF video.

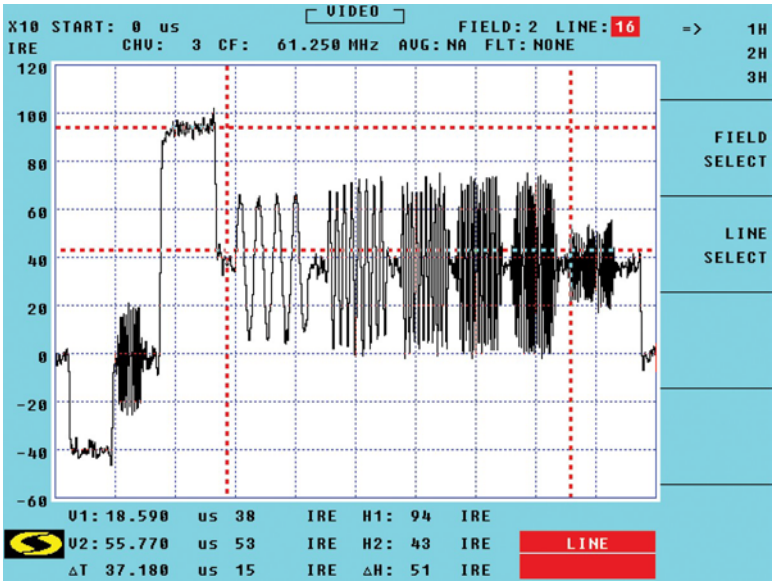


Figure 7-1: FCC Multiburst Test Signal

The following examples show the same test signal, which is the FCC color bars, in both the waveform monitor and vectorscope displays.

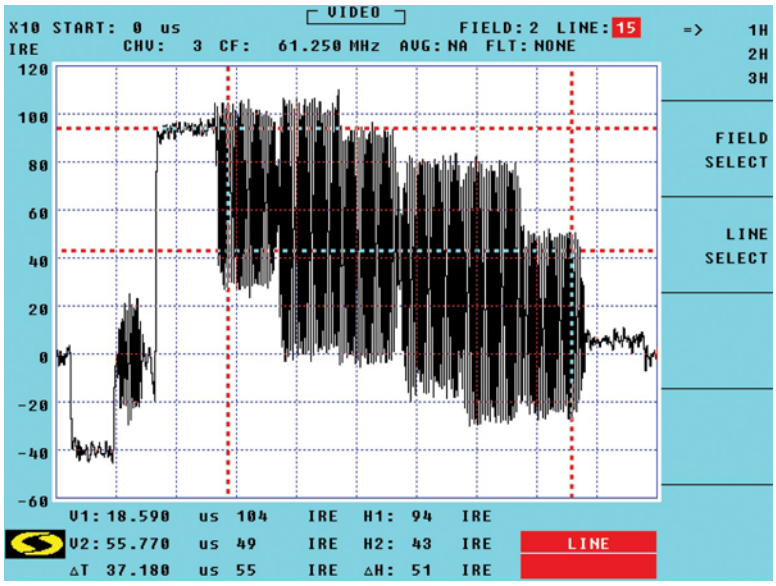


Figure 7-2: FCC Color Bars in Waveform Monitor Display

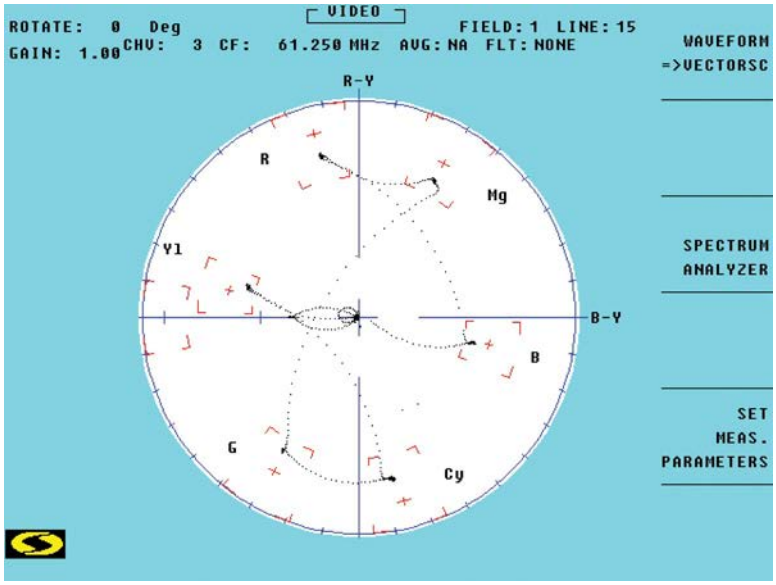


Figure 7-3: FCC Color Bars in Vectorscope Display

To begin testing a video signal:

1. Select a test signal, and then choose values for its parameters. There are six possible measurements available, but some measurements cannot be made on certain test signals.

Parameter	Setup
Test Signal	Choose according to test signal being transmitted. Press **ENTER** when this field is highlighted and scroll through the test signal types. Accepted values: NTC-7 (composite), Composite TX (Tek) (*FCC Composite*), Full line 5 step, Full line 10 step, Full line ramp, or Sine-squared pulse and bar.
Line	Press **ENTER** when this field is highlighted and use the rotary knob to identify the line that contains the desired test signal. Press **ENTER** to continue to the next field. Accepted values: 7 to 35
Field	Press **ENTER** when this field is highlighted and use the rotary knob to identify the field that contains the desired test signal. Press ENTER to continue to the next field. Accepted values: 1 or 2
Measurements	Press **ENTER** when each measurement field is highlighted to tag or untag the measurement to be performed with the selected test signal. Note that not all measurements are possible with every test signal. Use the rotary knob to move to the Markers field.
Markers	Press **ENTER** when each marker field is highlighted and use the rotary knob or arrow keys to move the markers to the correct time position for your test signal. On the display, the selected marker appears in red. The blue lines indicate the current markers. Press **ENTER** once you have moved the selected marker to continue to the next field.

2. Press **F5** SAVE SETUP to record the changes and exit the measurement parameter setup screen. To revert to default values, press **F6**.

The default values are based on Tektronix standard test signals and their line and field assignment for instruments such as the FCC assignments.

7.2 Measuring in Vectorscope Mode

The AT2500's vectorscope graticule has 6 targets for the 6 color bar test signal. Each dot of the color bar signal should fall on one of the crosshairs if the chroma gain and phase relationships are correct. There is also a line at –180° used as a reference for correctly positioning the burst display (Burst Phase Reference line).

To use the vectorscope display for measuring signal quality:

1. Press **F1** and select VECTORSC. If you are in waveform monitor mode, press **ESC** first in order to return to the Video menu.
2. Press **FREQ** and select a channel containing a test signal such as standard color bars, and then press **SPAN** to select the appropriate field and line using **F1** FIELD and **F3** LINE.

3. If the measurement parameters have not yet been set up, see *Section 7.1.2*.
4. To adjust the signal's display, press **AMPL.** Use the softkey menus:

   F1 GAIN. When selected, enter a number or rotate the rotary knob to increase or decrease the color saturation. Gain adjustment appears in the upper left part of the screen. Default value is 1.

   F2 ROTATE. When selected, rotate the knob to angle the display. Rotation angle appears in the upper left part of the screen. Default value is 0 degrees.

   F4 DEFAULT. Resets the gain and rotation to default values.

5. Press **F3** DIFF GAIN/PHASE ON/OFF to turn on or off the display of the current measurement for differential gain and phase. When active, the current readings appear in the upper left part of the screen, as well as a P or F notation to indicate whether the test passed or failed. See *Section 7.4, "Video Measurements"* for more details on test results.

7.3 Using the Waveform Monitor

To use the waveform monitor:

1. Press **F1** and select WAVEFORM. If you are in vectorscope mode, press **ESC** first in order to return to the Video menu.
2. Press **TRACE** and select the trace acquisition and filtering options.

   F1 NO AVERAGE. By default, the waveform is displayed as data is acquired.

   F2 AVG 1..50. If desired, select the number of signal samples that the AT2500 acquires and averages before displaying the waveform.

   F3 NO FLT, LUMA, NOISE W., CHROMA. If desired, display only the luminance, only the chrominance, or apply a noise-weighting factor to the measurement. By default, no filter (NO FLT) is selected.

3. Press **FREQ** and select a channel containing a test signal.
4. Press **SPAN** and then select **F1** FIELD to choose field 1 or 2.
5. Select a line or lines to monitor. To select a single line, use the softkey **F3** LINE. To view multiple lines, press **F1** then choose 1H, 2H or 3H to view one, two or three lines at a time.
6. To adjust the vertical scale in IRE, press **AMPL**. Choose 5, 10 or 20 IRE units per division.
7. Once the signal is displayed, use markers as desired. Press **MARK** and then select up to four markers:

   F1 MARKER V1. Sets vertical marker 1.

   F2 MARKER V2. Sets vertical marker 2.

   F3 MARKER H1. Sets horizontal marker 1.

   F4 MARKER H2. Sets horizontal marker 2.

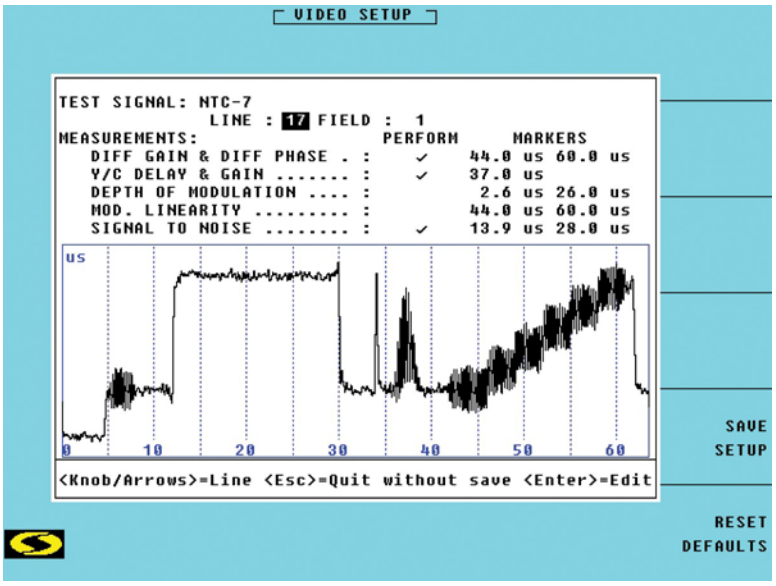


Figure 7-4: Setup for Tests with Waveform Monitor

8. To view a particular time window, press **F5** ZOOM. Note that this option is only available when a single line is viewed (1 H). Use the rotary knob or arrow keys to select the start position of the time window. This provides a 10x display of the selected window.
9. If the measurement parameters have not yet been set up, see *Section 7.1.2*.
10. Press **F6** MEASURE to begin measuring. See *Section 7.4* for more details on test results.

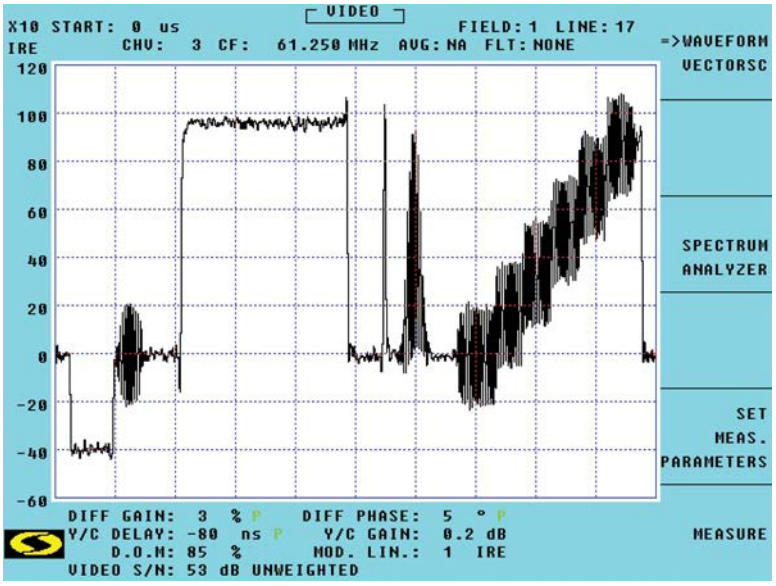


Figure 7-5: Waveform Monitor Display Showing Results

7.4 Video Measurements

7.4.1 Waveform Monitor Test Results

There are seven possible test results that may appear at the bottom of the screen in waveform monitor mode:

- Differential gain
- Differential phase
- Y/C luminance chrominance delay
- Y/C luminance chrominance gain
- Depth of modulation
- Modulation linearity
- Signal to noise (weighted or not depending on choice of filters)

The AT2500 displays a pass/fail flag for three of the tests, based on limits defined by the FCC:

Measurement	Passing Range
Differential gain:	+/- 20%
Differential phase:	+/- 10 °
Y/C (lum./chroma) delay:	+/- 170 nsec

7.4.2 Vectorsscope Test Results

In vectorscope mode, the results for differential gain and phase appear at the top left of the screen along with a pass/fail notation. No other automatic test results are available in this mode.

Incidental Carrier Phase Modulation (ICPM) is an apparent differential phase distortion that occurs in the demodulation of video signals with coherent demodulation. It is inherent to the demodulation of vestigial sideband signals and appears as a phase shift based on the amplitude of the sidebands. ICPM shows up on the AT2500's vectorscope display but is factored out in the calculation of the differential phase.

8 QAM 16/64/256 Digital Measurements

The QAM Analyzer Module is a standard feature on models RQ and RQv of the AT2500 series analyzer.

The QAM Analyzer Module demodulates and measures various parameters of 16, 64 and 256 quadrature amplitude modulation (QAM) signals carried through the cable system. Several types of measurements can be made using the built-in digital demodulator:

- Bit Error Rate (BER), Pre and Post Forward Error Correction (FEC)
- Modulation Error Ratio (MER) and Error Vector Magnitude (EVM)
- Group Delay

Display modes include:

- Constellation Display with zoom capabilities.
- Error Statistics Graph Display
- Adaptive Equalizer Display.

To access the QAM Analyzer Module, return to the main menu and select the **QAM ANALYZER** icon.

8.1 Setting up the QAM Analyzer

To access QAM mode, select the **QAM ANALYZER** icon from the main menu, or from Digital Channel Power Mode, select **F2 QAM ANALYZER**.

Based on the selected frequency, assuming the QAM channel is defined in the channel plan, the analyzer automatically selects 16, 64 or 256 QAM settings with the appropriate settings such as symbol rate, polarity, Annex A, B or C, and so on.

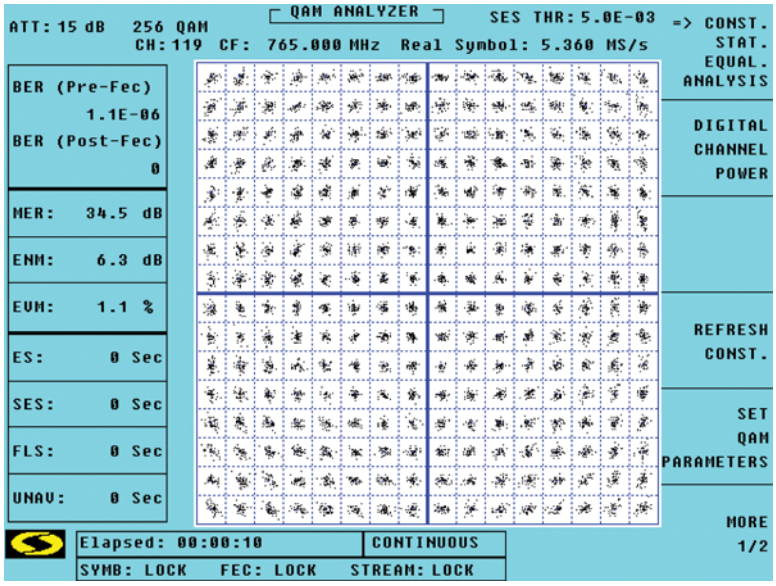


Figure 8-1: 256 QAM Constellation Display

1. Tune to the center frequency of the digital signal that you want to test. The AT2500 auto-ranges the attenuator setting and polarity setting before locking on the signal and performing the test.

   To tune while in QAM analyzer mode, press the **FREQ** key on the front panel. Select **F1 CENTER FREQ** and enter a frequency. Once you have entered the frequency, press the **ESC** key to return to the QAM menu.

2. If the QAM channel is not already in the channel plan, select **F5** SET QAM PARAMETERS.

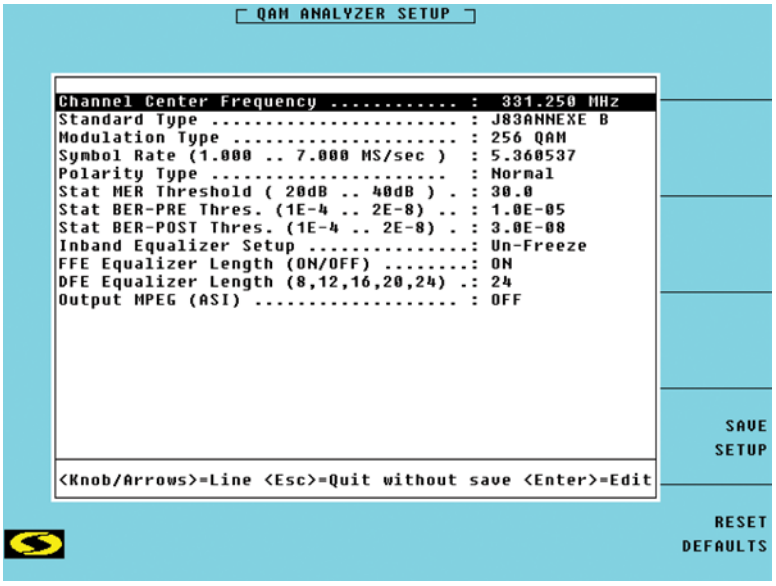


Figure 8-2: QAM Channel Setup Menu

Channel Center Frequency	Enter a center frequency in MHz.
Standard Type	Select J83ANNEX A, J83ANNEX B, J83ANNEX C, NO FEC DEC 6 MHz, NO FEC DEC 8 MHz, UP-STREAM QAM 16, UPSTREAM QAM 64.
Modulation Type	Select 16, 64 or 256 QAM.
Symbol	Defaults to typical value for modulation type: 2.560 for 16 QAM, 5.056941 for 64 QAM (Annex B) and 5.360 for 256 QAM. Symbol rate range is from 1.000 to 7.000 MS/sec.
Polarity Type	Select Normal or Reverse polarity. Reverse is used with IF signals from modulators (before up-conversion). Default setting is Automatic.
Stat MER Threshold	Sets visual limit line on screen in statistical mode. Range is 20 dB to 40 dB.
Stat BER-PRE Thres.	Sets visual limit line on screen in statistical mode. Range is 1E-4 to 2E-8.

Stat BER-POST Thres.	Sets visual limit line on screen in statistical mode. Range is 1E-4 to 2E-8.
In-band Equalizer Setup	Select Off, Freeze, Un-freeze, or Special.
FFE Equalizer Length	Toggle between ON and OFF.
DFE Equalizer Length	Select 8, 12, 16, 20, or 24.
Output MPEG (ASI)	Toggle between ON and OFF to turn on/off transport stream output on rear panel.

3. Once all QAM settings have been entered, select F5 SAVE SETUP to initialize the QAM measurement with the current settings. If you want to cancel your choices and return to the factory default values, press F6 Reset Defaults.
4. The AT2500 automatically optimizes the attenuator and polarity settings and starts testing the digital signal in real time. The test begins with an attempt to lock onto a known symbol rate, then the Forward Error Correction (FEC) function, and then tries to detect the presence of an MPEG transport stream. Refer to the bottom of the screen for a confirmation of the analyzer's ability to properly demodulate the signal and provide all possible measurement parameters.

The AT2500RQv can not decode bursty upstream QAM 16 signals because it requires a constant carrier in order to lock on the signal. A transmitter capable of generating a constant carrier such as a CM1000 with the USG (Upstream Signal Generator) module is required.

8.2 Testing QAM signal quality

The AT2500R displays certain signal quality statistics on the right side of the constellation display. They are:

- Bit Error Rate (BER), Pre and Post Forward Error Correction, refreshed every second
- Modulation Error Ratio (MER)
- Error Vector Magnitude (EVM)
- Estimated Noise Margin (ENM)

For an explanation of each of these error measurements, please consult the following sections.

It is recommended that the pre-selection filters be set to AUTO for all QAM measurements except when digital channel power is < 0 dBmV.

8.2.1 Pre and Post Bit Error Rate (BER)

BER measurements are done after digital decoding (Trellis decoding, de-randomization, and de-interleave) but as well as before *and* after Reed-Solomon error correction. The AT2500 error correction mechanism detects all errors.

BER Pre-FEC	Bit Error Rate Pre-Forward Error Correction. Indicates all errors found in the previous second. It is shown as the ratio of errored bits to the total number of bits transmitted in the second.

BER Post-FEC Bit Error Rate Post-Forward Error Correction Shows the ratio of uncorrected errored bits in a one second period. These are the bits that could not be corrected after the FEC circuits.

The pre-FEC BER is normally higher than the post-FEC BER. Typically pre-FEC BER increases with noise input while post-FEC BER remains at 0 until it comes very close to losing the FEC lock. At that point, it increases very rapidly. Disturbances other than pure noise, such as burst interference, have a different effect.

BER is displayed in scientific notation. The more negative the exponent, the better the BER. The AT2500 has a range of 0 to 1.0×10^{-4}.

In order to detect bit errors in a 16 QAM upstream signal, the transmitter must encode the data with a known bit stream and Reed-Solomon error correction. The CM1000 with USG transmits a pseudo random bit stream (PRBS) with the proper Reed-Solomon encoding to allow pre and post errors to be detected and displayed.

8.2.2 Modulation Error Ratio (MER)

MER is the best overall “figure of merit” measurement to determine 16/64/256 QAM signal quality and can be used to help diagnose transmission impairments. MER indicates the ratio, in dB, of average total signal power in the ideal constellation to average error power in the constellation as received by the AT2500. The measurement includes error power due to any particular type of impairment or any combination of impairments.

8.2.3 Estimated Noise Margin (ENM)

The ENM is an indication of the headroom of the system. It is calculated from the MER, taking into account modulation type (16, 64 or 256 QAM), the symbol rate and the bandwidth. It assumes noise disturbance only; other disturbances result in a false ENM. The headroom is related to the critical operating level or 1E-8 uncorrected error rate, at which point artifacts are visible in a picture during a digital video transmission or data retransmissions are necessary in the case where a cable modem is used.

8.2.4 Error Vector Magnitude (EVM)

EVM is the measurement of modulation quality of the transmitted signal before the forward error correction stage. EVM indicates how much interference or distortion is present on the signal. If there is significant degradation on the signal, the constellation points (displayed symbols) becomes unclear, i.e. scatter further from each of the target boxes or decision boundary centers, and the decoder may not be able to reconstruct the received signal correctly.

8.3 Constellation Display

To activate the constellation display, press **F1** to select **CONST**.

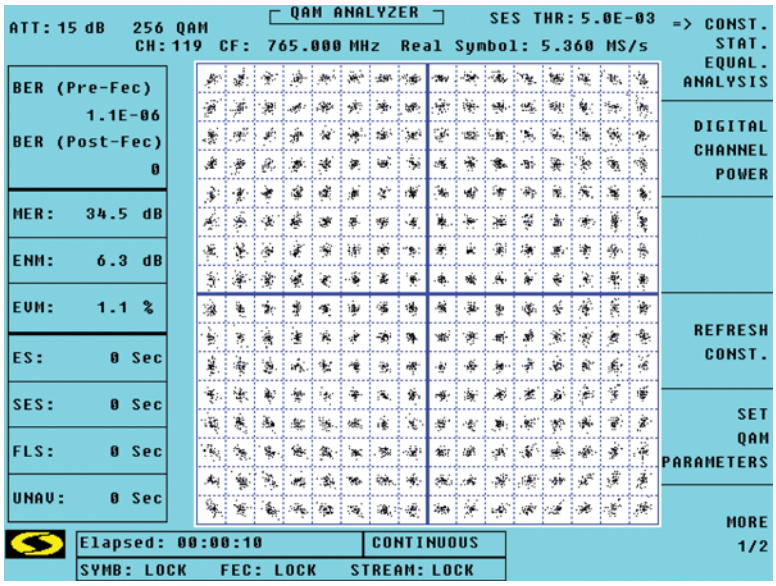


Figure 8-3: Constellation display

The constellation display shows both the “I” (in-phase component) and “Q” (quadrature component) values. Each location on the constellation is framed by decision boundaries. If the signal falls within these boundaries, the correct data is received. The data is in error if it falls outside of its boundaries into adjacent location such as when the signal is affected by noise or other interference.

The constellation display can be used to troubleshoot problems by helping to identify the type of impairment and isolate the source. Significant degradations in the signals can be identified including noise, coherent interference and transmission distortions as well as modulator impairments such as I/Q imbalance or quadrature error. Visual examination of the constellation can be a good first step for diagnosing signal disturbances.

The following list includes the characteristic visual effects of a few types of signal impairment:

Pure Thermal Noise	Appears as a cloud around the ideal point, getting lighter as it expands.
Phase Noise	Appears as crescent-shaped constellation points, more apparent on the outer edge, because of angular shift of the signal.
Coherent Distortion or CW Interference	Appears as doughnut shaped constellation with points all over, due to the sum of different frequency vectors (signal and interference).
Amplifier Compression	Appears as shift toward center for the outer edge points. Because it is more severe on large amplitude, it may be associated with phase shift (AM to PM conversion).

8.3.1 Zoom Mode

The ZOOM function frames a part of the constellation for closer viewing.

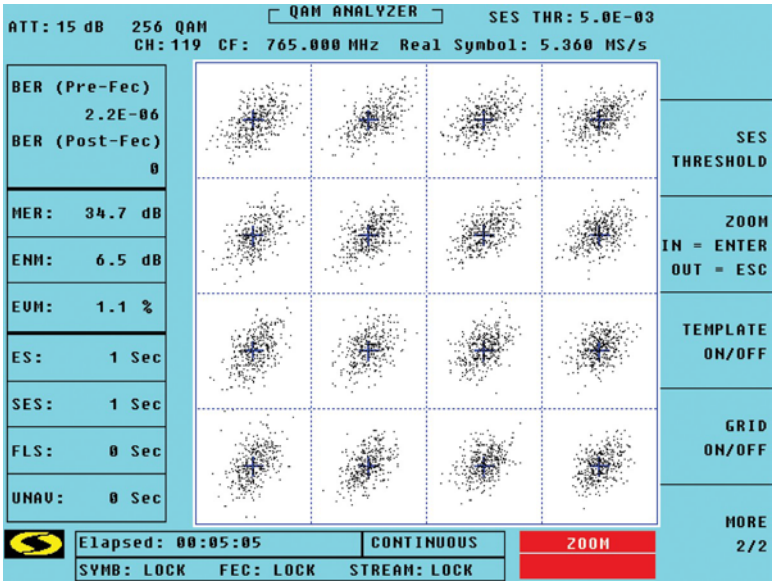


Figure 8-4: Zoom Display

To activate the Zoom function:

1. First select **F6** More 1/2 to go to the second menu level.
2. Press **F3** ZOOM to activate the zoom function. Use the rotary knob or arrow keys to move the frame to any one of the corners of the constellation.
3. Press **ENTER** to select the frame for zooming. QAM 64 has one level of zoom (from 64 to 16) and QAM 256 mode has two levels of zoom (256 to 64 to 16). Press **ESC** to zoom out. To toggle on or off the grid display, press **F5** GRID ON/OFF.

8.3.2 Symbol Display Settings

In constellation display mode, you can set select from three modes that determine the number of symbols displayed at any time.

To access the symbol display settings options:

1. From the QAM constellation display, press **TRACE**.
2. Select one of the display settings:

   F1 CONTINUOUS. In this mode, the AT2500 constantly populates the constellation display. It plots every symbol on the screen until stopped. There is no limit to the number of symbols that are displayed in this mode.

   F2 CYCLIC. In this mode, the AT2500 plots the number of symbols specified in the Sample Length field, then clears the screen and starts over.

   F3 TIME FILTER. In this mode, the AT2500 plots the number of symbols specified in the Sample Length field, then uses a first in/first out (FIFO) function to clear the oldest symbols and plot new symbols. The number of symbols displayed on screen is always the same.

   F4 SAMPLE LENGTH. Sets the number of symbols shown before clearing symbols from the constellation display.

8.4 Statistical Graph Display

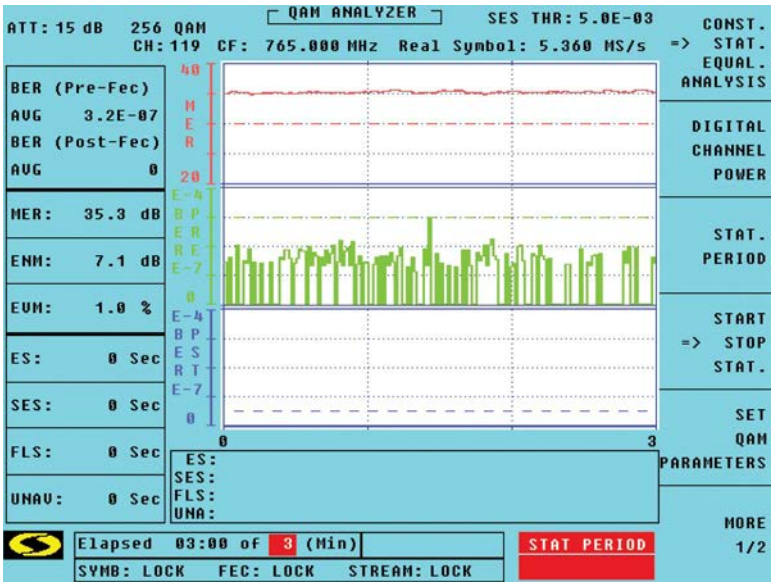


Figure 8-5: Statistical Graph Display

In addition to constellation analysis and the MER-EVM-ENM measurements, the AT2500 can gather and store statistics for a period of 1 to 60 minutes. With the VeEX, Inc. WinRemote II remote control software, the AT2500 can provide up to seven days of real-time acquisitions, with a 1-second resolution.

1. To activate the statistical display, use the **F1** key to select Stat.
2. Press **F3** key to select the desired acquisition period (1-60 minutes) in local mode.
3. To begin capturing data, press **F4** to start gathering statistics. The AT2500 displays four time markers for the following events:

   ES Errored second. Indicates the measurement seconds where there was at least one packet with an uncorrected error (post-FEC).

   SES Severely errored second within each measurement second. This means that the ratio of errored packets to transmitted packets is higher than the user-defined threshold (from 1E-4 to 1E-2).

   FLS Frame loss seconds. Indicates the number of measurement seconds where there was at least one frame lock loss.

   UNAV Unavailability time. Indicates that there has been at least 10 consecutive severely errored seconds.

The AT2500 dynamically updates the graph as it gathers new data for the MER-EVM-ENM as well as the ES, SES, FLS and Unavailability time markers. At the end of the user-defined period, the AT2500 saves all measurements so that they can be viewed as a global data set or viewed in detail.

The recorded measurements for BER (Pre and Post) represent the total period. However, during the measurement period, the AT2500 displays the values dynamically, second per second.

8.5 Adaptive Equalizer Display

To activate the adaptive equalizer display, use the **F1** key to select Equal.

The AT2500RQ can display the coefficients of the equalization filter, updated every second. This feature can be used to diagnose bandpass distortion (gain tilt, reflections).

There are three different displays in the equalizer screen:

- A bar graph showing the 32 coefficients: 8 Feed-Forward Equalizers (FFE) and 24 Decision Feedback Equalizers (DFE). The eighth coefficient is the main signal path, so it is normally very close to 0 dB (unity gain).
- A frequency response graph (from +5 to -3 dB) over the defined channel bandwidth.
- A group delay graph showing the delay in nsec (from +50 to -30 nsec) across the channel bandwidth.

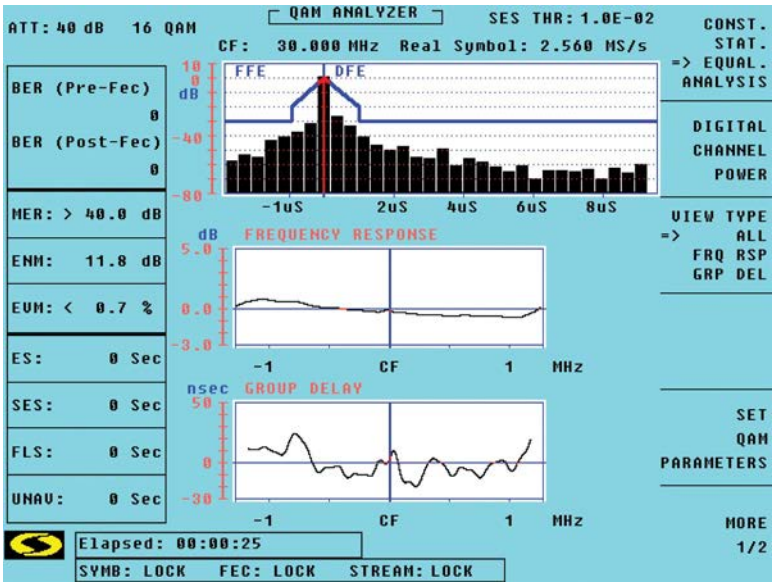


Figure 8-6: Equalizer Display in QAM Analyzer

See *Section 8.1, "Setting up the QAM Analyzer"*, to select the settings for the various equalizers.(i.e. In-band, FFE and DFE).

8.5.1 Frequency Response Display

The frequency response graph can be viewed independently from within the Equalizer Display by using the **F3** key to select FRQ RSP.

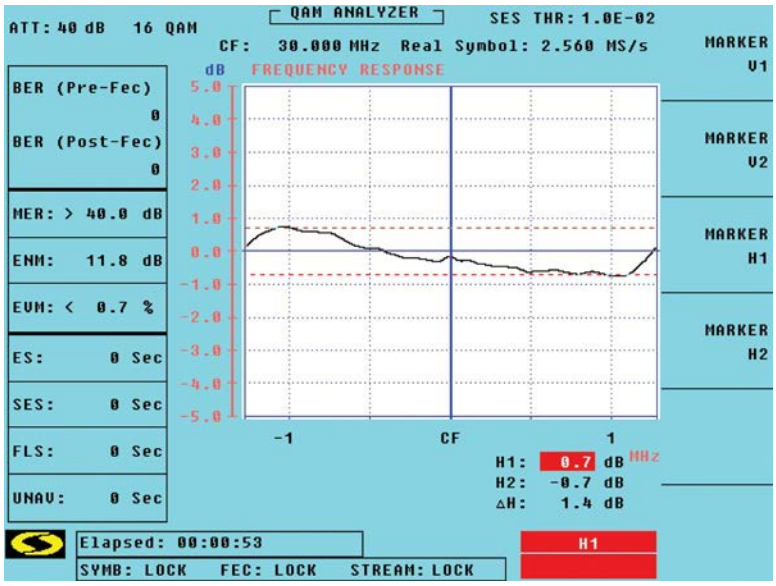


Figure 8-7: Frequency Response in Equalizer Display

In this mode, vertical and horizontal markers are available to perform specific measurements. The above figure for frequency response shows horizontal markers H1 and H2 used to measure the peak to valley of the frequency response plot.

8.5.2 Group Delay Response

The group delay response can be viewed independently from within the Equalizer Display by using the **F3** key to select GRP DEL.

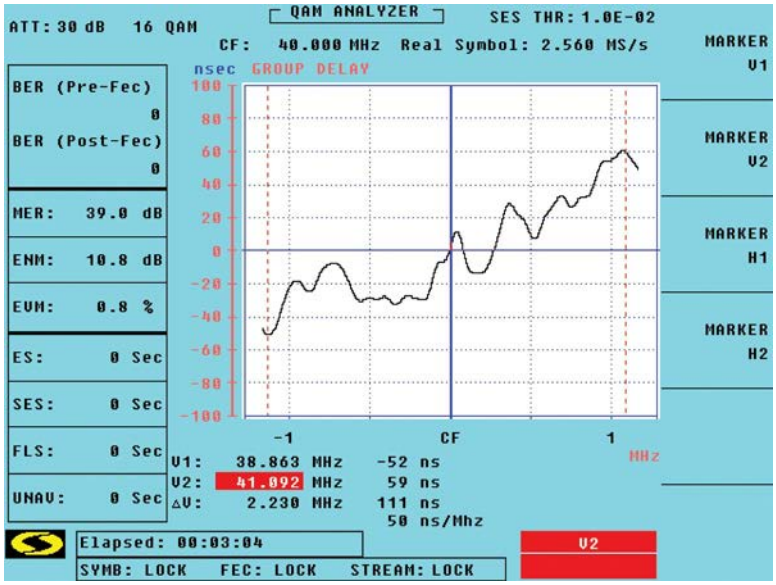


Figure 8-8: Group Delay Response in Equalizer Display

In the above group delay figure, vertical V1 and V2 markers indicate the frequency and delay at each point. When both V1 and V2 are used, the delta values in both frequency and time are displayed. Additionally, the slope of the curve between marker points is indicated in ns/MHz.

8.5.3 QAM Normalization

The AT2500 allows multiple QAM Normalization tables to be saved in memory. This is useful when the AT2500 is used as a test instrument to characterize QAM signatures such as in an equipment manufacturing application. For additional information on this application of the AT2500 please contact VeEX, Inc..

This feature is typically not used in regular cable TV applications.

Storing a QAM normalization table will override the default settings and can severely effect performance if used improperly.

To activate the QAM Normalization function:

1. First select **F6** MORE 1/2 to go to the second menu level.
2. Press **F1** NORMALIZE. to activate the QAM Normalization function. Use the softkey menus:

   F1 ADD NEW NORM. TABLE to save a new normalization table.

   F2 SELECT/UNSELECT CURRENT ITEM to select normalization table.

   F3 RENAME CURRENT ITEM to rename selected normalization table.

   F4 DELETE CURRENT ITEM to delete the selected normalization table.

8.6 QAM Impairment Analysis (QIA) Display

The QAM Impairment Analysis (QIA) function displays the results of 14 measurements at once:

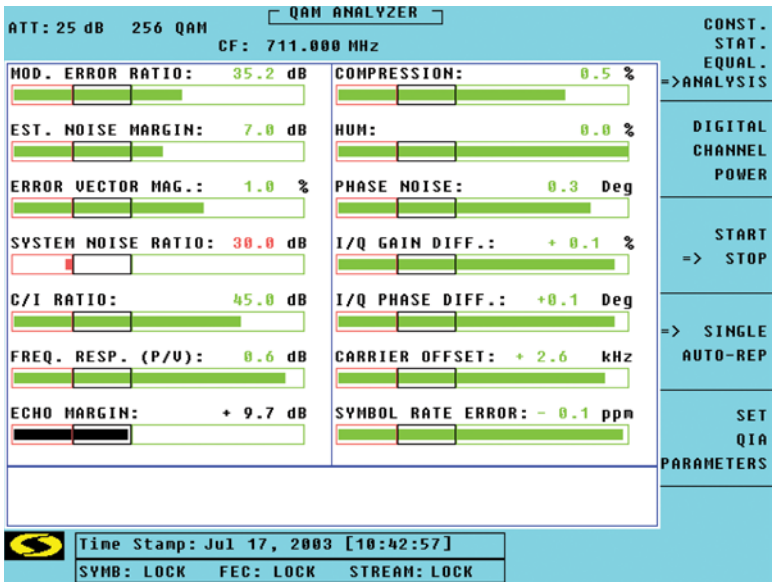


Figure 8-9: QAM Impairment Analysis (QIA) Screen

To activate the QIA display:

1. From QAM analyzer mode, press **F1** to select Analysis.
2. Press **F5** Set QIA Parameters. The AT2500 has two separate tables for 64 QAM and 256 QAM. Impairment Analysis for 16 QAM is not available.

3. Press **F1** to select the appropriate table for the signal modulation type. Choose a value for the Minor and Major limits of each parameter. The values you choose determine the limits of the color bar graphs in QIA mode (red, yellow, green). The following parameters can be set:

- Mod. error ratio (MER)
- Estimated noise margin (ENM)
- Error vector magnitude (EVM)
- I/Q gain differential
- I/O phase differential
- Phase noise
- System noise ratio
- Carrier offset
- Symbol rate error
- Carrier/Interference (C/I) rati o
- Compression
- Frequency Response (P/V)
- Echo margin
- Hum

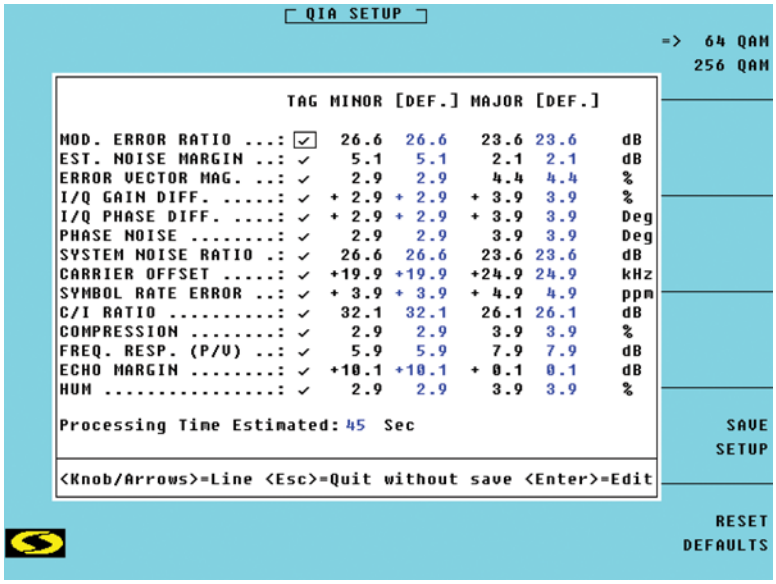


Figure 8-10: QIA Setup Menu

4. Press **F5** to save the setup and return to the QAM analyzer analysis screen.
5. Press **F3** to start the signal analysis.

9 WinCom II

9.1 Product Overview

The WinCom II software package is a data management software that is used with the VeEX, Inc. AT2000 and AT2500 series spectrum analyzer products, providing access to the information collected with the analyzer, enabling firmware upgrades, and allowing you to download files to the analyzer or store files on your PC.

The WinCom II software package communicates with the AT2500 series analyzers and also incorporates a version of WinCom for the AT2000 series. Many of the commands are common to both programs, especially for the AT2000 series. Unless otherwise stated, instructions are the same for both programs. Wherever required, this manual specifies whether the command is only for WinCom or only for WinCom II.

The WinCom application offers a built-in charting utility, TraceView. TraceView utilizes your PC to display the data collected with the analyzer so you can analyze, chart, and print various reports to help effectively manage your cable system. This utility displays record traces and exports measurement data directly to the Windows clipboard, in BMP format, to a VeEX, Inc. or FamilyWare proof of performance file (.CSV and .TSD), or an ASCII text file (.CSV) for processing in a spreadsheet program.

The WinCom II software package also provides an easy way of upgrading the AT2000 and AT2500 analyzers with the latest firmware, without having to return the unit to the factory.

Some upgrades require hardware changes as well as new firmware. In these situations, the unit must be returned to the factory.

Before using the WinCom or WinCom II software, you should already have a working knowledge of your model of the VeEX, Inc. spectrum analyzer and you should know how to save measurement data and site information. It is assumed the user has a basic knowledge of computers, the Windows operating system.

9.2 Preparing to Install WinCom II

Before you install WinCom II, make sure your computer meets the minimum requirements. To save time connecting your spectrum analyzer to your computer, make sure you have the right cables. Cables for direct connections are provided.

System Requirements

The following table shows the recommended minimum WinCom II requirements.

Category	Minimum Requirements
Machine Class	Pentium, 1 GHz or better
Main Memory	256 MB of RAM
Display/Video card	SVGA, 800 x 600 resolution
CD-ROM	Any type
Hard Disk Size	500 MB
LAN	Ethernet 10/100
Operating System	Windows 2000 or Windows XP

You need to connect your PC to a VeEX, Inc. spectrum analyzer in order to transfer files or upgrade firmware. Three standard connection types are supported:

Connection Type	Required Cable
Networked Ethernet communications (using a hub)	Standard Ethernet cable
Direct (PC to analyzer) Ethernet communications	Crossover Ethernet cable
Direct (PC to analyzer) serial communications	Null modem cable

9.2.1 Connecting to an Analyzer

The AT2000 and AT2500 analyzers support a direct RS-232 connection, a direct Ethernet 10Base-T connection or an Ethernet connection to a local area network (LAN). Null modem cables for direct connections are provided with WinCom II. For a LAN connection, use standard Ethernet cables. These cables are not provided.

On the analyzer, set up the remote connection. See *Section 9.2.4* for complete instructions on setting up TCP/IP or serial communications. Check the following:

- Make sure that you set the system type to Server.
- Make a note of the system ID since WinCom II requires this information to complete the connection setup.
- Make sure the analyzer is in remote mode.

The following sections cover the three possible connections (Figure 9-1):

1. an Ethernet connection to a local area network (LAN)
2. a direct Ethernet 10Base-T connection
3. a direct RS-232 connection

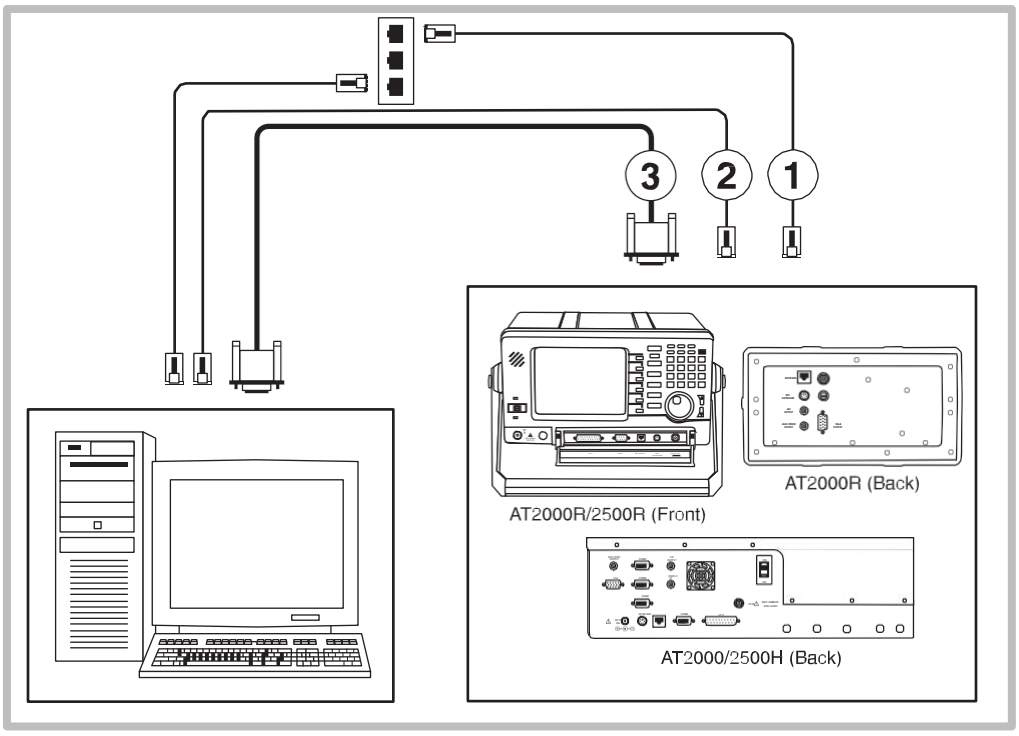


Figure 9-1: Connecting to an Analyzer

Cabling a Network Connection

To communicate over a LAN, the analyzer and your PC running WinCom II must be connected to the same network via a hub or router. Do not use crossover cables for these connections; use standard Ethernet cables. These cables are **not** provided.

Refer to Figure 9-1. These instructions are for ① in the diagram.

To set up a network connection:

1. Connect your PC to your network using a **straight-through** standard CAT-5 Ethernet cable.
2. Connect the analyzer to your network using a straight-through standard CAT-5 Ethernet cable. Use the RJ-45 jack on the analyzer. On “R” models, the RJ-45 jack is on the front of the unit. On “HM” models, the RJ-45 jack is on the rear of the unit.

Cabling a Direct Ethernet Connection

Refer to Figure 9-1. These instructions are for ② in the diagram.

To set up a direct Ethernet connection:

Connect your PC directly to the analyzer using a **crossover** Ethernet cable. This cable is provided with WinCom II. Use the RJ-45 jack on the analyzer. On “R” models, the RJ-45 jack is on the front of the unit. On “HM” models, the RJ-45 jack is on the rear of the unit.

Cabling a Direct Serial Connection

Refer to Figure 9-1. These instructions are for ③ in the diagram.

1. Connect your PC directly to the analyzer using a **null modem** serial cable. This cable is provided with WinCom II. Use one of the COM ports (DB-9 connectors) on the analyzer. On “R” models, the COM ports are on the front of the unit. On “HM” models, the COM ports are on the rear of the unit.
2. On the analyzer, set up the serial parameters for the remote connection. See *Section 3.4 , “Data Communications”*. Make sure that the communication parameters (baud rate, data bits, parity, etc.) match the settings on the analyzer before attempting communications. On the AT2500, please note that the maximum baud rate for serial communication is 115,200 baud.

9.2.2 Installing the WinCom II Software Package

You may receive WinCom II on a CD or from a Web download. The program’s content is the same for all media. To install WinCom II, you need to run the SETUP.EXE program. Access to this program varies according to the media.

To downgrade WinCom II to an older version, the newer version must be manually uninstalled before installing the older version. Do not install multiple versions of the software on the same computer since this impedes operation of all versions.

Media	Access to Setup Program
CD	With the WinCom II CD, the installation program starts automatically when the CD is inserted into the drive. If the program fails to start, browse to the root directory of the CD and click SETUP.EXE. Follow the onscreen prompts.
CD Suite	WinCom II may come on a CD containing other VeEX, Inc. software. Upon insertion of the CD, an installation program should automatically execute, allowing you to choose which of the applications to install. If the program fails to start, browse to the WinCom directory on the CD and click SETUP. EXE. Follow the onscreen prompts.
Web Download – ZIP File	Save the WinCom.ZIP file from the VeEX, Inc. website in a temporary directory on your computer, and then extract all of the files to a temporary directory, using PKUNZIP or WINZIP. Now, run the SETUP.EXE program, in the temporary directory, and follow the onscreen prompts. Once, installed, the temporary files can be deleted. Keep the ZIP file in case you need to re-install the software.
Web Download - EXE File	Save the WinCom-Inst.EXE file from the VeEX, Inc. web- site in a temporary directory on your computer and double-click on it to perform the installation. This self-extracting archive decompresses, installs and deletes temporary files automatically. Follow the onscreen prompts.

Once WinCom II is installed, contact VeEX, Inc. Sales Support to get a password to activate the software. See *section 11.2 Technical Support* for more information.

Registration

Every time you start an unregistered copy of WinCom II, the registration dialog box appears. When trying to launch WinCom II, the new dialog that appears will contain a Program ID. A license key is required to activate a 30-day or a fully licensed copy of the software. For the 30-day, once the time limit expires, the program will not function until registered.

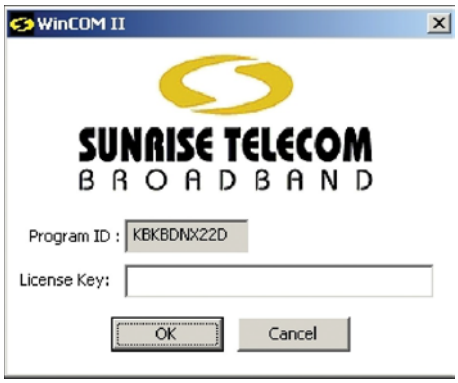


Figure 9-2: Registering WinCom II

To obtain your license key, contact VeEX, Inc. Customer Service.

VeEX, Inc. Customer Service Broadband Cable Group
Phone: 1-800-701-5208 or 1-408-360-2200
Fax: 1-408-363-8313
Email: catv_tech_support@sunrisetelecom.com

The program ID from the registration dialog box (Figure 9-2) will be requested by a Customer Service representative who will provide you with a password that can only be used on the registered computer. Once registered, you can proceed directly into the program when you start up WinCom II.

9.2.3 Setting up WinCom II

WinCom II can store multiple connection settings for the AT2000 or AT2500 series analyzer. When you create a connection setup, you must specify which type of analyzer you are using. Once connected, WinCom II displays only the functions that are available on the analyzer model you have specified. For example, with an AT2500, WinCom II displays menu options that only apply to a 1.5 GHz device. These options do not appear for the 1 GHz AT2000.

9.2.4 Setting up Communications

Creating a New Connection

To create a connection between your computer and the analyzer, go to WinCom II's **Options** menu and select **Communication Settings**. The device access configuration window appears.

The first time you call up this window, the fields are grayed out because there are no connections in the list. On the left side of the device access configuration window, click the "+" symbol to add a new device. You can now set up the connection to this device.

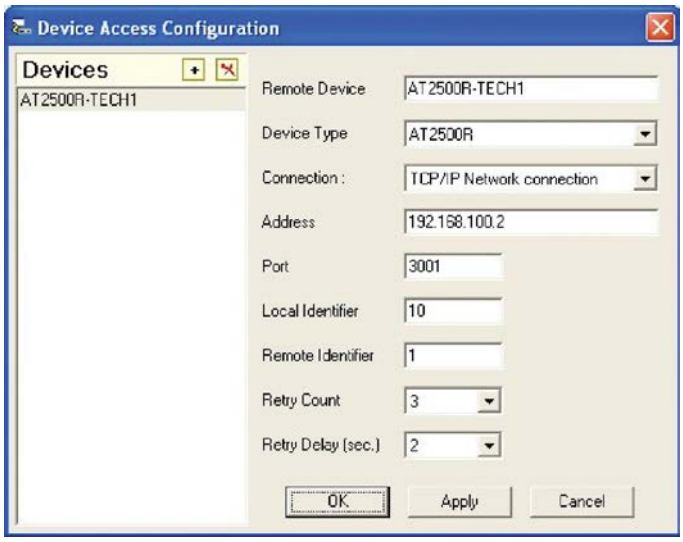


Figure 9-3: Setting Up Communications

1. In the Remote Device field, choose a name for the device. You can enter up to 16 characters, including spaces. This name must be unique. It appears in the list of possible devices when you choose Logon from the Communication menu.
2. In the Device Type field, select AT2000R, AT2000HM, AT2500R or HM. Make sure that you identify your device correctly. WinCom II uses this field to present appropriate menu choices for your device during initial handshaking.
3. In the Connection field, choose either "TCP/IP Network connection" or "Serial connection via COM*n*", indicating your PC's COM port (1 to 4). If you are using a modem, you must configure it in Windows and not in WinCom II. For direct serial connections, a null modem cable is required. For a direct TCI/IP connection, a crossover Ethernet cable is required.

   Depending on whether you are using a serial or Ethernet connection, WinCom II displays the appropriate fields so that you can specify the communication parameters.

Connection	Field	Description
TCP/IP	**Address**	Enter the IP address assigned to the analyzer to which you are connecting. Find out what address has been assigned to the analyzer before you can communicate with it. If the analyzer is connected to a LAN, it may be set up to receive its IP address from a DCHP server. If it is set up to use a static IP address, it may still be set to the factory default, which is 192.0.1.200.You can change the static IP address of the analyzer if desired. (Refer to the *Section 3.4.1* for instructions.)
	Port	Enter the port used for TCP/IP communication with the analyzer. It is possible to use a common IP address for multiple devices in one site and assign each of the units a different port number. You should generally use port numbers above 3000. The default port is 3001. **Note:** Avoid assigning port numbers that conflict with standard ports (such as port 21 reserved for FTP) or ports in use by other programs or equipment.
Serial	**Baud rate**	Select the port's speed (baud rate) for serial communications. The analyzer's default baud rate on COM 1 is 115,200. Possible values range from 2400 to 115,200. Choose a slower baud rate if the RS-232 cable connecting the PC to the analyzer is long. The speed on your PC's port and on the analyzer must match.

4. In the Local ID field, enter a number for your PC. It must be unique from all other local IDs in the system. The default is 10 and ID numbers may range from 10 to 98.
5. In the Remote ID field, enter the system ID assigned to the analyzer. By default, the spectrum analyzer's system ID is set to 1. When you have multiple devices on the same serial connection, the ID must be unique. For TCP/IP communications, the remote ID does not need to be unique since the IP address is used to route data to the correct unit.
6. In the Retry Count field, select the number of times (from 3 to 6) you want WinCom II to attempt to connect to an analyzer before responding with a timeout message.
7. In the Retry Delay (sec.) field, enter the number of seconds (from 1 to 10) that WinCom II should wait before attempting to connect again to the analyzer.
8. Click OK to save the setup.

Editing a Connection

To make changes to an existing connection between your computer and the analyzer:

1. In WinCom II's Options menu, select Communication Settings. The device access configuration window appears.
2. On the left side of the device access configuration window, select one of the devices from the list. Its name now appears in the Remote Device field. Keep this name unless you need to rename the connection.
3. Make any changes to the connection parameters. See steps 2 to 8 in the *Creating a New Connection* subsection in *Section 9.2.4*. Remember to click Apply or OK to save your changes.

9.2.5 Checking the Spectrum Analyzer Setup

Once the device connection has been defined, make sure that the spectrum analyzer is set up and connected to the PC or the network, and that the correct ports and cable are used. Before attempting to log on, please check the following:

1. You have connected the proper cabling.
2. The AT2000 has firmware version 4.21 or higher; and the AT2500 has firmware 1.00 or higher.
3. You have configured the analyzer's settings. Verify that:
   - You are using the appropriate port and setup
   - The unit is in server mode (system type is set to "Server")
   - The system ID is correct
   - The analyzer is in remote mode. From any mode except Menu, press the COMM function button to put the unit into remote mode. Or, select the Remote icon in the menu, and then select a mode such as Spectrum Analyzer.
4. You have configured the communications in WinCom II to match the communication settings in the analyzer.

If your current session crashed while connected to the analyzer, it may take up to three minutes before Windows will close the socket and before the analyzer will allow another log on attempt.

9.2.6 Logging on to a Spectrum Analyzer

The Communication menu in WinCom II includes two options for logging on to a spectrum analyzer:

- **Logon** - attempts to establish a communication link with the analyzer, using the last connection that was selected.
- **Logon Using** - allows you to select a connection from a list.

Depending on the type of connection, it may take some time to establish the connection.

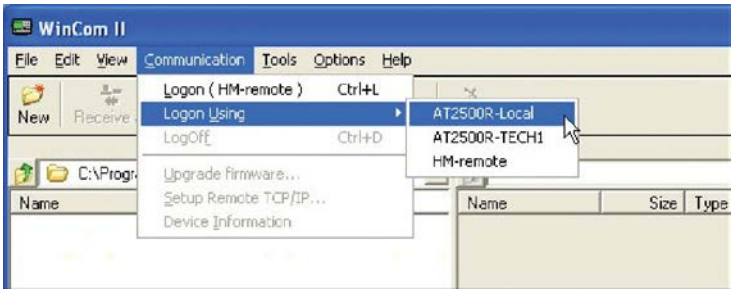


Figure 9-4: Choosing a Logon Setup

To start a session with a spectrum analyzer:

1. From the Communication menu, select either Logon or Logon Using. Make sure you choose a device that is connected to the PC or to the network.
2. If you were able to start the session successfully, the Remote Files pane on the right side of the window should now list the files in the remote spectrum analyzer.
3. To end your session, select Log Off from the Communication menu. This terminates the communication link to the analyzer, freeing it for use by others and allowing WinCom II to connect to another analyzer.

9.2.7 Choosing the Date Format

You can choose the date and time format that you want WinCom to use. This function is only available in WinCom.

To select a date format:

1. In the WinCom II Tools menu, select Launch WinCom. This opens a separate window for WinCom.
2. In the Options menu, select Date Format. A window appears for selecting international or U.S. standard formats.
3. From the drop down list, select the format you want to use. To help you choose, an example of the selected format appears at the bottom of the window.
4. Click OK to confirm your choice. WinCom updates the date display on any traces that you are viewing (see *Section 9.4, "TraceView"*).

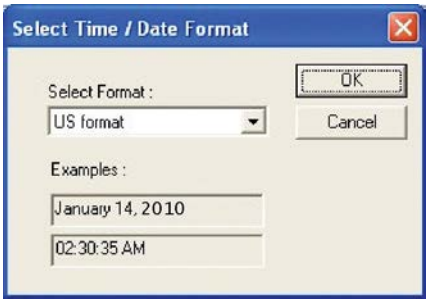


Figure 9-5: Setting the Date Format

9.3 File and Record Management

Each VeEX, Inc. AT2000 or AT2500 series analyzer can store measurements, traces and instrument settings in non-volatile memory. WinCom II is used to transfer data between your computer and a VeEX, Inc. analyzer, as well as manage the various files on your computer and on your analyzer.

When you first start WinCom II, there are no files stored on your computer. To begin storing traces and settings on your computer, you must first establish a connection with a spectrum analyzer. Then, you can retrieve files from the remote analyzer. To upload files from your computer to a remote analyzer, you must first create the file (such as a channel plan) or download the file from another analyzer.

For information on exporting records and instrument settings for proof-of-performance or FCC testing and compliance documentation, refer to section 9.4.6, "Exporting Data".

9.3.1 Naming Files and Records

WinCom supports two types of databases: the Records Database (Records.bin) and the WinCom Database File (*.WCD). Only the records database is uploaded to a remote analyzer. The number of traces that can be stored in a records database file is limited to 100 trace records for the AT2000 model. The WinCom database does not have a record count limit but is limited to the amount of free disk space you have. Always leave enough free disk space for Windows to operate properly.

WinCom II operates differently because the AT2500 series has a different file structure. It stores traces and settings as individual files, rather than as a database. The AT2500 can store 100 instrument settings and 250 trace records.

Each AT2000 and AT2500 file that you can retrieve or upload appears in the following table. Upon retrieval, AT2500 files retain the same name and file extension as the one that was used on the analyzer. For the AT2000, however, the files are renamed with the file extension indicated below. You can choose the first part of the file name.

AT2000 Files	AT2500 Files	Content
Records.bin (saved as *.bin on PC)	*.xml in Records directory	Stored measurement records and traces.
Settings.bin (saved as *.set on PC)	*.xml in Settings directory	Stored instrument setups.
Plans.bin (saved as *.pln on PC)	*.acp in Channel Plans directory	Channel plans for NTSC, PAL or other television standards.
Colors.bin (saved as *.clr on PC)	Colors.clr in Color Settings directory. You cannot change this name on the PC.	Customized color settings used on the analyzer.
Param.bin (saved as *.par on PC)	Params.prm in Parameter File directory. You cannot change this name on the PC.	User preferences for the analyzer.

Table 9-1: Files Stored in Analyzers

9.3.2 Data Management in the AT2500 series (WinCOM II)

This section applies to the AT2500 series analyzer and the WinCom II user interface. See *Section 9.3.3, “Data Management in the AT2000 Series”* if using an AT2000 series analyzer.

9.3.2.1 Selecting a Record

Instead of storing all records in one database file, the AT2500 stores each individual record in a specific directory (see Table 9-1). However, WinCom II stores the individual records in any directory you want. You may want to organize your records by type.

To select a record in WinCom II:

1. Browse to the desired directory. By default, WinCom II calls up the list of files in the \VeEX, Inc. directory. If required, browse to another directory. To do so, go to the File menu and choose Select folder, or use the drop down directory list in the Local Files pane to select a folder.
2. Once you are in the correct folder, click on a record to copy it to a remote AT2500

if you are already logged on.

9.3.2.2 Copying AT2500 Records with WinCom II

Use WinCom II's main interface to retrieve individual records or a set of records. In order to retrieve records from the AT2500, you must establish a communication connection with the AT2500. Note that in order to use WinCom II, the AT2500 must be put in remote mode. From any mode except Menu, press the COMM function button to put the unit into remote mode. Or, select the REMOTE icon in the menu, and then select a mode such as Spectrum Analyzer.

When you log on to an AT2500 series analyzer, you may see only the files on the right, in the Remote Files pane. By default, WinCom II displays the records in the AT2500's Traces directory. Browse to the correct directory on the AT2500 before you select a record.

To copy files to your computer from the remote analyzer:

1. Log on to an AT2500 series analyzer.
2. In the left pane, select the destination directory for your local files. By default, WinCom II opens the \VeEX, Inc. directory. To go to another directory, use the drop down window or use the File menu to choose Select Folder, Parent Folder or New Folder.
3. Browse to the appropriate directory on the AT2500. To display the directories, use the drop down box in the Remote Files pane on the right side of the window.
4. Select a record from the right pane, and then drag it to the left pane, or click Receive in the toolbar. You can also select Copy from the Edit menu. This step may be repeated for each record or for multiple records transfer. See Figure 9-6.
5. Multiple records may be selected in the Remote files (right pane) by holding down the SHIFT and/or CTRL key on the computer and clicking on the records you want transferred over. Once selected, either drag and drop the records, or click on RECEIVE in the toolbar to transfer them. If you want to copy all the records at one, click RECEIVE all in the toolbar.

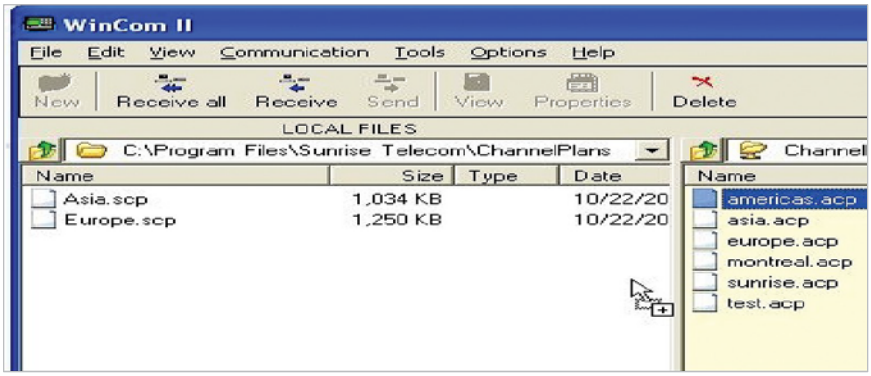


Figure 9-6: Dragging a Record from a Remote AT2500 to the Computer

To copy files from your computer to the remote AT2500 analyzer:

1. Log on to an AT2500 series analyzer.
2. In the right pane, select the directory on the remote AT2500 where you want to store the record. See Table 9-5 for a list of directories that the AT2500 uses to store records.
3. Browse to the appropriate directory on the AT2500. To display the directories, use the drop down box in the Remote Files pane on the right side of the window.
4. Select a local record from the left pane, and then drag it to the right pane, or click Send in the toolbar. You can also select Copy from the Edit menu and then select Paste when your cursor is in the Remote Files pane. This step may be repeated for each record, or for multiple records transfer, proceed to the next step.
5. Multiple records may be selected in the local pane by holding down the Shift and/or Ctrl key on the computer and clicking on the records you want transferred over. Once selected, either drag and drop the records or click on **Send** in the toolbar to transfer them.

9.3.3 Data Management in the AT2000 Series (WinCOM)

The following sections apply to the AT2000 series analyzer and the WinCom user interface. See the previous *Section*, *"Data Management in the AT2500 Series"* when using an AT2500 series analyzer.

9.3.3.1 Opening a Records Database

A Records Database file is an AT2000 format file, named RECORDS.BIN on the AT2000. It contains trace records such as captured analyzer traces and the analyzer settings corresponding to the trace. The number of traces that can be stored in a Records Database file is limited to 100 or 200 trace records, depending on the storage capabilities of your AT2000 model.

To open a Records database on a remote analyzer:

1. Connect to an AT2000 analyzer.
2. WinCom detects a connection with an AT2000 analyzer and opens the WinCom interface. The current Records Database file is displayed in the Traces pane on the right. You can now click on a record and view its properties, delete it, or copy it to your computer.

If you already have record database files stored on your computer, you can also open one of these files for editing.

To open a Records database if you are offline:

1. If you are not already in WinCom, go to the WinCom II Tools menu and select Launch WinCom. This opens a separate window for WinCom.
2. In WinCom, go to the File menu and select Open. Select a file that has the extension .BIN and click Open.

By default, WinCom calls up the list of files in the \VeEX, Inc.\Databases directory. If required, browse to another directory to locate the database file you want to open.

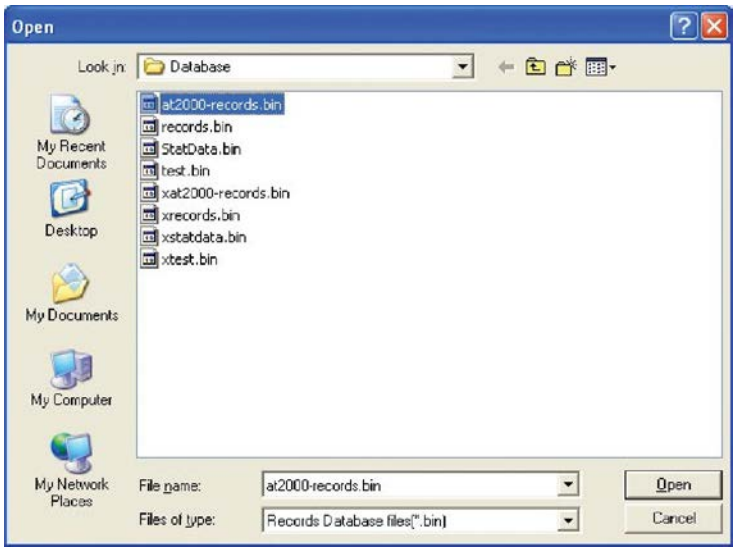


Figure 9-7: Opening a Records Database File

3. Once you click Open, the content of the records database appears in the right pane. You can now click on a record to view its properties or to delete it. You can also copy files in this records database to a WinCom database. See *Section 9.3.2.2 "Copying AT2500 Records with WinCom II"* for information on copying records and updating files.

9.3.3.2 Opening a WinCom Database

The WinCom database file is used for archival storage of AT2000 traces on the PC. It does not have a trace count limitation. It can be used for long-term storage of traces from multiple AT2000s. You can select trace records and convert then to a records database file that can then be uploaded to any AT2000 providing that you do not exceed the storage capacity of the AT2000.

You do not have to be connected to an analyzer in order to open a WinCom database.

To open a WinCom database:

1. In WinCom II, go to the Tools menu and select Launch WinCom. This opens a new window showing the WinCom interface.
2. In WinCom, go to the File menu and select Open. Select a file that has the extension .WCD, and click Open.

By default, WinCom calls up the list of files in the \VeEX, Inc.\Databases directory. If required, browse to another directory to locate the database file you want to open.

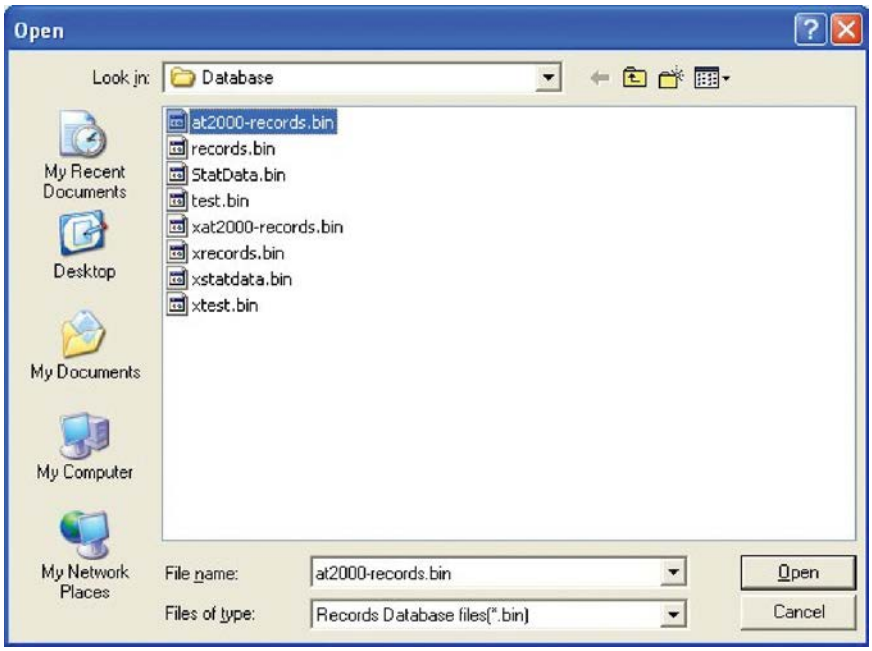


Figure 9-8: Opening a WinCom Database File

3. Once you click Open, the content of the WinCom database appears in the left pane. You can now click on a record to view its properties or to delete it. You can also copy one or more records to a remote AT2000 if you are already logged on.

9.3.3.3 Retrieving and Updating Traces (WinCom)

The Update and Retrieve options in the Communication menu are used to transfer data between WinCom and your AT2000 analyzer. You need to be connected to an AT2000 in order to transfer records. When you click the Update or Retrieve button, WinCom displays the list of files that you can transfer to and from the remote analyzer (see Figure 9-9).

Figure 9-9: Selecting Files for the AT2000 Series Analyzer

To copy a file from the remote analyzer to WinCom:

1. Log on to an AT2000 series analyzer.
2. Click on Retrieve in the WinCom database file management window (see Figure 9-10).
3. In the file selection window (see Figure 9-9), open the file on the remote analyzer that you want to retrieve. By default, WinCom selects the traces in the records database. However, you can select other files such as user parameters, colors, channel plans, etc.
4. Once you have selected the file, click OK. In the Save As window, choose a file name and directory. WinCom saves the file with the correct file extension according to the type of data you have selected. See Table 9-1 for a list of files and their extensions.
5. Click Save to begin retrieving the data from the remote analyzer.
6. For archival storage you may proceed to copy some or all of the desired traces by clicking on the copy or copy all buttons to move the traces from the right pane to the left pane of the WinCom database.

To copy a trace from WinCom to a remote analyzer:

1. Log on to an AT2000 series analyzer.
2. Click on copy to move the traces within the file from the WinCom database content (left pane) to the records database (right pane), (see Figure 9-10: WinCom Database File Management Window). The traces selected and copied to the records database will be the ones that will get moved over to the remote analyzer.
3. Click Update in the File transfer area in the center of the WinCom screen, or select Update from the Communication menu.
4. In the file selection dialog choose the specific file you want to upload to the remote analyzer. You must choose a file with the correct file extension, according to the type of data you have selected. See Table 9-1 for a list of files and their extensions. By default, WinCom selects the traces in the records database file. However, you can select other files such as user parameters, colors, channel plans, etc.
5. Click OK to begin copying the traces in the file to the remote analyzer.

IMPORTANT: *Any files you upload from WinCom to the AT2000 will overwrite the files with the same name on the remote analyzer. Data on the analyzer will be lost. This action cannot be undone.*

9.3.3.4 Creating and Updating Database Files (WinCom)

WinCom's Copy Trace options can be used to create and edit records database files and WinCom database files without logging on to an AT2000 analyzer. This "offline" mode is useful for organizing records in the WinCom database or the records database. Once you are ready to transfer files or individual records, log on to an AT2000 series analyzer. The analyzer's current Records Database file appears in the Traces pane on the right. You can now add to this remote database by copying traces from the WinCom database to the remote AT2000.

To copy traces with WinCom, you need to use the two panes in the main interface:

WinCom Database Frame	On the left side of the window, the WinCom database pane lists the traces in the current WinCom database file.
Traces Frame	On the right side of the window, the Traces pane lists the traces in the current Records.bin database file on a remote analyzer or in a records database file on your computer. If no records database is selected, this pane is empty (see Figure 9-10). You can add traces to this pane to update a database.

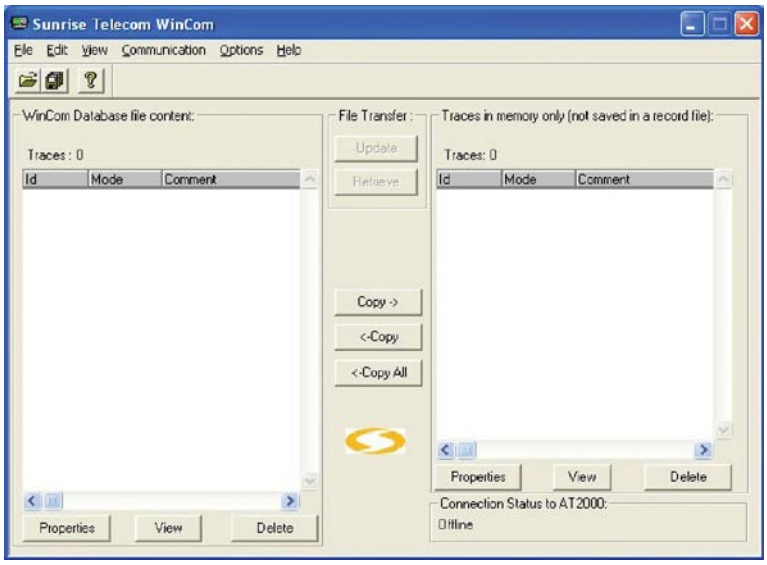


Figure 9-10: WinCom Database File Management Window

9.3.3.5 Creating and Updating a Records Database File

You can use stored records on your computer to create or update a records database file. This new or updated database file can then be uploaded to a remote analyzer when you are ready.

To create or edit a records database file:

1. Open the records database (see *Section 9.3.3.1, "Opening a Records Database"*) or the WinCom database (see *Section 9.3.3.2, "Opening a WinCom Database"*) that contains the records you want to include in your new or updated records database.
2. Select a record from the right pane (WinCom Database), and then click Copy. If you are editing a records database, you can also remove records. First, select the record(s) in the right pane then press Delete on your keyboard, or click the Delete button in the right pane. The records in your new records database appear on the right in the Traces pane. These records are stored in volatile memory until they are saved.

To select multiple records, press the Shift key or the Ctrl key before you click Copy or Delete.

3. Repeat step 2 until you have all of the records you need in the list of traces.

4. Save your changes.
   - To save the new records database file, go to the File menu and select Save, then Records Database. Choose a name for the file and click OK. You must keep the extension .bin.
   - To save changes to an updated records database, select Save As, then choose the name of your existing records database. Confirm the update by selecting “Yes” when you are asked if you want to overwrite the existing file.

9.3.3.6 Creating and Updating a WinCom Database File

You can use stored records on your computer to create a new WinCom database file or add to an existing WinCom database. When no WinCom database file has been specifically opened, an empty untitled database is created.

To create or edit a WinCom database file:

1. Open a records database that contains the records you want to include in your new WinCom database.
2. Select a record from the right pane (Records Database), and then click Copy. If you are editing a WinCom database, you can also remove records. First, select the record(s) in the left pane then press Delete on your keyboard, or click the Delete button in the left pane. The records now appear in the left, in the WinCom database file content pane, as an untitled database. These records are stored in volatile memory until they are saved.

To select multiple records, press the Shift key or the Ctrl key before you click Copy or Delete. To copy records from more than one records database file, close the current records database first and then open another one. Repeat step 2 until you have all the records you need.

3. Repeat step 2 until you have all of the records you need for your WinCom database.
4. Save your changes.
   - To save the new WinCom database file, go to the File menu and select Save, then select WinCom Database. Choose a name for the file and click OK. You must keep the extension .WCD.
   - To save changes to an updated WinCom database, select Save As, and then choose the name of your existing WinCom database. Confirm the update by selecting Yes when you are asked if you want to overwrite the existing file.

9.3.3.7 Viewing and Editing Record Properties (WinCom)

The AT2000 Properties for traces can be viewed and edited with WinCom. The properties include the analyzer’s mode, site ID, comments, and the date and time that the trace was captured. The properties appear as they were entered on the analyzer from which the trace originates. A description of the abbreviated analyzer modes appears at the end of this section.

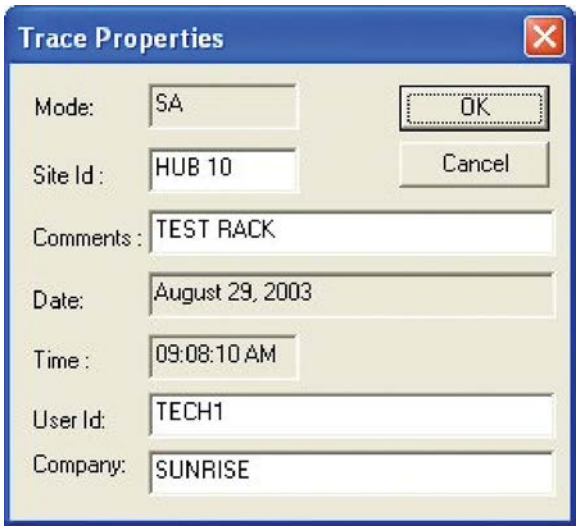


Figure 9-11: Viewing the Properties of a Record

To view or edit the properties of a trace:

1. Select the trace in the WinCom database or in the records database.
2. Click the Properties button in the appropriate pane: left pane for WinCom database, right pane for records database.
3. If desired, edit the user-definable fields. If the record is in a WinCom database, all fields except Mode, Date and Time can be edited. If the record is in a records database, only the Site ID and Comments fields can be edited. See Table 9-6for a description of the analyzer modes.

Editable Field	Format
Site ID	Up to 8 characters
Comments	Up to 40 characters
User ID	Up to 40 characters
Company	Up to 40 characters

4. Click OK to save your changes, or just click Close to exit the Properties window without making any changes.

Abbreviated Analyzer Modes Stored in Trace Records

Mode	Description
SA	Spectrum Analyzer Trace
TDM	Time Domain Measurement Trace
SLM1	Signal Level Meter Bar Graph (Frequency Counter)
SLM2	Signal Level Meter Bar Graph (TV Channel Mode)
SLM6	Signal Level Meter Bar Graph (6 channels)
HUM	Hum Modulation Trace

Mode	Description
DIST	Distortion Trace
AUTO	Auto Test
DPWR	Digital Power
QAM	QAM Trace
BAS	Bidirectional Alignment Trace
DM	Depth of Modulation
FR	Frequency Response
VID	Video

9.4 TraceView

WinCom II's built-in charting utility, TraceView, utilizes your PC to display the data collected with the analyzer. You can view any .XML trace file in WinCom II or you can open a database in WinCom that contains captured traces and double-click on a trace record to open the TraceView utility.

Once you have called up a trace, you can analyze data, print various reports or export measurement data directly to several formats such as .BMP or .CSV. For AT2500 series traces, the traces can be exported directly from TraceView to proof of performance reports such as VeEX, Inc. PoP (.CSV) or FamilyWare (.TSD). For AT2000 traces, you must first export the traces to an ASCII file (.CSV), and then import this file into the VeEX, Inc. preformatted Excel file (SunrisePoPMacros. xls) that includes macros for formatting data from .CSV files.

This chapter explains the functions for analyzing, printing and exporting data from the TraceView utility.

9.4.1 Viewing Trace Records

You can call up a trace record in either WinCom or WinCom II. WinCom opens records captured with the AT2000 series analyzer in the 1 MHz to 1 GHz range, whereas WinCom II opens .XML records captured with the AT2500 series analyzer in the 1 MHz to 1.5 GHz range.

9.4.1.1 Viewing AT2000 Traces

To view traces that were captured with an AT2000 series analyzer, you need to launch WinCom before you can use the TraceView utility.

1. In WinCom II, go to the Tools menu and select Launch WinCom.
2. Use the File menu and open any records file (.BIN) or database file (.WCD) that contains traces.
3. Double click on a trace in the file to open the TraceView utility and display the trace.
4. To view another trace from the same records file or database file, select Recall Records from the View menu to display the list of records in the most recently opened file. If the toolbar is displayed, you can click the Recall button.
5. To open a trace from a different file, select Open Database from TraceView's File menu, and then select a records file (.BIN) or database file (.WCD). When the list of records appears, select a trace and click Display to view it in the TraceView window.

9.4.1.2 Viewing AT2500 Traces

To view traces that were captured with an AT2500 series analyzer, use WinCom II's View menu. This opens the Trace View utility.

1. In WinCom II, browse to the directory where your traces are stored.
2. Highlight any .XML file that is a trace. If the trace you would like to view is that of a video trace (ie. a trace with the file extension .vid.xml), then proceed to *Section 9.4.3.6*.
3. Go to the View menu and select Trace.

You can also click the View button or simply press F7 on your keyboard when the trace is selected.

If the .XML trace file being viewed is that of a multiple trace display, one can turn on and off, each of the 4 possible traces within the display, by selecting the trace and checking on the trace to display and checking off the trace to hide. See Figure 9-12 below.

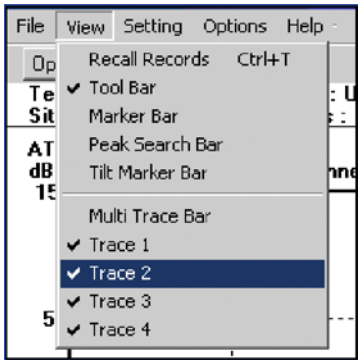


Figure 9-12: Viewing Multiple Traces

In addition, if the Multi Trace Bar is checked on, the displayed file will reveal the bar allowing the user to select via the individual trace buttons, which of the multiple traces is to be displayed. See Figure 9-13 below.

Figure 9-13: Multi Trace Bar

4. To view another trace file, go back to WinCom II's main window and highlight a different .XML file. Do not use the recall button unless you want to view a trace captured with an AT2000 series analyzer.

9.4.2 Spectrum Analyzer Instrument Settings

In order to help you analyze the information that is on screen, the WinCom II software provides control over many spectrum analyzer display parameters when you are viewing a trace. For example, you can change the units of measure or set markers. However, the changes you make to the display parameters only apply to WinCom II's TraceView. None of the stored traces are affected, and no new settings are saved with the trace.

This section explains how to change certain display settings for a trace, such as:

- vertical scale
- reference level
- markers

9.4.2.1 Vertical Scale

WinCom II displays traces on a graticule with 10 dB per division. You can, however, change the scale on the vertical axis of the graticule in order to zoom in on the signal.

To change the vertical scale:

1. Go to the Setting menu and select Vertical Scale.
2. Choose how many decibels per division you want to use. Each division can be 2 dB, 5 dB, or 10 dB.
3. Click OK to view the trace with the new vertical scale settings.
   When you change the vertical scale, WinCom II repositions the signal. For example, if you chose a smaller scale, WinCom II hides the upper and lower portions of the signal. You may also want to change the reference level in order to view a particular portion of the signal. Note that the reference level choices reflect the number of decibels per division.

9.4.2.2 Reference Level

When WinCom II displays a trace, it uses the same reference level that was active on the spectrum analyzer when the trace was captured. However, if you change the vertical scale, you may need to change the reference level in order to view a specific portion of the signal.

To change the reference level:

1. Go to the Setting menu and select Reference Level.
2. Choose the reference level from the drop down list. The choices that are available reflect the vertical scale you are using and the upper and lower limits of the spectrum analyzer display at the time the trace was captured. For example, if you have selected a 2 dB per division scale, then you can set the reference level in steps of 2 dB.
3. Click OK to apply the new reference level. When you change the reference level, WinCom II repositions the signal. If you do not see the portion of the signal you are interested in, select another reference level.

9.4.2.3 Markers (Vertical, Horizontal, Peak, and Tilt)

View Marker Bar

If you use markers frequently, you can display the marker toolbar that provides shortcuts to activating the vertical and horizontal markers. To display this toolbar, go to the Settings menu and select View Marker Bar.

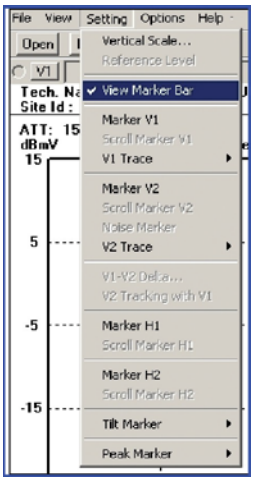


Figure 9-14: Settings menu

When a checkmark appears next to this option, the feature is active and the marker bar will appear as in the figure below. To hide the marker bar, go back to the Settings menu and select View Marker Bar again. The checkmark disappears, indicating that the marker bar is now disabled.

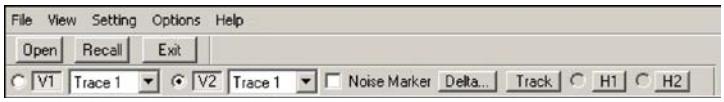


Figure 9-15: Marker bar

Markers (Vertical, Horizontal and Noise)

WinCom II includes two vertical markers, two horizontal markers and a noise marker to set level and frequency references. The vertical V1 and V2 markers indicate the frequency and, in certain appropriate spans, the level is also displayed. When both vertical markers are selected and displayed on the screen, the frequency and level deltas are automatically calculated. Instead of marker V2, you can choose to use the noise marker. When the noise marker is selected, WinCom II displays the noise in dB per Hz of the selected frequency.

When both horizontal markers are displayed on screen, WinCom II automatically calculates the delta levels, which can be useful for peak-to-valley measurements.

To turn on a marker:

1. Go to the Settings menu and select a marker: Marker V1, Marker V2, Marker H1, Marker H2 or Noise Marker. You can activate both vertical markers and both horizontal markers at the same time, but you cannot activate the Noise Marker at the same time as Marker V2. Alternatively, the marker bar can be used to activate the markers by selecting the marker buttons. When used in association with a multiple trace display, one can select the specific trace for which the markers are being used, via the drop down menu next to the vertical marker buttons.
2. A checkmark appears next to the active marker(s). To disable a marker, go back to the Settings menu and select the marker again. The checkmark disappears, indicating that the marker is now disabled. Alternatively, if the marker bar was being used, select the marker again to disable it.
3. Set your markers to the desired position by using the scroll bars at the bottom and on the right side of the screen (see next section).

Marker Scroll

The Scroll Marker choices in the Settings menu let you choose which marker is moved when you use the vertical or horizontal scroll bars at the bottom or on the right side of the screen.

This feature is only active when you are using the associated marker. By default, WinCom II activates the scroll function on the first marker you select. You can activate the scroll function on one vertical marker and one horizontal marker at the same time, but you cannot activate the scroll function on both vertical markers or on both horizontal markers. When the marker bar is being used, the scrolling function will only apply to the marker which has the small bullet icon next to it.

To activate the scroll function on markers:

1. Activate one or more markers (see preceding section).
2. Go to the Settings menu and activate the scroll function on a marker: Scroll Marker V1, Scroll Marker V2, Scroll Marker H1 or Scroll Marker H2. A small bullet appears to the left of the menu choice to indicate which marker you are moving when you use the scroll bars.
3. To disable scrolling on a marker, either disable the marker or activate the scroll function on another marker of the same type. For example, to disable scrolling of marker V1, select Scroll Marker V2. WinCom II automatically disables the scroll function on Marker V1.
4. Use the vertical or horizontal scroll bars to move the associated marker. For vertical markers, use the scroll bar at the bottom of the screen. For horizontal markers, use the scroll bar on the right side of the screen. The signal remains centered in the window.
5. A user may also input a preset delta value between the two vertical markers by selecting the V1-V2 delta option in the Settings menu, or selecting the Delta button in the marker bar. Either mode of selection will bring up the following dialog as shown in the figure below. The delta option allows the user to lock V2 to V1 at a specific frequency delta or offset so that both markers move together.

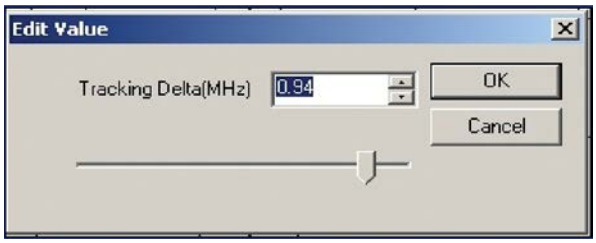


Figure 9-16: Tracking Delta dialog

6. The Track button must be toggled on so that the delta frequency between V2 and V1, defined in the previous step, establishes the locking of V2 to V1. Alternatively, the user may select the V2 tracking with V1 selection in the Settings menu to achieve the same functionality. When the scroll bar at the bottom of the screen is used, V2 and V1 will scroll together, with the delta frequency set between them, maintained. To disable the tracking of V2 to V1, click on the Track button to toggle off the functionality, or alternatively toggle off the V2 tracking with V1 selection in the Settings menu.

Peak Search Marker

The peak marker may be used to identify the various peak levels for a specific trace.

1. Go to the Settings menu and select the Peak Marker menu item, and then select the View Peak Search Bar menu item. Alternatively, the Peak Search Bar may be activated by selecting the menu item from the View menu. In either case, a check mark appearing next to the Peak Search Bar menu item indicates that this feature is active and will appear as in the figure below.

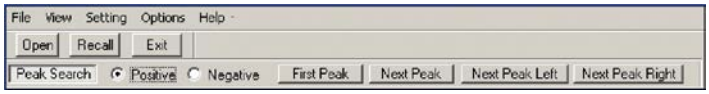


Figure 9-17: Peak Search Bar

2. Select the Positive or Negative peak search option within the Peak Search Bar. The small bullet will appear next to the active mode.
3. Select the First Peak button to select the highest peak when in the Positive mode, and the lowest peak in the Negative mode.
4. Select the Next Peak Left to find the next peak to the left of the current peak.
5. Select the Next Peak Right to find the next peak to the right of the current peak.

Tilt Marker

1. Go to the Settings menu and select the Tilt Marker menu item, and then select the View Tilt Marker Bar menu item. Alternatively, the Tilt Marker Bar may be activated by selecting the menu item from the View menu. In either case, a check mark appearing next to the Tilt Marker Bar menu item indicates that this feature is active, and will appear as in the figure below.

Figure 9-18: Tilt Marker Bar

2. Within the Tilt Marker Bar, select the Tilt Marker Shown button to show the active tilt marker.
3. Select the Tilt Low Freq button to set the low frequency reference value in the dialog that appears.
4. Select the Tilt High Freq to set the high frequency reference value in the dialog that appears.
5. Select the Low Freq Level to set the low frequency level (in dBmV) reference value in the dialog that appears.
6. Select the Tilt Offset to set the desired tilt level (in dB) reference value.

9.4.3 Defining Custom Settings for TraceView

TraceView can be customized so you can use the colors, temperature units and other units of measure that you want to. You can also show or hide toolbars.

This section explains how to change the settings of:

- colors
- temperature units
- display units
- toolbar display

9.4.3.1 Customizing the TraceView Colors

The color of the items displayed in TraceView can be customized to help you view and print the captured data.

To select a color scheme or custom colors:

1. Select Colors from the TraceView Options menu.

Figure 9-19: Choosing Color Options

2. Choose one of the four predefined color schemes:

Scheme	Description
Factory Default	This is the factory default color scheme, and is similar to the default indoor colors used on the spectrum analyzer.
B/W	This is a black and white color scheme. When printing on monochrome printers, a black and white scheme may be most suitable. Dark areas are minimized in order to conserve toner or ink.
Color Saving	This scheme limits the use of colors. It uses some color for traces, gridlines and markers while keeping everything else black and white to conserve toner or ink when printing.
Custom	This is a user-defined custom color scheme. Selecting this option restores the custom settings that were saved. Only one custom scheme can be saved in WinCom II.

3. If you want to use your own color scheme, start with the color scheme that is closest to what you want to use, and edit the component(s). The current color appears in a small box next to the item. To change this color, click on the item and select a new color from the choices. You can also create custom colors instead of choosing a predefined color.

There are eight editable screen components:

Component	Description
Graphic Background	This is the color of the graticule's background. Choose a color that allows enough contrast with the grid lines, traces, markers and thresholds.
Grid Lines	This is the color of the dotted grid lines.

Component	Description
Text	This is the color of the text that appears outside of the graticule.
Background	This is the color of the margin around the graticule, where text is shown. Choose a color that allows enough contrast with the text color.
Trace	This is the color of the captured trace or QAM signal.
Markers	This is the color of the vertical and horizontal markers and the zoom marker in QAM mode.
Trace2	This is the color of the second trace.
Trace3	This is the color of the third trace.
Trace4	This is the color of the fourth trace.
Thresholds	This is the color of the limit lines.

4. Once you have made your changes, click Save Custom to record your color scheme.

9.4.3.2 Choosing a Temperature Unit

The data captured with the spectrum analyzer includes the ambient temperature when the trace was captured. You can choose either Fahrenheit or Celsius in TraceView.

To change the temperature units:

1. Go to the Options menu and select Temperature Units to display the choices. A small bullet appears to the left of the menu choice to indicate which temperature unit is currently in use.
2. Select either Celsius or Fahrenheit. When you release the mouse, the TraceView display is updated with the new temperature units.

9.4.3.3 Display Units

The vertical axis on data captured with the spectrum analyzer is usually in dBmV (decibel referenced in a millivolt). You can change the units on the vertical axis to dBµV (decibel referenced in a microvolt) through TraceView's options menu.

To change the display units:

1. Go to the Options menu and select Display Units to display the choices. A small bullet appears to the left of the menu choice to indicate which temperature unit is currently in use.
2. Select either dBmV or dBµV. When you release the mouse, the TraceView vertical axis is updated with the new units.

9.4.3.4 Setting the Date Format

The data captured with the spectrum analyzer includes the date the trace was captured. You can choose between long and short International formats (day, month, year) or US long and short formats (month, day, year). To change the date format, see *Section 9.2.7, "Choosing the Date Format"*. Once you change the format, TraceView updates the date display on any traces that you are viewing.

9.4.3.5 Using the TraceView Toolbar

The Toolbar item controls whether or not the toolbar is displayed. The Toolbar provides quick access to frequently used commands.

To display the toolbar:

1. Go to the View menu and select Toolbar.
2. A checkmark appears to the left of this menu item to indicate that it is active, and the TraceView toolbar buttons (Open, Recall and Exit) appear in the upper part of the window. To hide the toolbar, select the Toolbar item again. The checkmark should disappear as well as the buttons.

9.4.3.6 Viewing Video Traces

This section has been included in the manual to differentiate all other trace displays from those of video traces (trace files with the .vid.xml extension), due to differences in the toolbar selections and the overall difference in look and feel for displayed video traces.

1. In WinCom II, browse to the directory where your traces are stored.
2. Highlight a .vid.xml file that is a video trace. The captured video trace may be that of a waveform monitor display as in Figure 9-20 or a vectorscope display as in Figure 9-21.
3. Go to the view menu and select Trace.

You can also click the View button or simply press F7 on your keyboard when the trace is selected. Alternatively, double-clicking the left mouse button will allow you to view the trace.

4. Proceed to step 5 if the video display is that of a waveform monitor, or to step 10 if the video trace is that of a vectorscope display.

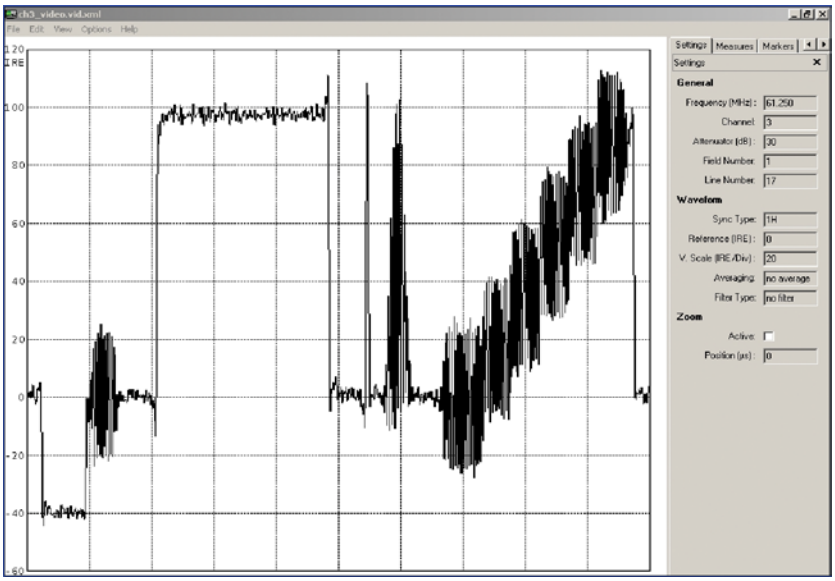


Figure 9-20: Viewing a video trace (waveform monitor)

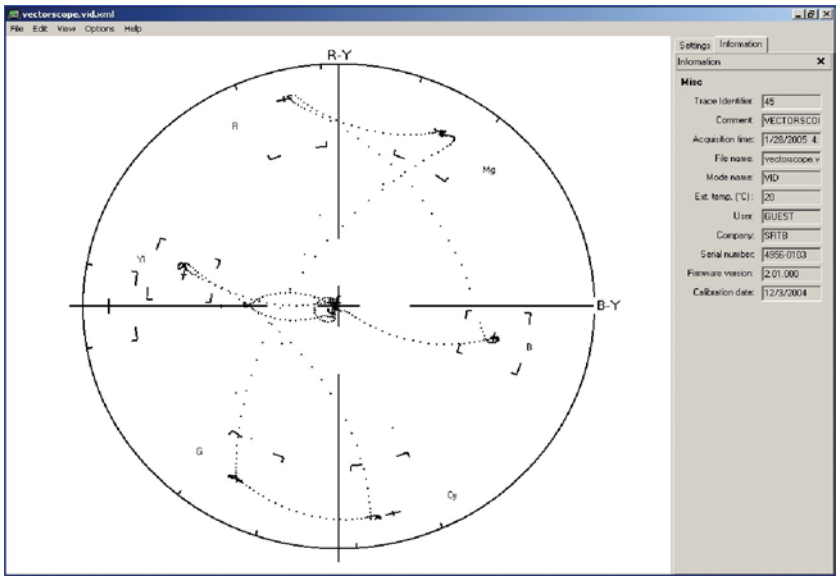


Figure 9-21: Viewing a video trace (vectorscope view)

5. To enable or disable the individual options available for a given video trace (waveform monitor), ensure that the options under the View menu item have been checked on or off, respectively. The options included for viewing are Settings, Markers, Measures and Information. The tab for the specific option will appear on the upper right hand side, next to the video trace.
6. Click on the Settings tab to view general and specific waveform settings for the stored video trace. As well, it can be determined if the Zoom feature was active when the trace was stored by the appearance or absence of a checkmark within the box.
7. Click on the Measures tab to view measurement results for Y/C luminance chrominance delay and gain, Depth of Modulation (if selected at time of measurement), Modulation Linearity (if selected at time of measurement), Signal to Noise.
8. Click on the Markers tab to enable the individual horizontal (H1 and H2) markers, as well as the individual vertical (V1 and V2) markers. The delta value for the horizontal markers will become visible when both H1 and H2 markers are enabled. As well, the delta value for the vertical markers will become visible when both V1 and V2 are enabled.
9. Click on the Information tab to view specific information regarding the trace and additional parameters regarding the analyzer which captured the trace.
10. To enable or disable the individual options available for a given video trace (vectorscope display), ensure that the options under the View menu item have been checked on or off, respectively. The options included for viewing are Settings, and Information. The tab for the specific option will appear on the upper right hand side, next to the video trace.
11. Click on the Settings tab to view general and specific settings for the stored video trace in the vectorscope display
12. Click on the Information tab to view specific information regarding the trace and additional parameters regarding the analyzer which captured the trace.

9.4.3.7 Customizing the Video Trace Colors

1. In the Options menu of a video trace, select Colors.

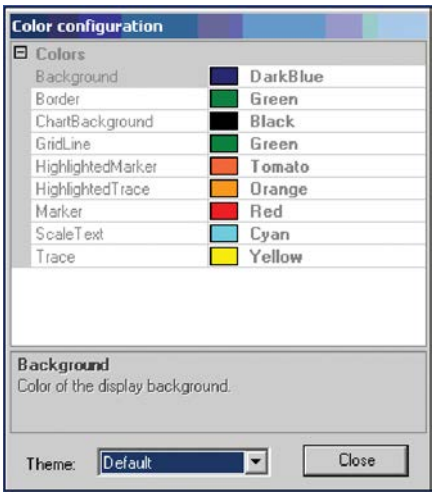


Figure 9-22: Choosing color options for video traces

2. Choose one of three defined color schemes:

Scheme	Description
Factory Default	This is the factory default color scheme, and is similar to the default indoor colors used on the spectrum analyzer.
B/W	This is a black and white color scheme.
Custom	This is a user-defined custom color scheme.

3. If you want to use your own color scheme, start with the color scheme that is closest to what you want to use your own color scheme that is closest to what you want to use, and edit the components. The current color appears in a small box next to the item. To change this color, click on the drag down button appearing to the right of the color selection.
4. Choose one of the three color palettes, namely; Custom, Web, System.
5. Select a color from within the chosen palette. Alternatively, you may simply overwrite the color that appears and type in the name of the color you would like to you use.

There are nine editable screen components.

Component	Description
Background	This is the color of the margin around the graticule, where text is shown. Choose a color that allows enough contrast with the text color.
Border	This is the color of the graph border color.
Chart(Graph) Background	This is the color of the chart (graph) background.
Grid Line	This is the color of the dotted grid lines.
Highlighted Marker	This is the color of the marker which is highlighted when the cursor is passed over it.

Highlighted Trace	This is the color of the trace which is highlighted when the cursor is passed over it (ex. a Vectorscope display which can be manipulated).
Marker	This is the color of the marker.
Scale Text	This is the color of the chart text.
Trace	This is the color of the trace.

9.4.4 Viewing QAM Data

You can call up a QAM record in either WinCom or WinCom II. WinCom opens records captured with the AT2000 series analyzer in the 1 MHz to 1 GHz range, whereas WinCom II opens .XML records captured with the AT2500 series analyzer in the 1 MHz to 1.5 GHz range.

Once you have called up a QAM record, you can change viewing options (see *Section 9.4.3*) and print the record (see *Section 9.4.5*) just like any trace record. In addition to these standard features, WinCom II offers extra controls for analyzing QAM records, as described in this section.

9.4.4.1 Zooming in on a Constellation

You can zoom in on a portion of the QAM constellation once you call up a QAM record.

To zoom in on a QAM constellation:

1. Call up the QAM constellation you want to view (see *Section 9.4.1*).
2. Move your mouse to mark any frame of the constellation. To zoom in, click the left mouse button once.
3. To keep zooming in, repeat step 2.
4. To zoom out, click the right mouse button.
5. To keep zooming out, repeat step 4.

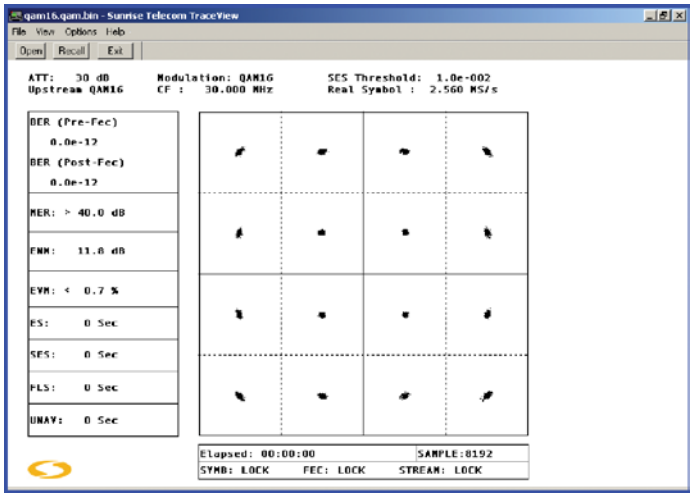


Figure 9-23: Viewing QAM Constellation

9.4.4.2 Viewing Statistical Data

If you are viewing QAM statistical data that was captured over a period of time with the spectrum analyzer, you can zoom in on a particular time.

To view statistics for a particular time:

1. Call up the trace or QAM image you want to print (see *Section 9.4.1*).
2. In the top part of the window, use the Screen Width field to change the window you are observing. By default, WinCom II displays the full statistical period.
3. In the Go To field, enter the elapsed time that you want to view. For example, if the statistics were taken over 2 minutes, you can view the statistics at the one-minute mark. Use the plus and minus buttons to scroll forward and backward in time.

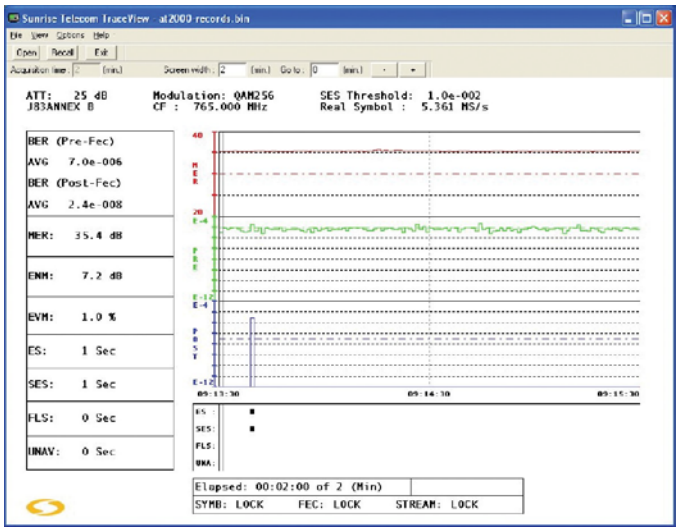


Figure 9-24: Viewing QAM Statistics

9.4.4.3 Viewing the Adaptive Equalizer Display

You can view the adaptive equalizer display once you call up a QAM record.

There are three different displays in the equalizer screen:

- Bar graph showing the 32 coefficients: 8 feed-forward Equalizers (FFE) and 24 Decision Feedback Equalizers (DFE). The eighth coefficient is the main signal path so it is normally very close to 0 dB (unity gain)
- Frequency response graph (from +5 to -3 dB) over the defined channel bandwidth.
- Group delay graph showing the delay in nsec across the channel bandwidth.

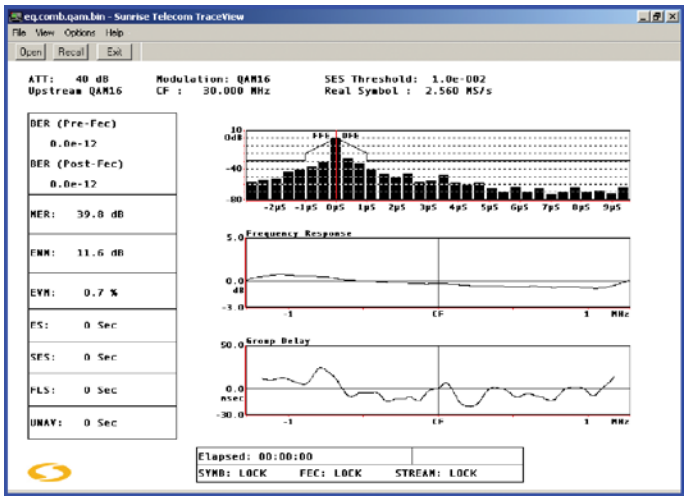


Figure 9-25: Viewing the Adaptive Equalizer Display

Each of the three displays can be viewed individually by placing the cursor over the desired display and clicking the left mouse button. Once the specific display is chosen, an enlarged view will be presented. To return to the combined view, simply click on the right mouse button.

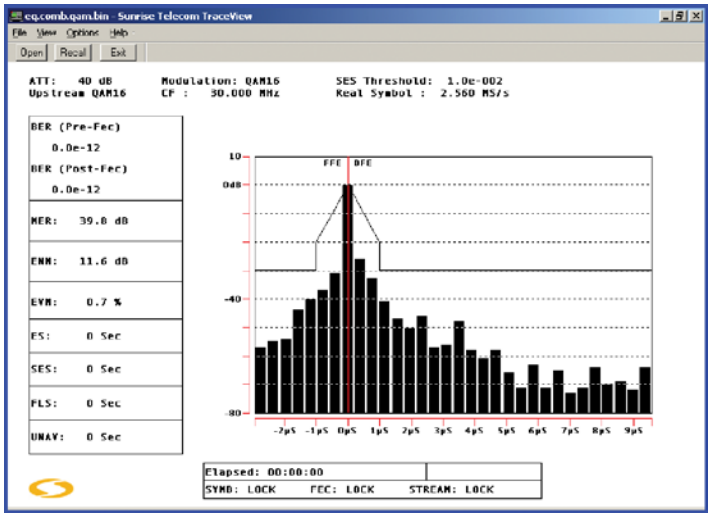


Figure 9-26: Equalizer Display

When selecting the frequency response graph, vertical and horizontal markers are available to perform specific measurements such as peak to valley of the frequency response plot, as shown below.

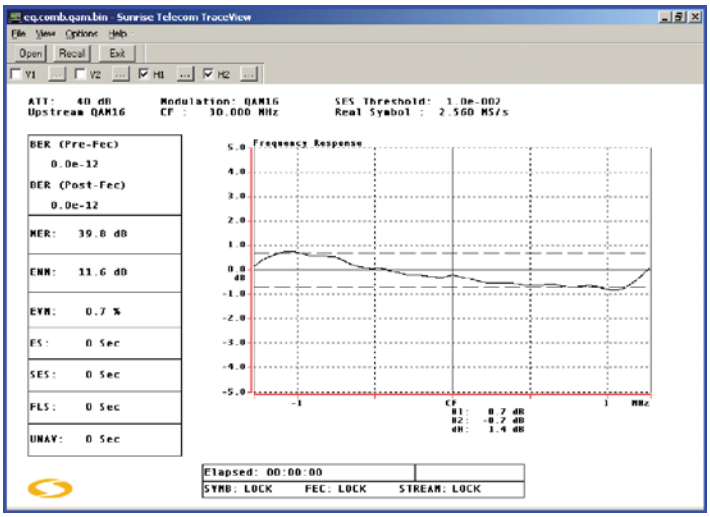


Figure 9-27: Frequency Response Display (with horizontal markers selected)

When selecting the group delay graph, vertical and horizontal markers are available to perform specific measurements. When both the vertical V1 and V2 markers are used, the delta values in both frequency and time are displayed. Additionally, the slope of the curve between marker points is indicated in ns/MHz.

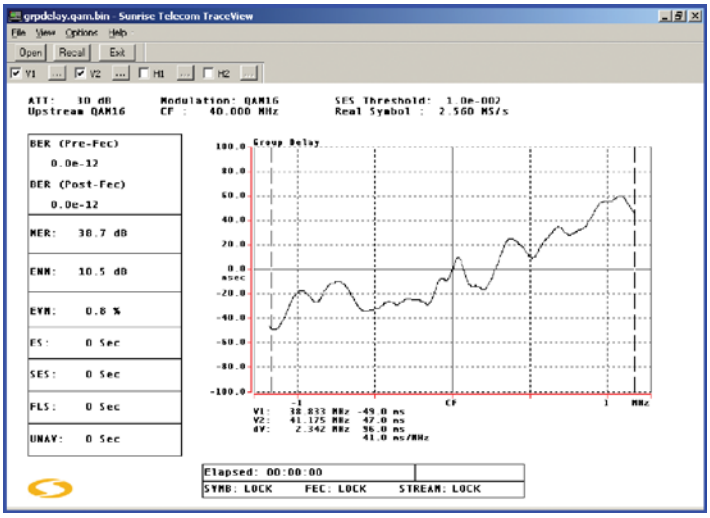


Figure 9-28: Group Delay Display (with vertical markers selected)

9.4.4.4 Using the QAM Mode Toolbar

The QAM Bar item controls whether or not the QAM toolbar is displayed. The QAM toolbar provides quick access to the Export command.

To activate the QAM toolbar:

1. Go to the View menu and select QAM Bar.
2. A checkmark appears to the left of this menu item to indicate that it is active, and the QAM toolbar buttons (Mode, Filter, Disable Grid, Disable Template, Setup and Export) appear in the upper part of the window. Only the Export button is

active. If you are viewing a QAM constellation or statistical data captured with the spectrum analyzer, click Export to save the data in an ASCII file. See *Section 9.4.6, "Exporting Data"* for detailed instructions.

You cannot export QAM data to VeEX, Inc. PoP (.CSV) or FamilyWare (.TSD). You can, however, export the image to a .BMP format for use as an im- age in another application (see section 9.4.6.3, "Exporting to the Clipboard").

3. To hide the toolbar, select the QAM bar item again. The checkmark should disappear as well as the buttons.

9.4.5 Printing Reports and Screens

Once you have set up your printer, you can print any image on your screen. You can also tag multiple records and print them all at once.

Defining the Print Setup

WinCom II's Print Setup lets you choose the target printer, set up its properties, select paper size, paper source, and page orientation.

To set up your printer:

1. From TraceView's File menu, select Print Setup.

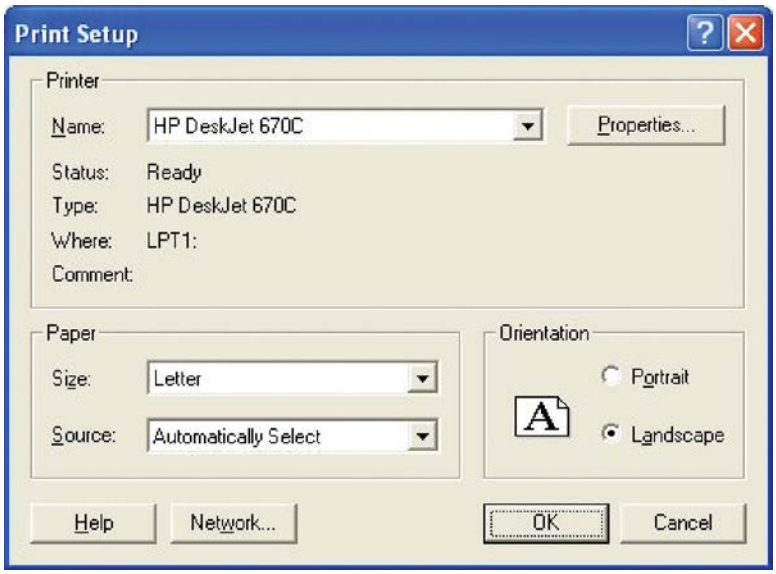


Figure 9-29: Setting up a Printer

2. Once you have made your changes, click OK to record your setup. WinCom II will use this setup when you print an image.

Using the Print Preview

WinCom II's Print Preview displays the image the way it will appear when printed. Use this preview to verify the image and page settings before printing.

To preview a trace before printing:

1. Call up the trace you want to view.
2. From TraceView's File menu, select Print Preview. The trace now appears on screen.
3. From the Preview mode, you can print the trace by selecting the Print button,

or zoom in on a portion of the image using the Zoom In button. To exit the Print Preview, click the Close button.

Printing a Screen

To print the image on your screen:

1. Call up the trace or QAM image you want to print.
2. Go to the File menu and select Print. WinCom II immediately sends the data to the printer that is defined in your printer setup.

Printing Multiple Records

To print multiple records from a WinCom database or records file:

1. From WinCom II, launch WinCom.
2. Open the WinCom database or the records file containing the traces that you want to print. See *Section 9.3.3.2, "Opening a WinCom Database"* to select a database or records file in WinCom.
3. In the Select Trace window, tag the records in the WinCom database or the records file that you want to print as follows:
   - To select a few records in the file, check the box in the Print column. Adjust the column width if necessary until you see the Print column. You can click on any column to sort the records, for example, by date or mode.
   - To select all of the records in the file, click Tag All. To change your choice, click Untag All.

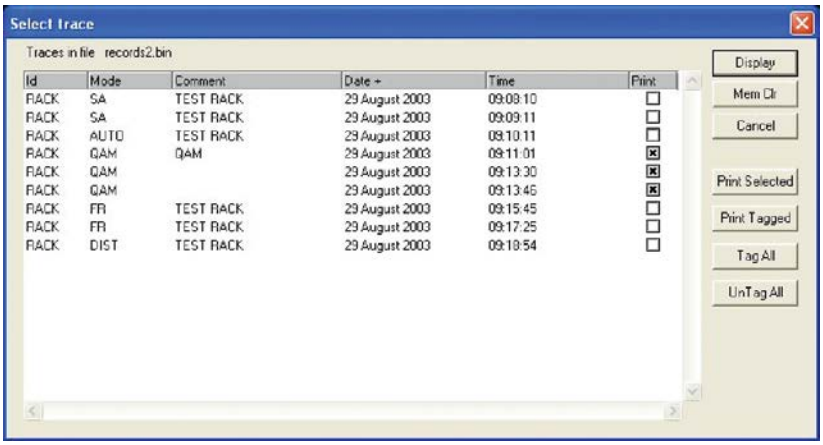


Figure 9-30: Printing Tagging Records

4. Once you have selected the records, click Print Tagged. WinCom sends the data to the printer that is defined in your printer setup.

9.4.6 Exporting Data

The data you capture with a VeEX, Inc. spectrum analyzer includes the model and serial number, most recent factory calibration date of the instrument as well as basic information such as date, time, temperature, company name and user name. This data is stored with the trace and is transferred to WinCom or WinCom II when you download files from the spectrum analyzer. The measurement results can then be exported directly into several formats:

- Comma separated value (.CSV) file format for use in a spreadsheet program

- .BMP file to be pasted into another application
- VeEX, Inc. POP format
- .TSD file on your PC, that is then imported into FamilyWare

IMPORTANT: *For FCC exports, make sure you enter the site ID in the spectrum analyzer in the correct format so that software can recognize the formatting and populate the proper cells.*

9.4.6.1 Exporting a Single Trace to ASCII Format (.CSV)

The Export in ASCII function converts data into a comma delimited text file (.CSV) format that can be imported into spreadsheet programs. If you use Excel, you can make use of VeEX, Inc.'s proof of performance (POP) macro, included with WinCom II.

To export a single trace to an ASCII file (.CSV format):

1. Call up the trace you want to export (see *Section 9.4.1*).
2. From TraceView's File menu, select Export in ASCII (.CSV) format. Browse to the directory where you want to save the trace in ASCII format.
3. Choose a name for the file and click Save. WinCom II adds the extension .CSV automatically unless you select another format.
4. Open the file in a spreadsheet program and use its charting functions to analyze the data. You can also open the VeEX, Inc. preformatted Excel file (SunrisePoPMacros.xls) that includes macros for formatting data from .CSV files. Once you are in the VeEX, Inc. preformatted Excel file, you can import your .CSV files.

9.4.6.2 Exporting Multiple Traces to ASCII Format (.CSV)

If you want to export multiple traces captured with the AT2000 series analyzer, you need to launch WinCom. The TraceView utility exports one trace at a time.

To export multiple traces from a WinCom database or records file:

1. From WinCom II, launch WinCom.
2. Open the WinCom database or the records file containing the traces that you want to export. See *Section 9.3.4* to select a database or records file.
3. Select the records in the WinCom database or the records file that you want to export.
4. From WinCom's File menu, select Export to .CSV, and then choose Selected Record Traces or Selected WinCom Database Traces.

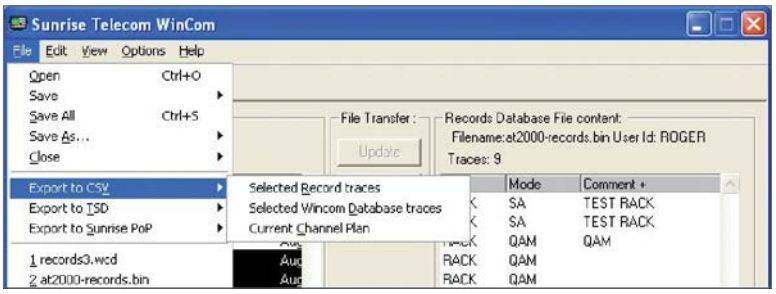


Figure 9-31: Exporting Selected Records to .CSV Format

5. In the Select Export Filename window, browse to the directory where you want to save the trace in ASCII format. You can create a new directory by modifying the path shown in the Base Filename field.

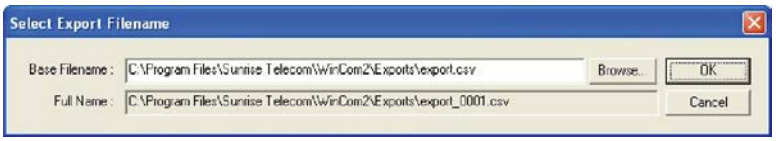


Figure 9-32: Saving Exported Files

6. In the Base Filename field, choose a root file name. Each trace that you export will start with this root filename. WinCom adds a sequential number such as 0001, 0002, etc. so that each exported trace has a unique name.
7. Click OK to begin exporting the files.

9.4.6.3 Exporting a Channel Plan

In order to use the VeEX, Inc. Excel Macro FCC POP report, you need to have a channel plan in .CSV format. You can export your current channel plan so you can use it in the report.

To export a channel plan:

1. From WinCom II, launch WinCom.
2. From WinCom's File menu, select Export to .CSV, then choose Current Channel Plan.

Note: *If the current channel plan is not the one you want to use, change the channel plan before you export it. To do so, go to the Options menu and select Current Channel Plan File. Browse to the directory where your channel plan file is located. The file must have the extension .PLN. Once you have loaded the correct channel plan, complete step 2 of this procedure.*

3. In the Save As window, browse to the directory where you want to save the exported plan. By default, WinCom saves the file as CHANNELPLAN.CSV in the same directory as your exported traces.
4. Click Save to export the channel plan. You can now import this plan into the Sunrise Telecom Excel Macro FCC POP report or other spreadsheet program.

IMPORTANT: *For purposes of data integrity, the channel plan should be finalized and used throughout the testing cycle.*

9.4.6.4 Exporting to the Clipboard (BMP)

This function copies the trace display area to the system clipboard in a bitmap format. This is essentially a picture of the trace that can be pasted into other applications such as word processing programs. Only one trace can be exported at a time.

To export a trace to the clipboard (.BMP format):

1. Call up the trace you want to export.
2. From TraceView's File menu, select Export to clipboard (.BMP format). The image is now in your Windows clipboard.

You must paste the image (Ctrl-V for most applications) before exporting another trace to the clipboard (.BMP format).

9.4.6.5 Exporting to the VeEX, Inc. POP Report

The VeEX, Inc. proof of performance (POP) report accepts multiple traces captured with the AT2000 series analyzer. You need to launch WinCom first in order to access this feature.

To export multiple traces from a WinCom database or records file to a Sunrise Telecom POP report:

1. From WinCom II, launch WinCom.
2. Open the WinCom database or the records file containing the traces that you want to export.
3. Select the records in the WinCom database or the records file that you want to export.
4. From WinCom's File menu, select Export to Sunrise PoP, and then choose Selected Record Traces or Selected WinCom Database Traces.

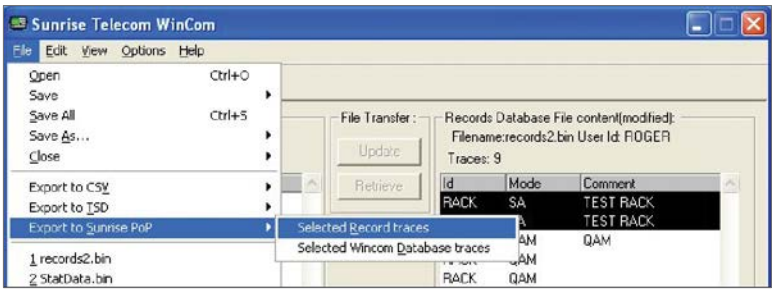


Figure 9-33: Exporting Selected Records or Traces to Sunrise POP Report

If there are any records that need additional formatting information for export to a TSD format, WinCom provides a window to edit the identification for the traces. Choose Headend Trace or Test Point Trace and edit the information. Click OK to continue.

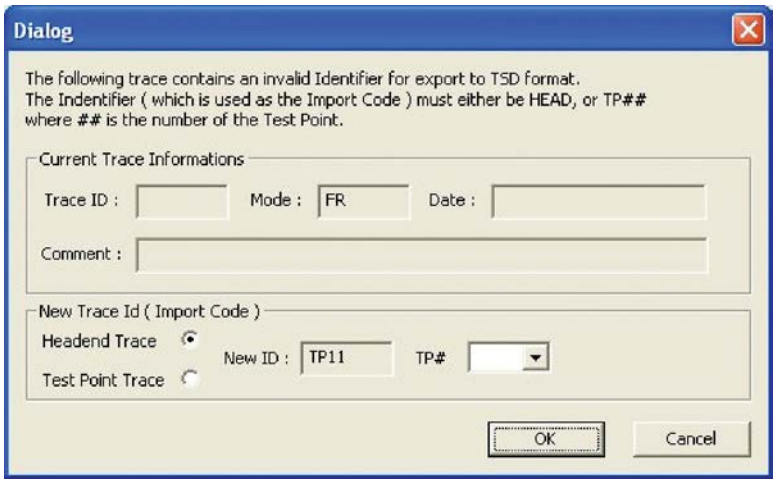


Figure 9-34: Modifying Identification Data for TSD Format

5. Import or edit the system information.
   WinCom prompts you to import information for your cable system that appears

in the report header. If you have exported this information into an ASCII format (see *Section 9.4.6.1*) as part of a records database, you can import the SystemInfo.csv file now.

Click Yes and browse to the directory where your system information is located. The file must have the extension .CSV. If you do not have a system information file, you can enter the information for the VeEX, Inc. report header now.

Follow the prompts on screen:

- company name
- system name
- street address (street and municipality)
- state or province
- ZIP or postal code
- number of subscribers
- number of integrated hubs
- system bandwidth
- year of the last triennial test
- the number of each test channel (1 to 13)

6. Select a channel plan.
   WinCom prompts you for a channel plan.
   - To use the channel plan that was exported with the records, click Yes.
   - To select a different channel plan for your own exported channel plan files, click No and browse to the directory where your channel plan is located. The file must have the extension .CSV. If you have not yet exported a channel plan, see *Section 9.4.6*. Select the channel plan and click OK to continue.
7. WinCom now opens the VeEX, Inc. preformatted Excel file and populates the appropriate cells, using the data for your system and the data in the records you selected.

9.4.6.6 Using the VeEX, Inc. Preformatted Excel File

The VeEX, Inc. preformatted Excel file (SunrisePoPMacros.xls) includes macros for formatting data from .CSV files. This Excel file and its macros run automatically when you export to a VeEX, Inc. POP format. Alternatively, you can open the file from the \VeEX, Inc.\Excel Pop Macros directory, and then import your .CSV files.

You can view, print, import and export data from this file:

- To view data, consult each tab in the Excel file to view the summary, headend and test point data.
- To print the page you are viewing, click Print Current Page. You may want to preview the page first to check the page layout. To do so, click Preview Current Page and make any adjustments as necessary from the preview window.
- To import more data into this file, click Import CSV files and select a file with the .CSV extension. For example, you can import channel plans or more traces.
- To export the Excel file to a FamilyWare .TSD format, click Export Data to TSD. WinCom will prompt you for any additional information that may be required such as the channel plan, list of test channels, system information and measurement results.
- To clear the data in the cells and start over, click Clear Current Page. This does not delete the formatting.

9.4.6.7 Exporting to a FamilyWare File (.TSD)

WinCom supports the FamilyWare .TSD format for proof of performance reporting. You can export traces directly to this format from WinCom. You need to launch WinCom first in order to access this feature.

You can also export data from the VeEX, Inc. preformatted Excel file to the .TSD format. See *Section 9.4.6.6*.

To export multiple traces from a WinCom database or records file to a Sunrise Telecom POP report:

1. From WinCom II, launch WinCom.
2. Open the WinCom database or the records file containing the traces that you want to export.
3. Select the records in the WinCom database or the records file that you want to export.
4. From WinCom's File menu, select Export to Sunrise PoP, and then choose Selected Record Traces or Selected WinCom Database Traces.

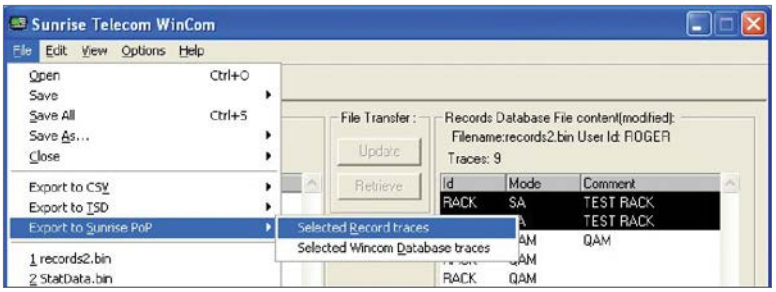


Figure 9-35: Exporting Selected Records or Traces to POP Format

If there are any records that need additional formatting information, WinCom provides a window to edit the identification for the traces. Choose Headend Trace or Test Point Trace, then edit the information. Click OK to continue.

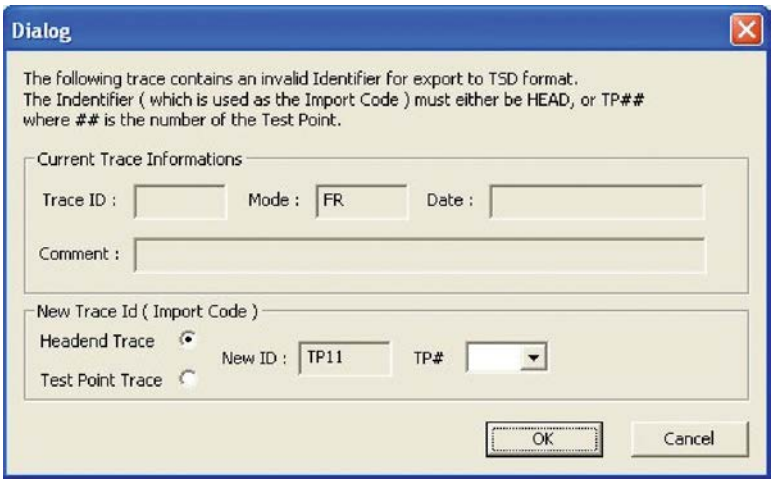


Figure 9-36: Editing dialog

5. Import or edit the system information.
   WinCom prompts you to import information for your cable system that appears

in the report header. If you have exported this information into an ASCII format (see *Section 4.6* starting) as part of a records database, you can import the SystemInfo.csv file now. Click Yes and browse to the directory where your system information is located. The file must have the extension .CSV. If you do not have a system information file, you can enter the information for the VeEX, Inc. report header now.

Follow the prompts on screen:

- company name
- system name
- street address (street and municipality)
- state (or province)
- ZIP code (or postal code)
- number of subscribers
- number of integrated hubs
- system bandwidth
- year of the last triennial test
- test channels (1 to 13)

6. WinCom prompts you for a channel plan.
   - To use the channel plan that was exported with the records, click Yes.
   - To select a different channel plan for your own exported channel plan files, click No and browse to the directory where your channel plan is located. The file must have the extension .CSV. If you have not yet exported a channel plan, see *Section 9.4.6*. Select the channel plan and click OK to continue.

IMPORTANT: *For purposes of data integrity, the channel plan should be finalized and used throughout the testing cycle.*

WinCom opens the VeEX, Inc. preformatted Excel file and populates the appropriate cells, using the data for your system and the data in the records you selected. Consult each tab in the Excel file to view the summary, headend and test point data.

9.5 Channel Plan Editor

The channel plan editor (applicable only to AT2500 channel plans) lets you make changes to an existing plan, or create a new plan either by starting fresh or by copying an existing plan. Use the channel plan editor to define each channel in the plan, such as its position, type, frequency and a selection of VITS parameters to indicate where particular test signals are for most of the CATV tests available.

In addition to standard TV or digital channels, the channel line-up can also include leakage detector pilot signals or data carriers.

9.5.1 Creating a Channel Plan File

A channel plan file can contain several channel plans. Each plan contains a specific channel line-up that you define. WinCom II includes a few sample channel plans (.SCP files) that contain typical channel parameters based on the television standards in various geographical regions. You may want to consult one of the sample channel line-ups before creating your own.

To create a new channel plan:

1. From the WinCom II Tools menu, select Launch Channel Plan Editor. By default, WinCom II opens either the last channel plan file that was opened, or, if this is the first time you are using the Channel Plan Editor, it opens a blank channel plan file window.

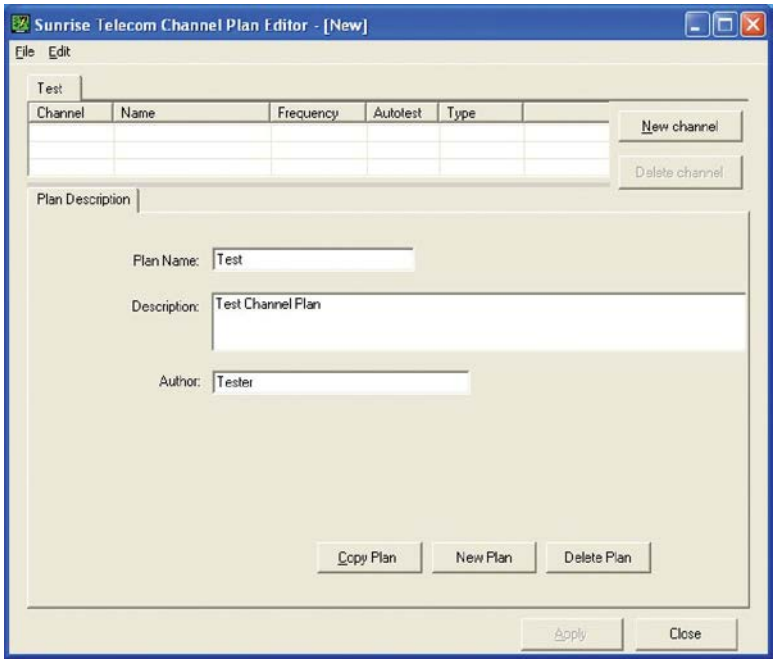


Figure 9-37: Creating a New Channel Plan

The top part of the Channel Plan Editor window shows the information for each channel in the plan. The bottom part provides fields to name your channel plan and add notes.

2. Enter the Plan Description information.
   - Select a name for your new channel plan. The name cannot have any spaces. If you want to separate words, use a character such as the underscore "_".
   - If desired, edit the description. Spaces are accepted in the description field.
   - If desired, enter your name in the Author field, without any spaces. If you want to enter your first and last name, separate each word with an underscore "_".
3. To save the basic setup for the channel plan file, go to the File menu and select Save As. Browse to the directory you want to use. By default, the Channel Plan directory is selected. Choose a name. WinCom II adds the file extension .SCP.
4. To continue adding channel plans to this file, click New Plan and repeat step 2. The new plan's tab appears when you click New Plan or when you select another channel plan.

You are now ready to add channels to a channel plan. See *Section 9.5.2.1* for analog channels, *Section 9.5.2.2* for digital channels, or *Section 9.5.2.3* for other channels.

9.5.2 Defining Channels

9.5.2.1 Defining an Analog Channel

To define a channel, you must first open a channel plan file in the Channel Plan Editor. See *Section 9.5.1* to open the Channel Plan Editor.

1. Open a channel plan file. When you launch the Channel Plan Editor, WinCom II opens the last channel plan file that was used. If this is not the channel plan file that you want to use, use the File menu to open another file with the extension .SCP. If this is the first time you are using the channel plan editor, a blank channel plan window appears.
2. Select the channel plan that will contain the new channel.

   A typical channel plan file contains several channel plans. The name of each plan in the file appears on a tab at the top of the window. If you are using a blank channel plan file, there are no tabs. Once you enter the channel plan file description (see *Section 9.5.1*), you will see a tab at the top of the window. To add channels to one of the channel plans, first select the channel plan by clicking on a tab.
3. To add a channel to a channel plan, click New Channel. This opens the window used to define each channel. Use the tab menus to access all of the fields you need to complete for each channel. Go to the Channel Information tab and enter the information for the first channel in this channel plan.

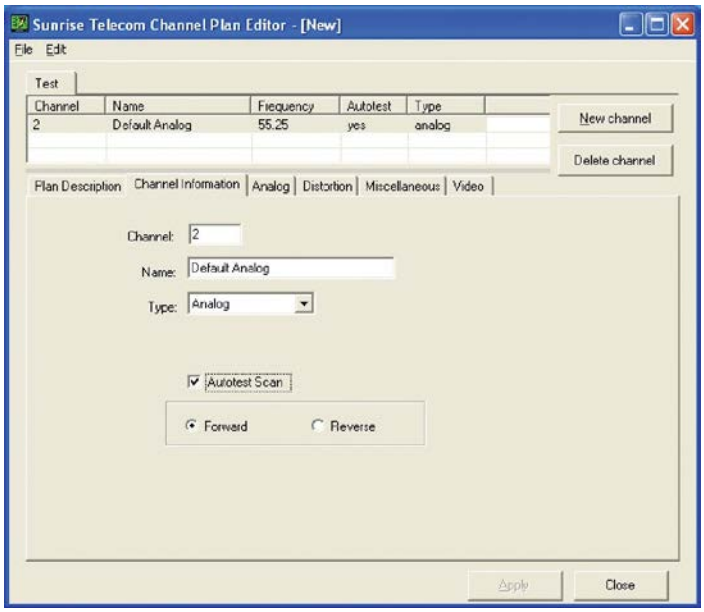


Figure 9-38: Setting up an Analog Channel

- Enter the channel number in the Channel field. You can use up to 4 alphanumeric characters.
- Enter a name, using up to 20 alphanumeric characters.
- Select the channel type: Analog, Digital, or Other. Once you select the type (analog, digital or other) the tab menus vary in order to present only the relevant fields you need. This section covers the instructions for analog channels.
- Select the Autotest Scan checkbox to include the channel in the automatic tests that the spectrum analyzer performs.
- Select Forward for downstream or forward path transmission channels, or select Reverse for upstream or return path signals.

4. Enter the analog channel's frequency information if you selected Analog in step 3. If you selected Digital, skip to *Section 9.5.2.2*. If you selected Other, skip to *Section 9.5.2.3.* Use these fields to define the channel's visual carrier frequency and scrambling, and the offset of the channel's aural carriers. You can also define FM and digital audio channels in this window.

Field	Data Range	Default Value
Frequency	5 to 1500 MHz	55.25
Modulation	NTSC-M, PAL-B, PAL-G/H, PAL-I, PAL-M, PAL-N, SECAM-B, SECAM-G/H, SECAM-K/L, Unknown	NTSC-M
Audio Freq	4 to 8 MHz	4.5
Audio 2 Type	None, FM, Digital	None
Audio 2 Freq*	4 to 8 MHz	0
Audio 2 BW*	0 to 2 MHz	0
Channel Width	Low: -2 to -1 MHz High: 4 to 6.75 MHz	-1.25 4.75
Scrambling	None, Horizontal, Vertical	None

* These fields can only be edited if you selected FM or Digital in the Audio 2 Type field.

5. Enter the analog channel's distortion information. Use this window to define the composite triple beat (CTB), carrier to composite noise (CCN) and composite second order (CSO) distortion parameters.

Field	Data Range	Default value
Video Noise BW	4 to 6 MHz	4
CTB Gated Line	7 to 35	15
CTB Gated Field	Field 1, Field 2, Both	Field 1
CTB Freq. Offset	-9.99 to 9.99 MHz	0
CSO Gated Line	7 to 35	15
CSO Gate Field	Field 1, Field 2, Both	Field 1
Freq. Offset Low 1*	-9.99 to 0 MHz	-1.25
Freq. Offset High 1*	0 to 9.99 MHz	0.75
Freq. Offset High 2*	0 to 9.99 MHz	1.25
Freq. Offset Low 2*	-9.99 to 0 MHz	-0.75
CCN Gated Line	7 to 35	15
CCN Gated Field	Field 1, Field 2, Both	Field 1
CCN Freq. Offset	Low: -9.99 to 9.99 MHz High: -9.99 to 9.99 MHz	2 2

* Select the checkbox to tag the frequency.

6. Enter the analog channel's miscellaneous information. Use this window to define the channel's in-channel frequency response and depth of modulation parameters.

Field	Data Range	Default Value
IRC Line	7 to 35	19
IRC Field	Field 1, Field 2	Field 1
IRC Signal Type	Multiburst, GCR, Cable Sweep	Multiburst
IRC Freq. 1	.5 to 5 MHz	0.5
IRC Freq. 2	.5 to 5 MHz	1.25
IRC Freq. 3	.5 to 5 MHz	2.0
IRC Freq. 4	.5 to 5 MHz	3.0
IRC Freq. 5	.5 to 5 MHz	3.6
Hum	Video, CW	Video
Hum Freq	50, 60 Hz	60
DOM Line	7 to 35	17
DOM Field	Field 1, Field 2	Field 1
DOM Signal Type	Multiburst, NTC-7, Composite TX	Multiburst

7. Enter the analog channel's video test information. Use this window to define the channel's luminance and chrominance parameters as well as signal to noise.

Field	Data Range	Default Value
Video Diff Gain/Phase		
Line	7 to 35	17
Field	Field 1, Field 2	Field 1
Signal Type	NTC-7, Composite TX, Full line 5 steps, Full line 10 steps, Full line ramp	NTC-7
Video YC		
Line	7 to 35	17
Field	Field 1, Field 2	Field 1
Signal Type	NTC-7, Composite TX, Sine-squared pulse & bar	NTC-7
Video SN		
Line	7 to 35	17
Field	Field 1, Field 2	Field 1
Signal Type	NTC-7, Composite TX, Sine-squared pulse & bar	NTC-7

8. Click Apply to record your changes. You may continue adding more channels to this plan. Remember to save the channel plan file from time to time when you are editing the file.

9.5.2.2 Defining a Digital Channel

To define a digital channel, you must first open a channel plan file in the Channel Plan Editor (see *Section 9.5.1*). Once you have opened the Channel Plan Editor, choose a channel plan file, and then select the channel plan within the file where you want to add the new digital channel. See steps 1 and 2 in *Section 9.5.2.1* to open a channel plan.

To add a digital channel to a channel plan:

1. Click New Channel or select New Channel from the Edit menu. Go to the Channel Information tab and enter the information for the first channel in this channel plan:
   - Enter the channel number in the Channel field. You can use up to 4 alphanumeric characters.
   - Enter a name, using up to 20 alphanumeric characters.
   - Select the channel type: Analog, Digital, or Other. Once you select the type (analog, digital or other) the tab menus vary in order to present only the relevant fields you need. This section covers the instructions for digital channels.
   - Select the Autotest Scan checkbox to include the channel in the automatic tests that the spectrum analyzer performs.
   - Select Forward for downstream or forward path transmission channels, or select Reverse for upstream or return path signals.
2. Enter the digital channel's frequency and modulation information if you selected Digital in step 1. If you selected Analog, see *Section 9.5.2.1*. If you selected Other, skip to *Section 9.5.2.3*. Use these fields to define the digital channel's polarity and bandwidth.

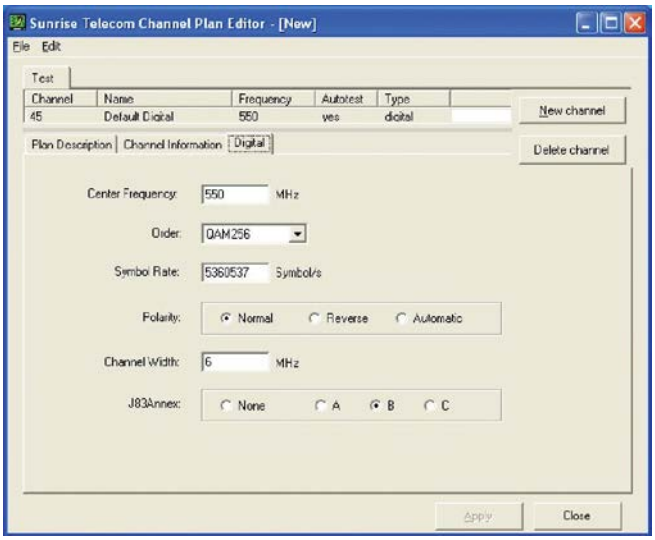


Figure 9-39: Setting up a Digital Channel

Field	Data Range	Default value
Center Frequency	5 to 1500 MHz	555
Order	QAM64, QAM256	QAM256
Symbol Rate	5 - 7 MS/s	5360537
Polarity	Normal, Reverse, Automatic	Normal
Channel width	1 to 10 MHz	6
J83 Annex	None, A, B, C	B

3. Click Apply to record your changes and then continue adding more channels to this plan. Remember to save the channel plan file from time to time when you are editing the file.

9.5.2.3 Defining Other Channels

"Other" channels can be leakage detection pilot carriers or other carriers such as QAM16 upstream signals used for monitoring. They are not standard analog or digital channels.

To add a special carrier to the channel plan, you must first open a channel plan file in the Channel Plan Editor (see *Section 9.5.1*). Once you have opened the Channel Plan Editor, choose a channel plan file, and then select the channel plan within the file where you want to add the new channel. See steps 1 and 2 in *Section 9.5.2.1* to open a channel plan.

1. To add one channel, click New Channel or select New Channel from the Edit menu. Go to the Channel Information tab and enter the information for the first channel in this channel plan.
   - Enter the channel number in the Channel field. You can use up to 4 alphanumeric characters.
   - Enter a name, using up to 20 alphanumeric characters.
   - Select the channel type: Analog, Digital, or Other. Once you select the type (analog, digital or other) the tab menus vary in order to present only the relevant fields you need. This section covers the instructions for Other channels.
   - Select the Autotest Scan checkbox to include the channel in the automatic tests that the spectrum analyzer performs.

- Select Forward for downstream or forward path transmission channels, or select Reverse for upstream or return path signals.

2. Enter the channel's center frequency and modulation if you selected Other in step 1. If you selected Analog, see *Section 9.5.2.1*. If you selected Digital, see *Section 9.5.2.2*. Use these fields to define the modulation and bandwidth.

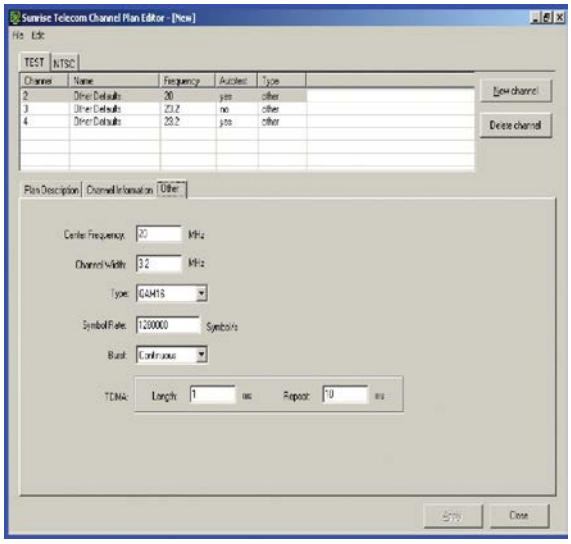


Figure 9-40: Setting up Other Channels

Field	Data Range	Default value
Center Frequency	5 to 1500 MHz	88.1
Channel Width	0.1 to 10 MHz	0.2
Type	QPSK, QAM16, QAM32, FSK, BPSK, CW, VSB-AM, FM, CDMA	FM
Symbol Rate*	0 to 99999999 S/s	0
Burst	Burst, Continuous	Continuous
TDMA Length	0 to 999999 ms	0
Repeat	0 to 999999 ms	0

* Not used for FM and CW carriers.

3. Click Apply to record your changes and then continue adding more channels to this plan. Remember to save the channel plan file from time to time when you are editing the file.

9.5.2.4 Defining Multiple Channels

WinCom II's Create Multiple Channels command lets you add a group of similar channels to a channel plan all at once. Use this method to save time setting up a channel plan.

To define a multiple channels, you must first open a channel plan file in the Channel Plan Editor (see *Section 9.5.1*). Once you have opened the Channel Plan Editor, choose a channel plan file, and then select the channel plan within the file where you want to add the new channels. See steps 1 and 2 in *Section 9.5.2.1* to open a channel plan.

To create multiple channels:

1. From the Channel Plan Editor, select Create Multiple Channels from the Edit menu. By default, WinCom II opens a single channel range, starting at 55.25 MHz.

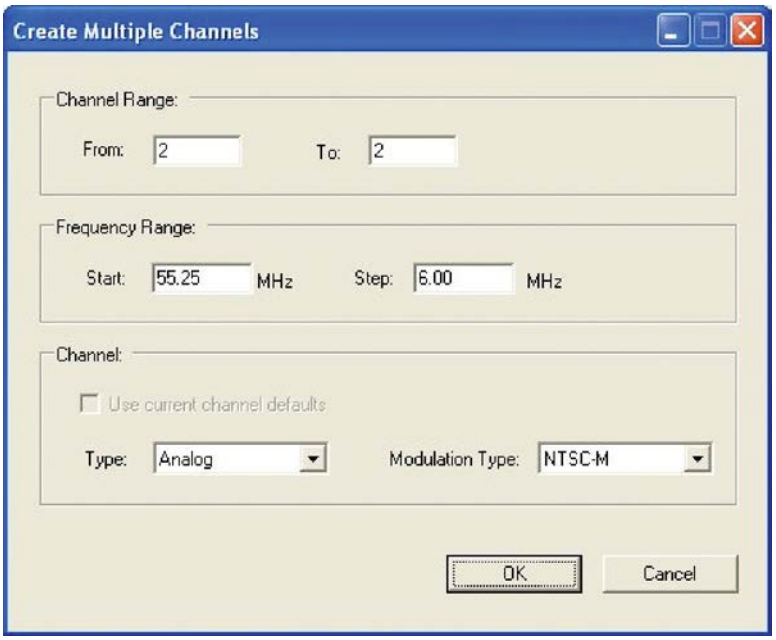


Figure 9-41: Creating Multiple Channels

2. In the Channel Range section, decide how many channels you want to add. Enter the starting and ending channel numbers in the From and To fields.
3. In the Frequency Range section, enter the starting frequency for the first channel and the number of megahertz between each channel. WinCom II calculates the frequencies automatically for all of the channels in the range.
4. In the Channel section, define the basic parameters that are common to all of the channels you are adding:
   - Select the channel type from the available choices: Analog, Digital, or Other.
   - Select the modulation type from the available choices: NTSC-M, PAL-B, PAL-G/H, PAL-I, PAL-M, PAL-N, SECAM-B, SECAM-G/H, SECAM-K/L.

In a new channel plan, all of the channels use WinCom II's default values for analog, digital or other channels. Refer to section 9.5.1 for details on the parameters for each channel type.

5. Click OK to create the new channels. You can now select each channel in the list at the top of the window, and edit any specific parameters. For editing analog channel parameters, see *Section 9.5.2.1.* For digital channels, see *Section 9.5.2.2*. For "other" channels, see *Section 9.5.2.3*.
6. To create another series of channels in the same channel plan, select Create Multiple Channels again from the Edit menu. You can now apply the channel parameters of the first series of channels you defined, in steps 4 and 5, to the new series of channels are creating. To do so, select the checkbox "Use values from channel x instead of defaults", where x is the highest channel you defined. To keep the defaults for the selected channel type, leave this checkbox unselected.

9.5.3 Copying a Channel Plan

WinCom II's Copy Plan command creates a new channel plan using an existing plan. This is an easy way to copy channel settings that are common to multiple locations. You can then add or delete certain channels to customize your new plan.

WinCom II comes with several sample channel plan files. You may want to choose a sample file that is closest to your current plan, and then use the Copy Plan method to save time setting up a channel plan.

To copy a plan:

1. First open a channel plan file in the Channel Plan Editor (see *Section 9.5.1*).
2. Once you have opened the Channel Plan Editor, choose a channel plan file, and then select the channel plan within the file that you want to copy. Use the tabs at the top of the window to select a channel plan.
3. Click Copy Plan to create a new plan. The new plan's tab appears.
4. Edit the plan description:
   - You can change the name of the plan in the Plan Name field in the bottom part of the window. By default, WinCom II adds the number "1" to the name of the new plan to indicate that it is a copy. Select a new name for your channel plan. The name cannot have any spaces. If you want to separate words, use a character such as the underscore or dash.
   - If desired, edit the description. Spaces are accepted in the description field.
   - If desired, enter your name in the Author field, without any spaces. If you want to enter your first and last name, separate each word with an underscore or dash.

You can now edit the channel plan or some of the channels in the plan. To add or delete channels, see *Section 9.5.4*. For details on changing channel parameters, refer to *Section 9.5.2.1* for analog channels, *Section 9.5.2.2* for digital channels, or *Section 9.5.2.3* for other channels.

9.5.4 Editing a Channel Plan

If you have copied a channel plan to use as a starting point, you may want to make changes for a particular location. You can add or delete channels as required, or edit the settings for a particular channel.

IIMPORTANT: *For AT2500 series used in conjunction with WinCom II software version 2.2, alterations can be made to the channel plans while making measurements in the field. S/W version 2.2 provides the ability to import edited channel plans via the Channel Plan Editor, therefore eliminating the need to replicate them exactly on the PC.*

Prior to WinCom II software version 2.2, no alterations to the channel plans can be made while making measurements in the field. If any changes have been made in the field, the data will not be exported properly to FCC reports such as the VeEX, Inc. report or Family Ware POP program. Make sure you replicate the changes exactly on the PC that will receive the field traces and produce the FCC report.

In either case, for purposes of data integrity, the channel plan should be finalized and used throughout the testing cycle.

To edit a plan:

1. First open a channel plan file in the Channel Plan Editor (see *Section 9.5.1*).
2. Once you have opened the Channel Plan Editor, choose a channel plan file, and then select the channel plan within the file that you want to edit. Use the tabs at the top of the window to select a channel plan.

You can now make changes to the channel plan or to a specific channel.

Action	Commands and Reference to Instructions
Copying a plan	Click Copy Plan (see *Section 9.5.3*).
Creating a plan	Click New Plan (see *Section 9.5.1*).
Deleting a plan	Click Delete Plan to remove the selected plan from the file.
Creating a channel	Click New Channel to add a channel to the selected plan (see *Section 9.5.2*).
Deleting a channel	Click Delete Channel to remove the channel plan from the plan.
Editing a channel	Select a channel and use the tabs to access the channel parameter menus. The tabs vary according the channel type. See *Section 9.5.2.1* for analog channels, *Section 9.5.2.2* for digital channels, or *Section 9.5.2.3* for other channels.

9.5.5. Saving, Importing, & Exporting a Channel Plan

WinCom II can import and export the channel plans you create or edit into a format that can be uploaded to a spectrum analyzer. Channel plan files which have the .SCP file extension are editable. Channel plan files with the .SCP file extension are exported to a file of type .ACP. Channel plan files with the .ACP extension are required in order to transfer the channel plan to a spectrum analyzer. The Channel Plan Editor utility within WinCom II provides the ability to export and convert .SCP files to .ACP files.

9.5.5.1 Saving a Channel Plan File

To save a channel plan file in a format that can be edited by WinCom II:

1. Choose Save or Save As from the Channel Plan Editor's File menu. Save overwrites the channel plan file with your changes, and keeps the same name. Save As opens a dialog box so you can choose another name and directory.
2. Browse to the directory you want to use. By default, the Channel Plan directory is selected.
3. Choose a name for your channel plan file. WinCom II adds the file extension .SCP automatically.
4. Click OK to record your changes in the channel plan file.

When you exit a channel plan file or when you open a new file, WinCom II prompts you to save your changes. This is a normal save operation and does not allow you to change the name or location of the file.

9.5.5.2 Importing a Channel Plan File

To import channel plan files from the AT2500 spectrum analyzer (files with .ACP extension) into the Channel Plan Editor format (files with .SCP extension):

1. Choose the **Channel Plans** entry in the Remote Files.
2. Select the specific file which contains the channel plan to be imported.
3. Move the file over to the local files into a desired directory where the channel plan is to reside.
4. Launch the Channel Plan Editor.
5. Choose Import from the Channel Plan Editor's File menu. This opens the Import dialog box.
6. Browse to the directory which contains the channel plan and open the file.
7. Proceed to make changes for each channel as required to the imported channel plan file.
8. Refer to *Section 9.5.5.1* to save the file.

Exporting a Channel Plan File

IMPORTANT: *For AT2500 series used in conjunction with WinCom II software version 2.2, alterations can be made to the channel plans while making measurements in the field. S/W version 2.2 provides the ability to import edited channel plans via the Channel Plan Editor, therefore eliminating the need to replicate them exactly on the PC.*

Prior to WinCom II software version 2.2, no alterations to the channel plans can be made while making measurements in the field. If any changes have been made in the field, the data will not be exported properly to FCC reports such as the VeEX, Inc. report or Family Ware POP program. Make sure you replicate the changes exactly on the PC that will receive the field traces and produce the FCC report.

In either case, for purposes of data integrity, the channel plan should be finalized and used throughout the testing cycle.

To export a channel plan file in a format that can be transferred to an AT2500 series spectrum analyzer:

1. Choose Export from the Channel Plan Editor's File menu. This opens the Export dialog box.
2. Browse to the directory you want to use. By default, the Channel Plan directory is selected.
3. Choose a name for your channel plan file. WinCom II adds the file extension .ACP automatically.
4. Click Save to export the channel plan file to a format for the AT2500 series spectrum analyzer.
5. Move the file over from the local files to the remote files.

9.6 Troubleshooting and Maintenance

This section includes procedures for using WinCom II on another computer, uninstalling WinCom II, and for upgrading the spectrum analyzer. VeEX, Inc.'s technical support contact information is included in Chapter 11 "VeEX, Inc. Service and Support".

9.6.1 Moving to a New Computer

WinCom II only works on the computer that you used to install and register the software. If you need to install WinCom II on a different computer, you need to obtain a new password for that computer.

When moving WinCom II to another computer you must, as stated in the License Agreement, remove WinCom or WinCom II from the old computer.

Follow the instructions for program removal in the next section, then install and register WinCom II on another computer. See *Section 9.2.2, "Installing the WinCom II Software Package"* for installation and registration instructions.

9.6.2 Uninstalling WinCom II

WinCom II must be removed from your computer if you want to install it on a different computer, in accordance with the License Agreement.

WinCom II is removed from your computer the same way that any other program is removed using the Windows operating system. Some steps in the program removal procedure may be slightly different depending on your operating system.

To remove WinCom II:

Go to the Windows Control Panel. You can access the Control Panel through the Windows Start menu. For Windows 2000, select Settings then Control Panel.

- In the Control Panel, select Add/Remove Programs.
- Select WinCom II from the displayed list and click Add/Remove or Remove, depending on your operating system. Follow the onscreen prompts.

IMPORTANT: *Data files are never deleted, only program files.*

9.6.3 Upgrading Firmware

WinCom II includes a simple utility for upgrading the spectrum analyzer's firmware with a special firmware file from SunriseTelecom:

AT2000 "L" type analyzers	file extension .ULF
AT2000 "D" type analyzers	file extension .UDF
AT2500 with parallel port	file extension .TAR.GZ
AT2500 with USB port	file extension .RUN

All user parameters are set to their factory default values when you upgrade the firmware. Your channel plan is still in memory, but it may not be selected as the default plan. All stored measurements and settings are also kept in memory. As a precaution, download the stored data from the spectrum analyzer every time you upgrade or update the firmware to avoid the possibility of losing data due to the incompatibility of a given parameter. See section 9.4.6, "Exporting Data" for more information.

For firmware upgrades, the spectrum analyzer must be in remote mode. From any mode except Menu, press the COMM function button to put the unit into remote mode. Or, select the Remote icon in the menu, and then select a mode such as Spectrum Analyzer.

To upgrade the spectrum analyzer's firmware:

Make sure you have the appropriate firmware. VeEX, Inc. provides update files on disk, or they can be downloaded from the website at www.sunrisetelecom.com. You must have a password in order to download files from the web site. Contact VeEX, Inc.'s customer support department to obtain a password.

1. Make sure the spectrum analyzer is in remote mode.
2. Run the WinCom II software and establish communication with the spectrum analyzer.
3. Select Upgrade Firmware from the WinCom II Communications menu. Using the dialog box, select the firmware file. The firmware file has the extension ".TAR.GZ" for an AT2500 with a parallel port or ".RUN" for an AT2500 with USB ports.
4. Double-click on the file to start the upgrade procedure.
5. Once the file transfer is complete, WinCom II will attempt to reconnect to the AT2500. It may take several minutes for the new firmware to load in the AT2500, in which case the reconnect attempt will time out.
6. Remember to set up your user parameters in the spectrum analyzer.

9.6.4 Troubleshooting Communication Errors

If you are having problems following a Windows session crash while you were connected to the analyzer, please note that it may take up to 3 minutes before Windows closes the socket and before the analyzer allows another log on attempt.

If you still cannot connect after 3 minutes, check the following.

1. Check for cabling errors. The spectrum analyzer needs to be connected to the PC or to the same network as the PC. Note that for direct connections, a cross-over cable (Ethernet) or null modem cable (serial) is required. For connection information, see Chapter 2.
2. Check the firmware version of the spectrum analyzer. In order to operate with WinCom II, you need firmware version 4.21 or higher for the AT2000, and you need firmware 1.00 or higher for the AT2500.
   - Check the analyzer's remote setup:
   - server mode active (system type is set to "Server")
   - system ID matches the ID in WinCom II's connection
   - TCP/IP network is initialized
   - analyzer is in remote mode

   From any mode except Menu, press the COMM function button to put the unit into remote mode.

   - Check the port setup used for remote communication on the analyzer and on the PC. Make sure that you have configured the communications in WinCom II to match the communication settings in the analyzer:
   - For serial communications, make sure the port speed matches.
   - For TCP/IP connections, make sure you have the correct subnet mask and gateway, if applicable. Check the IP address of the analyzer.

Legal Notices

WinCom II License Agreement

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10 AT2500 WebRemote

10.1 Welcome

WebRemote is a web application built into VeEX, Inc. AT2500 series spectrum analyzer products, providing remote access to the analyzer functions from your PC. It offers control of the unit's digital channel functions such as digital channel power, bit error rate, modulation error rate and other QAM signal quality parameters. It includes a digital channel mode and three views for QAM analysis: constellation view, statistical graph view and adaptive equalizer parameters display.

The menus are similar to the menus of the VeEX, Inc. QAM analyzer. WebRe- mote also enhances certain features of the VeEX, Inc. analyzers. For example, WebRemote can display peak hold, min hold and live trace simultaneously. .

10.2 Preparing to Install Firmware for WebRemote

Before you install the firmware upgrade so that you can access the AT2500 WebRemote, make sure your computer meets the minimum requirements. To save time connecting your spectrum analyzer to your network, make sure you have the right cables.

10.2.1 System Requirements

The following table shows the recommended minimum requirements.

Category	Minimum Requirements
Machine Class	Pentium IV
Main Memory	1 GB of RAM
Display/Video card	SVGA, 1024 x 768 resolution
LAN	Ethernet 10/100/1G or wireless
Browser	Adobe Flash player 10

Table 10-1: WebRemote Requirements

10.2.2 Connection Requirements

You need to connect your VeEX, Inc. spectrum analyzer to a network to ac- cess it remotely. Three standard connection types are supported:

Connection Type	Required Cable
1. Networked Ethernet communications (using a hub)	Standard Ethernet cable
2. Direct (PC to analyzer) Ethernet communications	Crossover Ethernet cable
3. Direct (PC to analyzer) serial communications	Null modem cable

Table 10-2: Connection Types and Cabling Requirements

10.2.3 Connecting to an Analyzer

The AT2000 and AT2500 analyzers support a direct Ethernet 10Base-T connection or an Ethernet connection to a local area network (LAN). Null modem cables for direct connections are not provided with WebRemote. For a LAN connection, use standard Ethernet cables.

On the analyzer, you need to set up the remote connection. *See section 3.4.1 for complete instructions on setting up TCP/IP or serial communications.* Check the following:

- Make sure that you set the system type to Server.
- Make sure the analyzer is in REMOTE mode.
- If your analyzer is connected to a switch (see Figure 10-2), make sure that the switch is in REMOTE mode.

The following sections cover the three possible connections, as shown in Figure 10-1:

1. an Ethernet connection to a local area network (LAN)
2. a direct Ethernet 10Base-T connection

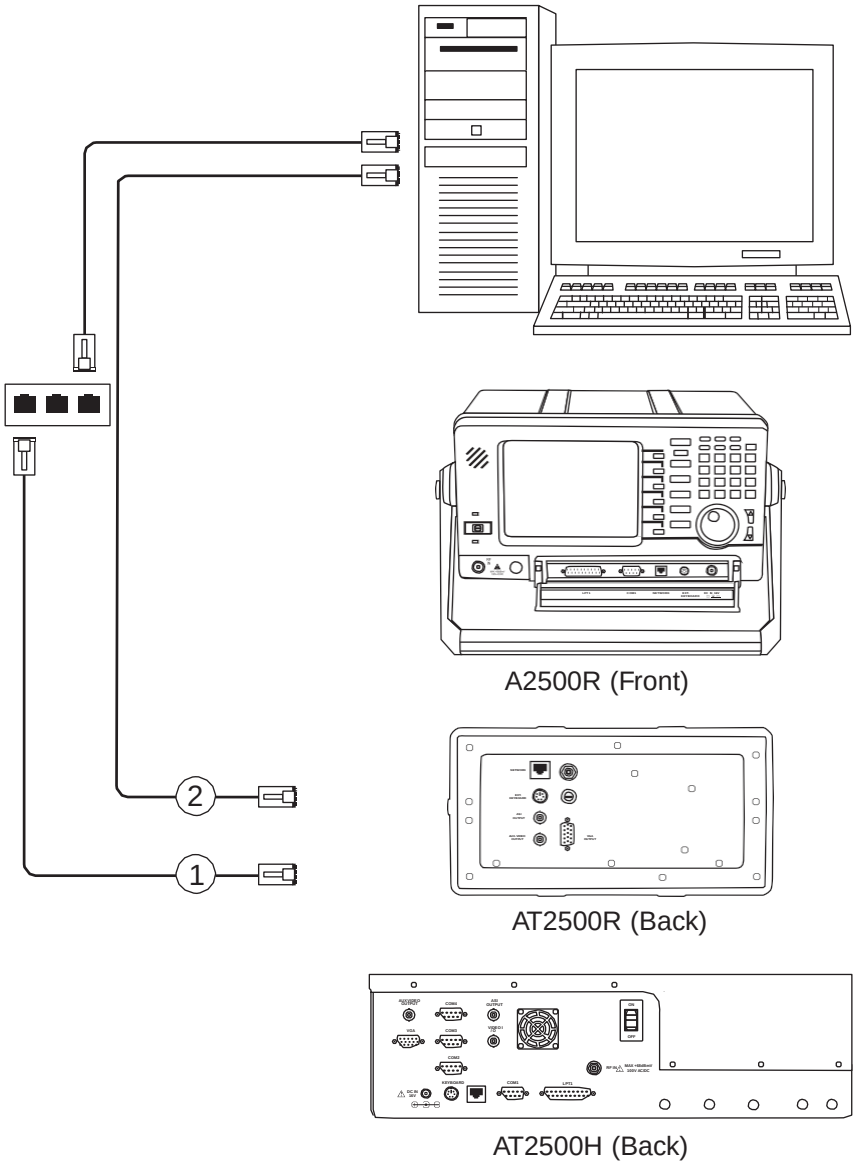

Figure 10-1: Connecting to an Analyzer

You can also connect to a spectrum analyzer that is monitoring nodes with the AT1600 series switches. Make sure that you use the cables provided with the switch to complete all connections. Refer to the AT1600M series user manual for details on using switches.

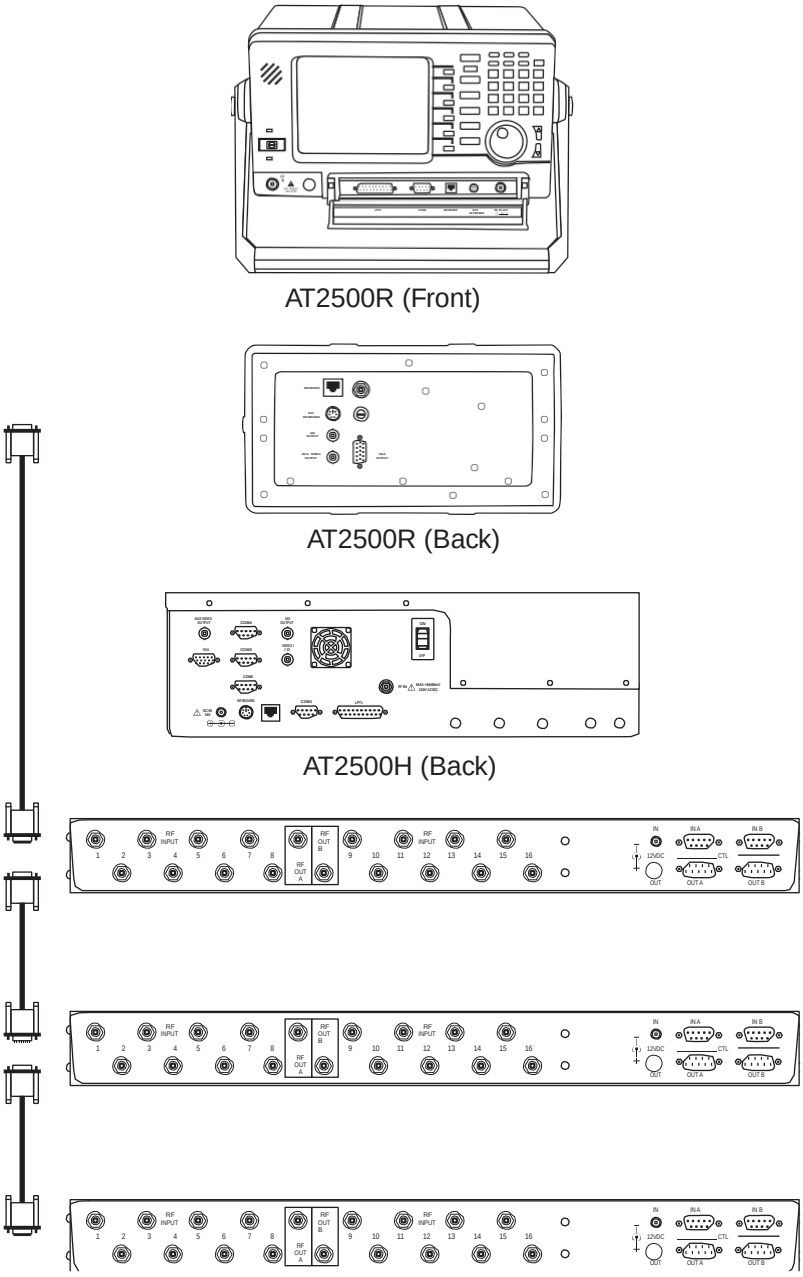

Figure 10-2: Cabling an Analyzer with AT1600 Series Switches 2-3

Cabling a Network Connection

To communicate over a LAN, the analyzer and your PC must be connected to the same network via a hub or router. Do not use crossover cables for these connections; use standard Ethernet cables. These cables are not provided.

Refer to Figure 10-1. These instructions are for the cabling numbered “1” in the diagram.

To set up a network connection:

1. Connect your PC to your network using a straight-through standard CAT-5 Ethernet cable.
2. Connect the analyzer to your network using a straight-through standard CAT-5 Ethernet cable. Use the RJ-45 jack on the analyzer. Depending on the year and model, the RJ-45 connector can be found either in the back or the front of the unit. On “R” models, the RJ-45 jack is either on the front or rear of the unit. On “HM” models, the RJ-45 jack is on the rear of the unit.

Cabling a Direct Ethernet Connection

Refer to Figure 10-1. These instructions are for the cabling numbered “2” in the diagram.

To set up a direct Ethernet connection:

- Connect your PC directly to the analyzer using a crossover Ethernet cable. This cable is not provided with WebRemote. Use the RJ-45 jack on the analyzer. On “R” models, the RJ-45 jack is either on the front or back of the unit. On “HM” models, the RJ-45 jack is on the rear of the unit.

10.3 Installation and Registration

To access the AT2500 WebRemote, you must install the firmware upgrade to each analyzer you want to access remotely. The firmware upgrade allows you to enter a license key, which activates WebRemote. After entering the license key on the analyzer, you can then access it remotely via WebRemote.

To access your analyzer via WebRemote, your analyzer must be connected to the network and have ports 80, 843, and 3001 unblocked on your network's firewall.

10.3.1 Installing the Firmware

You can download the firmware update files from the VeEX, Inc. web site at www.sunrisetelecom.com. You must have a password to download files. Contact VeEX, Inc. Customer Service at 1-800-701-5208 or catv_tech_support@sunrisetelecom.com to obtain a password.

To upgrade the analyzer's firmware:

1. Download the firmware file to your computer from VeEX, Inc..
2. Make sure the spectrum analyzer is in REMOTE mode.
3. Run the WinCom II software and establish communication with the spectrum analyzer. For more information about WinCom II, see *Chapter 9 WinCom II*.
4. Select **Upgrade Firmware** from the WinCom II Communications menu. Using the dialog box, select the firmware file that you downloaded to your computer from VeEX, Inc.. The firmware file has the extension ".TAR.GZ" for an AT2500 with a parallel port or ".RUN" for an AT2500 with USB ports.
5. Double-click on the file to start the upgrade procedure.
6. Once the file transfer is complete, WinCom II will attempt to reconnect to the AT2500. It may take several minutes for the new firmware to load in the AT2500, in which case the reconnect attempt will time out.

If you are having problems connecting, see 9.6.4 Troubleshooting Communication Errors on page 9-53.

10.3.2 Entering the License Code for WebRemote

WARNING: DO NOT CHANGE your existing license code until you have received the appropriate WebRemote license code from VeEX, Inc. Customer Service. Entering an incorrect license code/password results in locking the analyzer from use.

After installing the firmware to your analyzer, contact VeEX, Inc. Customer Service at 1-800-701-5208 or catv_tech_support@sunrisetelecom.com for the WebRemote license key. To enter the license key on your analyzer:

1. On your spectrum analyzer, press **MENU**.
2. Press **+/- 1 2 3**.

3. Press **MENU**. The **Password** screen appears with your unique license code. Write this code/password down in case you inadvertently lock your analyzer from use and need to re-enter it.

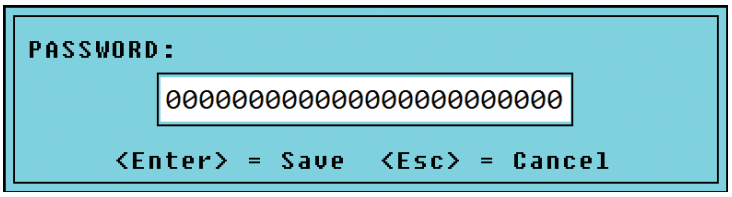

Figure 10-3: Entering the License Code

4. Type the NEW license code exactly as it was given to you by VeEX, Inc. Customer Service.
5. Press **ENTER**.
6. Reboot your analyzer. It is now unlocked for access via WebRemote.

10.3.3 Checking the Spectrum Analyzer Setup

Once you have updated the firmware on your analyzer and entered the license code for WebRemote, make sure that the analyzer is set up and connected to the network and that the correct ports and cable are used. Before attempting to access the analyzer via WebRemote, check the following:

- You have connected the proper cabling (*see section 10.2.3*).
- The spectrum analyzer has WebRemote firmware upgrade installed.
- The system ID is correct.
- The analyzer is in REMOTE mode.
  - On the “R” series, from any mode except Menu, press the COMM function button to put the unit into REMOTE mode.
  - Or, select the Remote icon in the menu, and then select a mode such as Spectrum Analyzer.
  - On “HM” models, the unit is normally set to operate in REMOTE mode by default.
- If there are any switches connected to the spectrum analyzer, make sure that they are in REMOTE mode also.

If your current session terminated abnormally while connected to the analyzer, it may take up to 3 minutes before Windows will close the socket and before the analyzer will allow another log on attempt.

10.4 Connecting via WebRemote

After upgrading the firmware on your spectrum analyzer and setting the analyzer to REMOTE mode, you can then access it via WebRemote.

To access the analyzer, open a browser on your computer and type the analyzer's IP address in the address bar. The AT2500 WebRemote main screen appears.

Figure 10-4: AT2500 WebRemote Main Screen

10.5 Setting up WebRemote

10.5.1 Customizing the Colors

The color of the items displayed in WebRemote can be customized to help you view and print the data on your screen.

To select a color scheme or custom colors:

1. From the **Settings** menu, select **Set Colors**. The screen appears which allows you to choose your color options.

Figure 10-5: Choosing Color Options

2. Choose one of the four pre-defined color schemes:

Scheme	Description
Defaults	This is the factory default color scheme, and is similar to the default indoor colors used on the spectrum analyzer.
Black-White	This is a black and white color scheme. When printing on monochrome printers, a black and white scheme may be most suitable. Dark areas are minimized in order to conserve toner or ink.
Store	This scheme limits the use of colors. It uses some color for traces, gridlines and markers while keeping everything else black and white to conserve toner or ink when printing.
Custom	This is a user-defined custom color scheme. Selecting this option restores the custom settings that were saved. Only one custom scheme can be saved.

Table 10-3: Pre-defined Color Schemes

3. If you want to use your own color scheme, start with the color scheme that is closest to what you want to use, and edit the component(s). The current color appears in a small box next to the item. To change this color, click on the color and select a new color from the choices. There are eight editable screen components:

Component	Description
Graphic BKG	This is the color of the graticule's background. Choose a color that allows enough contrast with the grid lines, traces, markers and thresholds.
Grid Lines	This is the color of the dotted grid lines.
Text	This is the color of the text that appears outside of the graticule or display area.
Background	This is the color of the margin around the graticule, where text is shown. Choose a color that allows enough contrast with the text color.
Trace	This is the color of the live trace.
Markers	This is the color of the vertical markers and the horizontal or frame marker.
Trace 2	This is the color of the recalled trace. Choose a color that is different from the live trace to help compare traces.
Threshold	This is the color of the limit lines, if applicable.

Table 10-4: Screen Components

4. Once you have made your changes, click **Store** to record your color scheme. Click **Custom** to revert to your saved color scheme at any time.

You may save only one custom color scheme. If you make any changes to your custom color scheme and click Store, you will override your previously saved color scheme.

10.6 Connecting to the Analyzer

To connect to the analyzer, click **Settings** from the menu at the top and then click **Connect**.

Figure 10-6: Connecting to the Analyzer

10.7 Controlling the Instrument

WebRemote provides control over many spectrum analyzer display parameters when you are logged on to a remote analyzer. For example, you can change the center frequency and span, or set the reference level.

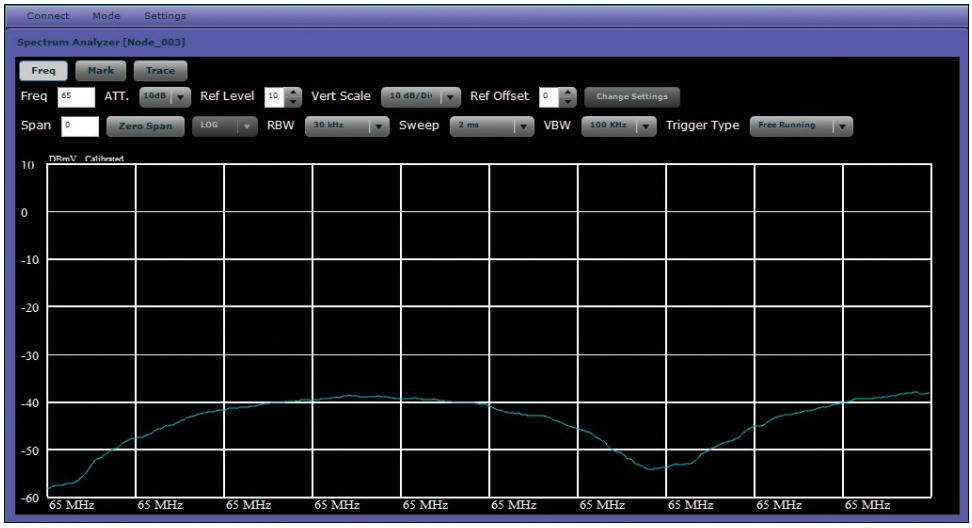

Figure 10-7: Spectrum Analyzer Mode

10.7.1 Setting the Center Frequency

To select a center frequency:

1. Click **Freq**. The trace settings appear above the trace graticule.

Figure 10-8: Setting Center Frequency

2. In the **Freq** box, enter the new MHz value for the spectrum analyzer's center frequency.
3. Press **ENTER** or click **Change Settings** to view the change.

10.7.2 Setting the Span and Sweep Options

The Span settings affect how the spectrum analyzer's IF filter is used on a given span. The Span also affects how the trace is processed.

To enter the Frequency Span:

1. Click **Freq**. The trace settings appear above the trace graticule.

Figure 10-9: Setting Span

2. In the **Span** box, enter the new MHz value for the spectrum analyzer's frequency span.
3. Press **ENTER** or click **Change Settings** to view the change.

Zero Span

Use the Zero Span button to access the spectrum analyzer's built-in AM/FM demodulator. You can toggle between zero span and maximum span by clicking the Zero Span button again.

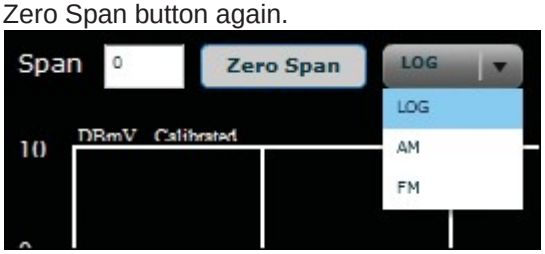

Figure 10-10: Zero Span Options

LOG

Use the **LOG** drop-down list box to select the Zero Span settings. The Zero Span value must be set to 0 to access these options. The options are:

LOG—Selects logarithmic scaling by activating the audio demodulator to detect aural signals.

AM—Selects the amplitude modulation (AM) detector and sets the vertical scale to a percent of modulation.

FM—Selects the frequency modulation (FM) detector and sets the vertical scale to deviation in kHz.

Click **Change Settings** after making changes to ensure that your settings have taken affect on the analyzer.

Resolution Bandwidth, Video Bandwidth and Sweep Time

Enter the resolution bandwidth (RBW), sweep time (SWT) and video bandwidth (VBW) to ensure calibrated measurements.

For viewing a TV channel, the RBW and VBW should be set to 300 kHz and 100 kHz respectively, or wider if the span is greater than 10 MHz. You can, however, adjust the settings manually if required.

If you manually change the RBW, VBW and SWT settings to values that are incompatible for an accurate measurement, an "uncalibrated" message appears.

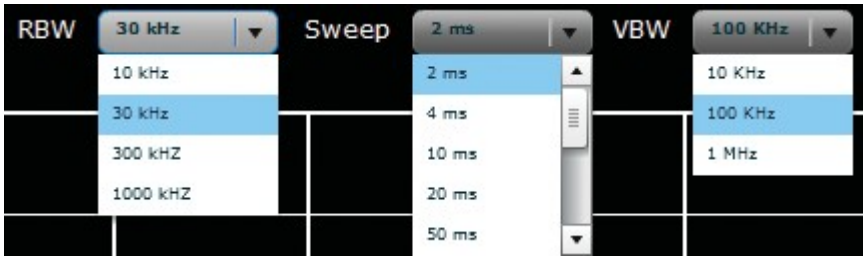

Figure 10-11: Bandwidth and Sweep Time Options

To set up the resolution bandwidth, sweep time and video bandwidth, click the drop-down list box and select the value for each parameter. The table below describes each parameter.

RBW Resolution Bandwidth -- Selects the IF filter setting for a measurement.

To change the bandwidth manually, use the drop down menu to select one of the accepted values: 10, 30, 300 or 1000 kHz.

Sweep Sweep Time -- Selects a sweep time in milliseconds (ms). If the sweep time is too slow for the bandwidth, the message “uncalibrated” appears to indicate that insufficient data is available to display the waveform properly.

To change the sweep time manually, use the drop down menu to select one of the accepted values. See your spectrum analyzer specifications for available sweep times and zero span horizontal times.

VBW Video Bandwidth -- Selects a video bandwidth in kilohertz (kHz).

To change the bandwidth manually, use the drop down menu to select one of the accepted values: 10kHz, 100kHz or 1MHz.

Sweep Mode Settings

Three sweep method options are available from the Trigger Type drop-down menu. Enabling one option disables the other two. By default the analyzer runs in Free Running mode. The Line Trigger and Video Trigger modes “freeze” the spectrum analyzer trace and display activity related to power line applications or TV signals.

Figure 10-12: Sweep Mode Options

Free Running Free Run -- In this mode, the spectrum analyzer continually scans and retraces the signal. The scan-retrace cycle repeats indefinitely.

Line Trigger Power Line -- In this mode, the spectrum analyzer scan-retrace cycle repeats at the power line frequency, which is 60 Hz or 50 Hz depending on how the channel is defined in the channel plan.

Video Trigger TV Frame -- In this mode, the scan’s starting time repeats at the video frame rate, which is 29.97 Hz or 25 Hz depending on how the channel is defined in the channel plan.

10.7.3 Setting the Amplitude Options

WebRemote also gives you access to options that affect the spectrum analyzer's internal attenuator and the reference level for displaying a trace.

Attenuation Settings

The spectrum analyzer's input attenuation can be changed according to the signal you are reading. The input attenuation is linked to the reference level, so that when you change the input attenuation, the reference level changes by the same amount. You can fine-tune the reference level adjustment once you have set the input attenuation.

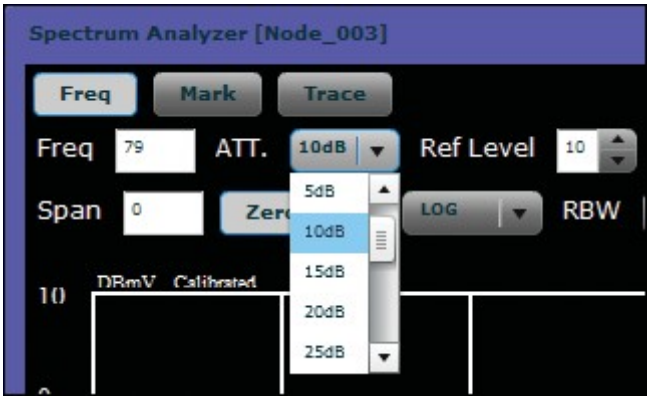

Figure 10-13: Setting Input Attenuation

To change the input attenuation:

- Click the **ATT.** drop-down menu and choose the attenuation from the list. The input attenuation can be set from 0 dB to 65 dB, in steps of 5 dB. When you change the input attenuation, the reference level changes by the same number of decibels and repositions the signal.

Reference Level

WebRemote uses the same reference level that was active on the spectrum analyzer when the trace was captured. However, if you change the vertical scale, you may need to change the reference level in order to view a specific portion of the signal. You may also want to change the reference level to position your signal at the top of the graticule.

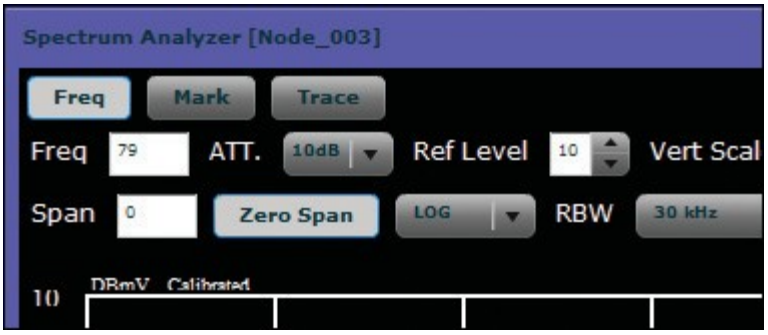

Figure 10-14: Setting the Reference Level

To change the reference level:

1. Click the up and down arrows next to the **Ref Level** box to adjust the Reference Level. Choose a value from –10 dB to 75 dB, in steps of 1 dB.
2. Click **Change Settings** to apply the new reference level. When you change the reference level, WebRemote repositions the signal. This change does not affect the input attenuation or vertical scale.

Vertical Scale

By default, WebRemote displays traces on a graticule with 10 dB per division. You can, however, change the scale on the vertical axis of the graticule to zoom in on the signal.

Figure 10-15: Setting the Vertical Scale

To change the vertical scale:

1. Click the **Vert Scal** drop-down arrow and choose how many decibels per division you want to use. Each division can be 2 dB, 5 dB, or 10 dB.
2. Click **Change Settings** to view the trace with the new vertical scale settings.

When you change the vertical scale, WebRemote repositions the signal. For example, if you chose a smaller scale, WebRemote hides the upper and lower portions of the signal. You may also want to change the reference level to view a particular portion of the signal.

Reference Offset

You can change the spectrum analyzer's reference offset to compensate for external filters. This function is useful when working with amplifiers or other equipment that have test points. All that has to be done for test point (TP) compensation is to enter the value of that TP.

WebRemote provides the option of setting the offset value from -40 to +40 dB. All level readings will be compensated automatically.

Figure 10-16: Setting the Reference Offset

To change the reference offset:

1. Click the **Ref Offset** up and down arrows to choose a value from –40 dB to 40 dB, in steps of 1 dB.
2. Click **Change Settings** to apply the new reference offset. When you change the reference offset, WebRemote repositions the signal and changes the reference level by the same number of decibels. This change does not affect the input attenuation or vertical scale.

10.7.4 Using Markers

If you use markers frequently, you can display the marker toolbar that provides shortcuts for activating the vertical and horizontal markers. To display this toolbar, click **Mark**. The marker options appear below the trace graticule. To view or hide the marker bars, click the checkboxes next to the marker options.

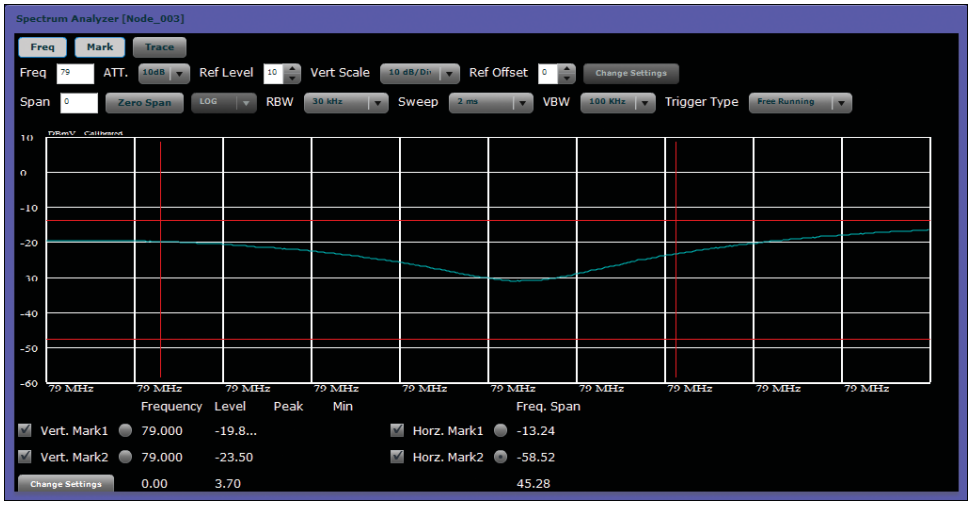

Figure 10-17: Using the Markers Menu

Markers (Vertical and Horizontal)

WebRemote includes two vertical markers and two horizontal markers to set level and frequency references. The vertical V1 and V2 markers indicate the frequency. For certain appropriate spans, the level is also displayed. When you select both vertical markers, WebRemote calculates the frequency and level deltas automatically.

When both horizontal markers are displayed on screen, WebRemote calculates the delta levels automatically, which can be useful for peak-to-valley measurements.

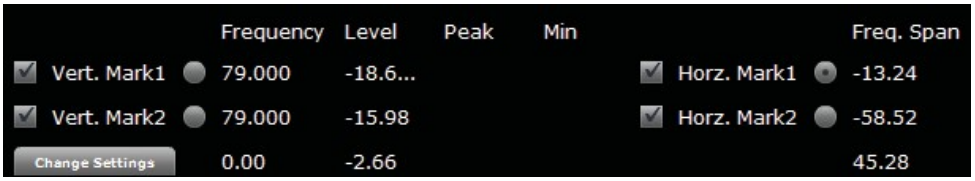

Figure 10-18: Setting the Vertical and Horizontal Markers

To turn on a marker:

1. Click **Mark** at the top of the screen. The marker options appear below the graticule: Vert. Mark1, Vert. Mark2, Horz. Mark1, and Horz. Mark2. You can activate both vertical markers and both horizontal markers at the same time.
2. A checkmark appears next to the active marker(s). To disable a marker, click the checkbox. The checkmark disappears, indicating that the marker is now disabled.
3. Set your markers to the desired position by clicking the radio button next to the marker option and then clicking the location on the graticule for that marker.

10.7.5 Setting the Trace Options

The Trace options provide access to a number of options that affect how the spectrum analyzer processes each trace. Access these options by clicking Trace at the top of the screen.

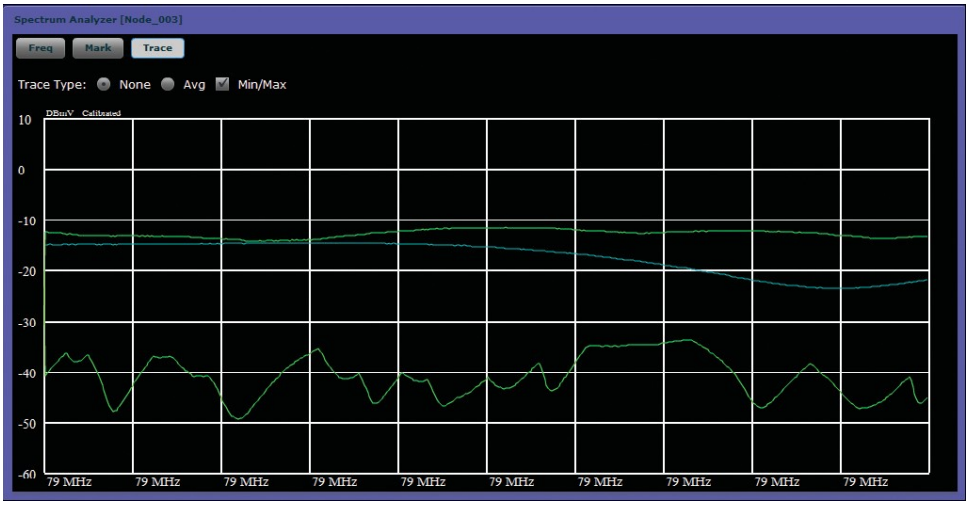

Figure 10-19: Setting the Live Trace Type

Figure 10-20: Trace Menu

You can set the spectrum analyzer to display the average value of each data point based on a certain number of captures.

To change the trace processing method:

1. At the top of the screen, click **Trace**. The Trace Type options appear above the graticule. The choices are:

None	The spectrum analyzer's averaging function is off. Data appears as it is captured.
Avg	The spectrum analyzer displays the average value of the past 8 captured traces (fast averaging).
Min/Max	The spectrum analyzer displays live Min and Max trace data as it is captured and overlays it on the cumulative trace (none or average).

2. Click the radio button for one of the choices. When you release the mouse, WebRemote applies the new trace processing method.

10.8 Selecting a Switch

The VeEX, Inc. spectrum analyzer can control a remote RF network switch attached to one of its COM ports. You can use WebRemote to select one of the RF inputs on the remote switch to view signals on a portion of the network.

1. To control a switch, click **Settings** from the menu at the top and then click **Port**.

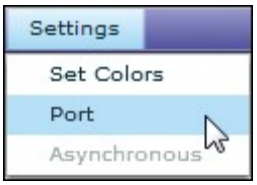

Figure 10-21: Setting the Live Trace Type

The **Port Selection** screen appears.

Figure 10-22: Setting the Live Trace Type

2. Click the drop-down arrow and select the switch and node (port) you want to observe.
3. Click **OK**.

10.9 Digital Channel Power

Digital Channel Power mode is part of the CATVPAK feature set that is standard on all “R” models of the AT2500 series analyzers. Once you are logged on to a remote analyzer you can control the analyzer and any switches that may be connected to it so that you can change the settings and measure digital channel power.

10.9.1 Selecting Digital Power Mode

Digital Channel Power is the default mode for WebRemote. It provides a frequency domain view of digital channels and includes digital power level measurement functions. In this mode, it is easier to view a QAM carrier when you select a center frequency.

To access Digital Channel Power mode, click **Mode** from the menu at the top, then click **DCP**. A small bullet appears next to this item in the menu to indicate that Digital Channel Power mode is active.

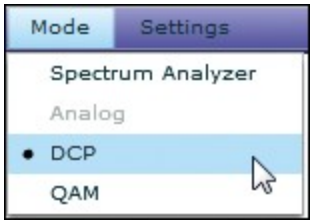

Figure 10-23: Selecting Digital Channel Power Mode

After accessing Digital Power mode, you can control analyzer parameters similarly as when you are in Spectrum Analyzer mode. *See section 10.7 for more information on how to control the analyzer while in Digital Power Mode.*

10.9.2 Measuring Channel Power

The VeEX, Inc. analyzer measures digital channel power by averaging the sum of power level acquisitions across the desired measurement bandwidth.

To measure digital channel power:

1. Make sure that WebRemote is in digital channel power mode (*see section 10.9.1*).
2. Enter the desired center frequency to be measured (*see section 10.7.1*).
3. To adjust the digital channel's bandwidth, enter the value in the **Bandwidth** box.. By default, WebRemote uses a 6 MHz bandwidth.
4. Click **Measure** to initiate the automatic measurement.

Figure 10-24: Measuring Digital Channel Power

10.10 QAM Analyzer

The QAM Analyzer Module is a standard feature on all “Q” models of the AT2000 and AT2500 series analyzers. In QAM Analyzer mode, you can view a constellation display, an equalizer display, a group delay display, and a frequency response display.

10.10.1 Selecting QAM Mode

To access QAM mode, click **Mode** from the menu at the top, then click **QAM**. A small bullet appears next to this item in the menu to indicate that QAM mode is active.

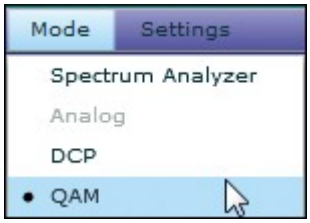

Figure 10-25: Selecting QAM Mode

After accessing QAM mode, you can control analyzer parameters similarly as when you are in Spectrum Analyzer mode.

10.10.2 Setting QAM Parameters

Once you are in QAM Analyzer mode, you can change the QAM setup to use the appropriate settings for the channel you are measuring. By default, when the QAM channel is defined in the channel plan, the analyzer automatically selects 16, 64, or 256 QAM settings with the appropriate settings such as symbol rate, polarity, standard type (Annex A, B or C, etc). You can also edit these settings.

1. Tune to the center frequency of the digital signal that you want to test. To tune while in QAM analyzer mode, enter the value in the Freq. box then press Change Settings.

Figure 10-26: Choosing QAM Channel Parameters

2. Choose the parameters for the channel your are testing:

Field	Values
Standard Type	Select one of the following: J83 ANNEX A, J83 ANNEX B, J83 ANNEX C, NO FEC 6MHZ, NO FEC 8MHZ, US QAM 16, US QAM 64.
Modulation Type	Select 16, 64, or 256 QAM.
Symbol Rate	WebRemote uses your selections for Standard Type and Modulation Type to calculate the correct Symbol Rate value. You can also enter a symbol rate of 1.000 to 7.000 MS/sec, manually.
Polarity Type	Select Automatic, Normal or Reverse polarity. Reverse is used with IF signals from modulators (before up conversion). Default setting is Automatic.

Table 10-5: QAM Channel Parameters

10.10.3 Choosing a View

Once you are in QAM analyzer mode, WebRemote displays the signal in the mode that was last used: constellation, equalizer, frequency response, or group delay. As soon as the analyzer has locked onto a QAM signal, it starts testing certain signal quality parameters.

- To activate a particular view mode, click **Constellation** or **Equalizer Mode** to change modes.
- Once in Equalizer Mode, click the **Group Delay** or **Frequency Response** graphs to view a larger version.

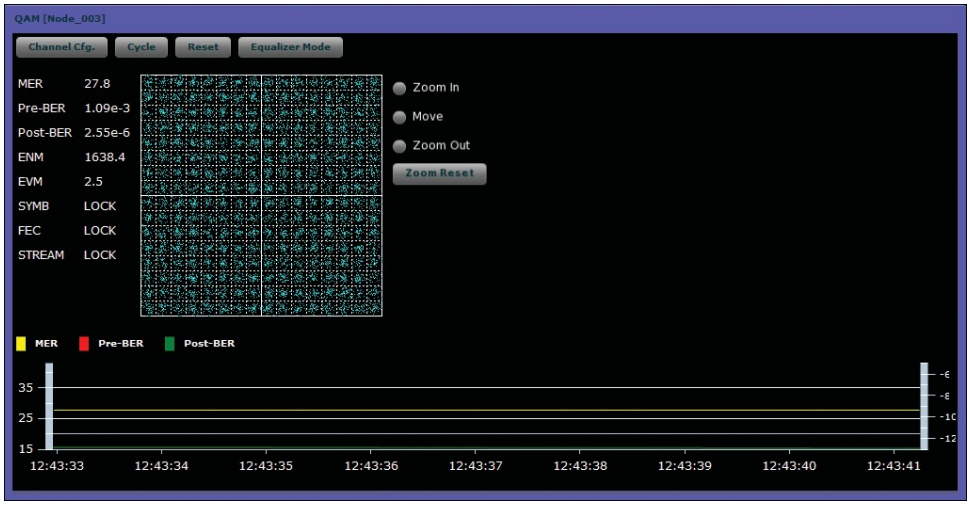

Figure 10-27: QAM Constellation View

Figure 10-28: QAM Equalizer Mode View

10.10.4 Testing Signal Quality

As soon as the analyzer has locked onto a QAM signal, it starts testing certain signal quality parameters.

In all of the QAM modes, WebRemote shows the results on the left side of the display. They are:

MER	Modulation Error Ratio (MER) indicates the ratio, in dB, of average total signal power in the ideal constellation to average error power in the constellation as received by the analyzer.
Pre-BER	Bit Error Rate (BER) Pre-Forward Error Correction (FEC) indicates all errors found in the previous second. It is shown as the ratio of errored bits to the total number of bits transmitted in the second. This figure is refreshed every second. The pre-FEC BER is normally higher than the post-FEC BER. BER is displayed in scientific notation. The more negative the exponent, the better the BER. In Statistical Graph Display mode, the pre-FEC BER figure is measured as soon as you click Start. The figure in the top left of the screen represents the cumulative pre-FEC BER for the time elapsed. In the graph, the measurements are refreshed every second.
Post-BER	Bit Error Rate Post-Forward Error Correction shows the ratio of uncorrected errored bits in a one second period. These are the bits that could not be corrected after the FEC circuits. This figure is refreshed every second. In Statistical Graph Display mode, the post-FEC BER figure is measured as soon as you click Start. The figure in the top left of the screen represents the cumulative post-FEC BER figure for the time elapsed. In the graph, the measurements are refreshed every second.
ENM	Estimated Noise Margin (ENM) is calculated from the MER, taking into account modulation type (16, 64 or 256 QAM), the symbol rate and the bandwidth.
EVM	Error Vector Magnitude (EVM) indicates the modulation quality of the transmitted signal before the forward error correction stage.
SYMB	Shows LOCK or UNLOCK to indicate whether the analyzer has synchronized with the QAM symbol rate.
FEC	Shows LOCK or UNLOCK to indicate whether the analyzer has synchronized with the Forward Error Correction (FEC).
STREAM	Shows LOCK or UNLOCK to indicate whether the analyzer has detected the presence of an MPEG transport stream and has synchronized with this stream.

Table 10-6: RF Signal Measurements

10.10.5 Using the Constellation View Options

Setting the Symbol Display Mode

In constellation display mode, you can select from two symbol display modes that determine the number of symbols displayed at any time: cyclic or continuous.

1. To choose a mode, click the button labeled **Cycle** in the QAM toolbar. The drop-down menu appears above the graticule.

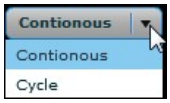

Figure 10-29: QAM Symbol View Menu

2. Click the drop-down arrow and select **Continuous** or **Cycle**.
3. Click **Cycle** in the **QAM** toolbar again to remove the drop-down menu from the display.

Mode	Symbol Display
Cycle	The analyzer plots the number of symbols specified in the Conserved Symbols field in the channel's QAM setup, and then clears the screen and starts over.
Continuous	The analyzer constantly populates the constellation display. It plots every symbol on the screen until stopped. There is no limit to the number of symbols that are displayed in this mode.

Table 10-7: Constellation Symbol View Options

Using the Zoom Functions

In Constellation mode, you can use your mouse to zoom in on a part of the constellation for closer viewing, or you can select the Zoom functions via the Constellations item in the Setting menu.

Figure 10-30: Constellation Zoom Options

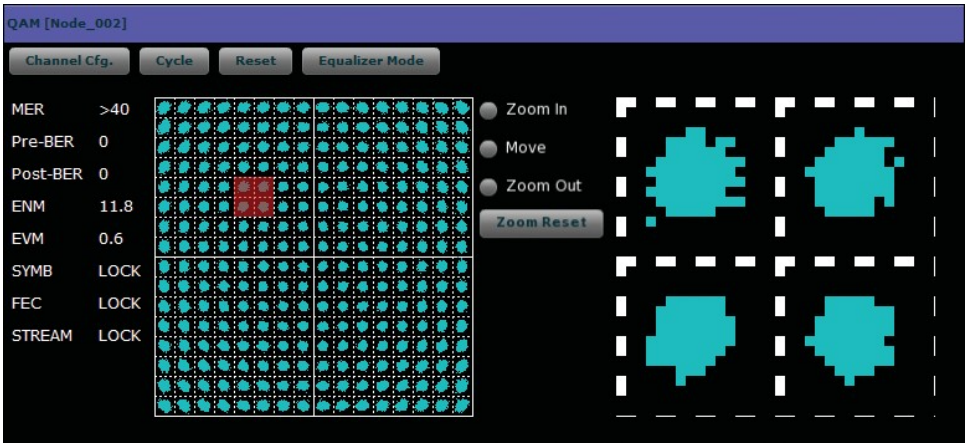

Figure 10-31: Zooming In On the Constellation

To zoom in on an area using your mouse:

1. Click the **Zoom In** radio button to the right of the constellation grid.
2. Click a quadrant on the constellation. A red outline appears around the quadrant you clicked if you are using the factory preset color scheme.
3. Click once to zoom in by a factor of 4. Continue to select a frame and click the mouse until you have zoomed in to the desired level. WebRemote allows you to zoom in on a single square in the constellation map.

To zoom out on an area using your mouse:

1. To zoom out, click the **Zoom Out** radio button to the right of the constellation grid.
2. Click a quadrant on the constellation. A red outline appears around the quadrant you clicked if you are using the factory preset color scheme.
3. Click once to zoom out by a factor of 4. Continue to select a frame and click the mouse until you have zoomed out to the desired level or the full view.

To look at another frame without zooming in or out:

1. After zooming in or out to your desired view level, click the **Move** radio button.
2. Click a frame on the constellation. A red outline appears around the quadrant you clicked if you are using the factory preset color scheme. The selection will be at the same zoom view you most recently used.

10.10.6 Resetting the Constellation Display

WebRemote processes the real-time statistics for the signal that the remote analyzer is measuring, and displays the results on the constellation. To clear the constellation, click **Reset** below the zoom options.

10.10.7 Using the Adaptive Equalizer Options

WebRemote equalizer view displays the coefficients of the equalization filter, updated every second. This feature can be used to diagnose bandpass distortion (gain tilt, reflections). To activate the adaptive equalizer view, click **Equalizer Mode** n the QAM toolbar.

There are three different graphs in the Equalizer Mode view:

- a bar graph showing the 32 coefficients: 8 Feed-Forward Equalizers (FFE) and 24 Decision Feedback Equalizers (DFE). The eighth coefficient is the main signal path, so it is normally very close to 0 dB (unity gain). This graph has a slope line and a defined grid.
- a frequency response graph (from -3 to +5 dB) over the defined channel bandwidth.
- a group delay graph showing the delay in nsec (from –30 to +50 nsec) across the channel bandwidth.

10.11 Troubleshooting WebRemote

10.11.1 Communication Errors

If you are having problems following an abnormal termination of your Windows session while you were connected to the analyzer, please note that it may take up to three minutes before Windows closes the socket and before the analyzer allows another log on attempt.

If you still cannot connect after three minutes, check the following.

1. **Check for cabling errors.** The spectrum analyzer should be connected to the PC or to the same network as the PC. Note that for direct connections, a cross-over cable (Ethernet) or null modem cable (serial) is required. *For connection information, see section 10.2.2.*
2. **Check the firmware version** of the spectrum analyzer. In order to operate with WebRemote, you need firmware version 3.5 or higher for the AT2500.
3. **Check the analyzer's remote setup:**
   - server mode active (system type is set to "Server")
   - TCP/IP network is initialized
   - analyzer is in REMOTE mode

On the "R" series, from any mode except MENU, press the **COMM** *function button to put the unit into REMOTE mode. On "HM" models, the unit is normally set to operate in REMOTE mode by default.*

4. **Check the port setup** used for remote communication on the analyzer and on the PC. Make sure that you have configured the communications in your browser settings to match the communication settings in the analyzer:
   - For TCP/IP connections, make sure you have the correct subnet mask and gateway, if applicable.
   - Make sure that Ports 80, 843, and 3001 are unblocked on your network's firewall.
5. **Check the IP address** in your browser's address bar to make sure it matches the IP address of the analyzer you are trying to remotely access.
6. **Check the analyzer model.**
7. **Check to make sure Flash Player 10 is installed.**

11 VeEX, Inc. Service and Support

VeEX, Inc. is committed to excellent service worldwide. Our goal is to provide you with professional assistance in the use of our software and services, wherever you are located.

Technical Support and Customer Service solutions vary by country. If you have questions about the services described below, contact Technical support.

11.1 AT2500R Maintenance

11.1.1 RF Connector Replacement

Since the RF input and output connectors may receive many insertions per day of coaxial cable, the life of the connectors can be fairly short. The connectors are a 1 GHz rated, common type “F” double female that can be easily replaced with the aid of a 7/16-inch wrench. No case disassembly is required. Exact replacement F-connectors are available from VeEX, Inc..

11.1.2 Battery Pack Replacement

Sealed lead-acid batteries will last for hundreds of charge-discharge cycles, if properly cared for. However, after the normal lifetime of service, the battery pack will need to be replaced. This requires some disassembly of the unit.

To replace the battery pack:

1. Remove the unit from its canvas carry bag.
2. Remove the six (6) Phillips screws on the upper /rear of the AT2500R unit.
3. Slide the upper cover towards the rear and lift up and out.
4. Carefully unplug the two-wire terminal connectors and do not short the positive and negative battery connections.
5. Remove the strap that holds down the sealed lead-acid battery by removing the securing screws: one is located on the rear panel and the other is located on the chassis.
6. Insert the new battery pack into the battery holder portion of the chassis.
7. Re-install the hold down strap and chassis screws and reconnect the two-wire terminal connectors to the replacement battery. Respect terminal polarity.
8. To reinstall the chassis into the case, slide the chassis assembly into the case and replace the six (6) Phillips screws on the upper/rear of the AT2500R unit.

When re-assembly is completed, turn the unit on and press **MENU** to display the charge level of the battery. If the battery is nearly discharged (10.5 to 11 Volts), connect the AC power supply into the mains power and the AT2500, turn the analyzer off and allow the battery to charge at least 4 hours.

11.2 Technical Support

VeEX, Inc. is located in the Eastern Time zone with regular office hours from 5:00 am to 5:00 pm. A toll-free number covering all of North America is provided at no charge. Key VeEX, Inc. personnel can always be reached any time of the day through a toll-free number or electronic mail service over the Internet.

International customers should contact the nearest VeEX, Inc. representative, or the factory at:

North America Toll Free: 1-800-701-5208
Outside of North America: 1-408-360-2200
Fax: 1-408-363-8313
E-mail address for Technical Support: catv_tech_support@sunrisetelecom.com
website: www.sunrisetelecom.com

11.3 VeEX, Inc. Office Locations

VeEX, Inc. offices are located around the world:

VEEX, INC. (Headquarters)
302 Enzo Drive, San Jose, CA 95138, USA
Tel: 408-363-8000, Fax: 408-363-8313
info@sunrisetelecom.com

VEEX, INC. ATLANTA
3075 Northwoods Circle, Norcross, GA 30071, USA
Tel: 770-446-6086, Fax: 770-446-6850
catv@sunrisetelecom.com

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info@sunrisetelecom.com.cn

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6 Allée de Londres 91140 Villejust, FRANCE
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france@sunrisetelecom.com

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378 2400 Fax: +49 7473 378 2400
info@sunrisetelecom.de

VEEX, INC. TAIWAN
21, Wu Chuan 3rd Road, Wu-Ku Hsiang
Taipei County, 248, Taiwan, R.O.C.
Tel: +886-2-5578-0788, Fax: +886-2-2298-2575
info@sunrisetelecom.com.tw

11.4 Returning Equipment to VeEX, Inc.

VeEX, Inc. manufactures equipment to very high standards. Products are warranted against defects in materials and workmanship, as specified in our published product warranty. When properly used and operated, your equipment will provide many years of service. Should it become necessary to return the equipment to VeEX, Inc. for in or out of warranty repairs or for calibration, please see Customer's Responsibility below for the steps to follow.

If products are repaired or altered by persons not authorized by VeEX, Inc., or not in accordance with instructions furnished by VeEX, Inc. or if the products have become defective due to a result of misuse, improper repair, abnormal operating conditions, then the labor and materials required to effect the changes will be billed at our standard repair rates.

Customer's Responsibility

1. Contact VeEX, Inc. and request a Returned Material Authorization (RMA) number. Be sure to have your model and serial number ready.
2. After receiving the RMA number, return the equipment with an accurate description of the symptoms and be sure to state the authorization number on your paperwork. The client is responsible for all transportation charges to VeEX, Inc..

Original packaging is preferred. If unavailable, carefully package the equipment in alternate packing material to ensure adequate protection during shipping.

VeEX, Inc.'s Responsibility

1. VeEX, Inc. will acknowledge the receipt of the returned equipment and at that time bring any discrepancies to your attention.
2. VeEX, Inc. will replace or repair, at its discretion, any component or subassembly it deems necessary to return the unit to a proper condition.
3. After the necessary repairs, VeEX, Inc. will perform complete test and recalibration of the unit.

All precautions are taken by VeEX, Inc. to ensure that every unit meets all electrical and mechanical specifications prior to returning the equipment to the client.

VeEX, Inc. is not responsible for failures caused by transportation to/from the customer's location, nor by rough handling by the customer after receipt causing further damage to the product. VeEX, Inc. is solely responsible for the defects stated above and in our standard product warranty policy.

If you require information or assistance, contact VeEX, Inc. at **1-800-701-5208** toll-free from anywhere in North America or by fax at **1-408-363-8313** or by e-mail to: **catv_tech_support@sunrisetelecom.com**.

12 Reference

12.1 AT2500R Specifications

All specifications apply over the standard 0°C to + 50°C operating temperature range, after a minimum of 2½ hours of storage within the operating temperature range, if the unit is not fully at ambient temperature. The AT2500R meets all its specifications within 1 minute after it is turned on, providing that the AT2500 is within the one-year calibration cycle. The AT2500's autocal feature assures its accuracy by periodically self-testing and triggering a non-obstructive calibration, as required.

12.1.1 Miscellaneous

Parameter	Value
Size	304 x 177 x 355 mm (12" W x 7" H x 14" D)
Weight	10 kg (22 pounds)
Temperature, Operating	0 to +50°C
Temperature, Storage	-20°C to +55°C
Pollution Degree	II
Installation Category	II
Altitude	Up to 2000 m
Humidity	80% up to 31°C Decreasing linearly to 50% at 40°C
Shock and Vibration	3 g maximum
Power Supply Class	II, Tolerance: 16 VDC, 4.06 A PSU2065
Current Consumption	2.2 A max 2 A typical at 12 VDC
Ingress Protection of Enclosure	IPX1. IEC60529-1 Using protective case

12.1.2 Mechanical and Environmental Specifications

General

Temperature Readout Range	-15°C to 100°C ± 1.5°C
Display type	TFT Active Matrix Color LCD
Display size	162.5 mm (6.4 inches)

Power

Internal Battery Charger	Automatic Fast / Slow / Floating
Charger Protection*	Reverse polarity, Over/Under voltage 12/18 V
Power Supply PSU2065	100V/250V, 50/60 Hz, 16 VDC, 4.06 A
Certification	UL1950 UL / CUS 2L85 E136791 CSA950 LR36665 CE TUV / IEC 1950 PSE Australian APP. No. N/6655

** Power supply voltage range: 16 VDC +/-10%, under-voltage internal protection <12 VDC, over-voltage internal protection >18 VDC.*

Battery

Battery Type	Rechargeable lead acid, 12 Volt 7 Ah.
Charge Time	Approx. <4 hours
Operating Time	Approx. >2 hours (RQ active) (Model AT2500RQv, with QAM ON and LCD ON)

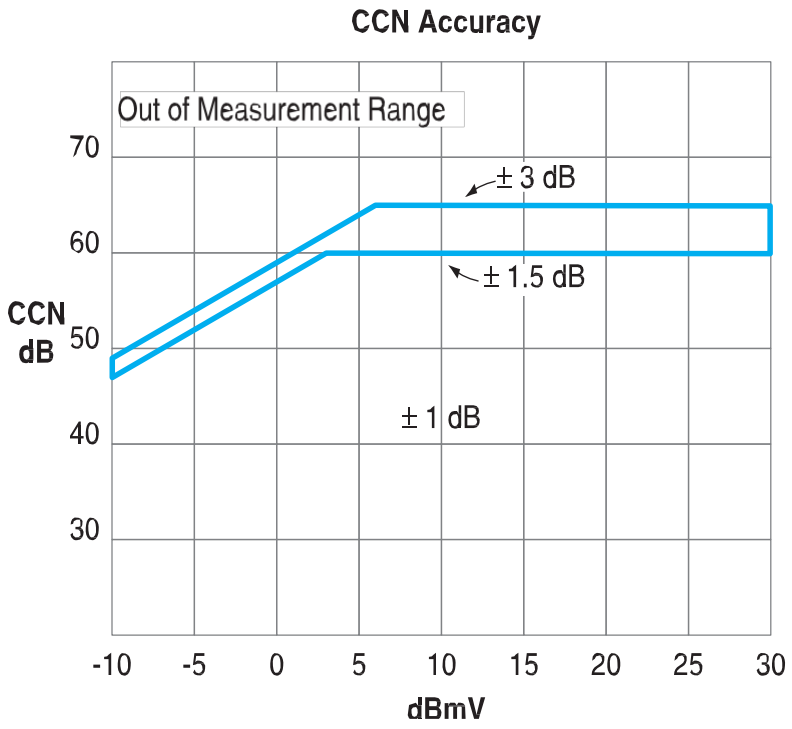

Figure 12-1: CCN Accuracy

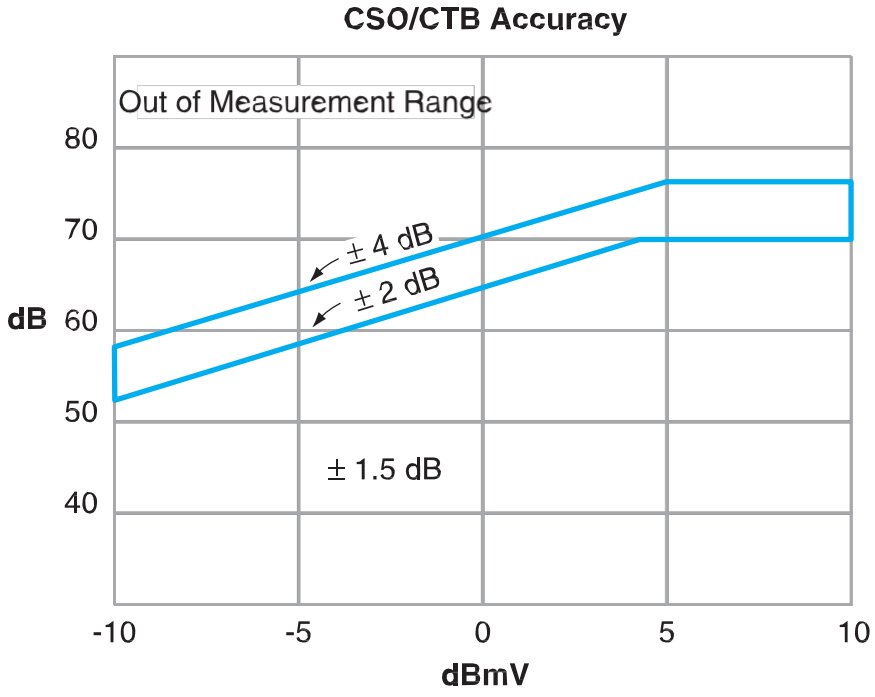

Figure 12-2: CSO/CTB Accuracy

12.2 Compliance documentation

VEEX, INC.
BROADBAND

STATEMENT OF COMPLIANCE

This product has been designed and tested in accordance with IEC Publication 1010, Safety Requirements for Electronic Measuring Apparatus, and has been supplied in a safe condition. The instruction documentation contains information and warnings which must be followed by the user to ensure safe operation and to maintain the product in a safe condition.

SUNRISE TELECOM
BROADBAND

DECLARATION OF CONFORMITY

Application of Council Directive(s): 89/336/EEC- the EMC directive

Manufacturer's Name: VeEX, Inc. Broadband
Manufacturer's Address: 10281 Renaude-Lapointe
Anjou, Quebec HlJ 2T4 CANADA

Manufacturer's Telephone Number: TEL: (514) 725-6652 FAX: (514) 725-5637

Equipment Type/Environment: Measurement, Control and Laboratory Eguigment

Model Number: AT2500HE/HM/HQ/HV/HQV/HMQ/HMV/HMQV Fixed/Rack-mounted Headend Sgectrum Analyser

AT2500R!RQ!RV!RQV Portable/bench Sgectrum Analyser

Standard(s) to which Conformity is Declared:

EN 61326-1:1997	Electrical Equipment for Measurement, Control and Laboratory Use, and Product Family Standards EN 61000-3-2, EN 61000-3-3
FCC Compliance	Emissions comply with FCC CFR 47, Part 15, Subpart B, Sections 15.107 & 15.109
EN 61010-1:1990 + A1:1992 + A2:1995 + 107A	Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use, Part 1: General Requirements
CAN/CSA-C22.2 No. 1010.1-92	Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use, Part I: General Requirements Amendment 2:1997 to CAN/CSA-C22.2 No. 1010.1-92
UL 61010C-1	Electrical Measuring and Test Equipment for Measurement Use, Part 1: General Requirements

Immunity Standard	Description	Severity Applied	Performance Criteria
EN 61000-4-2	Electrostatic Discharge	4 kV direct and indirect contact, 4 kV air	B
EN 61000-4-3	Radiated RF Immunity	3V/m, 80-1000 MHz 80% AM with I kHz sine wave	A
EN 61000-4-4	Electrical Fast Transient/Burst	+/-I kV on AC lines, +/-0.5 kV on 110 lines	B
EN 61000-4-5	Surge Immunity Test	+/-0.5 kV IM +/-0.5 kV CM 1.2J.Is/50J.IS Tr/Th	B
EN 61000-4-6	Conducted RF Immunity	I/O lines> 3 m and AC, DC, and Earth Port lines 3V rms, 0.15 –80 MHz 150 ohms, I kHz 80% AM modulation	A
EN 61000-4-11	Voltage Interrupts	I Cycle/ 100% (AC power line & I/0 lines)	C
EN 61000-3-2	Harmonic Current Emission	Class A level	N/A
EN 61000-3-3	Voltage Fluctuations and Flicker	Maximum Relative Voltage Change dmax < 4%	N/A

I, the undersigned, hereby declare that the equipment specified above conforms to the above Directive and Standards and carry CE marking accordingly.

Declared By

Signature:

Full Name: Gerard Terreault

Position: V.P. Technologies

Company: VeEX, Inc. Broadband

Address: 10281 Renaude-Lapointe
Anjou, Quebec HIJ 2T4 CANADA

Date: 2006111108

Legal ReJ:!resentative in Eurol!e

Signature:

Full Name:

Position:

Company:

Address:

Date:

CSA INTERNATIONAL

Certificate of Compliance

Certificate: 1205053

Master Contract: 210768

Project: 1805638

Date Issued: 2006/07/11

Issued to: VeEX, Inc. Broadband

10281 Renaude-Lapointe
Anjou, QC HIJ 2T4
Canada

The products listed below are eligible to bear the CSA Mark shown with adjacent indicators 'C' and 'US'

c ® us

Issued by: Abdelkrim Kassou, Jr. Eng.

Authorized by: Helene Vaillancourt,
Operations Manager

PRODUCTS

CLASS 3631 04 -ELECTRICAL MEASUREMENT AND TEST EQUIPMENT
CLASS 363184 -ELECTRICAL EQUIPMENT FOR MEASUREMENT USE- Certified to US Standards

Part A:

Spectrum Analyser Fixed/rack-mounted or Portable/bench top, Models: AT-2000HEIHMIHQ (Rack mount version), IPXO and AT-2000R/RQ (Portable version), IPXI INPUT: 120 VAC, 60HZ, 67W*, OUTPUT: 12VDC@3.5 A (BATTERY CHARGER) OR BATTERY OPERATFD 12VDC@ 2.2 A.

Part B:

The 'C' and 'US' indicators adjacent to the CSA Mark signify that the product has been evaluated to the applicable CSA and ANSI/UL Standards. for use in Canada and the U.S.. respectively. This 'US' indicator includes products eligible to bear the 'NRTL' indicator. NRTL. i.e. National Recognized Testing Laboratory. is a designation granted by the U.S. Occupational Safety and Health Administration (OSHA) to laboratories which have been recognized to perform certification to U.S. Standards.

D 507 Rev. 2()()4.06-30

CSA INTERNATIONAL

Certificate: 1205053 **Master Contract:** 2l0768

Project: 1805638 **Date Issued:** 2006/07/11

Spectnun Analyser Fixed/rack-mounted, model: AT-2500HE/HM/HQ/HV/HQV/HMQ/HMV/HMQV, rating: 100-240 Vac, 50-60Hz, l.OA *, IPXO. (Difference between models is software or video signals)

Part C:

Spectrum Analyser, Portable/bench top, model: AT-2500R/RQ/RV/RQV,

ratings: Input: 100-240 Vac, 50-60Hz, l.OA* / BATTERY OPERATED: 12VDC@ 2.2 A., IPXl.

(Difference between models is software or video signals)

CONDITIONS OF ACCEPTABILITY

PART A:

(*)Note: The above unit is intended to be supplied with a certified Class 2 power supply which was part of this evaluation rated input: 120Vac, 60Hz, 67W, rated output: 12Vdc, 3.5A. The Manufacturer shall make sure that the certified power supply provided with the product that is acceptable to the authorities in the country where the equipment is to be used.

PARTB andC:

(*)Note: The above unit is intended to be supplied with a certified external power supply which was part of this evaluation rated Input: 100-240 Vac, 50-60Hz, l.OA, Output: 16Vdc/ 4.06A. The Manufacturer shall make sure that the certified external power supply provided with the product that is acceptable to the authorities in the country where the equipment is to be used.

APPLICABLE REQUIREMENTS

- CAN/CSA-C22.2 No 1010.1-92- Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use, Part 1: General Requirements Amendment 2: 1997 to CAN/CSA-C22.2 No 1010.1-92
- UL 61010C-l - Electrical Measuring and Test Equipment for Measurement Use; Part I: General Requirements

D 507 Rev. 2004-0630

CSA INTERNATIONAL

Supplement to Certificate of Compliance

Certificate: 1205053 Master Contract: 210768

The products listed, including the latest revision described below, are eligible to be marked in accordance with the referenced Certificate.

Product Certification History

Project	Date	Description
1805638	2006/07/ll	Update to CSA report 1205053 to add an alternate construction.
1579001	2004/11/25	Addition of ventilation openings and fans to existing model.

History

1438886	2003/07/24	Addition of new models: AT-2500HEIHM/HQIHVIHQV/HMQ/HMVIHMQV (Part B) and AT-2500R/RQ/RV/RQV (Part C).
1205053	2002/04/16	Original Certification.

IEC IECEE CB SCHEME

Ref. Certif. No.

CA/7725/CSA

IEC SYSTEM FOR MUTUAL RECOGNITION OF TEST CERTIFICATES FOR ELECTRICAL EQUIPMENT (IECEE) CB SCHEME

SYSTEME CEI D'ACCEPTATION MUTUELLE DE CERTIFICATS D'ESSAIS DES EQUIPEMENTS ELECTRIQUES (IECEE) METHODE OC

CB TEST CERTIFICATE

CERTIFICAT D'ESSAI OC

Product Produit	Spectrum Ana:lyzer Units
Name and address of the applicant Nom et adresse du demandeur	SUNRISE 'T'EliECOM BROADBAND 10281 RenaucJe.,Lapointe Aqjou:,'Hll-2T4,. Canada
Name and address of the manufacturer Nom et adresse du fabricant	S ailabove
Name and address of the factory Nom et adresse de l'usine	Same as above
Note: *Wht•ll mortitan oth! jilctory, pleast' report on page 2* Note: *Lorsqrt> ily plus d uu usiue, l'ftttillrz utiliserla 1' ... page*	O Additional Informarion on page 2
Ratings and prillcipal characteristics Valeurs nominales et caracteristiques principales	100-240 Vac,5o-60Hz, l.OA*, IPXO (Fixed/rack-mounted models) and 100-240 Vac,5o-60Hz, l.OA*IBATI'ERY OPERATED: 12VDC@ 2.2 .Ai,WXl.(Portable/bench top models)
Trademark (if any) Marque de fabrique (si elle ex.iste)	SlJ RISE TELECOM BROADBAND
Model / Type Ref. Ref. De type	AT 2SboHEIHMIHQIHVIHQV/HMQ/HMV/HMQV (Ftxedlraek•mounted models) and AT-2500R/RQ/RV/RQV (Portable/bench top models)
1,,uu•uu••a• information (if necessary may also be reported 2) . iotimnatiognnplementaires (si necessaire,peuvent es Sl.!t la 2"'" page	O Additional Information on page 2
A sample of the product was tested and found to be in conformity with Un echantillon de ce produit a ete essaye eta ere considere COIWORne .t Ia	IEC PUBLICATION 60601-1 EOITIOI\ 1 IEC (ilOlQ..l, including.Amendments No. 1(1992) and No.2 (199S)'aud:NationahleviatioiJS to CB Bulletin 1Q7A
shown in the Test Report Ref. No. which forms part of Ceitificate indique dans le Rapport d'essais numero de reference qui constitue partie de ce Certificat	CB 2l0V68-1438890-l579007 1805639)

This CB Test Certificate is issued by the Qnal Body
Ce Certificat d'essai OC est etabli par l'Organisme !'"atiOftat de Certification

CSA INTERNATIONAL

CSA Intenmt:ioOal
178 Rexdale Boulevard
Toronto, ON M9W 1R3

Date: July 26, 2006

Gianluca Arcari, P.

Issued 2003-05 1/l

12.3 Glossary

12.3.1 Abbreviations

ASCII	American Standard Code for Information Interchange
ASI	Asynchronous Serial Interface
BAS	Bi-directional Alignment System
BER	Bit Error Rate
BPS	Bits Per Second
CCN	Carrier to Composite Noise
CSO	Composite Second Order
CTB	Composite Triple Beat
CW	Carrier Wave or Continuous Wave
DFE	Decision Feedback Equalizer
DHCP	Dynamic Host Configuration Protocol
DNS	Domain Name Server
ENM	Estimated Noise Margin
ES	Errored Second
EVM	Error Vector Magnitude
FCC	Federal Communications Commission
FEC	Forward Error Correction
FFE	Feed Forward Equalizer
FIFO	First In First Out
FLS	Frame Loss Second
FPS	Frames Per Second
ITU	International Telecommunication Union
MER	Modulation Error Ratio
MPEG	Motion Pictures Expert Group
POP	Proof of Performance
PPM	Parts Per Million
PRBS	Pseudo Random Bit Stream
QAM	Quadrature Amplitude Modulation
RBW	Resolution Bandwidth
RMS	Root-Mean-Square
SES	Severely Errored Second
SWT	Sweep Time
TCP/IP	Transmission Communication Protocol/Internet Protocol
TDM	Time Domain
UL	Underwriters' Laboratory
USB	Universal Serial Bus
VBW	Video Bandwidth
VITS	Vertical Interval Test Signal

12.3.2 Terms

Autocal	Routine that automatically adjusts the AT2500's measurement functions to a set of computer-generated traceable calibration standards, compensated for the current ambient temperature.
Autotest	Function to automatically measure frequencies and levels for all tagged channels and frequencies in the active channel plan.
Baud Rate	See Speed.
Beat-Near-Noise Correction	The beat correction factor obtained when the internal noise of the spectrum analyzer is compared to the measured system noise (in dB).
Bit Error Rate (BER)	Measurement for a digital signal that indicates the ratio of data received in error compared to the total number of bits received in a given period, e.g. 1 second. Pre-FEC BER measurements show the ratio of errors after digital decoding (i.e. after Trellis decoding, de-randomization and de-interleave) but before and after Reed-Solomon error correction. Post-FEC BER measurements show the ratio over a second of errors that cannot be corrected and which are therefore transmitted.
Carrier-To-Composite Noise Ratio (CCN)	The relationship of a carrier's power level to the system noise floor, expressed in dB. This measurement is calculated from the power in a sinusoidal signal, whose peak is equal to the peak of a visual carrier, divided by the system noise power in a 4 MHz bandwidth.
Channel Plan	List of channels (line-up) for a particular headend or location.
Channel Plan Directory	List of channel plan files in the AT2500 memory.
Channel Plan File	List of channel plans within a selected file. A channel plan contains individual channel line-ups.
Composite Second Order (CSO)	Distortion measurement that shows the products generated by the direct addition or subtraction of fundamental visual carrier frequencies. CSO products normally fall at ±750 kHz or ±1.25 MHz from the visual carriers.
Composite Triple Beat (CTB)	Distortion measurement that shows the ratio, expressed in dB, of the peak level of the RF signal to the peak of the average level of the cluster of distortion components centered around the carrier frequency. CTB is another type of third order intermodulation unique to CATV, since the majority of channels are spaced exactly 6 MHz (or another fixed offset) from each other.
Digital Channel Power	Sum of power level acquisitions across the desired measurement bandwidth.

DOCSIS	Data Over Cable Service Interface Specification is a standard developed to provide a common set of rules enabling interoperability between transmitting equipment and receiving equipment through a transmission channel.
Domain	A name that identifies one or more IP addresses.
Error Vector Magnitude (EVM)	Measurement of modulation quality of the transmitted signal before the forward error correction stage. It is calculated as follows: Error Vector Magnitude = (maximum symbol magnitude / rms error magnitude) X 100%
Errored Second (ES)	Indicates that one packet has an uncorrected error within a measurement second (post-FEC).
Estimated Noise Margin (ENM)	Indication of the headroom of the system, expressed in dB. ENM is calculated from the MER, taking into account QAM modulation type, symbol rate and bandwidth.
Forward Error Correction (FEC)	Method for controlling errors in a one-way system by sending extra information along with the data, which can be used by the receiver to check and correct the data using a predetermined algorithm.
Frame Loss Second (FLS)	Indicates that within a measurement second, the frame lock has been lost at least once.
Free Run Mode	Mode of operation where the AT2500 continually scans and retraces the signal. The scan-retrace cycle repeats indefinitely until a different mode is selected.
Gateway	Alternate term for router. Computer network device that connects autonomous systems by intercepting and routing data from one network to another. Gateways use the subnet number of data and determine which IP addresses to process based on a subnet mask.
Hub	Computer network device that accepts data from multiple points and then forwards the data using a switch.
Hum Modulation	The total peak-to-peak power line hum and low frequency AM modulation at all frequencies from DC to 1 kHz expressed as a percentage relative to the peak level of the reference carrier.
Mapping	In QAM modulation, the allocation of the symbol bits to each of the location of the constellation.
Modulation Error Ratio (MER)	The ratio of average total signal power in the ideal constellation to the average error power in the constellation as received by the AT2500, expressed in dB. It is calculated as follows: 10 X log (average symbol power/average error power) dB

Noise-Near-Noise Correction	Changes in attenuation automatically applied to CCN measurements for the measurement band, based on the calibrated noise floor of the AT2500.
Preset	Function that returns the AT2500 instrument settings to their factory-default values.
Pwr Line Mode	Mode of operation where the AT2500 scan-retrace cycle repeats at the power line frequency, which is 60 Hz or 50 Hz depending on how the channel is defined in the channel plan.
Reference Level	Measurement level in dBmV shown at the top of the AT2500's graticule display. The reference level is user-definable with a given range.
Reference Offset	Adjustment factor in dB applied to the signal level read by the AT2500 in order to take into account external gain or loss due to amplifiers, pads, filters, cables and so on, thus modifying the level displayed on the AT2500.
Remote Spectrum Mode	Mode of operation where the AT2500 is controlled by a VeEX, Inc. software application running on a PC.
Resolution (Frequency)	Difference in frequency between two data points, based on the number of data points (display resolution) and on the span.
Resolution Bandwidth (RBW)	The width of the AT2500's adjustable IF filter. Optimal RBW is related to sweep time, span and video bandwidth.
Router	Device that forwards packets between networks. The decision to forward or not is based on the network layer and routing tables.
Sensitivity	Ability to measure low-level signals. Input attenuator and resolution bandwidth settings affect the sensitivity by changing the signal-to-noise ratio. Attenuator settings affect the level of signal passing through the input of the instrument, whereas the resolution bandwidth affects the level of internal noise without affecting the signal.
Severely Errored Seconds (SES)	Indicates the total number of measurement seconds where the ratio of errored packets to transmitted packets is higher than a user settable threshold (from 1E-4 to 1E-2).
Signal-to-Noise Ratio (S/N)	The ratio of the amplitude of the desired signal to the amplitude of noise signals. S/N is usually expressed in dB as 20 X log (amplitude ratio) or 10 X log (power ratio), in peak values for impulse noise and RMS values for random noise.
Softkey	Onscreen menu options that correspond to one of the six unlabeled buttons to the right of the AT2500's display.

Speed	Rate at which the data is sent through the AT2500's serial port, measured in bits per seconds (bps) or in baud (state changes per second). Baud and bps are synonymous only for two-level modulation with no framing or stop bits. The AT2500's maximum speed is 115000 bps.
Subnet	A segment of an IP network. In an IP address, a portion of the address is used to identify the subnet. A subnet mask is used by routers to forward data to the network segment, based on its own routing tables. A typical subnet mask is 255.255.255.0, which indicates that the router should allow or deny access based on the first three parts of the IP address.
Sweep Time	The time that the AT2500 takes to read all the data points on the AT2500 display. Sweep time is related to span, resolution bandwidth and video bandwidth.
Switch	In return path monitoring applications, a device that selects an input
Tag	In the AT2500, a checkmark indicating that a channel, record or test option has been selected.
Test Point	Connection on a device used for making signal measurements.
TV Frame Mode	Mode of operation where the AT2500 scan's starting time repeats at the video frame rate, which is 29.97 Hz or 25 Hz depending on how the channel is defined in the channel plan.
Unav	Unavailability Time. A period of at least 10 consecutive severely errored seconds. The unavailability status is cleared when the AT2500 detects 10 consecutive non-SES seconds. The 10 non-SES seconds are not included in the unavailability time.
Video Bandwidth (VBW)	The adjustable video averaging function on the AT2500. Optimal VBW is related to sweep time, RBW and span.
Zero Span Mode	AT2500 mode for viewing signals in the time domain instead of the frequency domain typically used for TV signal analysis.

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