IQview

User's Guide

Litepoint Corporation

LPT802-11-L00

Version 1.1.0

November 07, 2003

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Revision History

Release date	Revision	Change Description
August 1, 2003	1.0.0	Initial release
November 7, 2003	1.1.0	• Addition information about updated IQsignal user interface. EVM.EXE was renamed IQsignal.EXE • Introduction of VSGpanel application • Updated certification information • Updated safety and compliance information

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Litepoint Corporation certifies this product met its published specifications at the time of shipment from the factory. Litepoint further certifies that is calibration measurements are traceable to the United States National Institute of Standards and Technology, to the extent allowed by the Institute's calibration facility and to the calibration facilities of other International Standards Organization members.

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Compliance

The equipment complies with the provisions of the Directive of the Council of the European Union on the approximation of the laws of the Member States.

-relating to electrical equipment for use within defined voltage limits

(73/23/EEC revised by 93/68/EEC)

-relating to electromagnetic compatibility

(89/336/EEC revised by 91/263/EEC, 92/31/EEC, 93/68/EEC)

Additionally the equipment complies with provisions of the US Federal Communications Commission and the Standards Council of Canada in regards to product safety and emissions.

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Conformity is proven by compliance with the following standards:

EN61010-1: 1993 + A2 : 1995

UL 61010A R4.02

CAN/CSA c22.2 No. 1010)

EN55011/ CISPR 11 : 1998 + A1+A2

EN61326-1 : 1997 + A1 + A2

FCC Part 15 Class A / 04.99

IC CS003

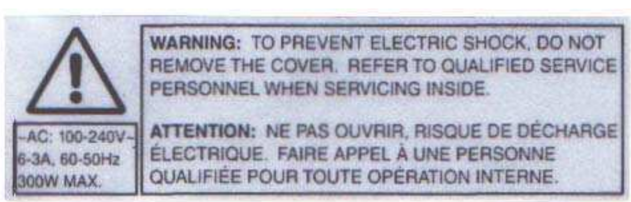
For the assessment of electromagnetic compatibility, the limits of radio interference for Class A equipment as well as the immunity to interference for operation in industry have been used as a basis.

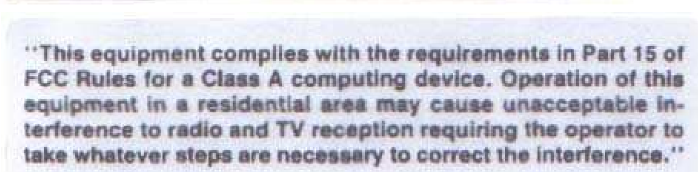
Safety Information

The equipment is certified for both 120 and 220V (50/60Hz) use. Always use a three-prong AC power cord providing earth grounding. The main plug should only be inserted into a socket outlet with protective earth contact. Failure to ensure adequate grounding may cause electric shock and damage to the equipment.

The equipment shall be used in accordance with the instruction specified by the manufacturer. If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

Safety related symbols used on equipment and documentation:





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Service and Support

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Chapter 1 Introduction

Purpose of this Guide

This guide describes the user interfaces for the following software applications, which can be installed on a PC to operate one or more IQview testers.

- IQview EVM Measurement Application
- IQview Administrative Tool

Audience Level

This user guide is intended for experienced personnel who know how to operate spectrum analyzers, RF signal generators, RF signal analyzers and oscilloscopes.

Related Documentation

- IQview Preliminary Datasheet, WLAN 2.4 / 5 GHz RF Tester

Contents of Box

The following hardware components should be included in your box:

- IQview 802.11 Tester
- IQview 802.11 Tester software installation CD
- Cross-over Ethernet CAT 5 cable
- Power cable

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Hardware and Software Requirements

The following hardware components and software is required to successfully run the IQview Tester.

- One or more IQview Testers
- The IQview Software Suite which consists of the following:
- IQview Administrative Tool (intended only for system administrators and must be installed at start up)
- PC running Windows 2000 or XP, CD-ROM drive, Ethernet 10/100
- Screen resolution minimum 1024 x 768

Multiple IQview Testers and PCs

An IQview testing system may include multiple IQview Testers and/or multiple PCs. The software suite running on a controlling PC communicates with the tester using a Local Area Network (LAN) connection. In a system including more than one tester, testers are distinguished one from another by having different LAN Internet Protocol (IP) addresses and tester names. Also, a tester may be locked, so that only one PC is allowed to have complete access and control.

NOTE: When communicating via a LAN, the controlling PC does not need to be physically close to the testers that it is controlling.

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IQview 802.11 RF Description

The IQview 802.11 RF Tester is a signal vector-based device that integrates a vector signal generator and analyzer in a single unit. This device is especially designed for debugging in a research and design environment and for high-volume production, prototype and pilot testing, and on-site and calibration support.

IQview is a dedicated single device test solution that replaces spectrum analyzers, RF signal generators and signal analyzers and oscilloscopes. Specifically designed for 802.11 systems and components, IQview provides high quality and performance at a fraction of the cost of traditional test instruments. Created by designers of some of the most advanced wireless systems and components on the market today, IQview is equally at home in the laboratory and the manufacturing floor. Product characteristics learned during development travel directly to manufacturing and Q/A reducing the time to bring-up manufacturing and quickly resolving manufacturing yield issues.

Hardware Description

The IQview Tester, which is desktop and rack-mountable in a 19” standard rack, can be used remotely to perform diagnostics and is software upgradeable.

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Figure 1-1. IQview 802.11 RF Tester

Front Panel

Figure 1-2 shows in detail the front panel of the IQview 802.11 RF Tester.

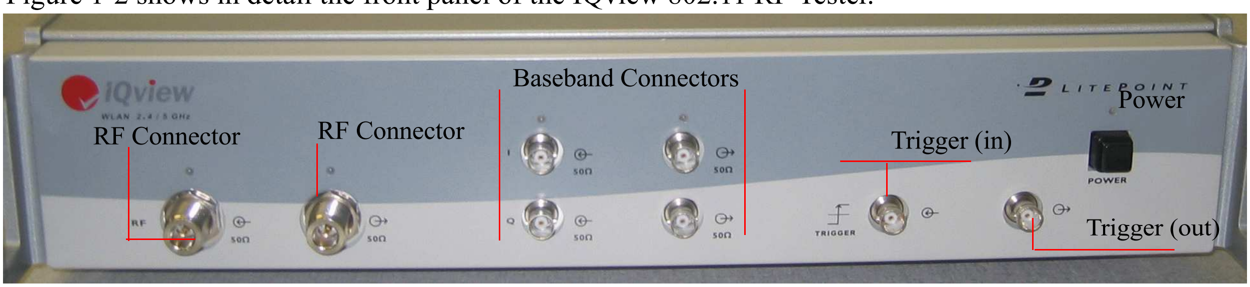

Figure 1-2. IQview 802.11 RF Tester, Front Panel

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Table 1-1 lists and describes the front panel connectors.

Table 1-1. Front Panel Connectors

Front Panel Connectors	Type	Description
RF Transmit	N-connector	50 ohm RF output signal for both 2.4-2.5GHz and 4.9-6.0GHz
RF Receive	N-connector	50 ohm RF output signal for both 2.4-2.5GHz and 4.9-6.0GHz
I/Q Baseband Transmit	BNC-connector	Single / Differential 50 ohm I/Q Baseband output signal
I/Q Baseband Receive	BNC-connector	Single / Differential 50 ohm I/Q Baseband input signal
Trigger Input	BNC-connector	Edge triggered input connector TTL 5V
Marker Output	BNC-connector	Output pulse connector TTL 5V

Table 1-2 lists and describes the front panel LEDs.

Table 1-2. Front Panel LEDs

LEDs	Color	Definition
RF Transmit	Green/Red	No light = Inactive Green = Active Red = Fault Condition
RF Receive	Green/Red	No light = Inactive Green = Active Red = Fault Condition
I/Q Baseband Transmit	Green/Red	No light = Inactive Green = Active Red = Fault Condition
I/Q Baseband Receive	Green/Red	No light = Inactive Green = Active Red = Fault Condition
Power	Green/Red	No light = Tester is OFF Green = Tester is ready for use Red = Tester is starting up

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Rear Panel

Figure 1-3 shows in detail the rear panel of the IQview 802.11 RF Tester.

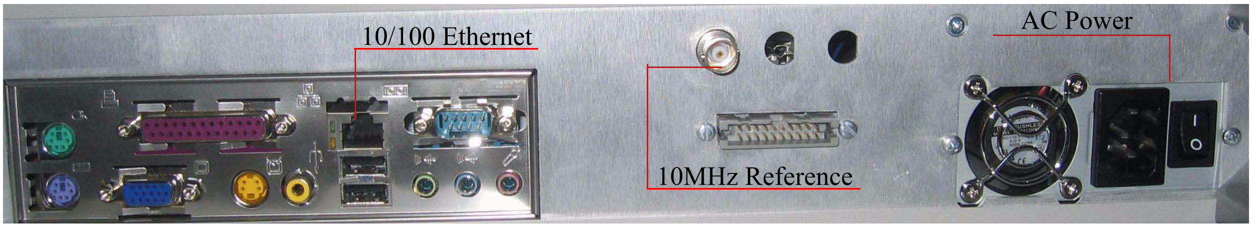

Figure 1-3. IQview Tester Rear Panel

Table 1-3 lists and describes the rear panel connectors.

Table 1-3. Rear Panel Connectors

Connector	Type	Description
10/100 Mbps Ethernet	RJ45	Standard Ethernet connector
10 MHz Reference	BNC-connector	10 MHz reference clock input connector
AC	AC plug	120/220V AC 50/60 power supply connector

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Software Description

With a user friendly Graphical User Interface (GUI), the tester acts as a LAN interface using Microsoft Windows and is easily integrated into existing production testing. Figure 1-4 illustrates the IQview EVM Measurement Opening window.

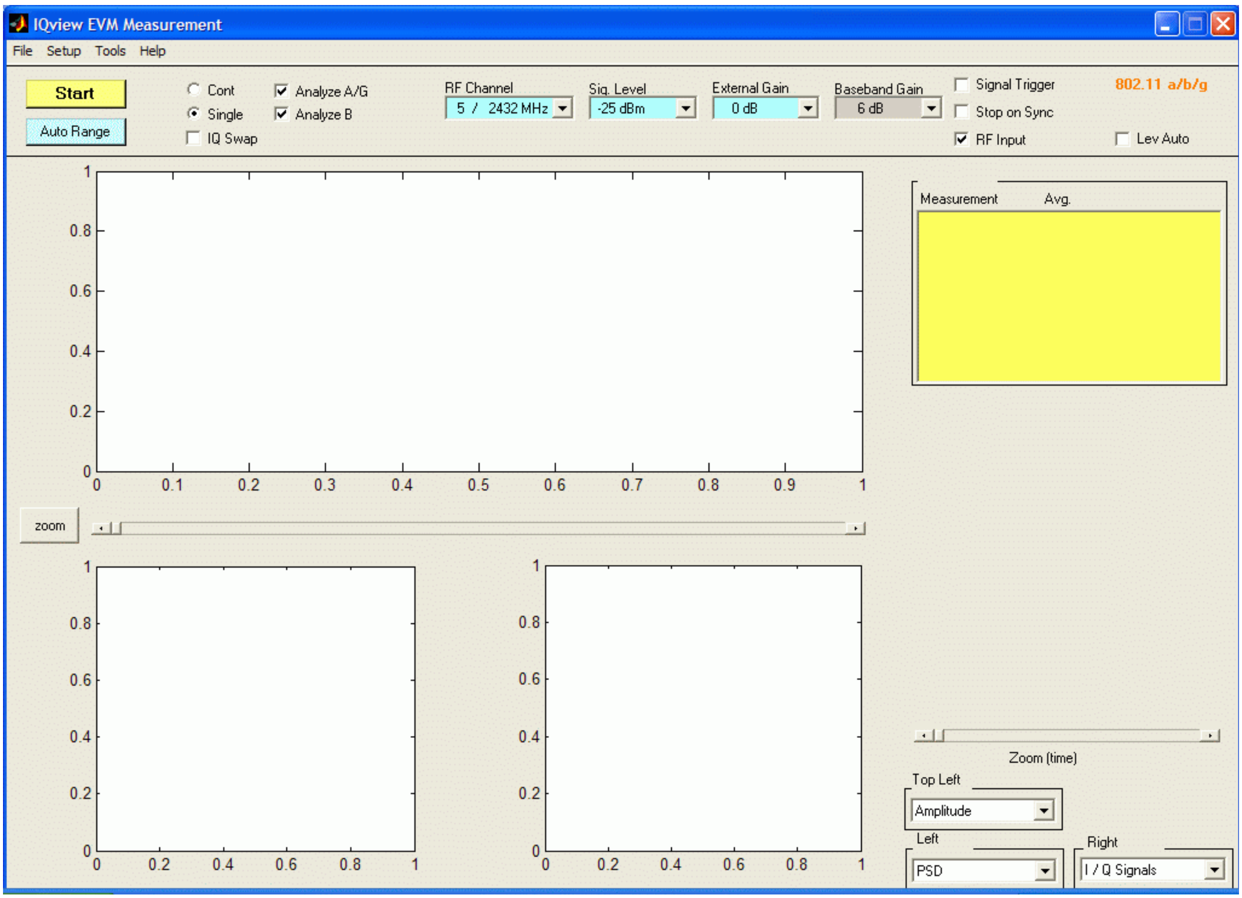

Figure 1-4. IQview EVM Measurement Opening Window

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IQview supports the following modulation formats:

- Multi-carrier, OFDM
  - Binary Phase Shift Keying (BPSK)
  - Quadrature Phase Shift Keying (QPSK)
  - 16 Quadrature Amplitude Modulation (QAM)
  - 64 QAM
- Complimentary Code Keying (CCK)
  - Binary Phase Shift Keying (BPSK)
  - Quadrature Phase Shift Keying (QPSK)
- Arbitrary Waveform

IQview captures the following:

- Average/Peak Power
- Amplitude Statistics (CCDF--Complimentary Cumulative Distribution Function) and Crest Factor
- PSD/Spectral Mask
- LO Leakage
- Clear Channel Assessment (CCA)
- Adjacent Channel Power
- Phase Noise
- Eye Diagram
- Spectrogram

IQview's operational modes include:

- RF Bands 2.4-2.5 GHz, 4.9-6.0 GHz
- Baseband I/Q Modulation/Demodulation
- Single Ended Baseband (Differential Optional)
- External Trigger

To install the software, see Chapter 2 Installing the Software

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Chapter 2 Installing the Software

Getting Started

Press the power button located on the front panel of the IQview 802.11 RF Tester.

The Power LED illuminates **red** and then changes to **green** once the unit is ready for operation.

NOTE: Startup takes approximately 30-45 seconds.

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Matching IP Addresses

CAUTION: Prior to changing the IP address of your PC, make sure you record your existing settings for future reference.

To ensure communications with the tester, your IP address must match the address of the IQview tester.

Table 2-1. Tester IP Factory Settings

IP Address (default)	192.168.100.254
Subnet Mask	255.255.0.0

1. Click the **Control Panel** icon in Windows.
2. Click the **Network and Internet Connection** icon, then select **Network Connections**.
3. Right click **Local Area Connection** icon and select **Properties**.
4. Make sure the **Internet Protocol (TCP/IP)** checkbox is checked.
5. Highlight **Internet Protocol (TCP/IP)**. Click **Properties**.

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6. Select **“Use the following IP address”** and enter an IP address in the range of:
   192.168.100.1 to 192.168.100.253
   (Make sure you do not choose an already existing IP address on your network.)
7. Tab to the Subnet Mask and enter the following subnet mask address:
   255.555.0.0
8. Click **OK**.

NOTE: If you want to change the factory settings of the tester, see Chapter 5, IQview Administration Tool.”

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Installing the IQview 802.11 Tester Software

1. Insert the **IQview CD-ROM**.
   The Windows Installer appears.
2. Continue through the installation by clicking the **Next** button.
3. When installation is complete, click **Close**.

The IQview EVM Measurement Application icon now appears on your desktop, as shown in the following figure.

Figure 2-1. IQview EVM Measurement

NOTE: If the installer does **not** start automatically, select **Start and Run...**
Run **setup.exe** from the CD-ROM. Follow the displayed instructions.

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Accessing the IQview EVM Measurement Application

1. Click the **IQview EVM Measurement Application** icon.

The IQview EVM Measurement Application window displays, as shown in the following figure.

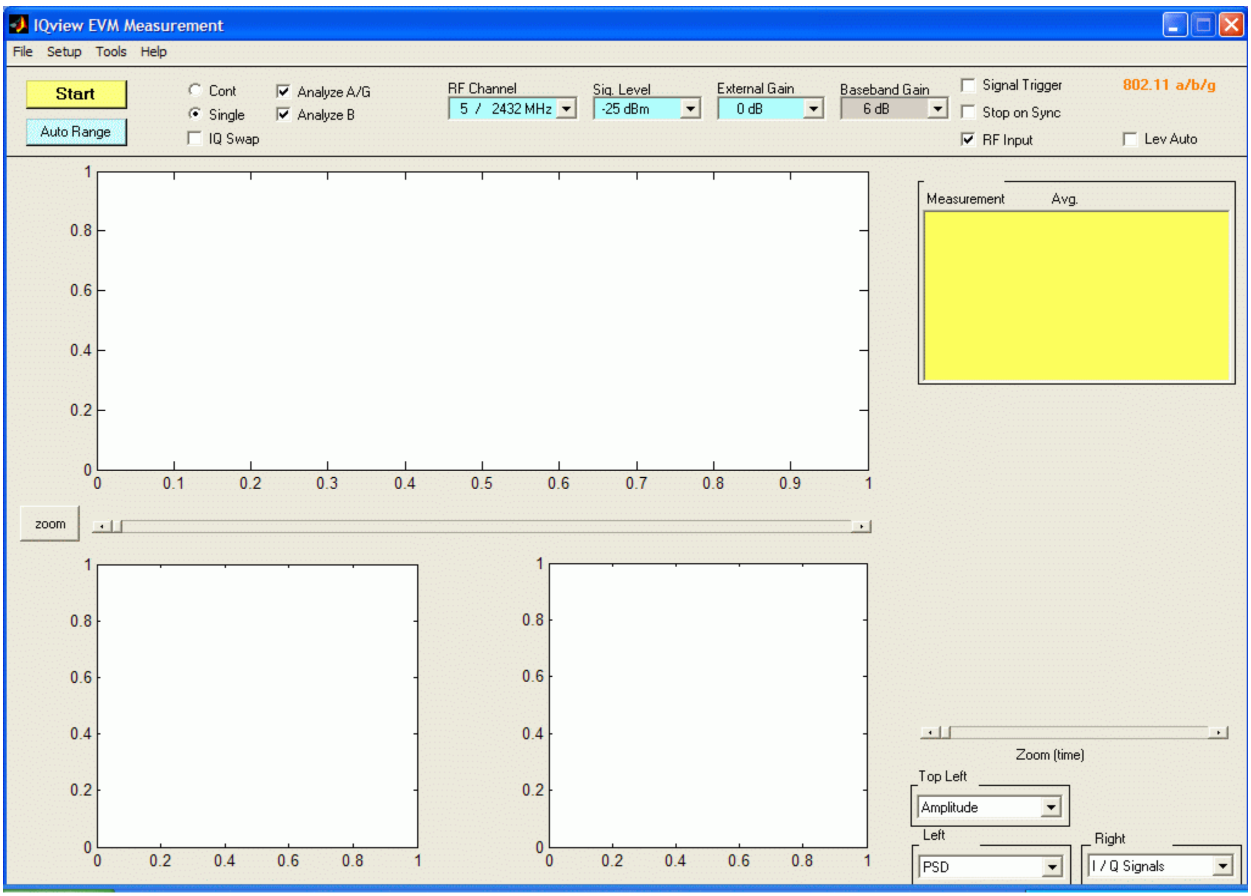

Figure 2-2. Measurement Application Window

You are now ready to use the tester. See Chapter 3Using the IQsignal Application

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Uninstalling the Software

The software can be uninstalled from the PC by performing the following steps:

1. Press **Start** with the mouse.
2. Select **Settings** and then select **Control Panel**[1].
3. Select **Add/Remove Programs**.
4. Select **IQview Applications**.
5. Press **Remove**, and then press **Yes** at the prompt.

1. The sequence of steps may vary among different versions of Windows, or if the PC's desktop displays an icon for Control Panel.

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Chapter 3 Using the IQsignal Application

The IQsignal is an Error Vector Magnitude (EVM) Measurement Application specifically designed for analyzing the complex signals generated in 802.11 a/b/g radio frequency (RF) communications. Additionally, the tool is capable of verifying compliance with the applicable 802.11a/b/g specification.

This tool includes two separate applications:

- Vector Signal Analyzer
- Vector Signal Generator

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Vector Signal Analyzer

The Vector Signal Analyzer captures RF or Baseband data being output by the transmitter portion of the 802.11 Device Under Test (DUT) into the tester's input ports and performs several different analyses of this captured data to verify the performance of the DUT. When the IQview EVM Measurement Application is launched, the Vector Signal Analyzer starts as the default application. If the tester's input ports are receiving a signal, the acquisition and analysis of that signal begins immediately as soon as the **Start** button is pressed.

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Figure 3-1 illustrates the EVM Measurement Application's main window after performing a data capture and analyzing the captured data.

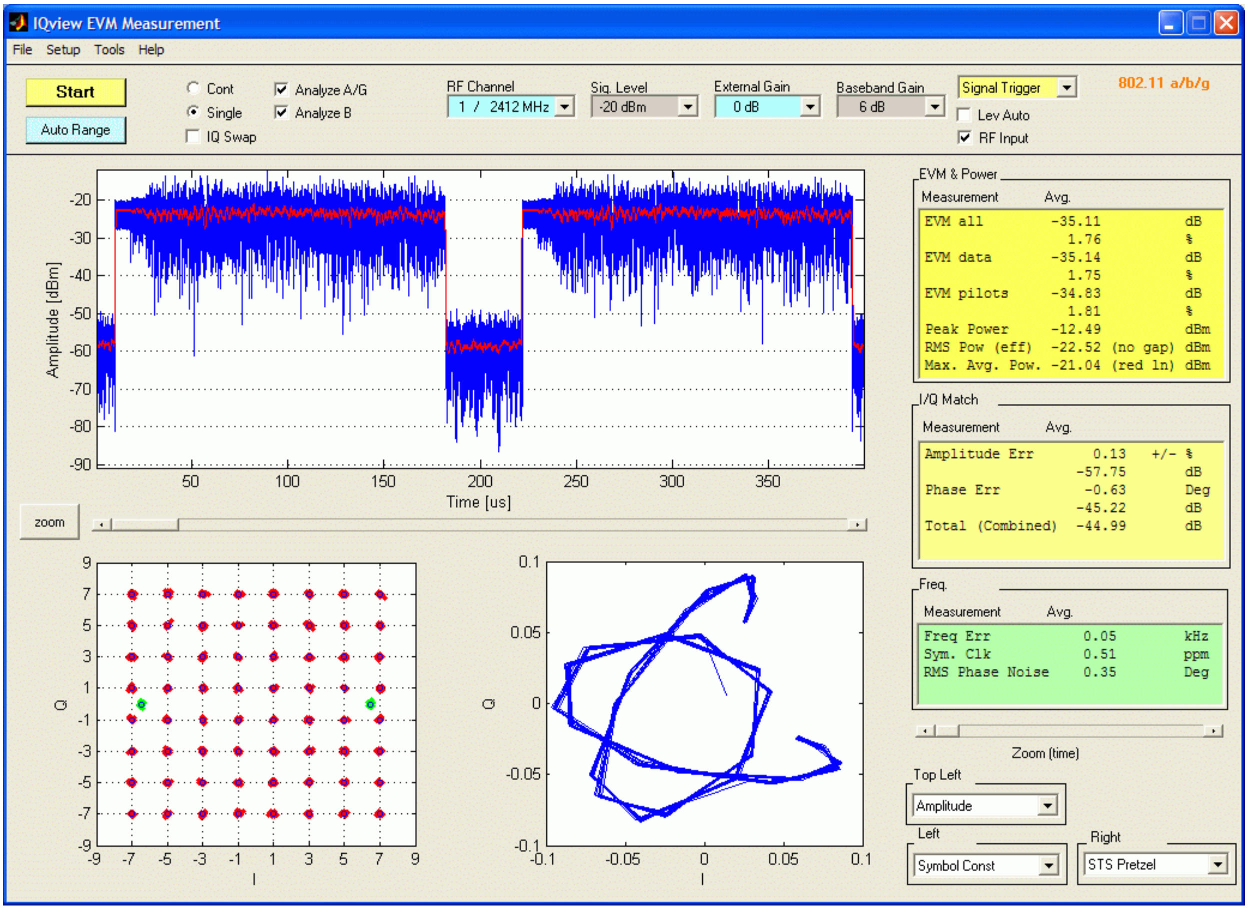

Figure 3-1. EVM Measurement Application Main Window

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Table 3-1 lists and defines the parameters that can be set at the main EVM Measurement Application window.

Table 3-1. EVM Measurement Application Window Description

Feature	Description
Start Button/Stop Button	Initiates either single mode or continuous mode data capture and analysis. While performing the data capture and analysis, the Start button displays the text Stop. During continuous mode operation, this button can be used to stop the measurement process.
Auto Range	Performs an automatic range setting and chapter. For further details, see Auto Level Continuous Mode located in this table.
Single/Continuous Mode	Enables single mode data capture and analysis operation. The “Cont” radio button enables continuous mode data capture and analysis.
IQ Swap	Allows an interchange between the I and Q channel data. This swapping capability is useful when the data source itself has its I and Q channels swapped.
Analyze A/G	Selects 802.11 a or g type for analysis.
Analyze B	Selects 802.1 b type for analysis.
Auto Level Continuous Mode	When checked, the Automatic Gain Control (AGC) takes effect to optimize the RF gain settings for every capture. When AGC is invoked, the instrument automatically adjusts the gain and then performs the actual data capture followed by the selected data analysis. When AGC has not been selected, the instrument uses the Signal Level setting to specify the gain.
RF Channel	Allows selection of a WLAN input channel from this pull-down list when the input mode is RF. (For further details, see "Parameters" presented later in this chapter). When the input mode is baseband, this setting has no effect. Available RF Channel selections for the 802.11 b/g standards are in the 2.4 Ghz range and 4.9-6.0 Ghz. range; for the 802.11a standard, the range is 4.9-6.0 Ghz.
Signal Level	Can be manually selected from this pull-down list whenever AGC Lev Auto selection is not in effect. When AGC is enabled, this setting has no effect.
Baseband Gain	When the input mode is baseband, a variable-gain amplifier Baseband Gain level may be selected from this pull-down list. (See Figure 5-9 and Table 5-4). When the input mode is RF, this setting has no effect. Available Baseband Gain selections are from -12 dB to 30 dB in increments of 6 dB.
Signal Trigger	Must stick with old screen version--Need definition.
Stop on Sync	Must stick with old screen version--Need definition.

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Table 3-1. EVM Measurement Application Window Description (Continued)

Feature	Description
Measurement	Displays measurement results in this window and in one of two window displays, depending on the choice made for Selection for Left Graph. If the current choice is PSD, Spectrum Mask or CCDF, then the Power Measurement Results window appears. If the current choice is Symbol Const (Symbol Constellation), Spectral Flatness, or LO (DC) Leakage, then the three EVM Measurement windows appear. For further details, see "Power Measurement Results Window" and "EVM & Power" in this chapter.
Select and Drag Function	Zooms in on the captured data to analyze the data and to show it in the top graph, with the time (horizontal) axis stretched out for the zoomed portion. Moving the Zoom Slider to the left causes the graphical display to zoom out; moving the Zoom Slider to the right causes the graphical display to zoom in, for example, to become stretched. When zooming in on data, the visible part of the data in the top graph represents the portion of the data that has been zoomed in on. Only the data shown in the top graph is analyzed. The Time Slider may be used to move the visible window of the zoomed selection back and forth along the time axis. For further details concerning the Time Slider, see "Using the Time Slider to Zoom" presented later in this chapter.
Selection for Right Graph	Selects the type of plot (from pull-down list) for display in the Right Graph window, located in the center of the screen at the bottom. For further details, see "Analyzing Mode Graph Options" presented later in this chapter. Available Right Graph selections are: • I/Q Signals • STS (Short Training Symbols) Pretzel • Frequency Error • EVM versus Carrier (OFDM) • EVM versus Symbol • 802.11b Eye Diagram
Zoom (Time) Slider	The Zoom (Time) Slider allows you to move the visible part of the data in the top graph to the left or to the right along the time (horizontal) axis, while maintaining the current zoom level. For further details concerning the Time Slider, see "Using the Slider Method to Zoom"
Power Time Graph	This window displays a graphical representation of the measured data. The blue trace represents the peak amplitude value, while the red trace represents the amplitude as a moving average of amplitude over one symbol length. All symbols are assumed to have the same length.

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Table 3-1. EVM Measurement Application Window Description (Continued)

Feature	Description
Selection for Left Graph	Selects the type of plot to be displayed in the Left Graph window, in the lower left corner of the screen. For further details, see "Analyzing Mode Graph Options" presented later in this chapter. Available Left Graph selections are the following: • PSD • Spectrum Mask • CCDF • Symbol Constellation • Spectral Flatness • LO (DC) Leakage • Phase Noise (PSD) • Phase Noise (Time) • POwer On Ramp • Power Down Ramp
Selection for Top Left Graph	Selects the type of plot to be displayed in the main plot window. For further details, see "Analyzing Mode Graph Options" presented later in this chapter. Available Top Left selections are the following: • Amplitude • Spectrogram

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Main Menu

The Main menu consists of the following menu items:

- File
- Setup
- Tools
- Help

Figure 3-2 illustrates the File Menu.

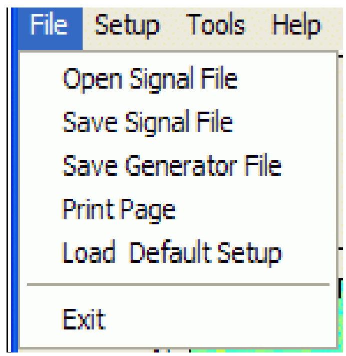

Figure 3-2. File Menu

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File Menu

Table 3-2 lists and defines the File Menu items.

Table 3-2. File Menu

Menu Items	Description
Open Signal File	Opens previously captured and saved data from a signal file for analysis. The filename * for a signal file has the file extension .SIG.
Save Signal File	Saves captured data to a signal file with extension .SIG for later analysis. .SIG files can be used only by the IQview EVM Measurement application.
Save Generator File	Saves captured data for use as a modulated signal in the Vector Signal Generator application. The filename for a modulated signal file has the file extension .MOD.
Load Default Setup	Loads the default settings for the application.
Exit	Exits the program.

Setup Menu

The Setup menu contains two major submenus:

- Parameters
- Load Calibration Files IQview

Figure 3-3 illustrates the Setup menu.

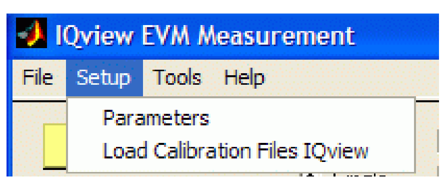

Figure 3-3. Setup Menu

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Parameters

You can set user-defined parameters at the Parameters window. Figure 3-4 illustrates the Parameters window.

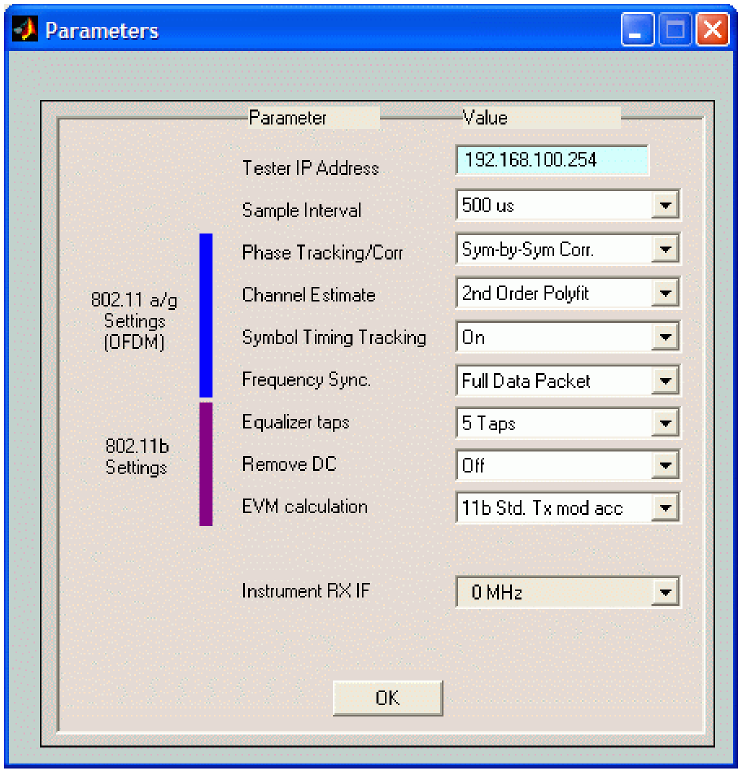

Figure 3-4. Parameters Window

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Table 3-3 lists and defines these parameter options.

Table 3-3. Parameters Window

Parameters	Description
Tester IP Address	The IP address of the tester being used must be entered into this window, prior to starting a test. The standard IP address format should be used, for example, 192.168.100.254. **CAUTION:** Verify that the subnet mask in Microsoft Windows is set accordingly.
Sample Interval	Selects the duration of time for a sample capture. For instance, if the 500 us setting is selected, then a sample is captured and analyzed for a 500 usec interval in time.
Phase Tracking/Corr (applies to 11a/g only)	Choices are: Off, Sym-by-Sym Corr., Moving Avg. 10 Sym. Selecting the Moving Average over 10 Symbols is recommended. The “Symbol-by-Symbol” Connection will mask phase noise in the transmitter. This can be used as a diagnostic tool. If the EVM improves significantly when switching from Moving Average to Symbol-to-Symbol, the transmitter is likely to have excessive phase noise. The Phase Tracking Off mode can be used when the carriers and references of the transmitter and receiver are phase locked or when low frequency carrier phase noise is suspected to be present. The Moving Average over 10 Symbols may mask low frequency phase noise.
Channel Estimate (applies to 11a/g only)	Choices are 2^{nd} Order Polyfit or Raw. In the Raw mode, the channel is estimated by averaging the 2 long symbols. No other averaging is performed. In the 2^{nd} Order Polyfit mode, the channel r3esponse is approximated by the best 2^{nd} order polynomial over the frequency band occupied by the long OFDM symbols. This mode should only be selected if the channel is essentially flat over the frequency band occupied by the OFDM signal. This mode should not be used when there is a substantial roll-off over the frequency band due to transmit filtering.
Symbol Timing Tracking (applies to 11a/g only)	Choices are Off/On. It is recommended to set this to On.

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Table 3-3. Parameters Window (Continued)

Parameters	Description
Frequency Sync. (applies to 11a/g only)	Choices are: Short Training Symbols, Long Training Symbols, Full Data Packet. Before the OFDM symbols are demodulated with an FFT, the received signal has to be corrected for the carrier frequency error. This error is either estimated on the basis of the Short or Long training symbols or over the full packet. The recommended setting is "Short Training Symbols", except when the received signal shows frequency dynamics during the start of the packet. In this case, either the Long Training Symbols or the Full Data Packet method should be used.
Equalizer taps (applies to 11b only)	Choices are Off, 5, 7, or 9 Taps. The recommended setting is Off. The larger the number of taps, the more the equalizer can correct for Inter Symbol Interference (ISI) present in the transmitter. If the EVM improves substantially when changing from 5 to 9 Taps, the transmitter is likely to have too much ISI. When the performance of a transmitter and receiver pair with matching filters is to be assessed, the 5 Tap setting should be used. When using the "EVM Calculation, 11b Std. Tx mod acc", see below. The Equalizer Taps should be set to Off.
Remove DC (applies to 11b only)	Choices are Off or On. The recommended setting is Off. The On setting should only be used if the DC Offsets are known to be substantial relative to the desired signal level. This can be the case if the RF signal level is extremely low, or if there is a DC present when using the baseband inputs.

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Table 3-3. Parameters Window (Continued)

Parameters	Description
EVM calculation (applies to 11b only)	Choices are: 11b Std., Tx mode acc or rms error vector. The "11b Standard Transmit Modulation Accuracy" method applies the algorithm defined in IEEE 802.11b-1999 Standard Section 18.4.7.8 to the sampled data after carrier and symbol timing recovery. The "rms error vector" method applies the standard rms error vector algorithm.[1]
Instrument RX IF	Normally, measurements are taken with RX IF set at 0 MHz. This menu item allows setting IF to the following options: 0 MHz, 5 MHz, 10 MHz and 11 MHz. Selects a final IF frequency different than zero (0). When selecting, the IF selected is larger than the highest signal being analyzed.

1. $\text{rms evm} = \sqrt{\overline{(\text{s\_in\_norm(k)} - \text{s\_dec(k)})^2}}$ with $\text{s\_in\_norm(k)} = \frac{\text{s\_in(k)}}{\sqrt{\overline{|\text{s\_in}|^2}}}$ and $\text{s\_dec(k)} = \frac{(\pm 1 \pm j)}{\sqrt{2}}$ select closest to s_in_norm(k). s_in(k) is the sampled data, once per chip, after carrier and symbol timing recovery.

Setting the Parameters

1. At the Setup window, select the **Parameters** menu.
   The Parameters window displays, as shown in Figure 3-4.
2. Enter the required **IP address**, for example, 192.168.100.254.
3. For the pull-down menu options, continue selecting the remaining user-defined options.
4. Click **OK**.
   When an acceptable IP address is entered and the remaining options have been set, the system displays the following message **"IQview connection established!"**.

NOTE: If you entered an unacceptable IP address, the following error message displays, **"IQView not found: Check IP Add/LAN."**, as shown in Figure 3-5.

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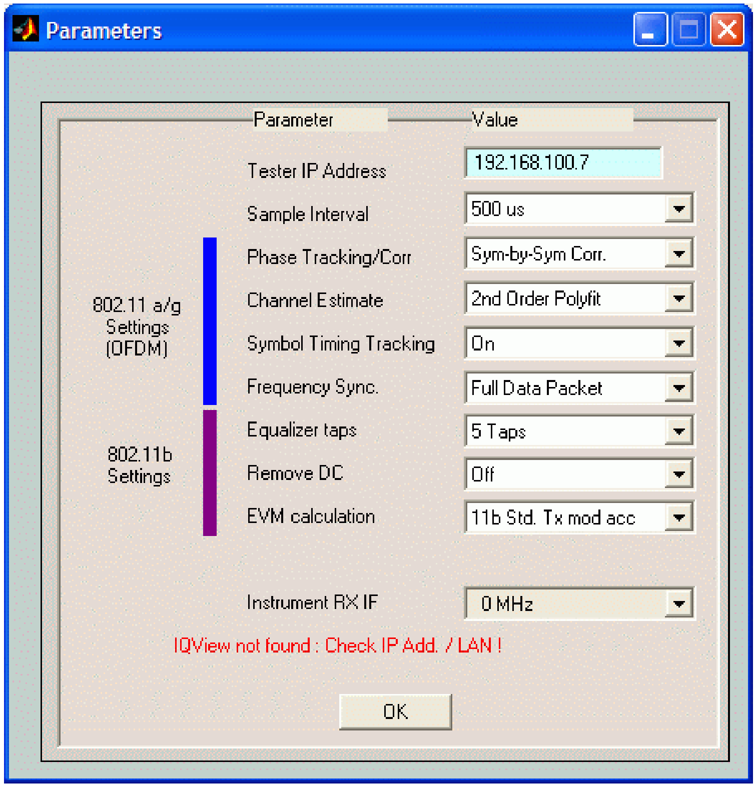

Figure 3-5. Parameters Window Indicating Connection Not Established

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Loading Calibration Files IQview

The Load Calibration Files IQview allows the user to load the required calibration files from the IQview Tester to a PC. Figure 3-6 illustrates the Load Calibration Files IQview menu item.

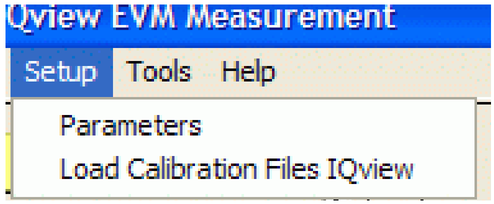

Figure 3-6. Load Calibration Files IQview Menu Item

To load the calibration files, simply select the **Load Calibration Files IQview** menu item and the files begin to immediately load. The system message, **"Loading Calibration data from IQview"** displays immediately on the top of the main screen.

Tools Menu

Figure 3-7 illustrates the Tools menu. For details on how to use the Vector Modulator, see "Vector Signal Generator" at the end of this chapter. The VSG panel opens a separate program that operates in continuous mode

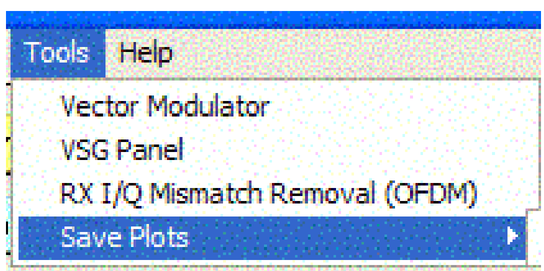

Figure 3-7. Tools Menu

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Table 3-4 lists and describes the Tools menu items.

Table 3-4. Tools Menu

Menu Items	Description
Vector Modulation	Starts the Vector Signal Generator application. For further details, see the section, "Vector Signal Generator" presented later in this chapter.
VSG Panel	Produces a pop-up window requesting the user to enable the VSGpanel application as a separate program from the desktop. In future releases, this program will be launched from this menu.
RF I/Q Mismatch Removal	Removes I/Q mismatch from the analysis making it possible to display the optimal performance of the DUT as if the I/Q mismatch were not present. This feature is only used for a and g signals. For example, if the DUT is analyzing an RF chip with an incoming RF signal and an outgoing VSA signal.
Save Plots	Saves the plots to a file.

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Analyzing Mode Graph Options

The Analyze Mode Graph Options consists of three drop down menus that are located at the bottom, far-right side of the main window:

- Left Top
- Left
- Right

These three window pull-down menus will allow you to capture 12 different graphs based on your captured data samples. Figure 3-8 shows the possible selection of drop-down menus to select different analysis to be performed on the captured signal, and Figure 3-9 illustrates the left and right Analyze Mode Graph Options menus.

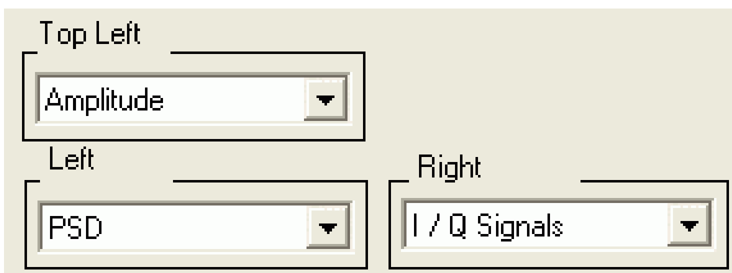

Figure 3-8. Drop-down Menus for Selecting Analysis on Captured Signal

To select an analysis graph from the drop-down menus, simply select a menu item. The Top Left drop down menu controls the plot shown in the main analysis window, the Left drop down menu controls the graph that displays in the lower, far-left side of the main window. The right drop-down menu controls the graph between the far left graphs and the drop-down menus.

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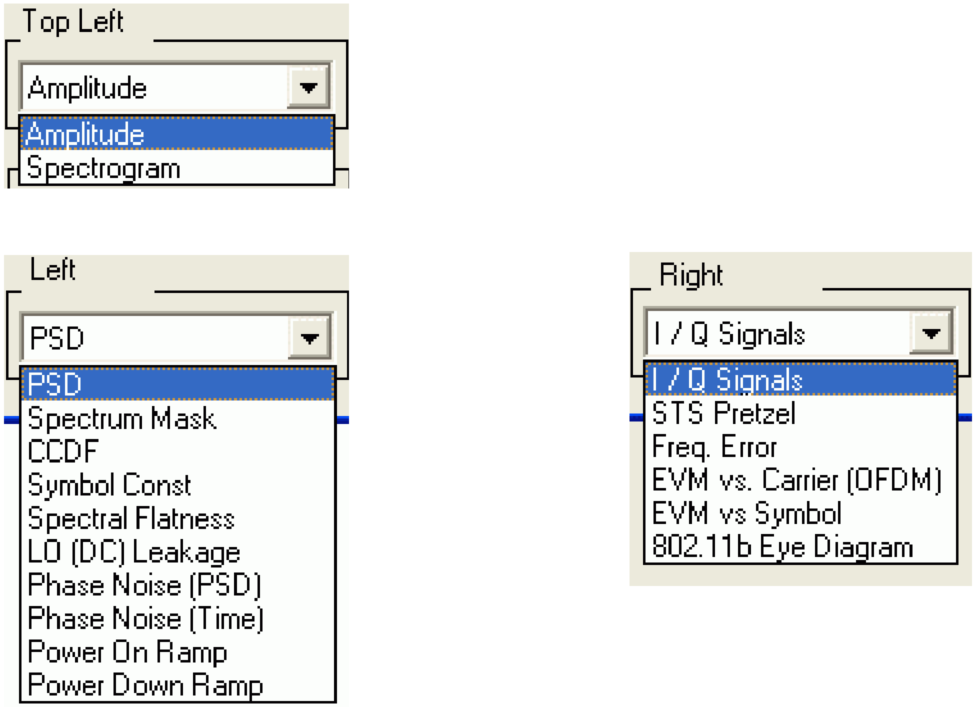

Figure 3-9. Analyze Mode Graph Options (Top Left, Left and Right Drop-Down Menus)

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Table 3-5 lists and describes the Analyze Mode Graph Options for the Top Left Menu.

Table 3-5. Analyze Mode Graph Options (Top Left Menu)

Options	Description
Amplitude	Shows the captured signal's amplitude over time. The plot shows both instantaneous power and the peak power averaged over a symbol time
Spectrogram	Presents a "3D plot" of the power at a given frequency over time. The display is a "top view" of a spectrum analyzer over time, where the color coding represents the signal strength at the given frequency. Red represents the strongest signal and green represents the weakest signal.

The amplitude option is the normal mode of operation, where the receive power vs. time is presented. Figure 3-10 shows a typical 802.11a/g captured signal when using amplitude mode. The blue graph represents the instantaneous power, and the red graph represents the power averaged over a symbol duration.

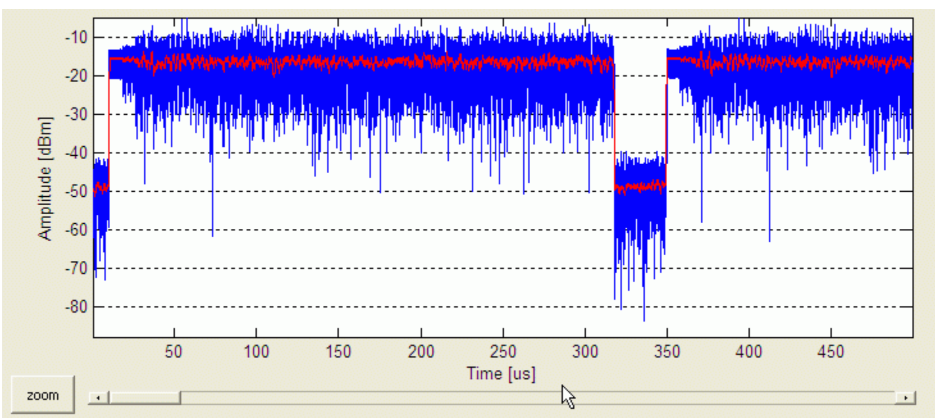

Figure 3-10. Amplitude Display Mode for 802.11a/g Signal

The spectrogram mode is useful for capturing "live" signals with an antenna. In many cases there can be a disturbing signal, that will be difficult to analyze with a normal spectrum plot. With the spectrogram the spectrum can be shown over time. The X axis represents time and the Y axis represents frequency. Figure 3-11 shows the spectrogram plot of a captured signal. The figure shows an 802.11b signal starting at 150 µsec and a wireless phone WDCT starting at 410 µsec at a carrier of +7 MHz to the WLAN signal. The equivalent spectrum plot is shown in Figure 3-12. The WDCT signal in this case may block the WLAN receiver.

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Figure 3-11 is an example of a spectrogram plot, showing an 802.11b signal in the center and an interfering WDCT signal offset about 7MHz in frequency and 410µsec in time.

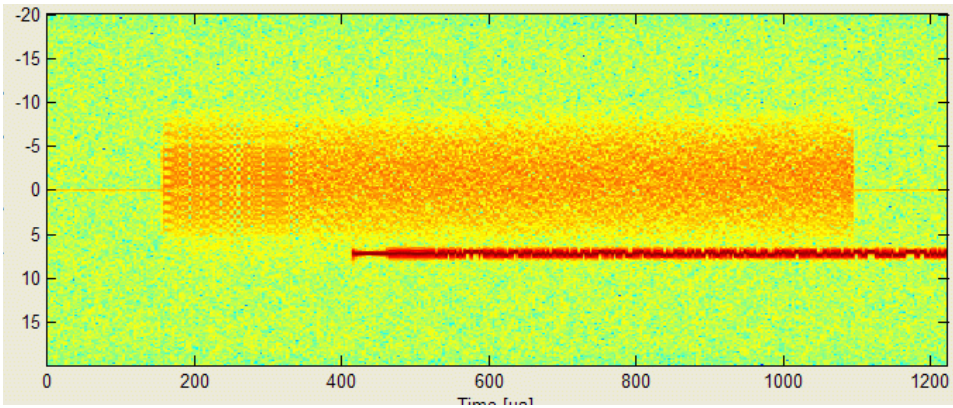

Figure 3-11. Spectrum Plot with WDCT Blocker

Figure 3-12 shows a traditional spectrum analyzer view of the signal captured in spectrogram mode in Figure 3-11.

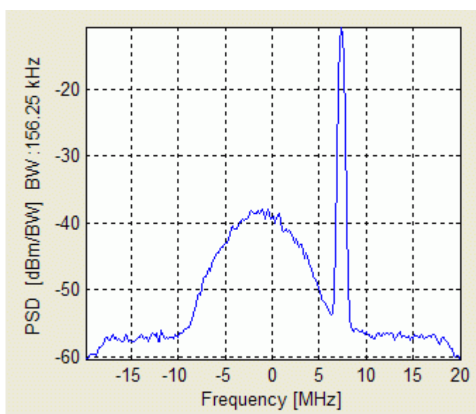

Figure 3-12. Traditional Spectrum Analyzer View

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Table 3-6 lists and describes the Analyze Mode Graph Options for the Left Menu.

Table 3-6. Analyze Mode Graph Options (Left Menu)

Options	Description
PSD	Plots the power density along the frequency spectrum for the analyzed signal, over the range of ñ20 MHz from the center frequency.
Spectrum Mask	Plots the spectrum of the analyzed signal along with the limits specified by IEEE 802.11, over the range of 33 MHz from the center frequency thus providing a quick visual check that the spectrum conforms to the 802.11 specification.
CCDF	Plots the peak to average power distribution an alternative measure for crest factor. The horizontal axis is for the power level above the average power level, and the vertical axis plots the probability of that power level occurring. This graph reveals any compression that has been applied; compression affects the behavior of the plot, which in the absence of compression appears.
Symbol Constellation	Shows the quality of the demodulated data in the complex plane for each symbol in the analyzed frame. The symbols are colored red; the pilot tones are colored green.
Spectral Flatness	Shows the spectral flatness of the sub-carrier spectrum as compared with the limits imposed by the 802.11 specification. This is only used for a and g signals.
LO (DC) Leakage	Shows the energy level of the carriers relative to that of the center carrier and therefore reveals the amount of LO Leakage. Only used for a and g signals.
Phase Noise (PSD)	Analyzes phase versus frequency.
Phase Noise (Time)	Analyzes phase versus time.
Power On Ramp	Used for 802.11 b mode.
Power Down Ramp	Used for 802.11 b mode.

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Power Spectrum Density

Figure 3-13 illustrates the Power Spectrum Density (PSD) graph for an 802.11a/g signal which is located in the Left Graph window.

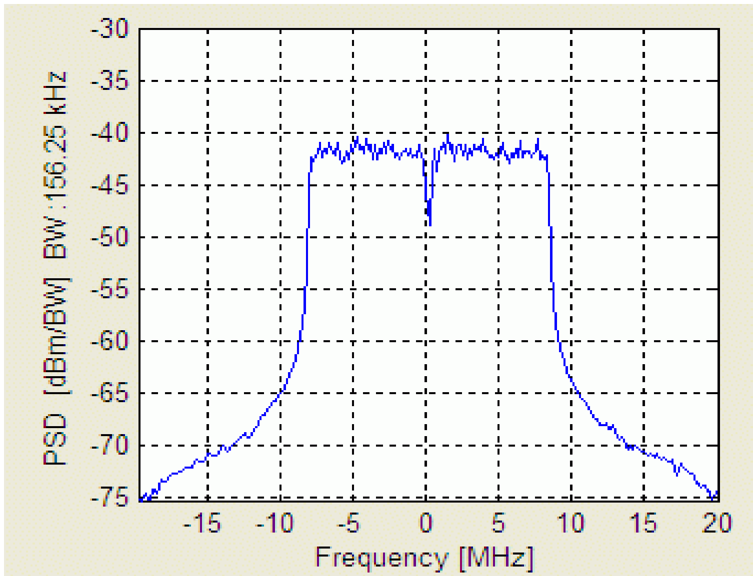

Figure 3-13. PSD Graph for 802.11a/g Signal

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Figure 3-14 illustrates the Power Spectrum Density (PSD) graph for an 802.11b signal.

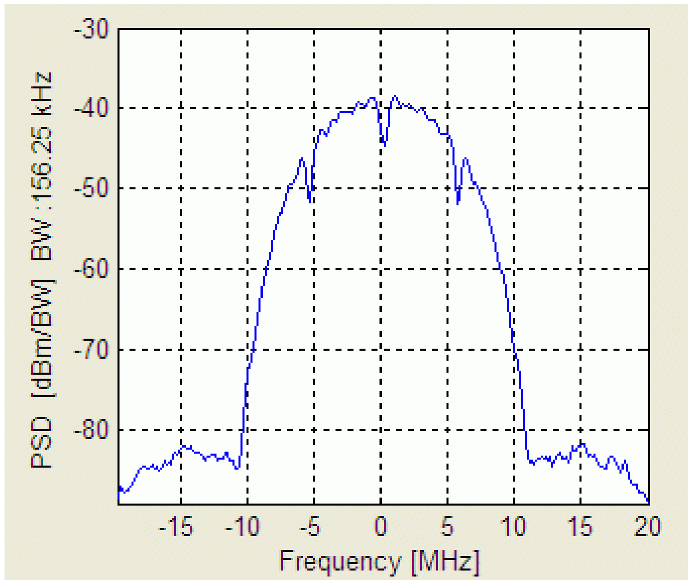

Figure 3-14. PSD Graph for 802.11b Signal

When the PSD graph is selected from the menu, the Power Measurement Results window also displays in the upper right corner of the main window, as shown in Figure 3-15. For details concerning the Power Measurement Results window, see the following section.

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Power Measurement Results Window

The Power Measurement Results window, as shown in Figure 3-15, lists the power measurements and averages in dBm for the following:

- Peak Power
- RMS Power (all)
- RMS Power (eff)
- Max. Avg.

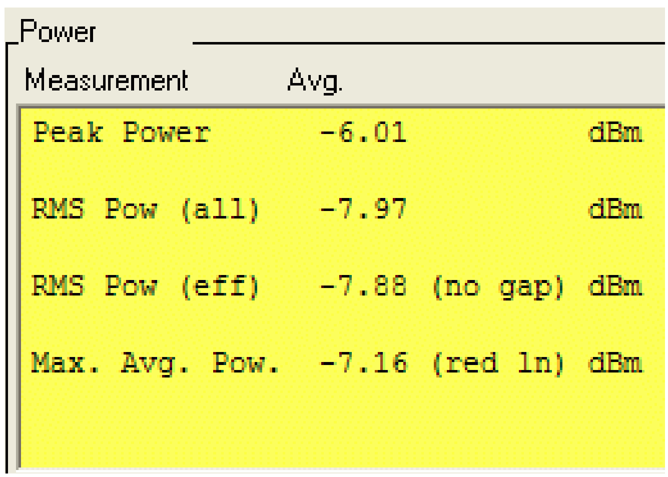

Figure 3-15. Power Measurement Results Window

The Power Measurements window (Figure 3-15) displays when any of the following menu items are selected simultaneously from the Left (PSD, Spectrum Mask, CCDF) and Right (IQ Signals, STS Pretzel) drop-down menus.

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These Power Measurement Results comprise the following values in dBm, where dBm means dB above 1 mW:

- Peak Power of the analyzed data frame
- RMS Power of the analyzed data frame
- Maximum Average Power of the analyzed data frame

This is the peak value of the amplitude, calculated as a moving average for each symbol in succession over one symbol length. All symbols are presumed to have the same length.

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EVM and Power Measurement Result Window

This window shows both the EVM and power measurements for 802.11 b (left window) and for 802.11a/g (right window) signals. Selecting the following menu items from the Left (Sym Const, Spectral Flatness, LO (DC) Leakage, Phase Noise (PSD), Phase Noise (Time), Power On Ramp, Power Down Ramp) and from the Right (Freq. Error, EVM vs. Carrier (OFDM), EVM vs. Symbol, 802.11.b Eye Diagram) drop-down menus displays the EVM and Power Measurement window, as shown in Figure 3-16.

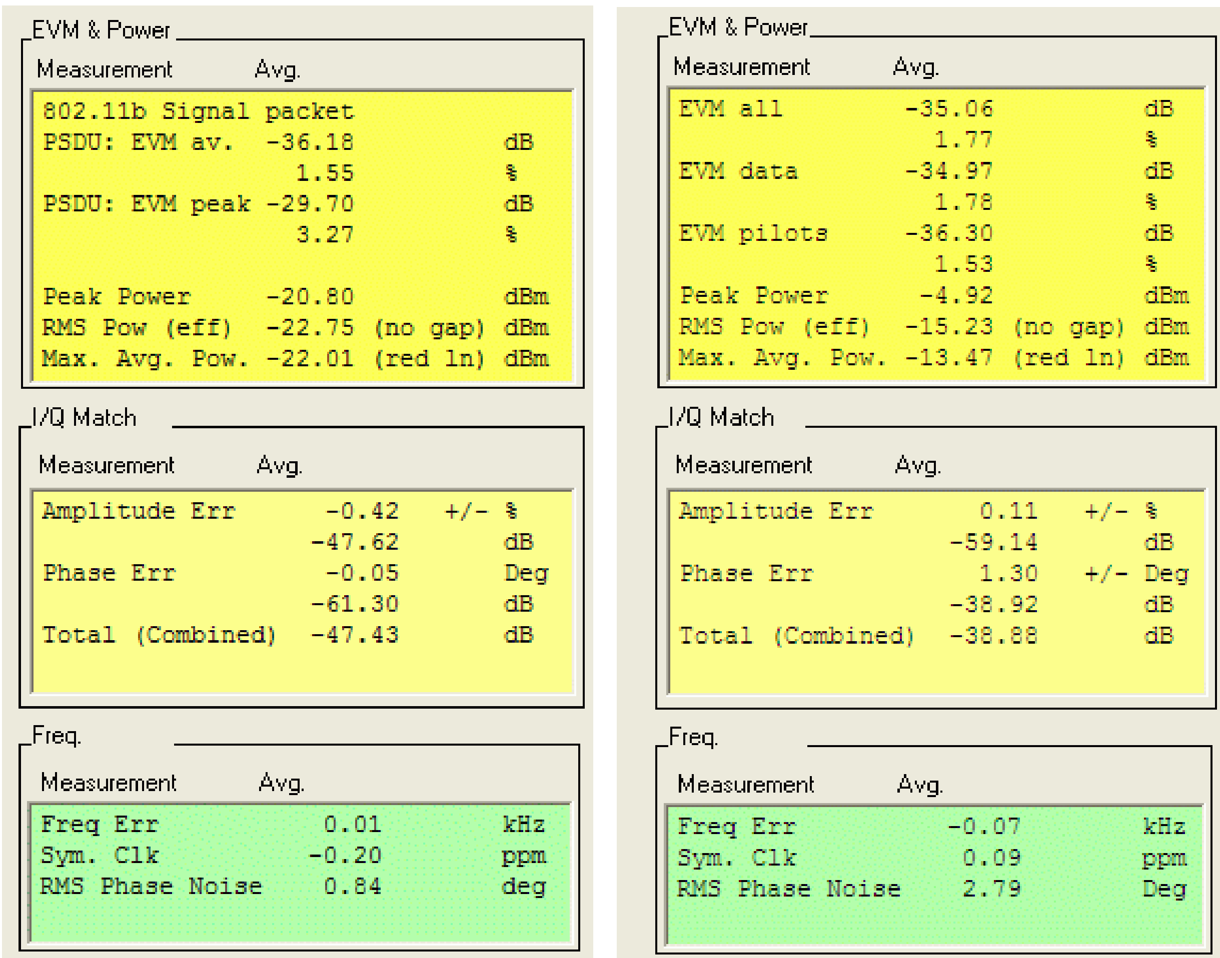

Figure 3-16. EVM & Power Measurements Result Window (802.11b, left and 802.11a/g, right)

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The EVM & Power frame displays the EVM in the PSDU and the power measurements over the whole frame. The power measurement results are the same as in Figure 3-11. For 802.11b signals, the average and the peak EVM are shown. Note that the Tools/Parameter window allows selection of two different EVM algorithms. When the classic EVM algorithm is used, the EVM is calculated over the full PSDU, or all samples present after the preamble if the sampled data does not extend over the full frame. If the IEEE 802.11b standard method is selected, the EVM is calculated over the last 1000 samples at 11 MHz, or the complete PSDU if fewer samples are present. The peak EVM is taken either over the full PSDU or over the 1000 samples for the first and the second method respectively.

For 802.11a/g signals, the average EVM is shown for the data and pilot carriers separately, as well as averaged over all carriers.

The I/Q Match frame shows the results for the I/Q Amplitude and Phase imbalances in % and Degrees respectively. The numbers in dB provide a first approximation of the achievable EVM if the Amplitude error (or Phase error) would be the only impairment present.

The Frequency frame shows the results for the carrier frequency error, the symbol clock frequency error, and the rms phase noise.

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Spectrum Mask

When the Spectrum Mask graph is selected, the Power Measurement Results window displays at the upper right corner of the main window, as shown in Figure 3-15.

Figure 3-17 illustrates the Spectrum Mask graph for 802.11b signal.

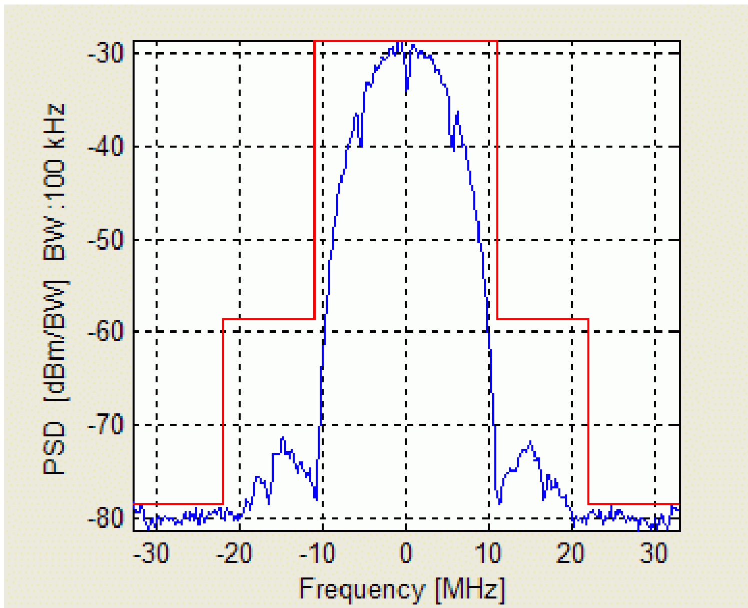

Figure 3-17. Spectrum Mask Graph for 802.11b Signal

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Figure 3-18 illustrates the Spectrum Mask graph for OFDM 802.11a/g signal.

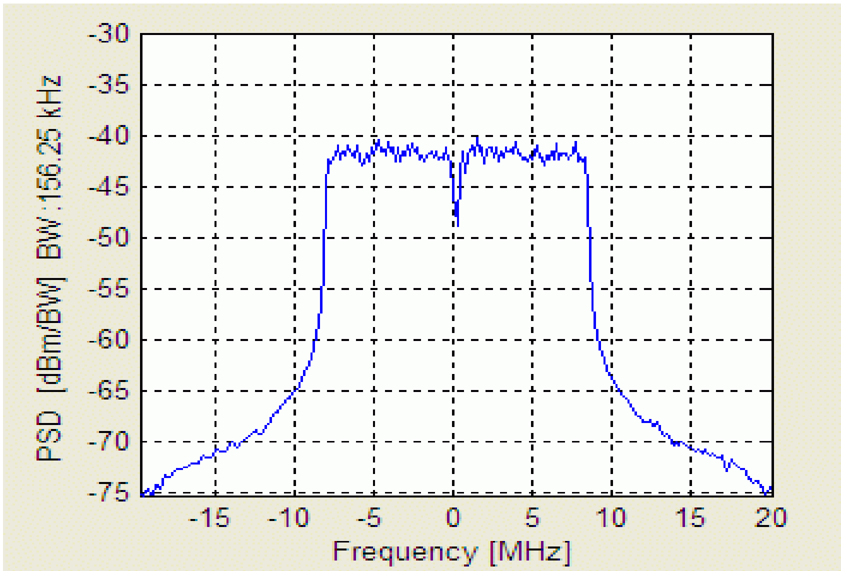

Figure 3-18. Spectrum Mask Graph OFDM 802.11a/g Signal

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CCDF

Figure 3-19 displays the CCDF (Complementary Cumulative Distribution Function) graph for OFDM 802.11a/g signal. Compare Figure 3-19 with Figure 3-20. When the CCDF graph is selected, the Power Measurement Results window displays at the upper right corner of the main window, as shown in Figure 3-23.

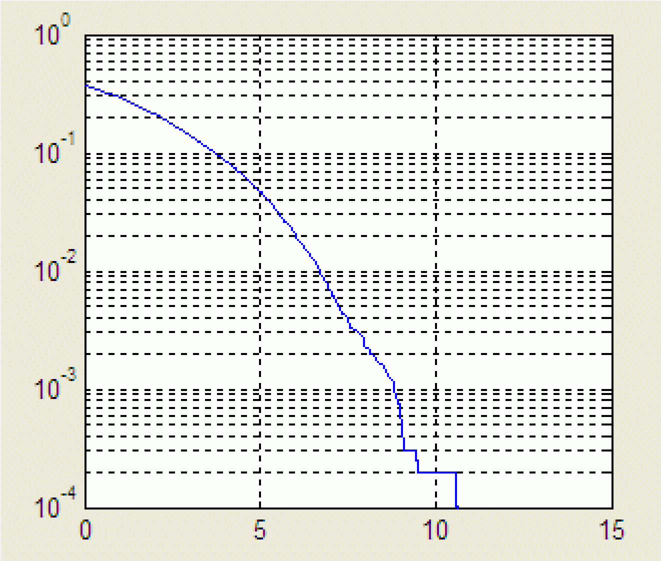

Figure 3-19. CCDF Graph for OFDM 802.11a/g Signal

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Figure 3-20 shows an example of a CCDF compressed signal.

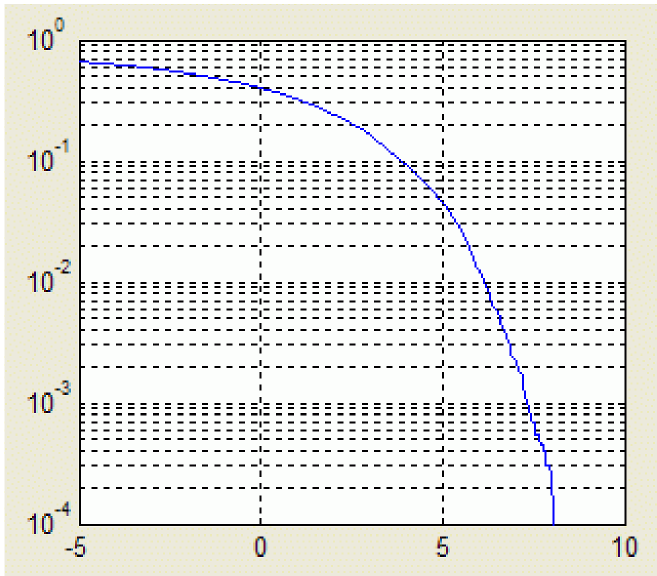

Figure 3-20. CCDF Compressed Signal Graph

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Symbol Constellation

The Symbol Constellation graph, which displays in the Left Graph window, shows the quality of the demodulated data in the complex plane for each symbol in the analyzed frame. Figure 3-21 shows a Symbol Constellation graph for an 802.11b signal. The green dots represent the demonstrated preamble (BPSK in this example) and the red dots represent the demonstrated PSDU (Physical layer Service Data Unit) for QPSK signal.

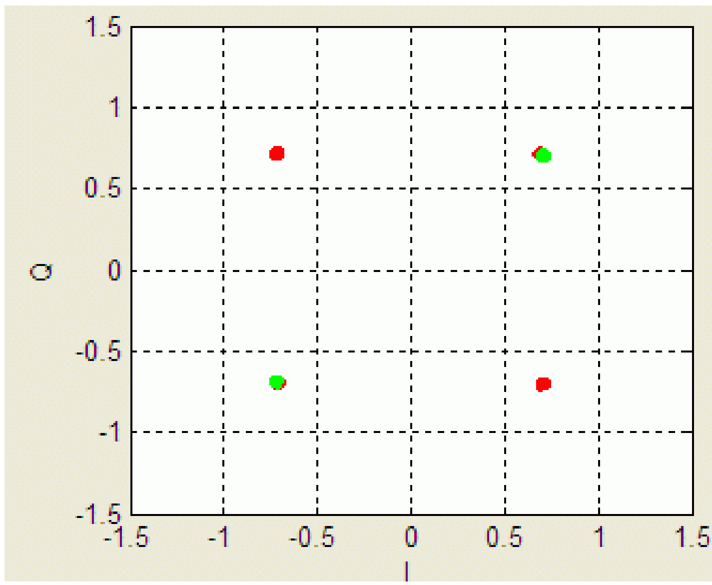

Figure 3-21. Symbol Constellation Graph for 802.11b Signal

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Figure 3-22 illustrates a Symbol Constellation graph for an OFDM 802.11a/g signal. The red dots/symbols represent data; the green dots/symbols represent the pilot tones.

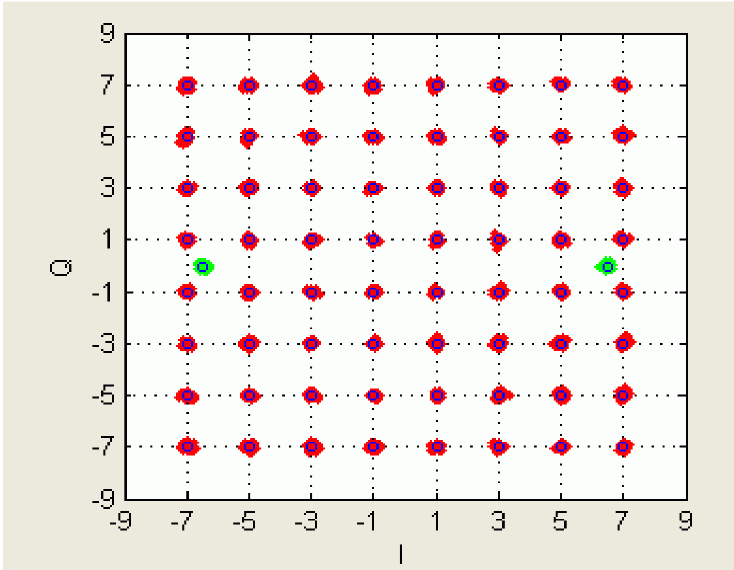

Figure 3-22. Symbol Constellation Graph for OFDM 802.11a/g Signal

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Measurement Results Window

The Measurement Results window, as shown in Figure 3-23, displays on the right side of the EVM application screen when selecting the following choices from the Left Graph:

- Symbol Constellation
- Spectral Flatness
- LO Leakage

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NOTE: For PSD, Spectrum Mask, and CCDF only the EVM & Power Measurement window displays.

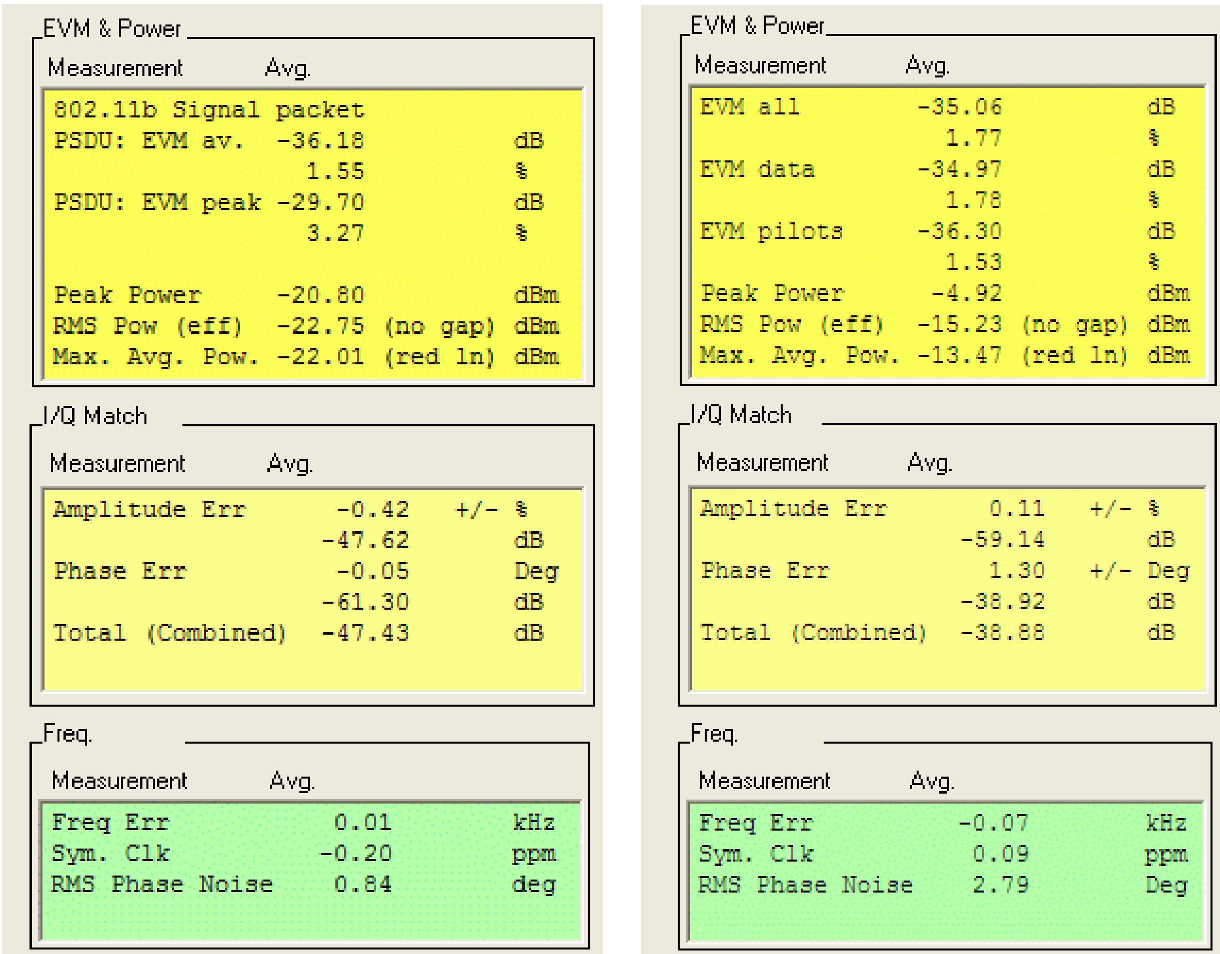

Figure 3-23. Measurement Results for 802.11a and 802.11b (CCK, left, OFDM, right)

The Measurement Results window is divided into three sections and shows the total and average measurements for the following:

- EVM & Power
- I/Q Match
- Frequency

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EVM & Power

The EVM results comprise three average values, each shown in dB and as a percentage:

- EVM all: The result is calculated over the entire frame being analyzed.
- EVM data: The result is calculated over only the frame portion containing data.
- EVM pilots: The result is calculated over only the frame portion containing pilot tones.

I/Q Match

The I/Q Match results comprise three average values, each shown in dB:

- Amplitude Err: The average amplitude error is shown as an EVM in dB, and as a percentage, for the best case in which there is no other source of error.
- Phase Err: The average phase error is shown as an EVM in dB, and also in degrees, for the best case in which there is no other source of error.
- Total (W Case): The amplitude error and the phase error are combined, and are shown as an EVM in dB.

Frequency

The Frequency results comprise two average values:

- Freq Err: The frequency error in kHz
- Sym. Clk: The Symbol Clock error in ppm (parts per million)
- RMS Phase Noise

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Spectral Flatness

The Spectral Flatness displays in the Right Graph window and shows an estimate based on the long training sequence the spectral flatness of the sub-carrier spectrum as compared with the limits imposed by the 802.11 specification. When the Spectral Flatness graph is selected, the Measurements windows also display in the upper-right corner of the main window, as shown in Figure 3-23. Figure 3-24 illustrates the Spectral Flatness graph for OFDM 802.11a/g signal.

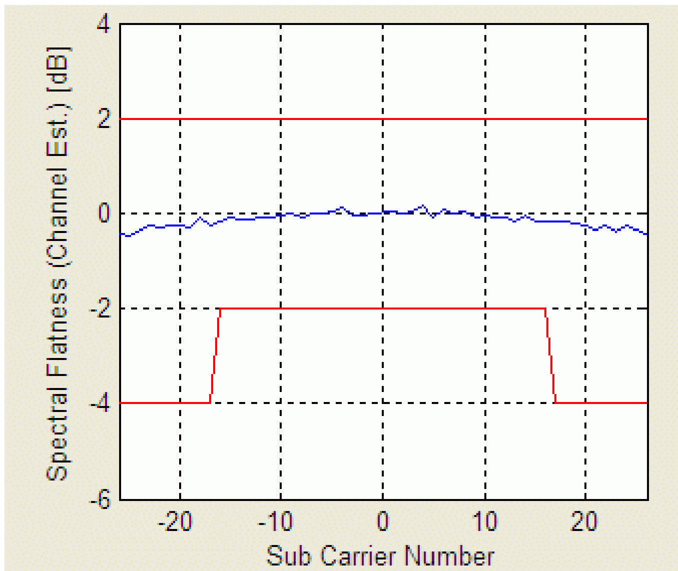

Figure 3-24. Spectral Flatness Graph for OFDM 802.11a/g Signal

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Local Oscillator Leakage

The LO (DC) Leakage result is measured during the long training symbol. It shows the energy level of the carriers relative to that of the center carrier, and thus reveals the amount of LO Leakage. When the LO Leakage graph is selected, the Measurements window also displays in the upper right corner of the main window, as shown in Figure 3-23.

Figure 3-25 illustrates the LO (DC) Leakage graph for OFDM 802.11a/g signal. The red plus sign (+) represents the IEEE specified 2dB limit.

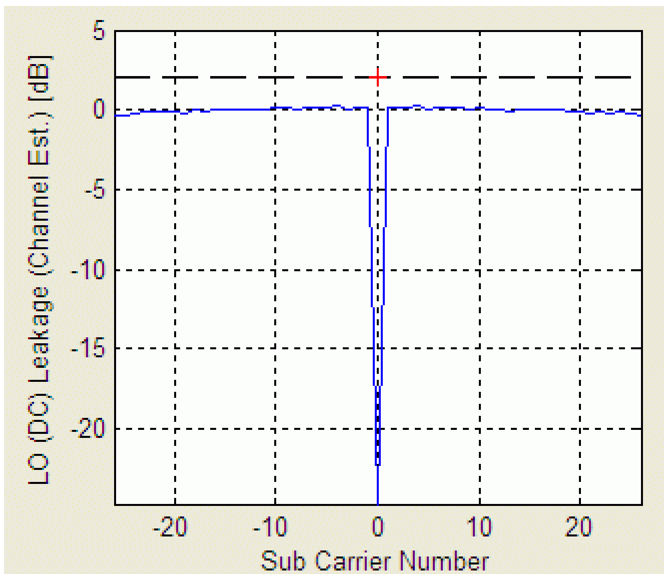

Figure 3-25. LO (DC) Leakage Graph for OFDM 802.11a/g Signal

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Phase Noise (PSD)

Figure 3-26 illustrates the Phase Noise (PSD) graph.

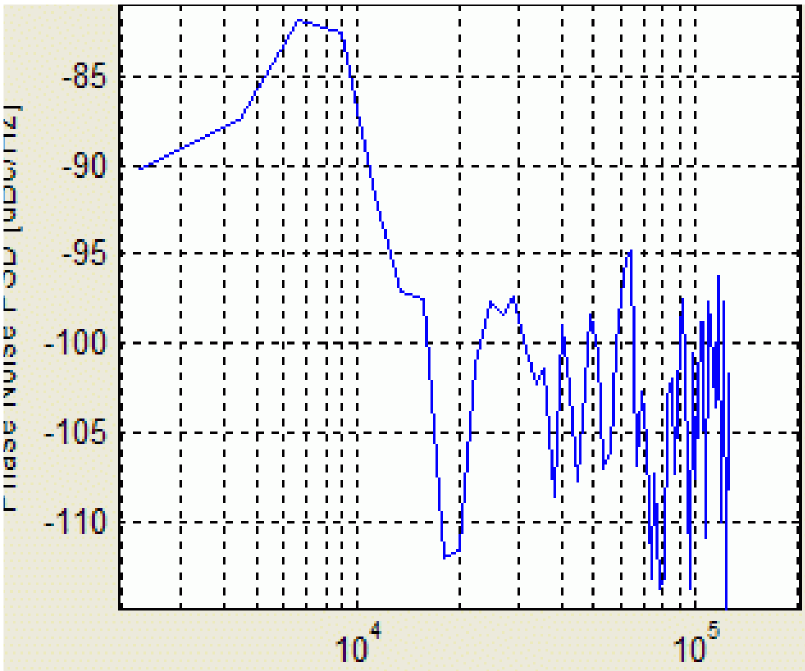

Figure 3-26. Phase Noise (PSD) Graph

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Phase Noise (Time)

Figure 3-27 illustrates the Phase Noise (Time) graph.

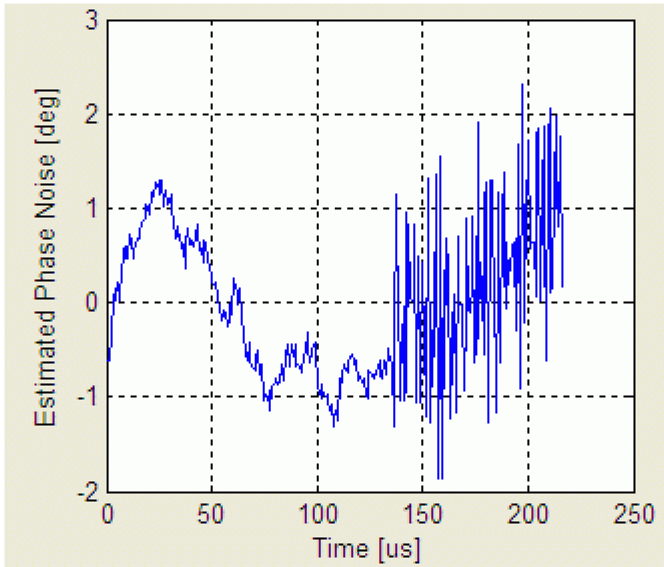

Figure 3-27. Phase Noise Time Graph (CCK)

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Figure 3-28 illustrates the Phase Noise Time graph for OFDM 802.11a/g signal.

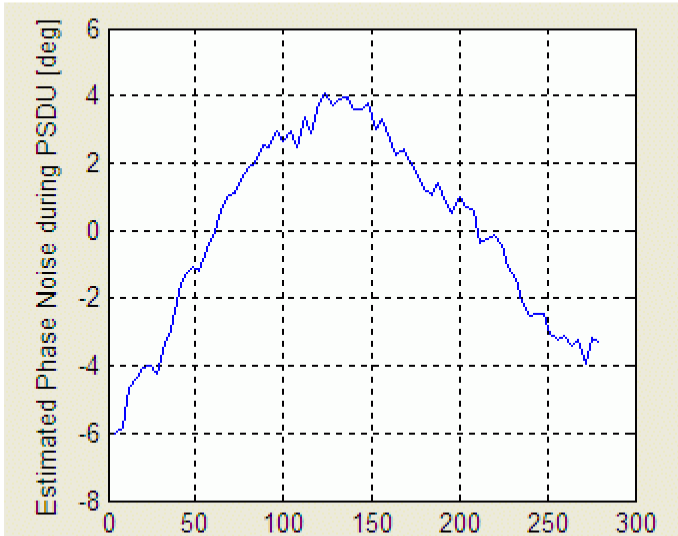

Figure 3-28. Phase Noise Time Graph for OFDM 802.1a/g Signal

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Power On Ramp

Figure 3-29 illustrates the Power On Ramp graph for 802.11b (11Mbps).

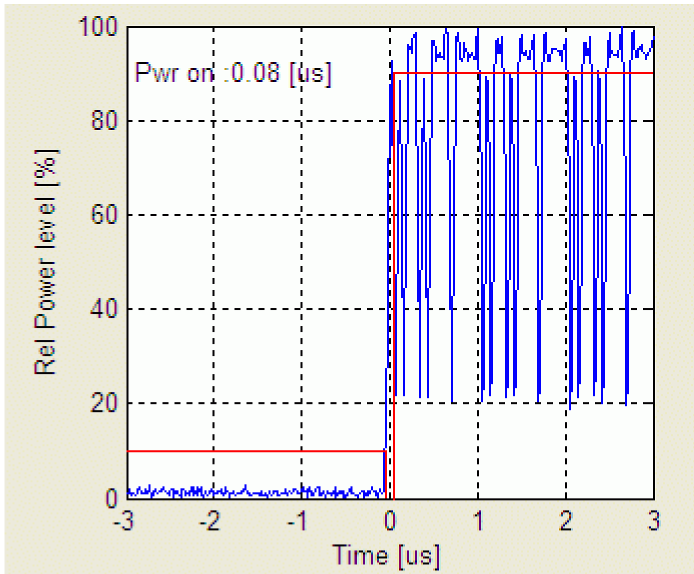

Figure 3-29. Power On Ramp Graph for 802.11b (11Mbps)

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Power Down Ramp

Figure 3-30 illustrates the Power Down Ramp graph for CCK.

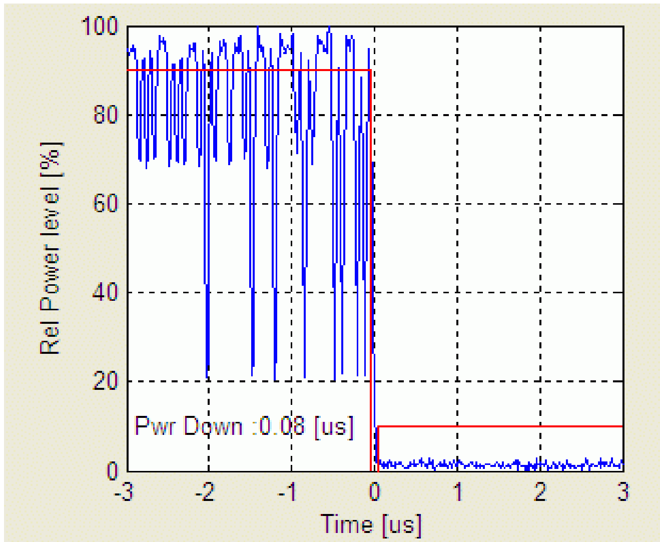

Figure 3-30. Power Down Ramp Graph for CCK

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I&Q Signals

The I&Q Signals shows the I and Q signals voltages plotted against time. When the I&Q Signals graph is selected, the Measurements window also displays in the upper right corner of the main window, as shown in Figure 3-23. Figure 3-31 illustrates the I&Q Signals graph for 802.11b.

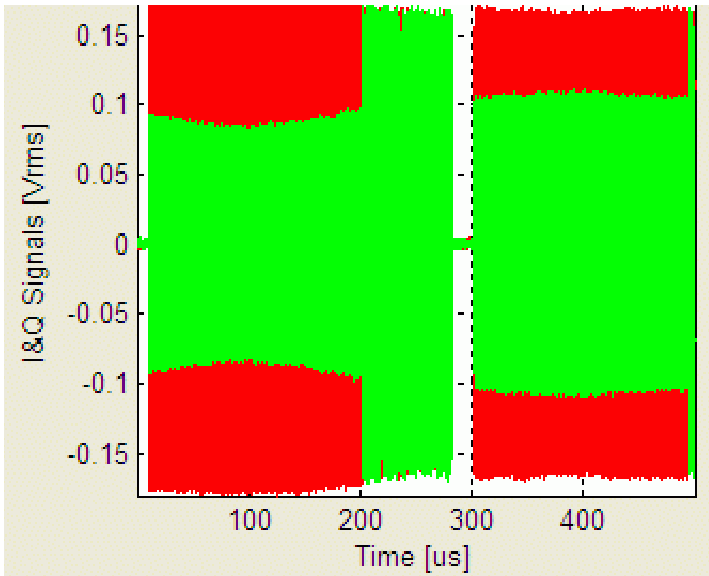

Figure 3-31. I&Q Signals for 802.11b

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Figure 3-32 illustrates the I&Q Signals graph for OFDM 802.11a/g signal.

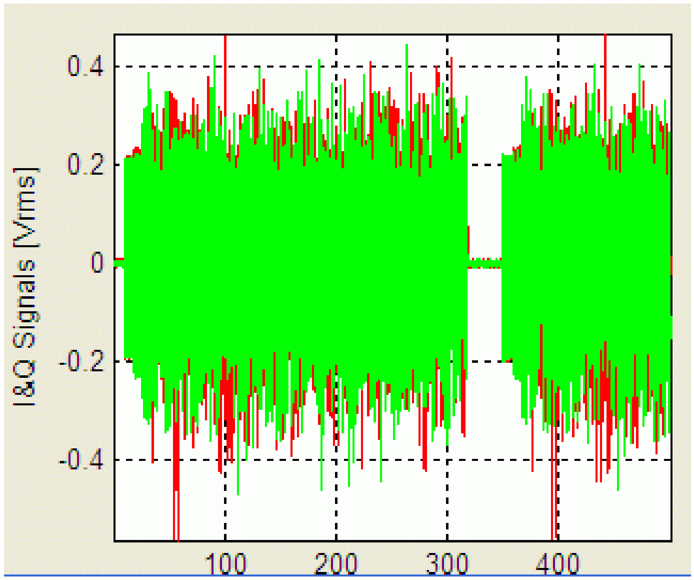

Figure 3-32. I&Q Signals for OFDM 802.11a/g

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Short Training Symbols

The Short Training Symbols (STS) pretzel, which displays in the right graph window, is an x-y plot of the I signal (along the x, or real, axis) versus the Q signal (along the y, or imaginary, axis) during the short preamble. The term 'pretzel' refers to the pretzel-like shape of the plot. The effects of phase and frequency errors, compression and filtering, and I/Q mismatch may after some practice be discerned from the shape of this plot.

Figure 3-33 illustrates an STS Pretzel measured from an OFDM 802.11a/g signal. **The STS Pretzel is not available for the 802.11b signal.**

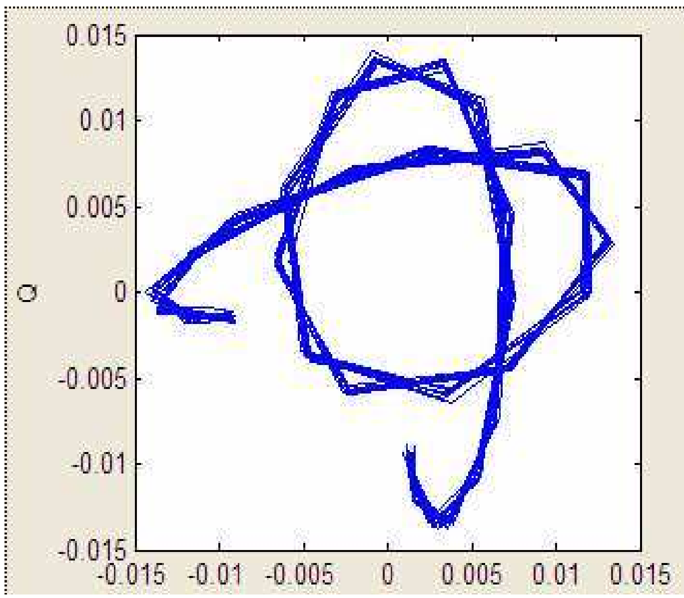

Figure 3-33. STS Pretzel from 801.11a/g Signal

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Frequency Error

The Frequency Error graph displays the frequency error of the captured data during the first part of the frame. Figure 3-34 illustrates Frequency Error without very small frequency error for 802.11b signal.

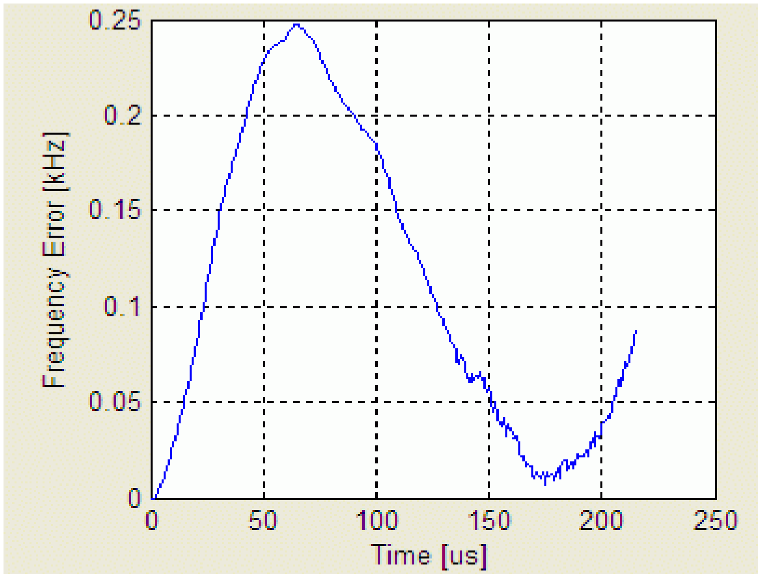

Figure 3-34. Frequency Error for Baseband Signal With Very Small Frequency Error for 802.11b

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Figure 3-35 illustrates a typical frequency pulling of the Voltage Control Oscillator (VCO) during the Short Training Symbols for OFDM 802.11a/g signal.

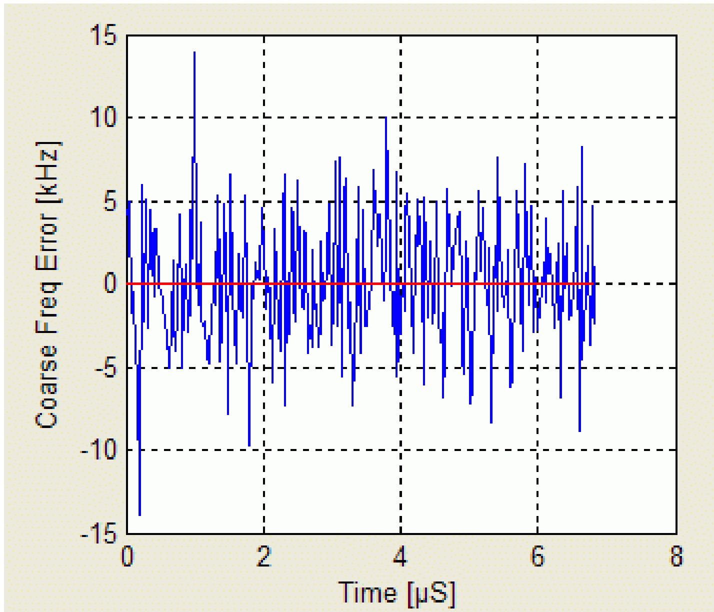

Figure 3-35. Coarse Frequency Error for Short Training Sequence (OFDM 802.11a/g Signal)

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Error Vector Magnitude Versus Carrier

The Error Vector Magnitude (EVM) versus the Carrier plot graph shows the EVM for each sub-carrier averaged over all symbols within the data frame. When the EVM versus Carrier graph is selected, the Measurements window also displays in the upper right corner of the main window, as shown in Figure 3-23.

Figure 3-36 illustrates the EVM Versus Carrier graph for OFDM 802.11a/g signal. EVM Versus Carrier is used only for 802.11a/g signal.

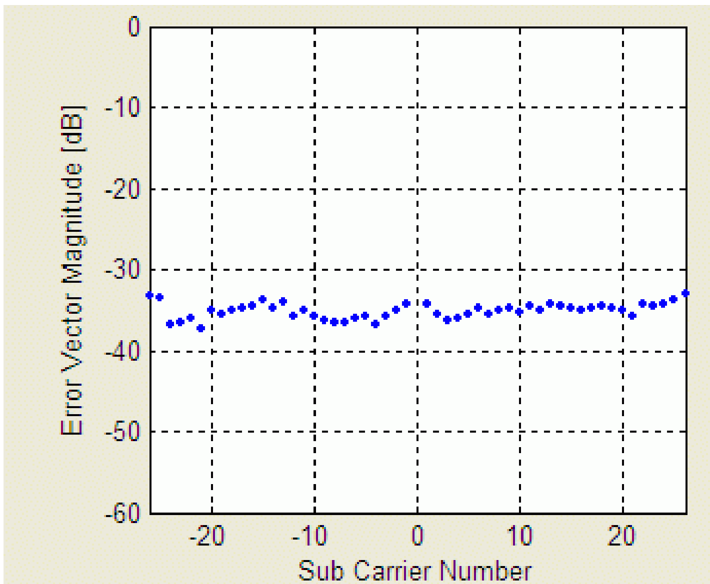

Figure 3-36. EVM Versus Carrier for OFDM 802.11a/g Signal

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Error Vector Magnitude (EVM) Versus Time

The EVM versus the Symbol plot shows the EVM for each symbol averaged over all sub-carriers within frame data. Figure 3-37 illustrates a graph for the EVM Versus Symbol Number for OFDM 802.11a/g signal.

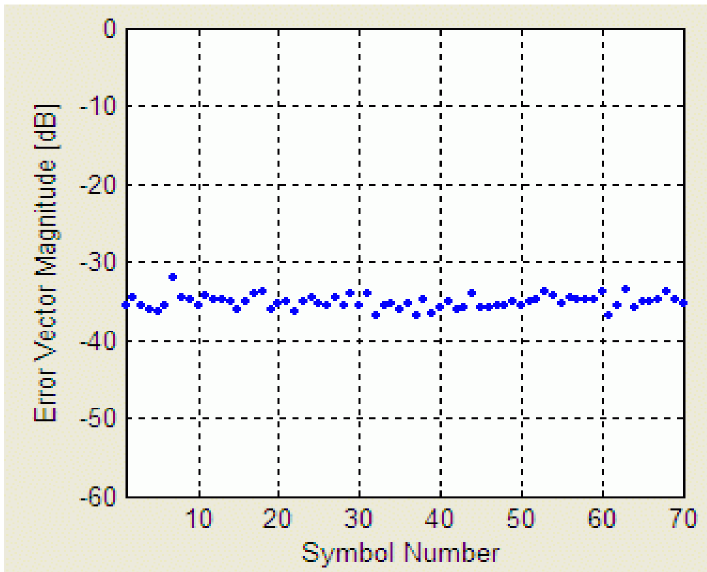

Figure 3-37. EVM Versus Symbol for OFDM 802.11a/g Signal

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Figure 3-38 illustrates the EVM Versus Time for 802.11b signal.

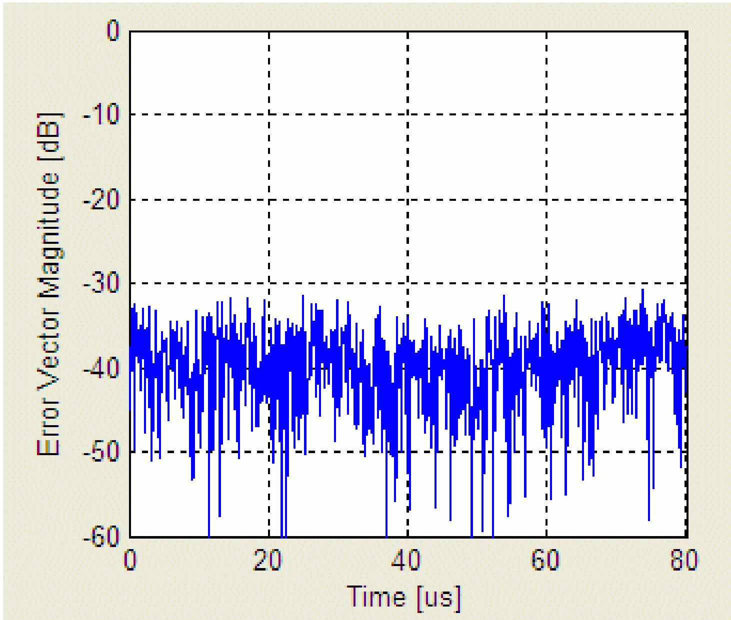

Figure 3-38. EVM Versus Time for 802.11b Signal (CCK)

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Eye Graph

The Eye graph analyzes the error vector magnitude. The Eye graph is available only for the 802.11b signal. Figure 3-39 illustrates the Eye Graph for 802.11b signal.

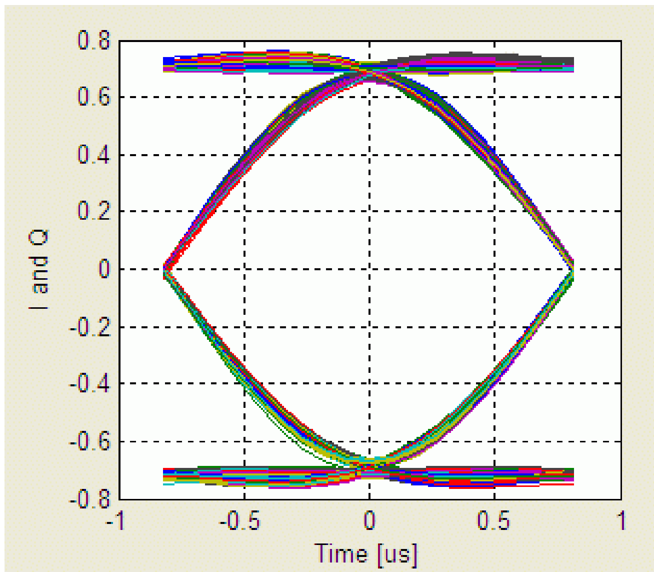

Figure 3-39. Eye Graph for 802.11b Signal

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Using the Zooming Tool

The IQView EVM application has a zooming tool that allows you to zoom in on the main data graph in order to stretch the plot out along the time (horizontal) axis. There are two methods for using the zoom tool:

- Slider Method
- Left-clicking and Dragging Method

Using the Slider Method to Zoom

The Zoom Slider is located in the bottom far-right side of the main window. As you move the Zoom Slider's control bar, all three graphs (top and bottom) on the main window change in unison. The Zoom Slider allows you to view from far right to far left the maximum size of the captured analysis displayed in the top graph. Figure 3-40 illustrates the zoom slide with the mouse pointing to the control bar of the slider.

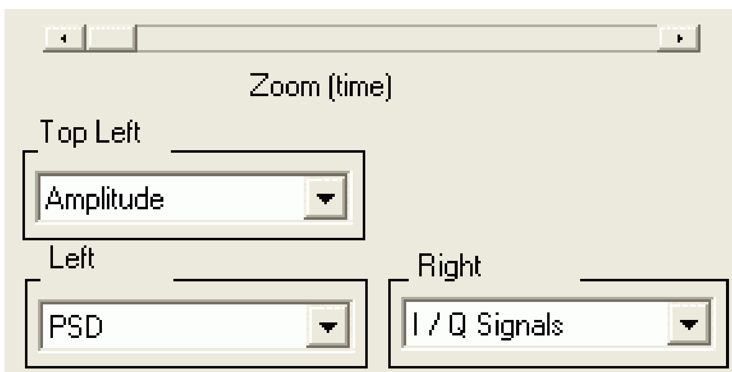

Figure 3-40. Zoom Slider

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The top graph (shown in Figure 3-41) illustrates a capture set up for 500 microsecond intervals. See "Parameters" in this chapter for changing the time intervals for analyzing captures.

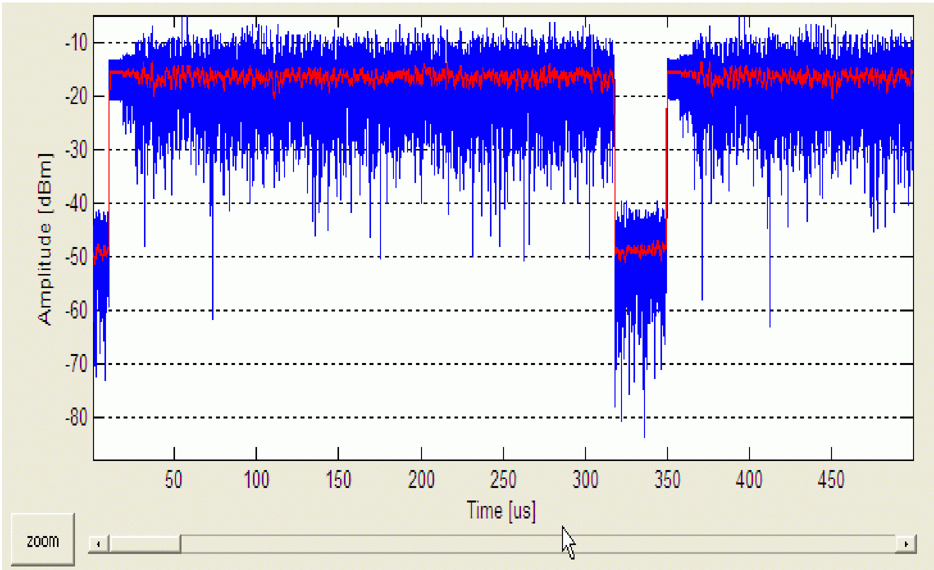

Figure 3-41. Amplitude Graph Showing Time Interval Capture in 500 Microseconds

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Using the Time Slider to Zoom

To focus on a specific section of the top graph, simply slide the Time Slider (as shown in Figure 3-42) to the desired portion of graph that you want to view. Notice that the slider bar now is positioned further to the right and as a result, the top graph focuses on a specific portion of the graph. Compare Figure 3-41 to Figure 3-42 to see the difference in the top graph after repositioning the Time Slider from left to right.

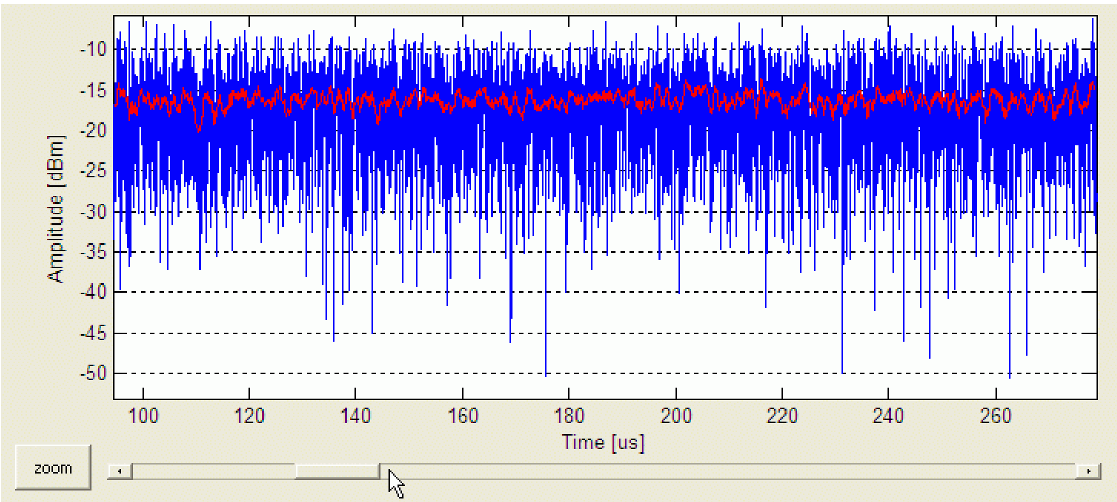

Figure 3-42. Zoom Time Slider Repositioned to the Right

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Using the Left-Click and Drag Method to Zoom

To use the left-click and drag method to zoom in on a particular section of the top graph, simply left click your mouse. As you begin a drag movement, a thin-lined rectangle (frame) appears. Discontinue dragging and release the mouse when you have selected the exact area of the graph that you want to focus on. Figure 3-43 illustrates the Left-Click and Drag Method for zooming.

NOTE: The bottom graphs do not change when performing this type of zoom.

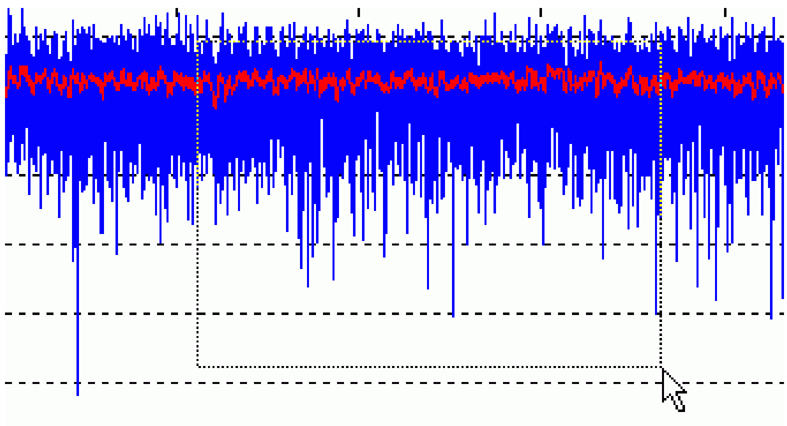

Figure 3-43. Left-Click and Drag Method

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Vector Signal Generator

The Vector Signal Generator is a separate program that generates complex signals that are distributed from the tester's RF or Baseband output ports to verify the performance of the receiver portion of the 802.11 Device Under Test (DUT).

To run the Vector Signal Generator application, select Vector Modulator, located in the Tools menu. Figure 3-44 illustrates the Vector Signal Generator's main window. The blue graph shows the instantaneous power of the signal, and the red signal shows the power averaged over one symbol. Table 3-7 lists and defines the Vector Signal Generator functions.

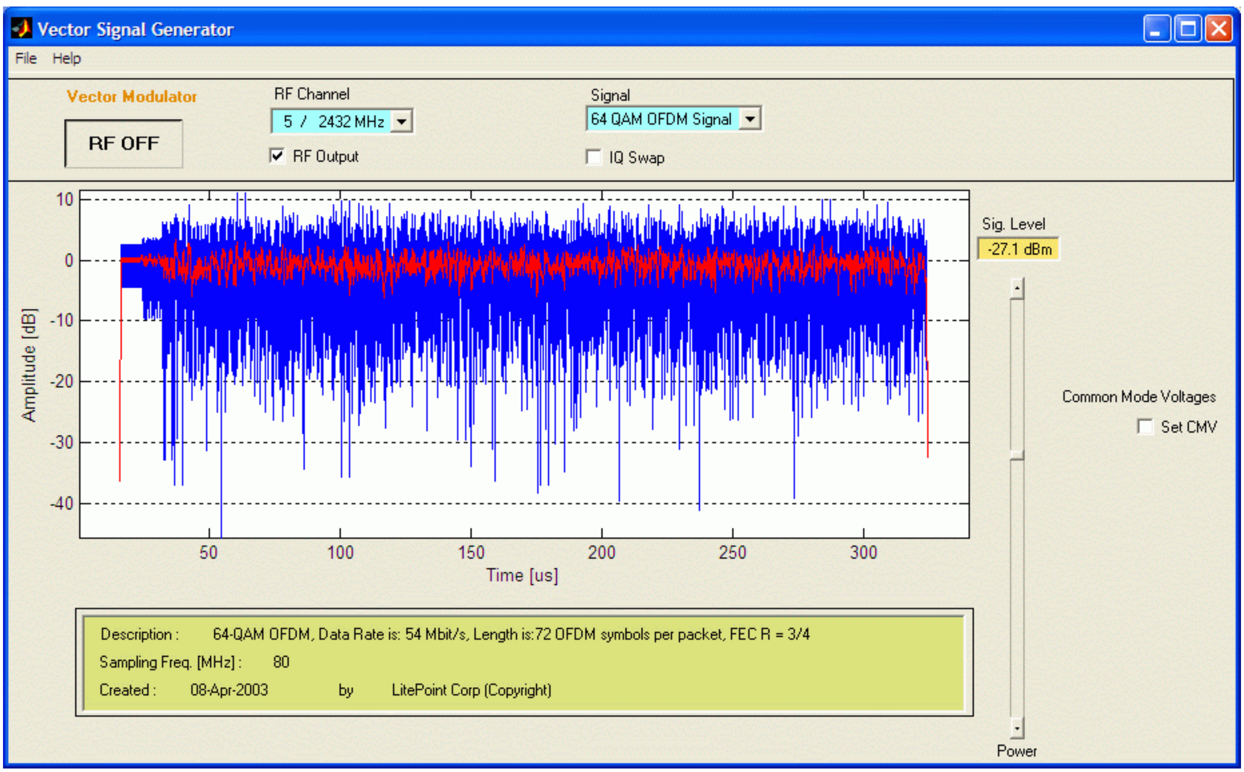

Figure 3-44. Vector Signal Generator Main Window

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Table 3-7. Vector Signal Generator Functions

Functions	Description
Start/Stop	Starts and stops the Vector Signal Generator application
RF Output (Checkbox)	Selects the output mode of the RF and Baseband ports. When checked, the vector signal is output on the RF port and monitored on the Baseband ports. If not checked, the vector signal is output on the Baseband ports.
RF Channel	Selects an RF output channel. Available selections are: • 2412 MHz to 2484 MHz in increments of 5 MHz. • 5180 MHz to 5805 MHz in increments of 20 MHz.
IQ Swap (Checkbox)	When checked, the I signal and the Q signal are interchanged on the RF or Baseband output ports. Otherwise, they are not interchanged.
Signal (Pull-Down List)	Selects the type of signal modulation to use from the following: • 64 QAM OFDM Signal • 16 QAM OFDM Signal • QPSK OFDM • BPSK OFDM • 802.11b 1Mb/s • 802.11b 2Mb/s • 802.11b 5.5Mb/s • 802.11b 11Mb/s
Signal Level	Shows the RMS signal level of the current output signal. Note, this box cannot be used to input the desired signal level. Use the slider to set the desired level, or enable the VSGpanel (see later)
Signal Level Slider	Sets the output signal level, by clicking on the directional arrows, or by dragging the level indicator. ***NOTE:*** *If the output level is set beyond the optimal performance range of the IQview vector signal generator, a red bomb signal will appear in the upper right hand of the application window. This is shown in Figure 3-45. By dragging the mouse over the bomb signal, additional information is provided.*
Information	Displays textual information about the signal being generated.
Graphical Representation	Provides a graphical representation of the output signal

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Figure 3-45 illustrates the "red bomb" which indicates that the vector signal generator is not working optimally.

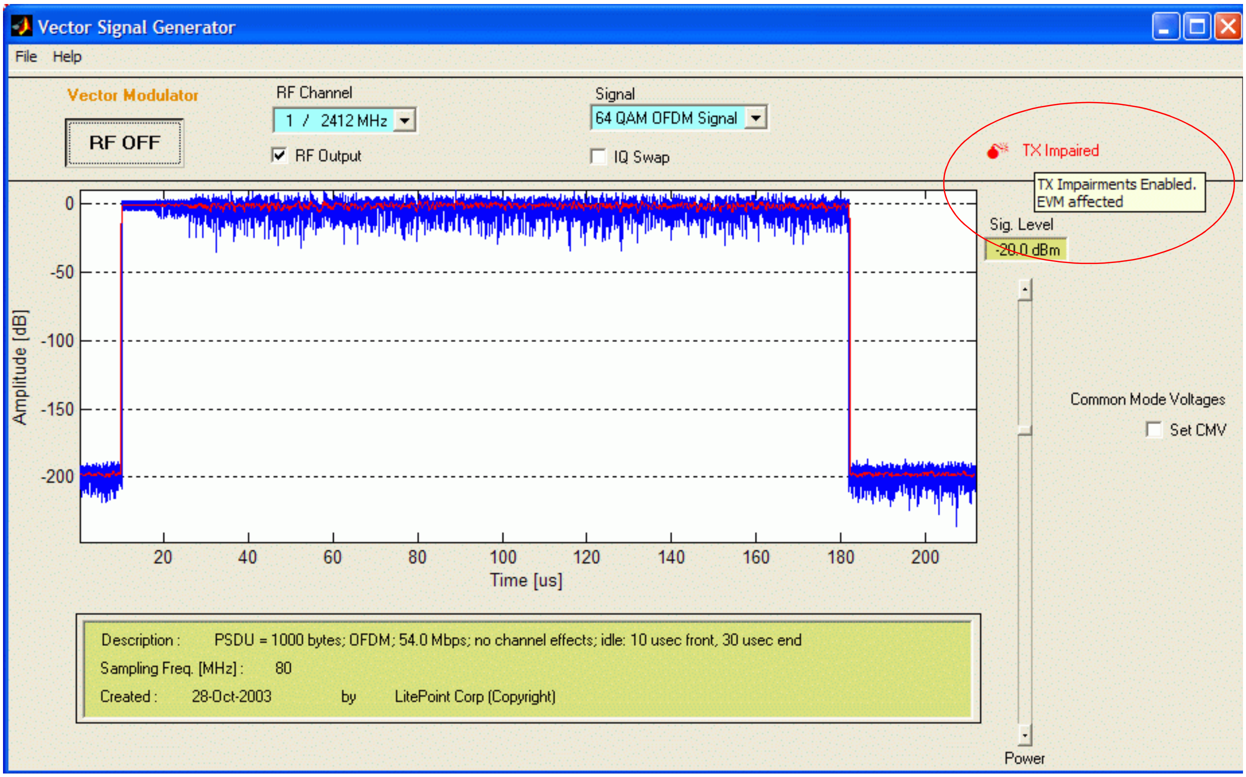

Figure 3-45. Red Bomb Indicator on VSG

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Main Menu

The main menu consists of the following two menus:

- File
- Help

File Menu

Figure 3-46 illustrates the Vector Signal Generator File menu. Table 3-8 lists and defines the File menu items.

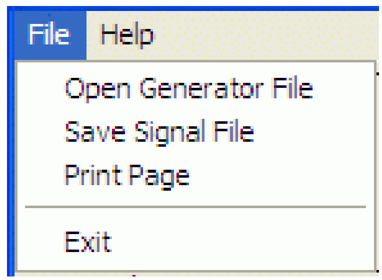

Figure 3-46. Vector Signal Generator File Menu

Table 3-8. Vector Signal Generator File Menu

Menu Items	Description
Open Generator File	Opens an existing generator signal file
Save Signal File	Saves a generator file
Print Page	Prints the current page
Exit	Exits the vector signal generator application

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The About submenu, which provides the IQview software version, is located in the Help menu.

Figure 3-47. About IQview Window

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VSG Panel Application

The Vector Signal Generator Panel application is an additional tool that can be used with the Vector Signal Generator. It allows the user to add impairments to the ideal signal generated by the VSG. The VSGpanel is activated directly from the desktop. The program allows impairments to be introduced in real-time by adjusting the appropriate scroll-bars. When activated, the VSGpanel window displays as shown in Figure 3-48.

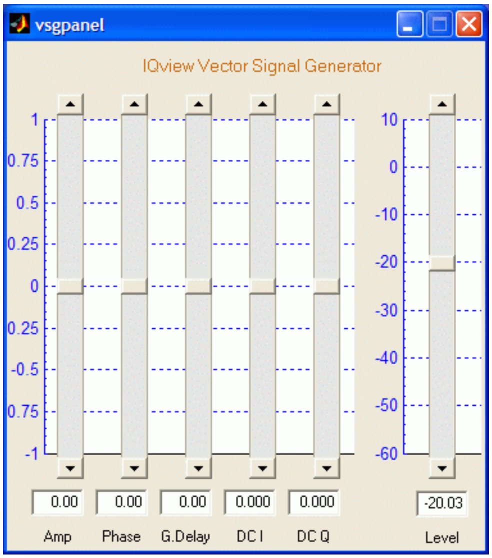

Figure 3-48. The VSGpanel Pop-up Window

The VSGpanel presents five different scroll bars on the left side of the window, and an output level scroll bar located on the right side. The scroll-bars can be operated in four different ways.

- By typing a number in the box below the scroll-bar
- By clicking the arrows on the scroll bar (This introduces a fine adjustment on the scroll-bar position.)
- By clicking on the area of the scroll bar between the level indicator and the scroll-bar arrow. (This introduces a coarse adjustment of the scroll-bar level indicator.)
- By dragging the level indicator to the desired position using the mouse

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The **first** scroll-bar adjusts the amplitude of the Q-channel. The amplitude of the Q-channel becomes:

$$Q = Q_{ref} \cdot \left(1 + \frac{Offset}{100}\right) \quad \textbf{(EQ 1)}$$

where *Q* is the resulting signal generated by the VSG, Q_{ref} is the original signal, and *Offset* is the value of the text box below the scroll bar. The unit for the value in the text box is (%).

The **second** scroll-bar adjusts the phase of the Q-channel relative to the I-channel. The phase of the Q channel becomes:

$$\angle Q = \angle Q_{ref} + \angle offset = \angle I + 90^{o} + \angle offset \quad \textbf{(EQ 2)}$$

where $\angle Q$ is the resultant phase, $\angle Q_{ref}$ is the reference phase of the Q channel (90^{o} on the I-channel), and $\angle offset$ is the offset angle presented in the text box below the scroll-bar. The unit for the value in the text box is degrees.

The **third** scroll-bar adjusts the group delay of the Q-channel. The samples stored in the Q-channel are delayed by the delay presented in the text box below the scroll-bar, and calculated by.

$$Q(t) = Q_{ref}(t - \Delta t) \quad \textbf{(EQ 3)}$$

where *Q(t)* represents the sample produced at time *t*, which in the original symbol would be produced at time $t\text{-}\Delta t$, Δt is the introduced delay. The unit for the value in the text box is nsec.

The **fourth** and **fifth** scroll-bars adjust the DC-offset introduced in the I-channel and Q-channel respectively. The resulting values can be calculated as:

$$I(t) = I_{ref}(t) + k \quad \textbf{(EQ 4)}$$

where *I(t)* represents the resulting signal in either I-channel or the Q-channel, $I_{ref}(t)$ represents the original signal, and *k* represents the DC-offset presented in the text-box below the scroll-bar. The unit for the value in the text box is volts when used on baseband outputs. This function is less useful on RF outputs.

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The scroll bar on the right side controls the output power of the VSG[1]. The unit for the value in the text box is dBm for RF output and dBV for baseband output.

All scroll bars can be operated simultaneously, and the updates to the signal will be done in real-time when IQsignal is running in continuous mode, or when pressing start in single capture mode in the IQsignal window, or when turning the power on or off in the vector signal generator application.

Caution: When introducing impairments using the VSGpanel, the impairments will exist even when a different application is selected. The IQsignal and the VSG applications will show a small "bomb" in the upper-right hand of interface window indicating impairments have been added. See Figure 3-49 and Figure 3-50. Dragging the mouse over the bomb will provide additional information about the type of impairments. Also, make sure to reset the impairment before exiting the VSGpanel program because in some cases the impairments may be maintained.

NOTE: If the VSG output enters compression, even without impairments, the bomb will also display, indicating non-optimal performance.

1. Note, when operating the VSGpanel in combination with the Vector Signal Generator application, an inconsistency can occur, where the two applications show different output power levels. The application to actually set/adjust the power is the one that has the correct displayed value.

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Figure 3-49 shows the measurement of a signal with approximately 4.5 degrees phase error introduced. Note the red bomb in the upper-right corner indicating impairments introduced by the vector signal generator.

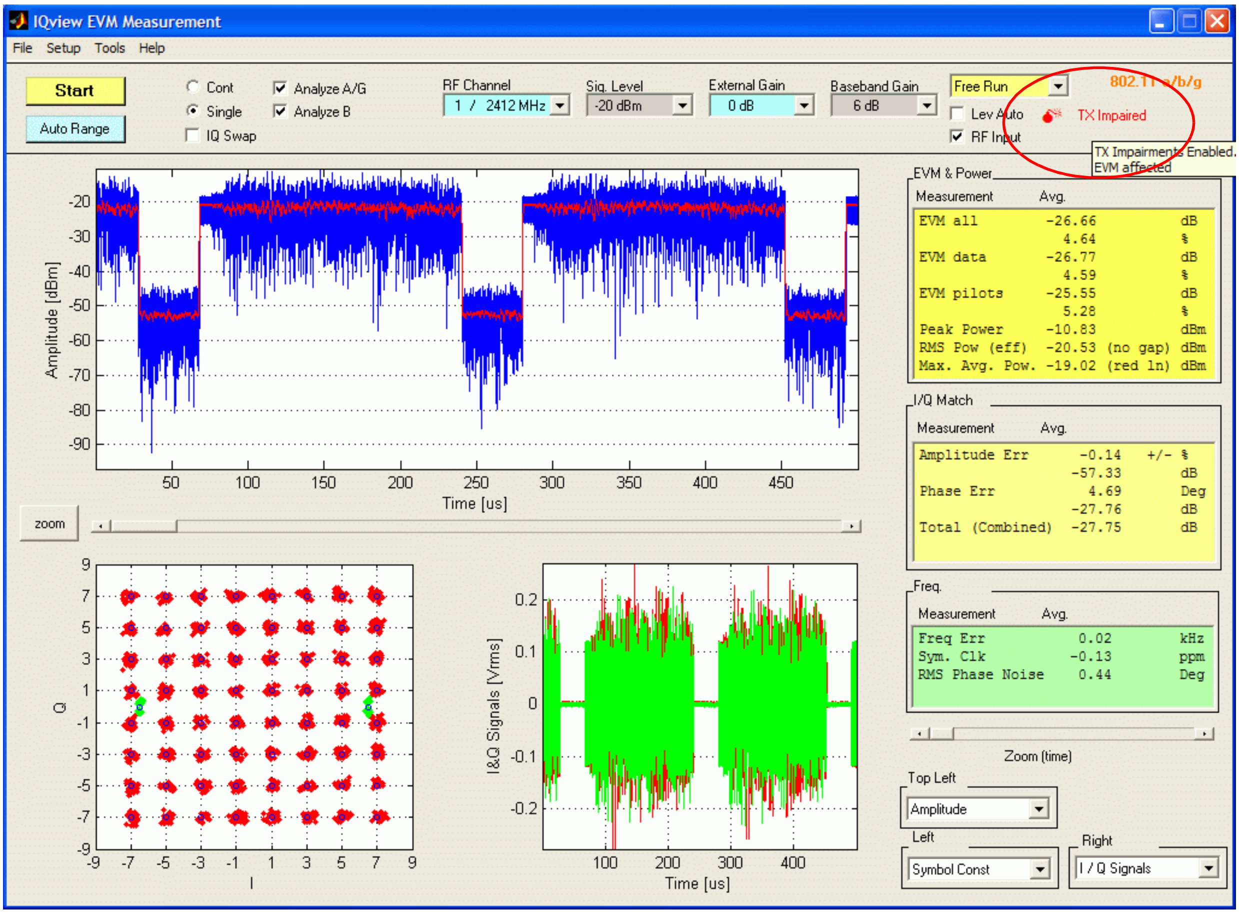

Figure 3-49. Red Bomb Indicator of Impaired Transmit IQ Signal

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Figure 3-50 is an example of the vector signal generator application when impairments are introduced by the VSGpanel. Note the red bomb in the upper-right corner.

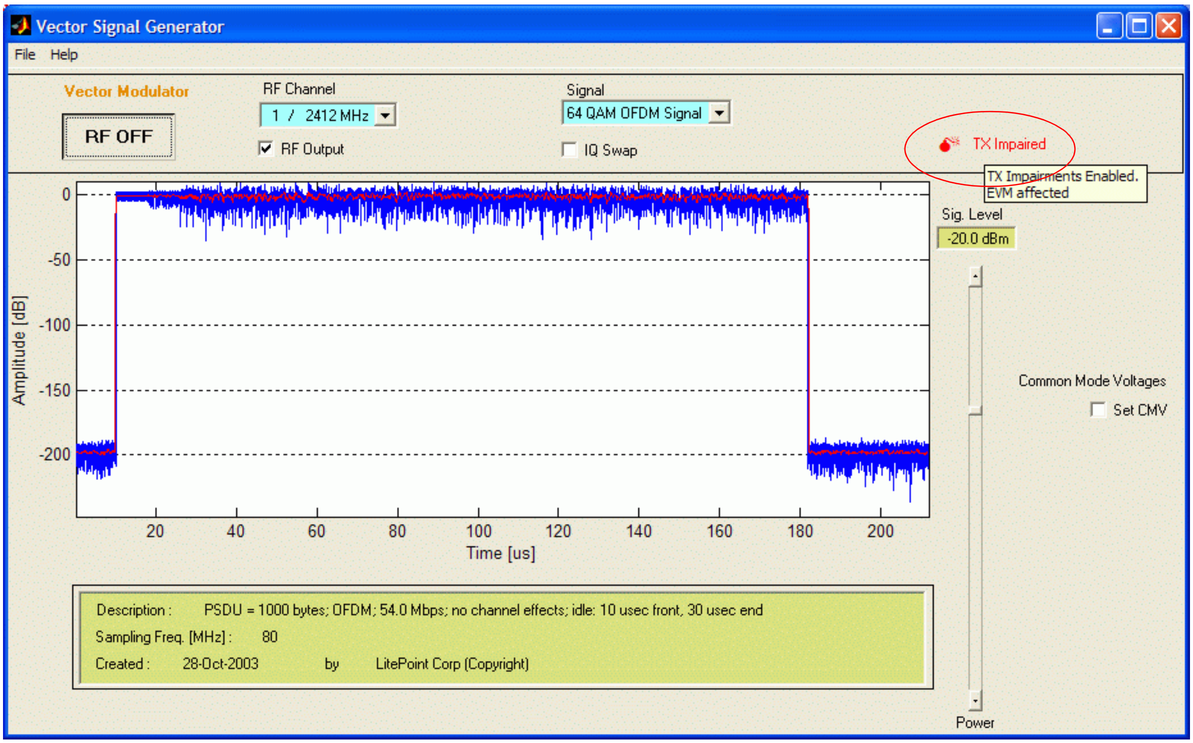

Figure 3-50. Red Bomb Indicator of Impaired Transmit VSG Signal

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Chapter 4 IQview Administration Tool

The IQview Administration Tool allows administrators to setup and control IQview 802.11 testers.

CAUTION: The IQview Administration tool should be used only by experienced administrators.

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Pre-requisites for Using the IQview Administration Tool

Prior to using the Administration Tool, read the following warnings and notes.

NOTE: Make sure that the PC hosting the IQview Administration Tool is configured to operate with the same basic network setup for scanning the intended testers. For example, if a tester has an IP address of 192.168.100.254 and a subnet mask of 255.255.0.0, then the PC hosting the IQview Administration Tool must have an IP address and subnet mask that allows the PC to communicate with the tester

NOTE: After changing the settings for a tester, the information shown in the Administration Tool window does not take effect until the tester has been restarted. Therefore, it is possible to change settings more than once before deciding that the settings are correct, as long as the tester has not been restarted.

WARNING: All network settings, such as the IP address and subnet mask, must be set up correctly prior to restarting or halting a tester. If the tester's IP address is changed significantly, for example, from 192.168.100.213 to 10.10.293.4, then the PC will **not** communicate with the tester unless the PC's address is changed accordingly. However, if the address is slightly modified, for example, from 192.168.100.213 to 192.168.100.214, then communication may be possible between the tester and the PC.

WARNING: Changing the IP address or the subnet mask may affect the Network Address and the Broadcast Address. See "IQview Settings" for more details.

NOTE: The IP Lock does not affect the operation of the IQview Administration Tool. Therefore, it is always possible to connect to the tester with the PC hosting the IQview Administration Tool and to change the tester's settings, provided that all other network settings are configured correctly.

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Administration Tool Description

The IQview Administration Tool scans the local area network for IQview testers; any testers that are discovered on the network appear in a list in the program window. This list provides an overview of the connected testers, including their IP addresses and their serial numbers.

By selecting a tester from the list or by manually entering an IP address, the administrator can retrieve many types of information from the tester. Listed below are some of the types of data that can be accessed:

- network settings (configurable)
- tester name (configurable)
- tester serial number
- software version
- hardware version

It is also possible to upgrade firmware, restart and halt testers remotely.

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Accessing the IQview Administration Tool

1. From the **Start** button, select **All Programs**, **IQview Applications 1.01**, **Accessories**, **IQview Administration Tool**.

The Administration Tool window displays, as shown in Figure 4-1.

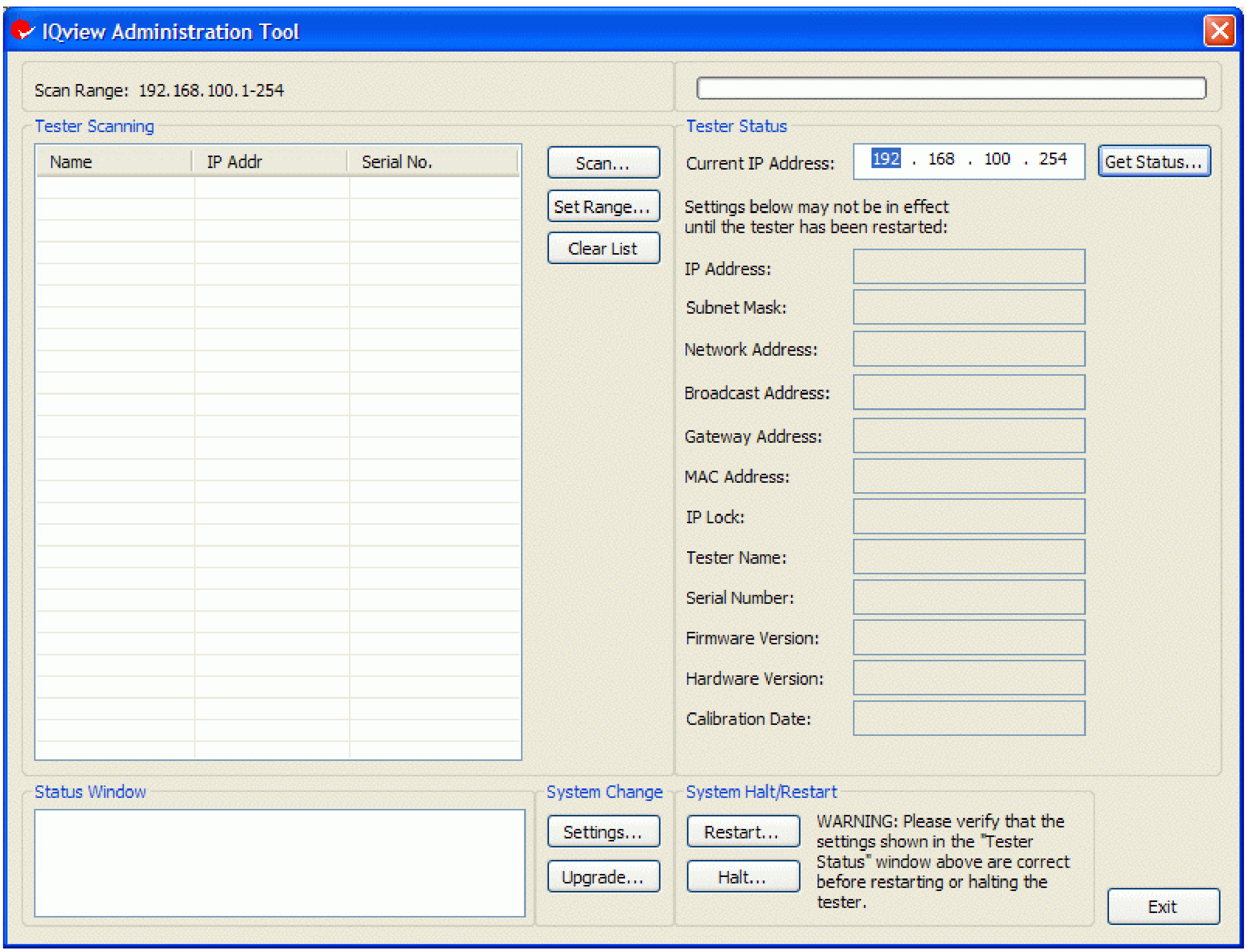

Figure 4-1. Administration Tool Main Window

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The IQview Administration Tool window, which is divided into five major areas, provides the following functions:

- Tester Scanning
- Tester Status
- Status Window
- System Change
- System Halt/Restart

Table 4-1 lists and describes the functions of the Administration Tool's main window.

Table 4-1. Administration Tool, Main Window

Functions	Description
Tester Scanning	
Scan... Button	Scans the LAN for existing testers. See "Setting the IQview Scan Range" for more details.
Set Range... Button	Allows user to enter the range of IP addresses for existing testers on the LAN. See "Setting the IQview Scan Range" for more details.
Tester Scanning (List)	Lists all testers which were found on the network after a scan is performed. The Tester Scanning window lists the Name, IP Address and Serial Number of each tester on the LAN. See "Tester Scanning List Description"for further details.
Clear List Button	Clears the contents of the Tester Scanning List
Progress Bar	Displays progress while retrieving/storing information in the tester and during a tester scan operation.
Tester Status	
Tester Status	Contains detailed information about the currently selected tester: IP Address, Subnet Mask, Network Address.Broadcast Address, Gateway Address, IP Lock, Tester Name, Serial Number, Software Version, Hardware Version, Calibration Date. Information can be updated in two ways: by manually entering the tester IP address and then pressing the Get Status button and by performing a tester scan and then double-clicking one of the displayed testers in the list.

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Table 4-1. Administration Tool, Main Window (Continued)

Functions	Description
Current IP Address	Displays the current IP address of the specified tester. You also can manually enter a tester's IP address. This method may be a useful shortcut if the user already knows the IP address of the tester and does not want to wait for a scan. Alternatively, whenever the user selects an entry from the Tester Scanning List, the Current IP Address field is automatically updated with an IP address from this list. All administrative functions, such as changing settings or upgrading a tester, are performed on the tester whose IP address displays in the Current IP Address window.
Get Status... Button[1]	Retrieves the most recent status of an existing tester.
Status Window	Displays the history of the most recently completed operation.
System Change	
Settings... Button	Allows users to access a dialog box to change certain settings shown in the Tester Status window. See "Changing the IQview System Settings"for more details on how to change the settings.
Upgrade... Button	Initiates an upgrade of the tester. The user must select the appropriate upgrade information file with a filename having a file extension *.inf, which should have been part of the software upgrade received; the upgrade operation will not take place until this file has been selected. See "IQview Administration Tool" for more details on how to upgrade an IQview tester.
System Halt/Restart	
Restart... Button[2]	Restarts the currently selected tester. While the tester is restarting, its power LED turns red. The tester is ready as soon as its power LED turns green again.
Halt... Button	Halts the currently selected tester. The tester's power LED turns red while the tester is halting.
Exit Button	Exits the program.

1. When the settings for a tester are changed, the information shown in these windows does not take effect until after the tester has been restarted. Therefore, it is possible to change any setting more than once before deciding that all the settings are correct, as long as the tester has not been restarted.

2. WARNING: All network settings for a tester, including its IP address and its subnet mask, must be set up correctly before attempting to restart it. If these settings are not set up correctly, the PC may not be able to communicate with the tester after it has been restarted, for instance, if the tester's IP address has been changed significantly from 192.168.100.213 to 10.10.293.4.

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Tester Scanning List Description

Double-clicking on an entry in the tester list retrieves detailed information about that tester and updates the tester information shown in the **Tester Status** window. Figure 4-2 displays the Tester Status window for a tester at IP address 192.168.100.7.

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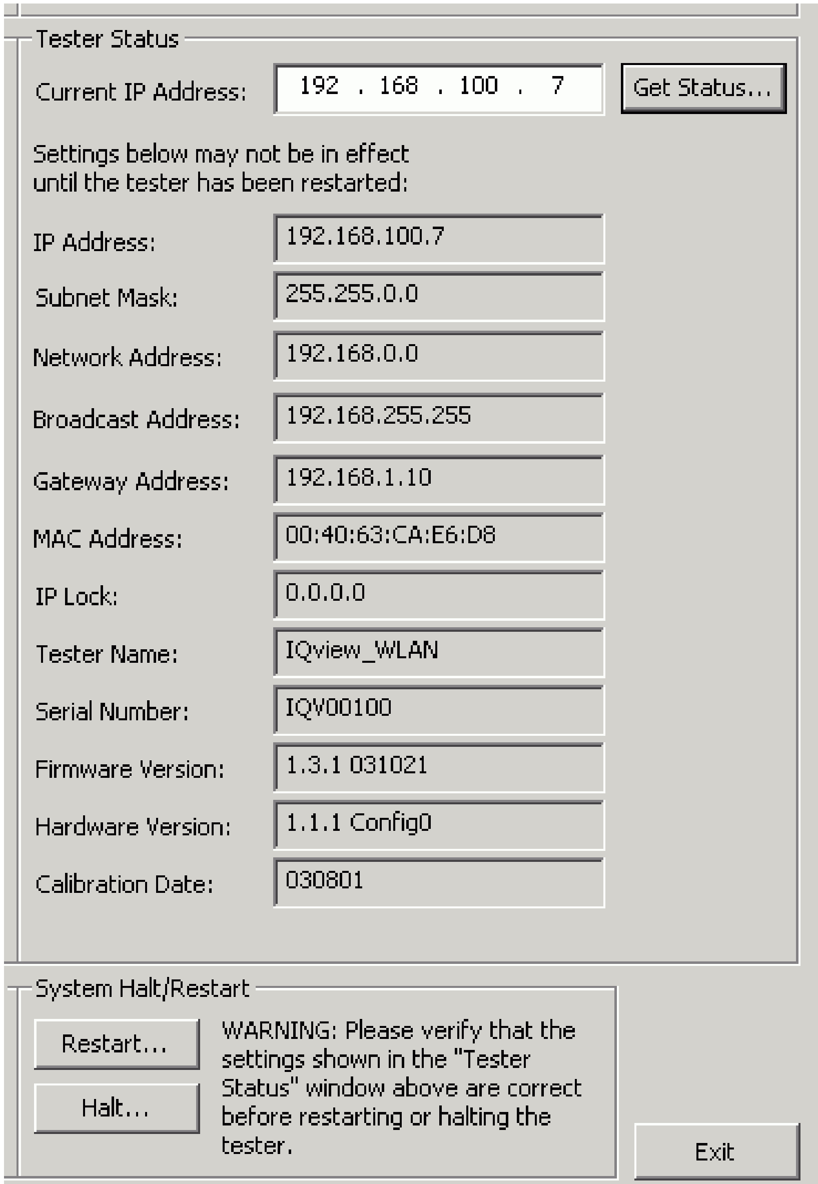

Figure 4-2. Status Window for Tester at IP Address 192.168.100.7

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When a user exists and later restarts the program, the system stores the current tester information in the Tester Scanning List. To clear the list, simply press the **Clear List** button.

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Setting the IQview Scan Range

Setting the IQview Scan Range allows the user to set a range of IP addresses for scanning testers.

NOTE: The scan range only affects the right-most field of the IP address. For example, by selecting the range between 192.168.100.100 and 120 as shown in Figure 4-3, only testers with IP addresses within the range of 192.168.100.100 and 192.168.100.120 will be scanned.

1. Select the **Set Range** button in the main window of the Administration Tool.
   The IQview Scan Range window appears.

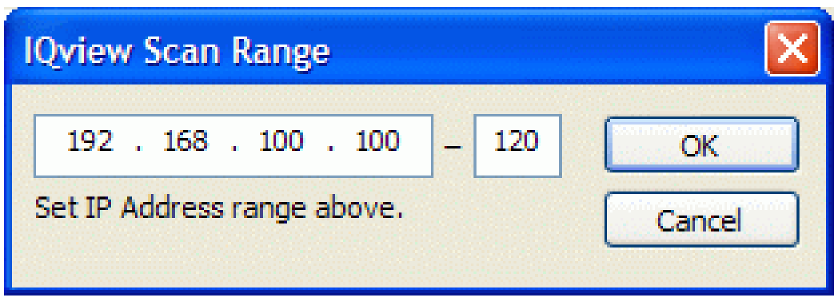

Figure 4-3. IQview Scan Range

2. Enter the IP Address range.
3. Press OK.
4. Press Scan.
   The Scan Range window displays a list of testers, as shown in Figure 4-4.

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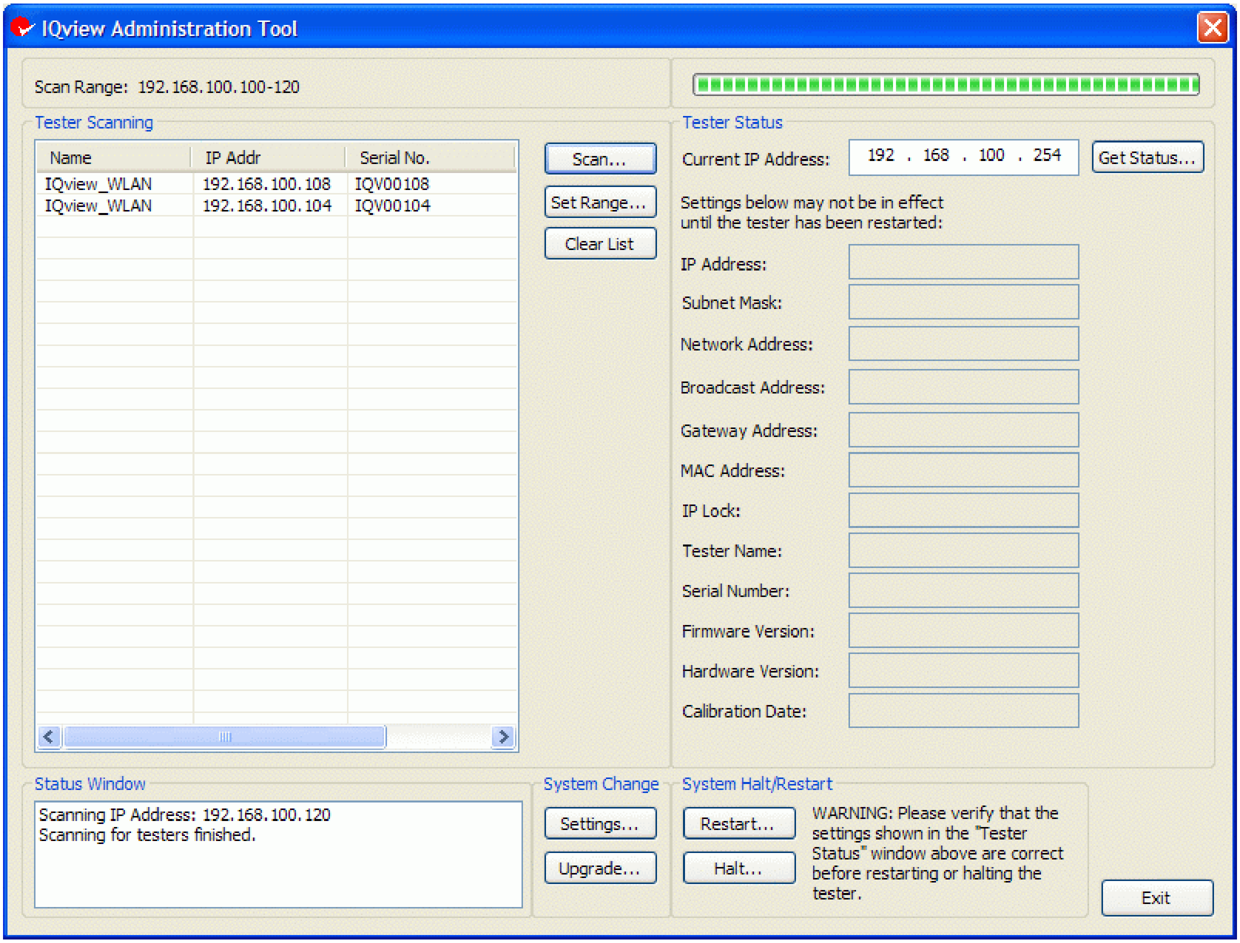

Figure 4-4. Tester Scanning List Window

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Changing the IQview System Settings

1. Select the **Settings** button, located at the bottom (middle section) of the Administration Tool screen. The System Settings window displays important tester settings, such as IP, Subnet Mask, Network and Broadcast Address, and IP Lock and Tester Name.

CAUTION: Make sure you thoroughly read this window prior to clicking OK.

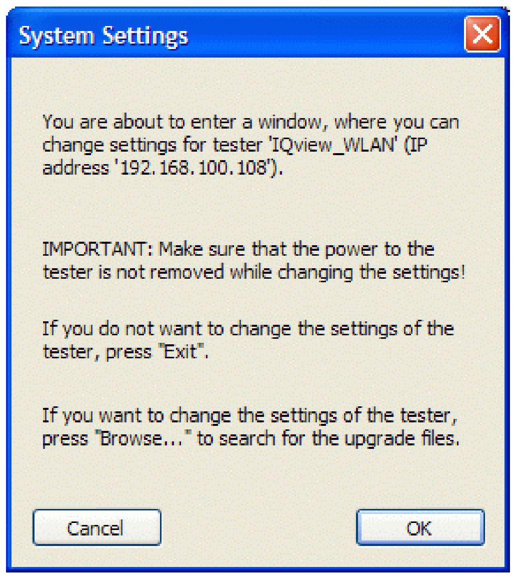

Figure 4-5. System Setting Dialog Box

2. Click **OK**.

The Change Settings window displays, as shown in Figure 4-6.

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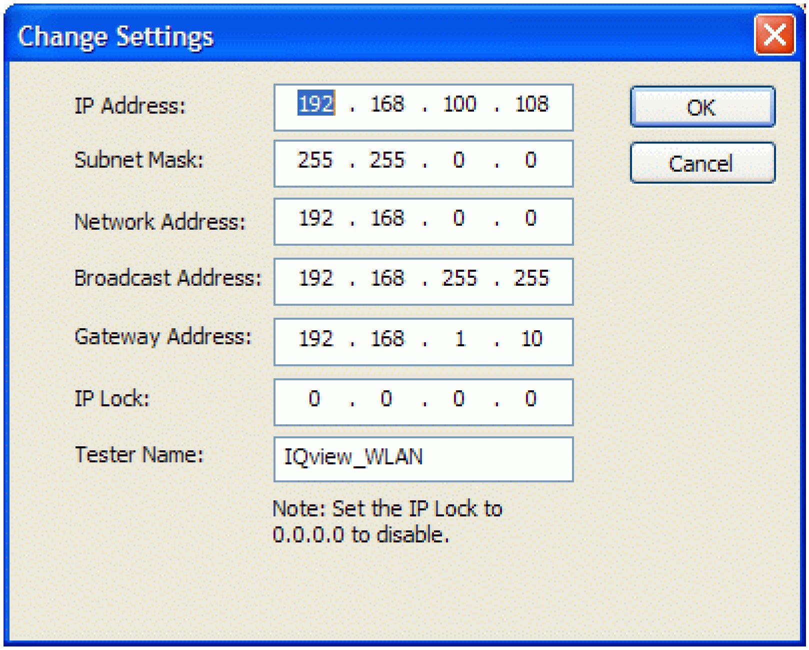

Figure 4-6. Change Settings Window

NOTE: Each time that either the IP Address or the Subnet Mask is changed, the tester's Network Address and Broadcast Address are set automatically according to the following Network Address and Broadcast Address rules. However, if the user manually changes these settings, the manual settings override the automatic rule-based settings.

The Network Address Rule

The Network Address is changed to the value of the IP Address, Boolean (bitwise) ANDed with the Subnet Mask. This Boolean AND operation forces those bits to be 0 in the Network Address which correspond in their bit position to bits that are set to 0 in the Subnet Mask. If for instance the IP Address is set to 192.168.100.211, and the Subnet Mask is set to 255.255.255.0, then the Network Address will be set to 192.168.100.0; since the rightmost 8 bits of the Subnet Mask are set to 0, the value of 211 gets masked off.

The Broadcast Address Rule

As with the Network Address, a similar calculation is also done for the Broadcast Address. However, in this case the bits that are masked out by the Subnet Mask are set to 1 instead of to 0 as applied to the Net-

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work Address. For example, if the Network Address is set to 192.168.100.0, then the corresponding Broadcast Address is set to 192.168.100.255.

After checking the tester status in the main window, if the Network Address or the Broadcast Address are not set to their desired values, return to the **Change Settings** window and change these settings individually.

Table 4-2. Change Settings Window

Parameters	Description
IP Address	Changes the IP Address of the tester. Any change to the IP Address may affect the Network Address and Broadcast Address settings, as mentioned above.
Subnet Mask	Changes the Subnet Mask of the tester. Any change to the Subnet Mask may affect the Network Address and Broadcast Address settings, as mentioned above.
Network Address	Changes the Network Address of the tester. The Network Address setting may be overridden when setting the IP Address or the Subnet Mask.
Broadcast Address	Changes the Broadcast Address of the tester. The Broadcast Address setting may be overridden when setting the IP Address or the Subnet Mask.
Gateway Address	Changes the Gateway Address of the tester.
IP Lock[1]	Changes the IP Lock of the tester. The IP Lock feature restricts access to only a specific PC so that only this particular PC can connect to the tester and perform measurements. Users of other PCs cannot interfere with measurements being performed with this tester even if they accidentally or deliberately attempt to connect to that same tester. This feature allows a single unified LAN to include IQview testers both in production areas and in development areas, without risk that a development application may interfere with production testing. To enable the IP Lock feature, set the IP Lock Address to the IP address to the PC that is allowed access. A setting of 0.0.0.0 disables the IP Lock feature.
Tester Name[2]	Changes the name of the tester, for instance to personalize the tester.
OK	Changes the settings to those displayed in the windows, once those are considered to be satisfactory.
Cancel	Cancels the changes.

1. The IP Lock does not affect the operation of the IQview Administration Tool. Thus, it is always possible for a PC hosting the IQview Administration Tool to connect to any tester and to change that tester's settings, provided that all other network settings are set correctly.

2. The Tester Name may not contain spaces. If a space is present in the name, only the first part of the name before the space is used.

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Figure 4-7 shows an IP address warning box and may appear if the following conditions exist:

- The changed IP address already exists on a working device on the same LAN. This situation may occur if the user changes the IP address of a tester, and then changes it back to its original value before the tester has been restarted.
- Another PC or tester on the same LAN already has been assigned the newly entered IP address.

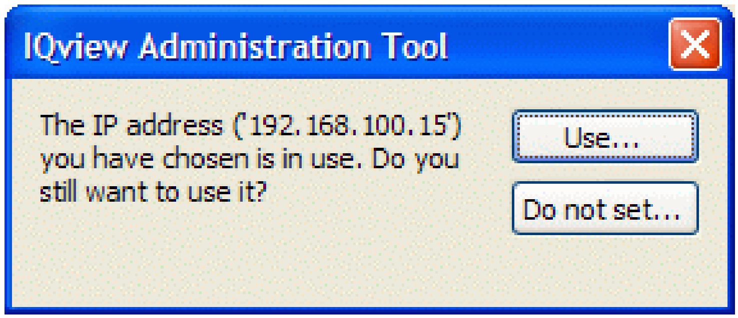

Figure 4-7. IP Address (Already in Use) Warning Box

WARNING: If address conflicts occur, make sure each device has a unique IP address. Duplicate addresses will disrupt the operation of the devices.

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Upgrading an IQview Tester

1. Select the **Upgrade** button located at the bottom (middle section) of the Administration Tool window. The IQview Software Upgrade window appears.

CAUTION: Make sure you thoroughly read this window prior to clicking OK

.

Figure 4-8. IQview Software Upgrade Window

2. Click **OK**.

   The Open window displays. This window allows you to locate the desired upgrade and to select the file associated with that upgrade. The filename must use the extension **.inf**.

3. To upgrade immediately, double-click this file.

If the upgrade file has been selected by single-clicking, the upgrade can be initiated by selecting the **Open** button.

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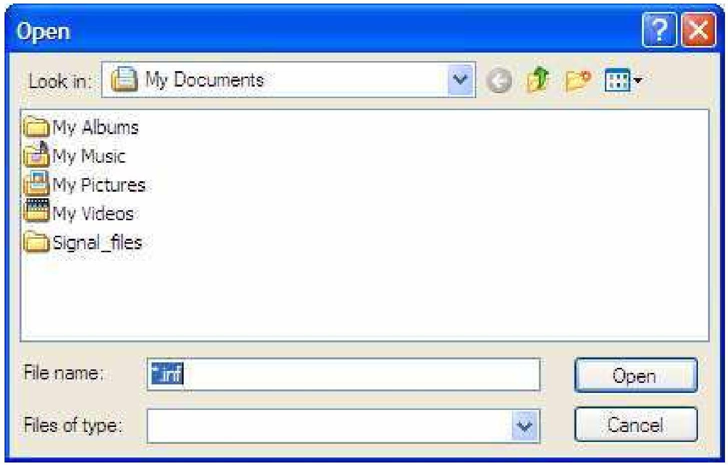

Figure 4-9. Open (File Locator) Window

4. Select the upgrade file.
5. Click **Open**.

After the upgrade is completed, a message box displays indicating a successful upgrade.

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