User Manual

Tektronix

WCA11G
IEEE802.11a/b/g Signal Analysis Software

071-1365-00

This document supports firmware version FV:v1.00 and above.

www.tektronix.com

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Preface

This manual provides user information about the WCA11G IEEE802.11a/b/g Signal Analysis Software.

Manual Structure

The manual contains the following sections:

Getting Started describes the product overview, system configuration, and installation procedures of the WCA11G IEEE802.11a/b/g Signal Analysis Software.

Operating Basics describes the software screen elements and provides basic operating information about the WCA11G software interface.

Reference provides in-depth descriptions of the WCA11G view formats for the following two analyses:

- Modulation Analysis such as Spectral Power, Constellation, EVM, Symbol Table, and Center Frequency Error.
- Power Analysis such as Spectrum Mask and Transmit Power On/Off.

Related Manual and Online Document

The following additional manuals are available for the WCA11G IEEE802.11a/b/g Signal Analysis Software:

The *WCA330 & WCA380 Wireless Communication Analyzer User Manual* (Tektronix part number 070-A792-XX) describes how to use the WCA330 and WCA380.

The *WCA330 & WCA380 Wireless Communication Analyzer Programmer Manual* (Tektronix part number 070-A794-XX) provides complete information on programming and remote control of the instrument through the GPIB/Ethernet interfaces.

The WCA11G Help system provides online user manual. The online user manual is integrated with the user interface application. The online user manual is preconfigured in the WCA11G software.

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*** This phone number is toll free in North America. After office hours, please leave a voice mail message.**
Outside North America, contact a Tektronix sales office or distributor; see the Tektronix web site for a list of offices.

Glossary of Acronyms

8PSK
8 Phase Shift Keying

16QAM
16 Quardrature Amplitude Modulation

64QAM
64 Quardrature Amplitude Modulation

AP
Access Point

BPSK
Binary Phase Shift Keying

CCK
Complementary Code Keying

DSSS
Direct Sequence Spread Spectrum

EVM
Error Vector Magnitude

IEEE
Institute of Electrical and Electronic Engineers

LAN
Local Area Network

MT
Mobile Terminal

OFDM
Orthogonal Frequency Division Multiplexing

PBCC
Packet Binary Convolutional Coding

PLCP
Physical Layer Convergence Protocol

QPSK
Quardrature Phase Shift Keying

WCA
Wireless Communication Analyzer

Getting Started

This section provides the following information:

- Product overview
- Hardware configuration
- Accessories
- Installation
- System settings

Product Overview

The WCA11G is an IEEE802.11a/b/g signal analysis software that performs a signal analysis of 5 GHz band high-speed wireless LAN transmitters (IEEE802.11a standard) and 2.4 GHz band high-speed wireless LAN transmitters (IEEE802.11b and IEEE802.11g standards).

You can configure an analysis system for the IEEE802.11a/b/g LAN transmitters by using the WCA11G software in combination with the WCA330/WCA380 Wireless Communication Analyzers. This system provides OFDM/DSSS modulation signal spectrum power analysis, constellation display, modulation accuracy measurement (EVM), a symbol table, center frequency deviation measurement, and spectrum mask.

Table 1-1 shows all the measurement items available in the WCA11G IEEE802.11a/b/g Signal Analysis Software and the supported standards.

Table 1-1: WCA11G measurement items

Items	Page	802.11a	802.11b	802.11g
Modulation Analysis (OFDM)				
Power vs. All Time	3-2	x		
Average Power vs. Time	3-3	x		x
Power Analysis Display	3-4			x
Power vs. SC_No	3-5	x		
Flatness	3-7	x		x
Constellation Analysis Display	3-7			x
Constellation/Symbol Constellation	3-8	x		
Average EVM vs. Time	3-12	x		x
EVM Analysis Display	3-13			x
EVM vs. SC_No	3-13	x		
Average MagErr vs. Time	3-16	x		x

Table 1-1: WCA11G measurement items (cont.)

Items	Page	802.11a	802.11b	802.11g
MagErr Analysis Display	3-17			x
MagErr vs. SC_No	3-18	x		
Average PhaseErr vs. Time	3-20	x		x
PhaseErr Analysis Display	3-21			x
PhaseErr vs. SC_No	3-22	x		
Center Frequency Error	3-24	x		x
OFDM Linearity	3-25	x		x
Symbol Table	3-26	x		x
Modulation Analysis (DSSS/CCK/PBCC)				
Power vs. All Time	3-2		x	x
Average Power vs. Time	3-3		x	x
Power Analysis Display	3-4			x
Power vs. Time	3-6		x	
Constellation Analysis Display	3-7			x
Constellation/Segment Constellation	3-11		x	
Average EVM vs. Time	3-12		x	x
EVM Analysis Display	3-13			x
EVM vs. Time	3-15		x	
Average MagErr vs. Time	3-16		x	x
MagErr Analysis Display	3-17			x
MagErr vs. Time	3-19		x	
Average PhaseErr vs. Time	3-20		x	x
PhaseErr Analysis Display	3-21			x
PhaseErr vs. Time	3-23		x	
Center Frequency Error	3-24		x	x
Symbol Table	3-26		x	x
Power Analysis				
Spectrum Mask (OFDM)	3-29	x		x
Spectrum Mask (DSSS)	3-31		x	x
Transmit Power On	3-32		x	x
Transmit Power Off	3-33		x	x

IEEE802.11a Measurements

Table 1-2 shows the measurement items that are required for the IEEE802.11a standard.

Table 1-2: Measurements for IEEE802.11a signals

Item	Description	Page
Power vs. All Time	Displays power in a line graph. The vertical axis represents power [dBm], and the horizontal axis represents time [ms]. This graph is displayed only in Main View. The analysis of the area between D_Marker 1 and D_Marker 2 is interlocked with other Views [View 1, View 2, or View 3]. The Main View always displays Power vs. All Time.	3-2
Average Power vs. Time	Displays power of one or all subcarriers in a line graph. The vertical axis represents power [dBm], and the horizontal axis represents time [ms].	3-3
Power vs. SC_No	Displays each subcarrier wave power as a symbol in a bar graph. The vertical axis represents power [dBm], and the horizontal axis represents subcarrier wave number [-26 to +26].	3-5
Flatness	Displays each subcarrier wave flatness in a bar graph. The vertical axis represents average energy deviation power [dB], and the horizontal axis represents subcarrier wave number [-26 to +26].	3-7
Constellation	Displays constellation of one or all subcarriers in a rectangular coordinates graph. The vertical axis represents Q, and the horizontal axis represents I.	3-8
Symbol Constellation	Displays constellation as a symbol in a rectangular coordinates graph. The vertical axis represents Q, and the horizontal axis represents I.	
Average EVM vs. Time	Displays EVM of one or all subcarriers in a line graph. The vertical axis represents EVM [%], and the horizontal axis represents time [ms].	3-12
EVM vs. SC_No	Displays EVM as a symbol in a bar graph. The vertical axis represents EVM [%], and the horizontal axis represents subcarrier wave number [-26 to +26].	3-13
Average MagErr vs. Time	Displays magnitude error of one or all subcarriers in a line graph. The vertical axis represents magnitude error [%], and the horizontal axis represents time [ms].	3-16
MagErr vs. SC_No	Displays magnitude error as a symbol in a bar graph. The vertical axis represents magnitude error [%], and the horizontal axis represents subcarrier number [-26 to +26].	3-18
Average PhaseErr vs. Time	Displays phase error of one or all subcarriers in a line graph. The vertical axis represents phase error [Degree], and the horizontal axis represents time [ms].	3-20
PhaseErr vs. SC_No	Displays phase error as a symbol in a bar graph. The vertical axis represents phase error [Degree], and the horizontal axis represents subcarrier number [-26 to +26].	3-22
Center Frequency Error	Displays carrier wave frequency deviation as a symbol in a line graph. The vertical axis represents deviation [kHz], and the horizontal axis represents time [ms].	3-24

Table 1-2: Measurements for IEEE802.11a signals (cont.)

Item	Description	Page
OFDM Linearity	Displays linearity of OFDM modulation in a line graph. The vertical axis represents actual measurement values [mW], and the horizontal axis represents ideal values [mW].	3-25
Symbol Table	Displays a table of symbol values (hexadecimal and binary).	3-26
Spectrum Mask	Displays spectrum waveform and mask in a line graph under PeakHold condition. The vertical axis represents power [dBm], and the horizontal axis represents frequency [Hz].	3-29

IEEE802.11b Measurements

Table 1-3 shows the measurement items that are required for IEEE802.11b standard.

Table 1-3: Measurements for IEEE802.11b signals

Item	Description	Page
Power vs. All Time	Refer to Table 1-2 on page 1-3.	3-2
Average Power vs. Time	Displays power of carriers in a line graph. The vertical axis represents power [dBm], and the horizontal axis represents time [ms].	3-3
Power vs. Time	Displays power of carriers by segment in a bar graph. The vertical axis represents power [dBm], and the horizontal axis represents time [ms].	3-6
Constellation	Displays constellation of carriers in a rectangular coordinates graph. The vertical axis represents Q, and the horizontal axis represents I.	3-11
Segment Constellation	Displays constellation of carriers by segment in a rectangular coordinates graph. The vertical axis represents Q, and the horizontal axis represents I.	
Average EVM vs. Time	Displays EVM of carriers in a line graph. The vertical axis represents EVM [%], and the horizontal axis represents time [ms].	3-12
EVM vs. Time	Displays EVM of carriers by segment in a bar graph. The vertical axis represents EVM [%], and the horizontal axis represents time [ms].	3-15
Average MagErr vs. Time	Displays magnitude error of carriers in a line graph. The vertical axis represents magnitude error [%], and the horizontal axis represents time [ms].	3-16
MagErr vs. Time	Displays magnitude error of carriers by segment in a bar graph. The vertical axis represents magnitude error [%], and the horizontal axis represents time [ms].	3-19
Average PhaseErr vs. Time	Displays phase error of carriers in a line graph. The vertical axis represents phase error [Degree], and the horizontal axis represents time [ms].	3-20
PhaseErr vs. Time	Displays phase error of carriers by segment in a bar graph. The vertical axis represents phase error [Degree], and the horizontal axis represents time [ms].	3-23

Table 1-3: Measurements for IEEE802.11b signals (cont.)

Item	Description	Page
Center Frequency Error	Displays carrier wave frequency deviation in a line graph. The vertical axis represents deviation [kHz], and the horizontal axis represents time [ms].	3-24
Symbol Table	Displays a table of symbol values (hexadecimal and binary).	3-26
Spectrum Mask	Displays spectrum waveform and mask in a line graph under PeakHold condition. The vertical axis represents power [dBm], and the horizontal axis represents frequency [Hz].	3-31
Transmit Power On	Displays the transmit power on ramp in a line graph. The vertical axis represents power [W], and the horizontal axis represents time [s].	3-32
Transmit Power Off	Displays the transmit power down ramp in a line graph. The vertical axis represents power [W], and the horizontal axis represents time [s].	3-33

IEEE802.11g Measurements

Table 1-4 shows the measurement items that are required for IEEE802.11g standard.

Table 1-4: Measurements for IEEE802.11g signals

Item	Description	Page
Power vs. All Time	Refer to Table 1-2 on page 1-3.	3-2
Average Power vs. Time	Displays power of carriers, or one or all subcarriers in a line graph. The vertical axis represents power [dBm], and the horizontal axis represents time [ms].	3-3
Power Analysis Display	Displays each subcarrier wave power as an OFDM symbol, or power by segment in a bar graph. The vertical axis represents power [dBm], and the horizontal axis represents subcarrier wave number [-26 to +26] or time [ms].	3-4
Flatness	Displays each subcarrier wave flatness in a bar graph. The vertical axis represents average energy deviation power [dB], and the horizontal axis represents subcarrier wave number [-26 to +26].	3-7
Constellation Analysis Display	Displays constellation of each subcarrier as an OFDM symbol, or constellation by segment in a rectangular coordinates graph. The vertical axis represents Q, and the horizontal axis represents I.	3-7
Constellation	Displays constellation in a rectangular coordinates graph. The vertical axis represents Q, and the horizontal axis represents I.	3-8, 3-11
Average EVM vs. Time	Displays EVM of carriers, or one or all subcarriers in a line graph. The vertical axis represents EVM [%], and the horizontal axis represents time [ms].	3-12

Table 1-4: Measurements for IEEE802.11g signals (cont.)

Item	Description	Page
EVM Analysis Display	Displays EVM as an OFDM symbol, or EVM by segment in a bar graph. The vertical axis represents EVM [%], and the horizontal axis represents subcarrier wave number [-26 to +26] or time [ms].	3-13
Average MagErr vs. Time	Displays magnitude error of carriers, or one or all subcarriers in a line graph. The vertical axis represents magnitude error [%], and the horizontal axis represents time [ms].	3-16
MagErr Analysis Display	Displays magnitude error as an OFDM symbol, or magnitude error by segment in a bar graph. The vertical axis represents magnitude error [%], and the horizontal axis represents subcarrier number [-26 to +26] or time [ms].	3-17
Average PhaseErr vs. Time	Displays phase error of carriers, or one or all subcarriers in a line graph. The vertical axis represents phase error [Degree], and the horizontal axis represents time [ms].	3-20
PhaseErr Analysis Display	Displays phase error as an OFDM symbol, or phase error by segment in a bar graph. The vertical axis represents phase error [Degree], and the horizontal axis represents subcarrier number [-26 to +26] or time [ms].	3-21
Center Frequency Error	Displays carrier wave frequency deviation as an OFDM symbol in a line graph. The vertical axis represents deviation [kHz], and the horizontal axis represents time [ms].	3-24
Symbol Table	Displays a table of symbol values (hexadecimal and binary).	3-26
OFDM Linearity	Displays linearity of OFDM modulation in a line graph. The vertical axis represents actual measurement values [mW], and the horizontal axis represents ideal values [mW].	3-25
Spectrum Mask	Displays spectrum waveform and mask in a line graph under PeakHold condition. The vertical axis represents power [dBm], and the horizontal axis represents frequency [Hz].	3-29, 3-31
Transmit Power On	Displays the transmit power on ramp in a line graph. The vertical axis represents power [W], and the horizontal axis represents time [s].	3-32
Transmit Power Off	Displays the transmit power down ramp in a line graph. The vertical axis represents power [W], and the horizontal axis represents time [s].	3-33

Hardware Configuration

Figure 1-1 shows the hardware configuration of an IEEE802.11a/b/g signal analysis system with the combination of the WCA11G software and the WCA330/WCA380 Wireless Communication Analyzer. Table 1-5 lists the equipment used in the system.

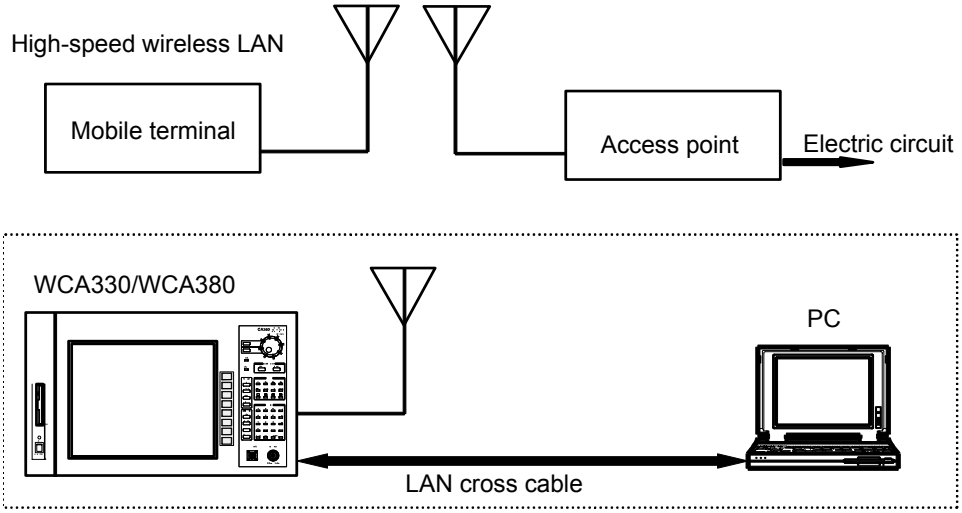


Figure 1-1: WCA11G signal analysis system hardware configuration

Table 1-5: Equipment used in the WCA11G signal analysis system

Items	Type	Quantity	Note
Wireless Communication Analyzer	WCA330/ WCA380	1	
LAN cross cable		1	
2.4 GHz and 5.2 GHz Bandwidth Antenna		1	Prepare separately

Difference between WCA330 and WCA380 Analyzers

The WCA330 and WCA380 Wireless Communication Analyzers have the same functions except for their measurement frequency ranges:

- WCA330: DC to 3 GHz
- WCA380: DC to 8 GHz

The descriptions in this manual apply to both the WCA330 and the WCA380 analyzers, unless otherwise noted. The word "analyzer" refers to both products.

Accessories

The following accessories are shipped with the WCA11G IEEE802.11a/b/g Signal Analysis Software:

- User manual, Tektronix part number 071-1365-XX
- LAN cross cable (3 m), 012-A228-00

Installation

This subsection contains instructions for installing the WCA11G software on your PC and provides information about the created folders.

PC System Requirements

Your PC requires the following minimum system requirements to install and operate the WCA11G software:

- OS: Microsoft Windows 98SE / Windows 2000 / Windows XP
- CPU: Pentium III Processor, at least 866 MHz
- RAM: At least 512 MB
- HDD: At least 100 MB available memory
- Display resolution: At least 1280 x 1024
- Network card: Ethernet card of 10BASE-T or 100BASE-T

Installation Instructions

The following installation instructions require that you are familiar with the basics of using the MS Windows operating system. If necessary, read your MS Windows user documentation before installing the WCA11G software.

Perform the following procedure to install the WCA11G software:

1. Be sure that your PC meets the requirements listed under *PC System Requirements* on page 1-8 before proceeding with the installation.
2. Insert the WCA11G IEEE802.11a/b/g Signal Analysis Software CD-ROM into a CD-ROM drive on your PC.
3. Double-click the **My computer** icon.
4. Double-click the **D: drive** icon (substitute your CD-ROM drive letter if it is different from D). The PC will display the contents of the WCA11G Signal Analysis Software CD-ROM.
5. Open the DISK1 folder.

6. Double-click **Setup.exe** in the folder.

   This copies initial files of the WCA11G software. For a while, the Welcome window appears on the PC desktop. Follow the on-screen instructions.

7. If the installation completes successfully, the Setup Complete window appears. Click the **Finish** button.

Created Folders

When the installation completes properly, the following folders are created:

C:\Program Files\Tektronix\WCA11g. This folder contains the WCA11g.exe program and other related files. The related files include the parameters required for communication and analysis. Do not delete or change the files.

C:\Program Files\Tektronix\WCA11g\CWX. This folder contains the graphic display formats. Do not delete or change the files.

C:\Program Files\Tektronix\WCA11g\ShareFolder\CFG. This folder contains the WCA330/WCA380 configuration files and trigger files. The analyzer refers to these setting files. Since the remote controlled analyzer directly accesses these files, the CFG folder must be shared.

C:\Program Files\Tektronix\WCA11g\ShareFolder\Data. This folder contains the measurement result files of the WCA11G software.

C:\Program Files\Tektronix\WCA11g\SystemDefault. This folder is used to recall the factory default settings of the WCA330/WCA380 instruments.

The path names listed above are the examples when you install the WCA11G software into the C drive.

System Settings

This subsection describes the initial settings of your analyzer and your PC. It is divided into the following three steps:

- Share the folders on your PC, page 1-10
- Configure the network settings of the analyzer, page 1-12
- Configure the network settings of your PC
  - MS Windows 98, page 1-17
  - MS Windows 2000 or MS Windows XP, page 1-19

NOTE. *The following procedure requires that you are familiar with the basics of using the MS Windows 98/MS Windows 2000/MS Windows XP operating systems.*

If necessary, consult the MS Windows documentation.

Sharing the Folders on a PC

Since the analyzer accesses the setting file in the PC through a network, you must share the setting files of the PC. Otherwise, an access error will appear on the analyzer display upon execution. Allow full access to ShareFolder. See Figure 1-2 and Figure 1-3.

For a PC running MS Windows 98. In the ShareFolder Properties dialog box, click **Shared As** and **Full**. See Figure 1-2.

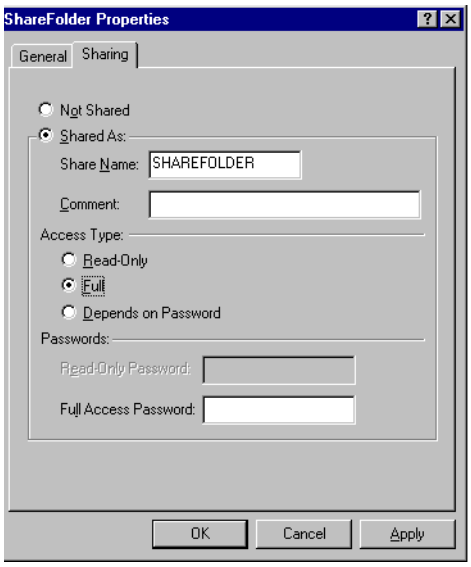


Figure 1-2: ShareFolder Properties dialog box (MS Windows 98)

For a PC running MS Windows 2000 or MS Windows XP. In the SharedFolder Properties dialog box, click **Share this folder** and **Maximum allowed**. See Figure 1-3.

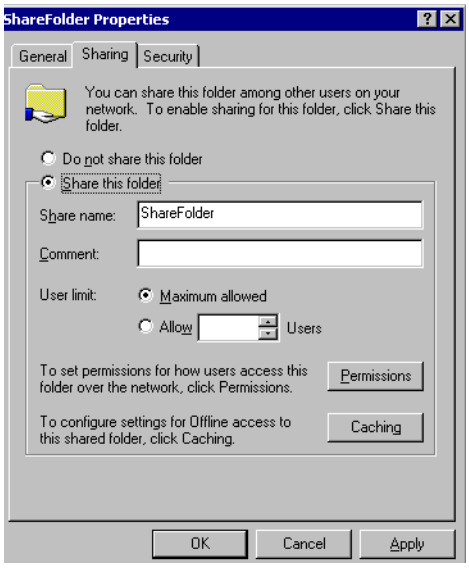


Figure 1-3: ShareFolder Properties dialog box (MS Windows 2000)

Setting the Network Parameters of the Analyzer

Perform the following procedure to set the network parameters of your analyzer:

1. Confirm that your analyzer is not powered on.
2. Connect the keyboard and mouse provided with the analyzer to the keyboard and mouse connectors on the rear panel of the analyzer.
3. Use a LAN cable to connect the analyzer and a hub.
4. Power on the analyzer.
5. Move the pointer to the bottom of the screen. The Windows 98 taskbar appears.
6. Select **Settings** > **Control Panel** from the Start menu. The Control Panel window appears.
7. Double-click the **Network** icon in the window. The Network dialog box appears as shown in Figure 1-4.

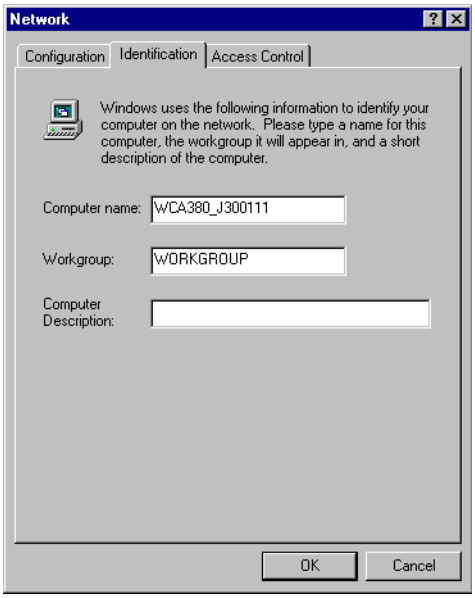


Figure 1-4: Network dialog box (Identification tab)

8. Click the **Identification** tab.
9. Check that **WCA380_J300XXX** or **WCA330_J300XXX** (XXX is the specific serial number of the analyzer) is displayed in the Computer name text box. This is the default computer name for the analyzer.
10. Check that **WORKGROUP** is displayed in the Workgroup text box.

To Automatically Acquire an IP Address. Do the following steps to connect the analyzer to a LAN. An IP address must be assigned by the name server. You need to use the same settings parameters between the analyzer and your PC.

1. Click the **Configuration** tab in the Network window.
2. In the network component field, click **Internet Protocol (TCP/IP)**.
3. Click the **Properties** button. The TCP/IP Properties dialog box appears as shown in Figure 1-5.

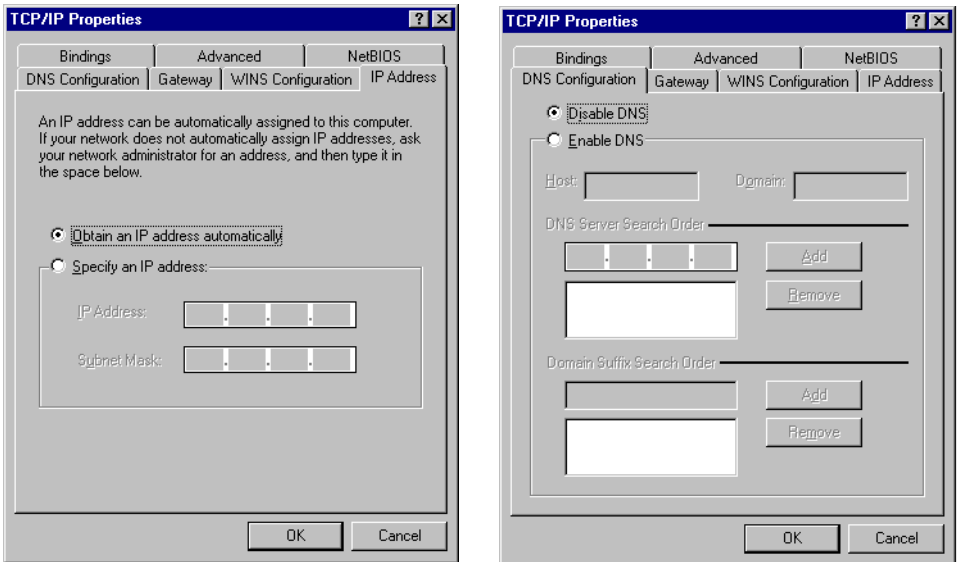


Figure 1-5: TCP/IP Properties dialog box

4. Click the **IP Address** tab, and then select **Obtain an IP address automatically**.
5. Click the **DNS Configuration** tab, and then select **Disable DNS**.
6. Click the **OK** button.

To Assign IP Address. When the name server is not in the network, perform the following procedure to set the network parameters:

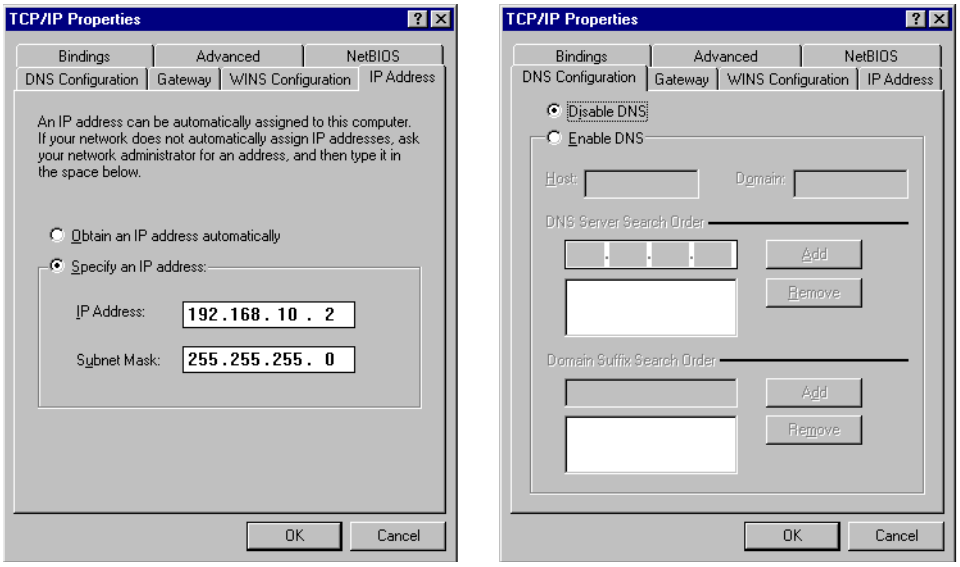


Figure 1-6: TCP/IP Properties dialog box for address setting

1. If you connect the analyzer directly to a single PC:
   a. In the TCP/IP Properties dialog box, select **Specify an IP address**.
   b. Set the **IP Address** parameter to the same IP address as the PC's address except for the last number. The last number must be different from the last number in the PC's IP address.
   c. Set the **Subnet Mask** parameter to the same subnet mask used by the PC. Do not enter a number if the PC does not have a net mask.
2. If you connect the analyzer to your network:
   a. In the TCP/IP Properties dialog box, select **Specify an IP address**.
   b. Ask your local network administrator and enter the appropriate addresses.

CAUTION. *To prevent communication conflicts on your network, ask your local network administrator for the correct numbers to enter in the dialog box.*

3. In the TCP/IP Properties dialog box, click the **DNS Configuration** tab and then select **Disable DNS**.
4. Click the **OK** button.

I/O Port and Line Code Settings of the Analyzer. Set the command input/output port for TCP/IP and new line code for reply message returned via the TCP/IP network. Do the following steps to set the TCP/IP parameters of the analyzer:

1. Push the WCA330/WCA380 front panel **CONFIG: UTILITY** button to display the Utility submenu as shown in Figure 1-7.
2. Click **More...**.

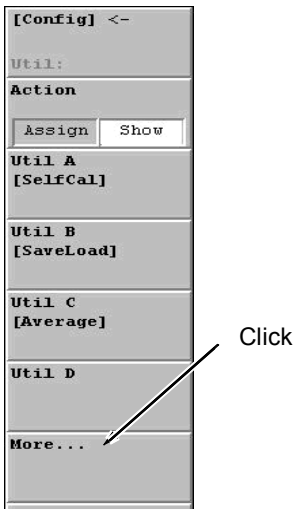


Figure 1-7: CONFIG:UTILITY submenu

3. The Util:More submenu appears as shown in Figure 1-8. Click **Util H [Remote]**.

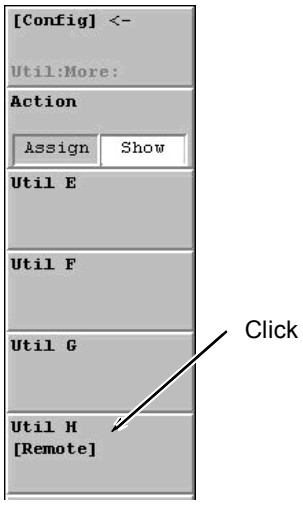


Figure 1-8: Util:More: submenu

4. Another submenu appears as shown in Figure 1-9. Click **TCP/IP...**.

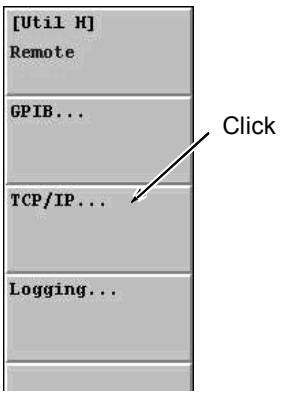


Figure 1-9: [Util H] Remote submenu

5. The Remote TCP/IP submenu appears as shown in Figure 1-10. Click the **Command Port** to set the number to **3066**, then click the **Event Port** to set the number to **3067**, and then click the **New Line** to set a new line code to **CRLF**.

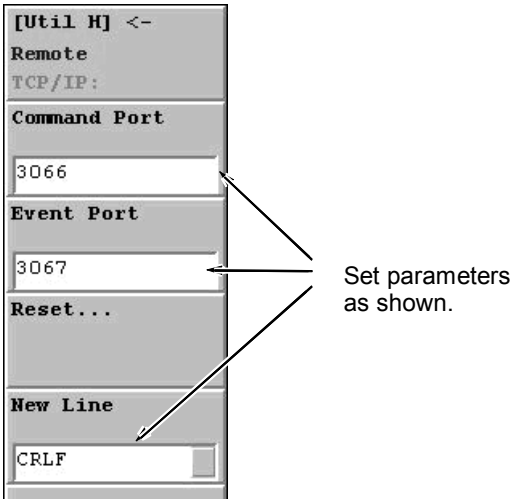


Figure 1-10: [Util H] Remote TCP/IP submenu

6. Use a LAN cable to connect the analyzer and a hub.

7. When the dialog box displays: "Do you want to reboot?", click **Yes**.

8. Push the **STANDBY** switch to reboot the analyzer.

Network Setting of Windows 98 PC

Perform the following procedures to set the network parameters of your PC. If your PC is running MS Windows 2000 or MS Windows XP, refer to page 1-19.

Do the following steps to set the network parameters of your PC running MS Windows 98:

1. Confirm that your PC is connected to a network.
2. Select **Settings** > **Control Panel** from the Start menu. The Control Panel window appears.
3. Double-click the **Network** icon in the window. The Network dialog box appears as shown in Figure 1-11.

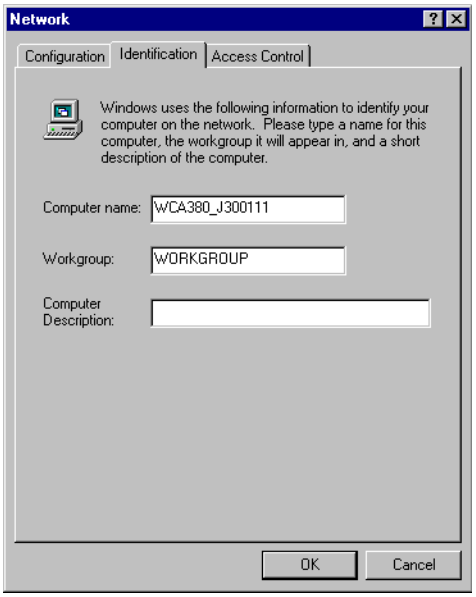


Figure 1-11: Network dialog box showing Identification tab

4. Click the **Identification** tab.
5. Enter your PC name (for example, PC123) in the Computer name text box.
6. Enter **WORKGROUP** in the Workgroup text box.
7. Click the **OK** button.

To Obtain an IP Address Automatically. Do the following steps to connect your PC to the LAN. An IP address must be assigned by the name server. You need to use the same settings parameters between the analyzer and your PC.

1. Click the **Configuration** tab in the Network dialog box.
2. In the network component field, click **Internet Protocol (TCP/IP)**.
3. Click the **Properties** button. The TCP/IP Properties dialog box appears.
4. Click the **IP Address** tab, and then select **Obtain an IP address automatically**.
5. Click the **DNS Configuration** tab, and then select **Disable DNS**.
6. Click the **OK** button.

To Assign an IP Address. When the name server is not in the network, do the following steps to set the network parameters:

1. If you connect the PC directly to the analyzer:
   a. In the TCP/IP Properties dialog box, select **Specify an IP address**.
   b. Set the **IP Address** parameter to the same IP address as the analyzer's address except for the last number. The last number must be different from the last number in the analyzer's IP address.
   c. Set the **Subnet Mask** parameter to the same subnet mask used by the analyzer. Do not enter a number if the analyzer does not have a net mask.
2. If you connect your PC to a network:
   a. In the TCP/IP Properties dialog box, select **Specify an IP address**.
   b. Ask your local network administrator and enter the appropriate addresses.

CAUTION. *To prevent communication conflicts on your network, ask your local network administrator for the correct numbers to enter in the dialog box.*

3. In the TCP/IP Properties dialog box, click the **DNS Configuration** tab and then select **Disable DNS**.
4. Click the **OK** button.

Network Setting of a PC Running Windows 2000 or Windows XP

Perform the following procedure to set the network parameters of the PC running MS Window 2000. For a PC running Windows XP, refer to the Windows documentation.

1. Confirm that your PC is connected to a network.
2. Select **Settings** > **Control Panel** from the Start menu. The Control Panel window appears.
3. Double-click the **System** icon in the window.
4. On the Network Identification tab, click **Properties**. The Identification Changes dialog box appears as shown Figure 1-12.

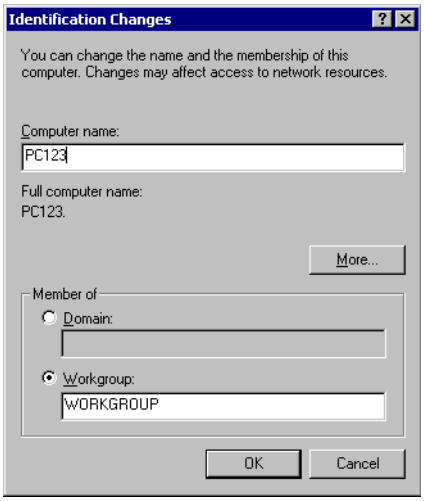


Figure 1-12: Identification Changes dialog box

5. Enter your PC name (for example, PC 123) in the Computer name text box.
6. Enter **WORKGROUP** in the Workgroup text box.

To Obtain an IP Address Automatically. Do the following steps to connect your PC to the LAN. An IP address must be assigned by the name server. You need to use the same settings parameters for both the analyzer and your PC.

1. Double-click the **Network and Dial-up Connections** icon in the Control Panel window. The Network and Dial-up Connections window appears.
2. Double-click the **Local Area Connection** icon. The Local Area Connection Properties dialog box appears.
3. Click the **Properties** button. The Local Area Connection Properties dialog box appears.
4. In the network component field, select **Internet Protocol (TCP/IP)** and then click the **Properties** button to display the dialog box shown below.

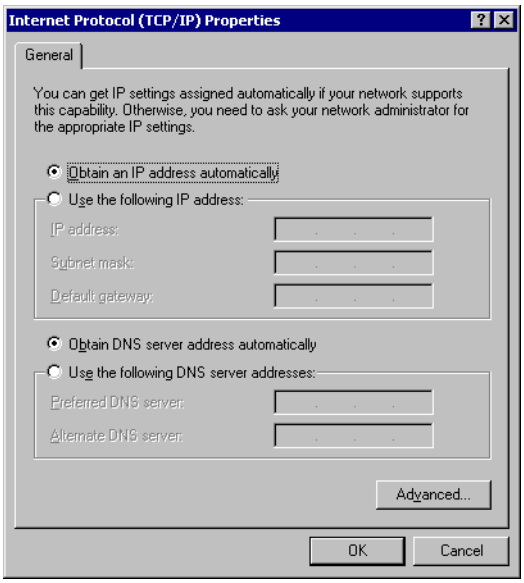


Figure 1-13: Internet Protocol (TCP/IP) Properties dialog box

5. In the dialog box, select **Obtain an IP address automatically** and **Obtain DNS server address automatically**.
6. Click the **OK** button.

To Assign an IP Address. When the name server is not in the network, do the following steps to set the network parameters:

1. Repeat the same steps described on page 1-20 to display the Internet Protocol (TCP/IP) Properties dialog box.

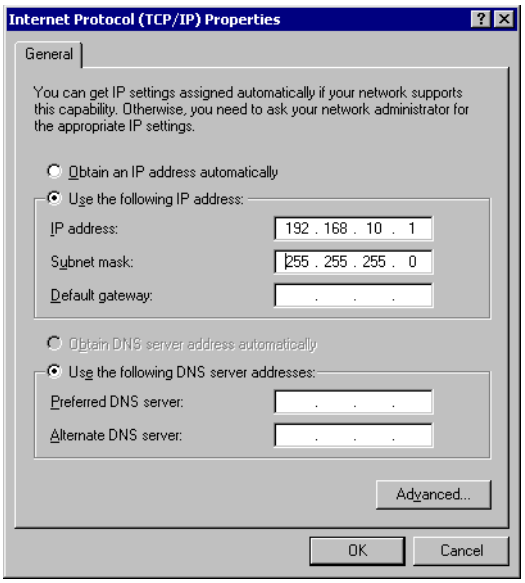


Figure 1-14: Internet Protocol (TCP/IP) Properties for IP Address Assignment

2. If you connect the PC directly to the analyzer:
   a. In the Internet Protocol (TCP/IP) Properties dialog box, select **Use the following IP address** and **Use the following DNS server address**.
   b. Set the **IP address** parameter to be the same IP address as the analyzer's address except for the last number. The last number must be different from the last number in the analyzer's IP address.
   c. Set the **Subnet mask** parameter to be the same subnet mask used by the analyzer. Do not enter a number if the analyzer does not have a net mask.
3. If you connect the PC to your network:
   a. In the dialog box, select **Use the following IP address**.
   b. Ask your local network administrator and enter the appropriate addresses.

CAUTION. *To prevent communication conflicts on your network, ask your local network administrator for the correct numbers to enter in the dialog box.*

Registering a User Name for MS Windows 2000 or MS Windows XP

You need to register a PC running MS Windows 2000 or MS Windows XP and the analyzer with the same user name (for example, test). Without the settings, you cannot access the PC because of the security features of MS Windows 2000 or MS Windows XP. If your PC is running on MS Windows 98, ignore this section.

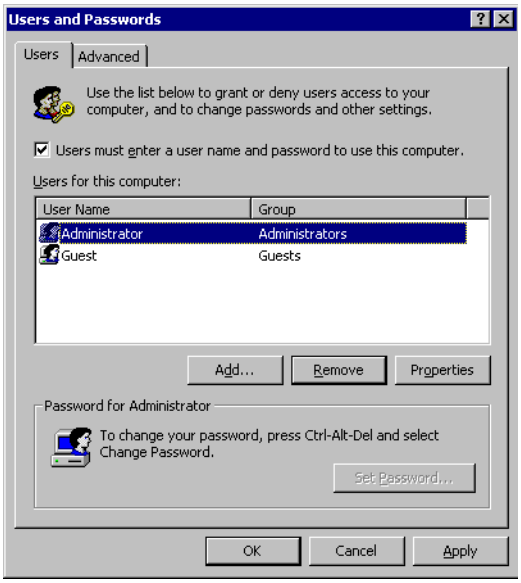
Registering a User Name on the PC running MS Windows 2000. Do the following steps to set a user name for the PC.

For a PC running Windows XP, refer to the Windows documentation.

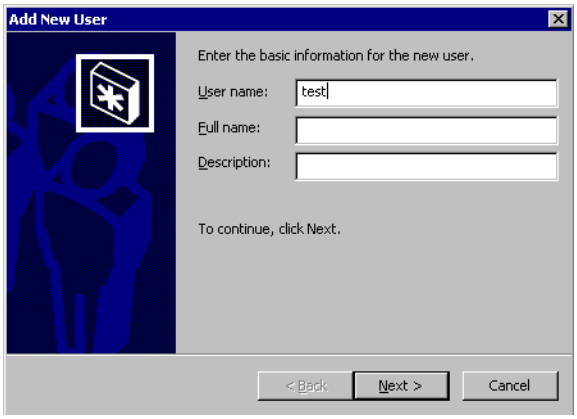
NOTE. *Communication between the analyzer and PC may not be performed properly when you log on to the network with a different user name from that used to register with MS Windows 2000 or MS Windows XP.*

1. Confirm that your PC is connected to a network.

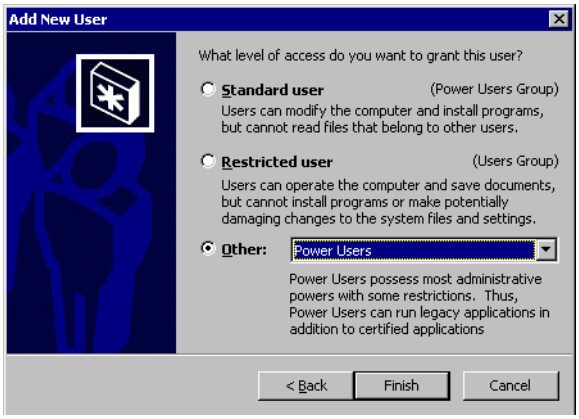
2. Click the icon  on the Control Panel to open the Users and Passwords dialog box.



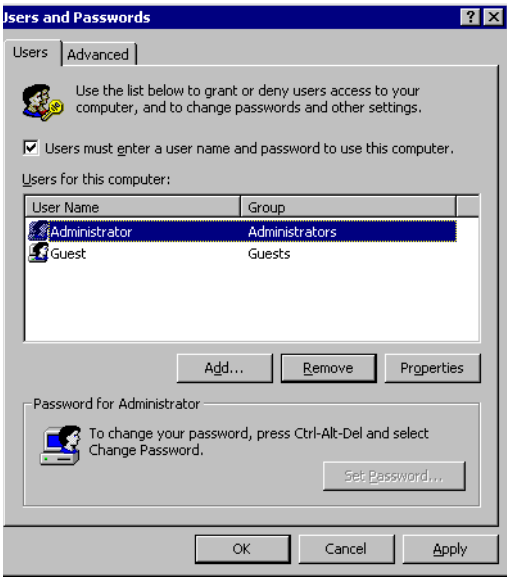
3. Click the **Add...** button on the Users tab. The Add New User dialog box appears.



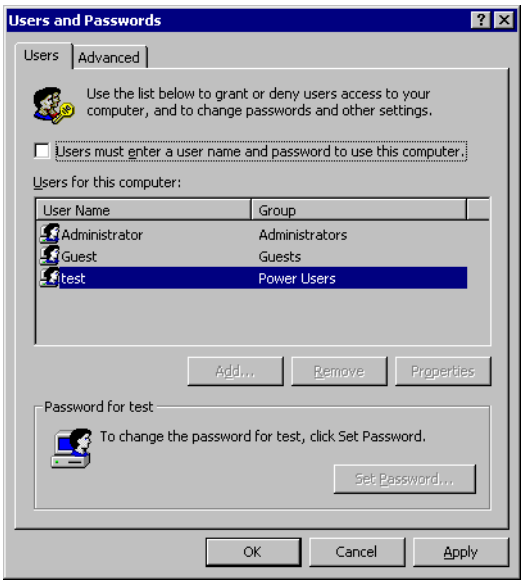
4. In the User name text box, enter **test**.
5. Click the **Next>** button to proceed to the next dialog box.
6. Click the **Next>** button without entering a password to proceed to the next dialog box.
7. Select **Power Users** from the list box at the right side of the Other option button.



8. Click the **Finish** button, and make sure that *test* is displayed on the Users and Passwords dialog box.



9. Clear the **Users must enter a user name and password to use this computer** check box.



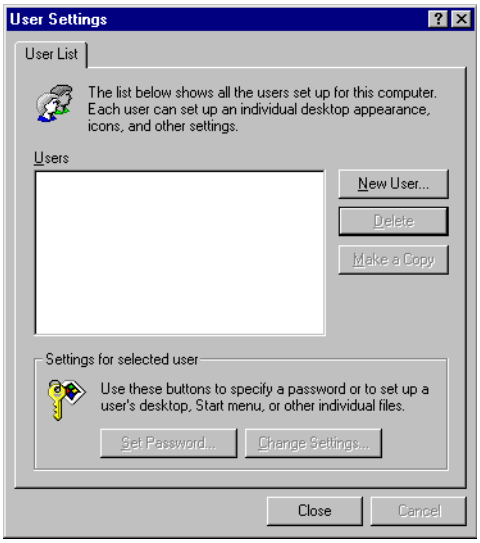
10. Click the **OK** button to complete the settings for the PC.

Registering a User Name for the Analyzer. Do the following steps to set up a user name for the WCA330/WCA380 analyzer:

1. Select **Start** > **Settings** > **Control Panel** from the Start menu. The Control Panel window appears.

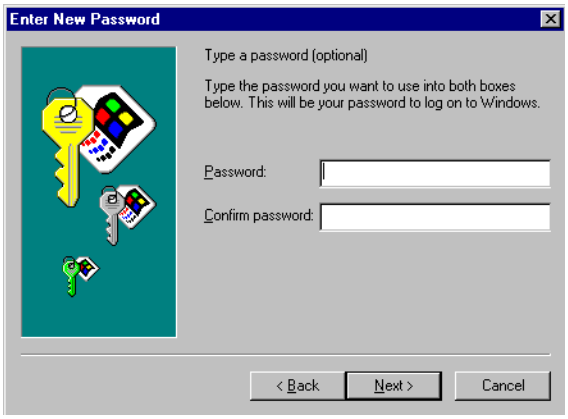
2. Click the icon 

on the Control Panel. The User Settings dialog box appears.

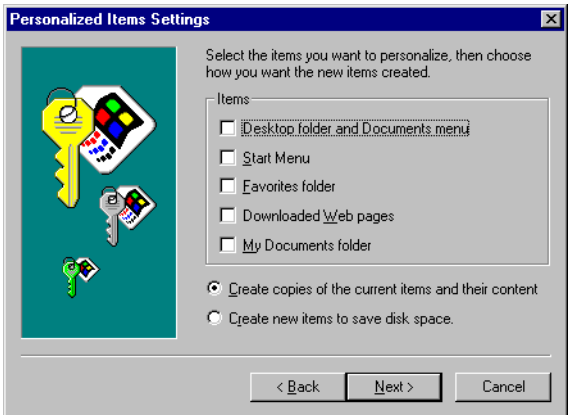


3. Click the **New User...** button in the dialog box. The Add User dialog box appears.

4. Enter **test** in the User name text box, and click the **Next>** button. The Enter New Password dialog box appears.



5. Click the **Next>** button without entering a password in the Password text box. The Personalized Items Settings dialog box appears.



6. In the dialog box, select **Create copies of the current items and their content**, and click the **Next>** button. The Ready to Finish dialog box appears.
7. Confirm the messages in the dialog box, and click the **Finish** button.
8. Click the icon 

in the Control Panel again to check that the user is added to the User List.

Operating Basics

This section describes the basic operation of the WCA11G IEEE802.11a/b/g Signal Analysis Software.

Screen Elements

Figure 2-1 shows the screen elements of the WCA11G software. The operation screen consists of four domains: *Menu Bar* on page 2-2, *Analysis Type buttons* on page 2-5, *Graph Frame* on page 2-5, and *Analysis Setting window* on page 2-6.

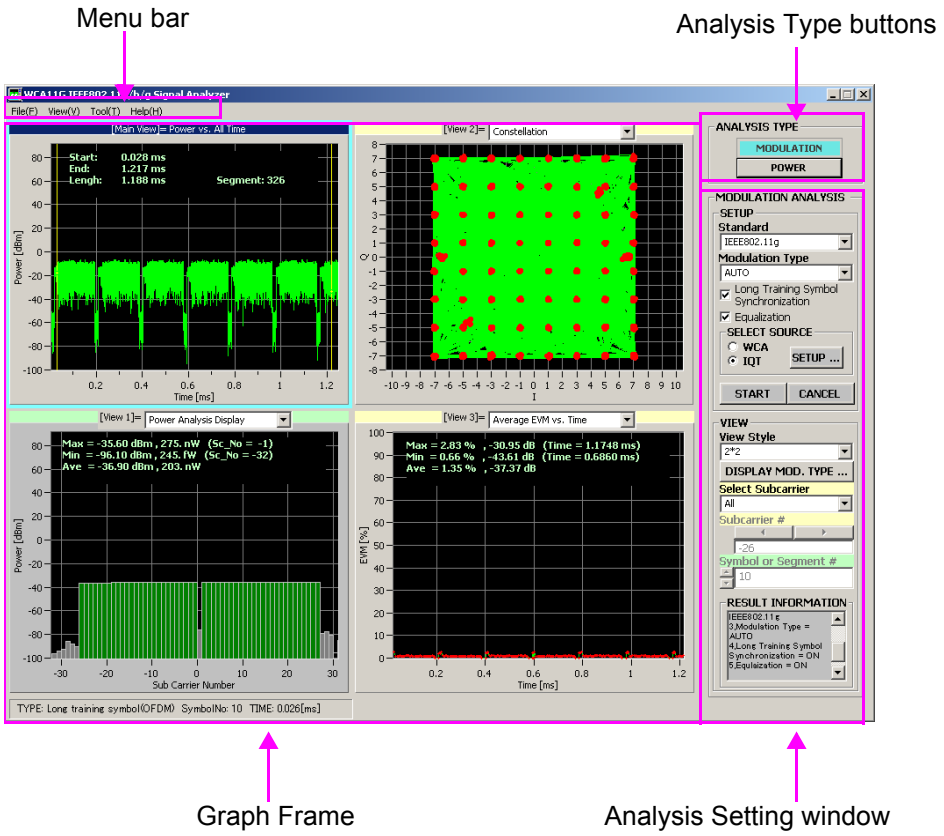


Figure 2-1: Screen elements

Menu Bar

A menu bar appears at the top of the screen. Table 2-1 shows the list of Menu Bar items.

Table 2-1: Menu Bar Items

Main	Sub		Function
File (F)	Select Source(S)	WCA(W)...	Opens Read From WCA dialog box, where you can set WCA300 series analysis parameters. See Figure 2-4 on page 2-8.
		IQT(I)...	Opens Read From WCA dialog box, where you can specify the files to be analyzed (IQT files). See Figure 2-5 on page 2-12.
	Result File(R)	Save(S)...	Opens save/recall dialog box, where you can save the analysis result.
		Recall(R)...	Opens save/recall dialog box, where you can recall the analysis result file.
	Setting File(I)	Save(S)...	Opens save/recall dialog box, where you can customize the default view format and save it as a customized setting file.
		Recall(R)...	Opens save/recall dialog box, where you can recall the customized view format.
	Save Symbol Table(T)...		Saves symbol table as text file. (Binary or Hexadecimal format can be selected.)
	Exit(E)		Exits from WCA11G software.
View (V)	PlotClear(P)		Clears displays in the Graph frame.
	Main (M) View1 (1) View2 (2) View3 (3)	Pan(P)	Moves the display area by dragging on the screen. Zoom function and Pan are exclusive.[1]
		Zoom(Z)	Magnifies the display area on the screen. Zoom function and Pan are exclusive.[1]
		View Reset(V)	Resets Zoom and Pan scale; automatically optimizes the scale of the graph display.[1]
		M_Marker1(1)	Check this menu to display the readings of M_Marker1 on each View screen.[2,3]
		M_Marker2(2)	Check this menu to display the readings of M_Marker2 on each View screen.[2,3]
		M_Marker Reset(M)	Check this menu to reset the positions of M_Marker1 and M_Marker2. The two markers return to their initial positions. Available when you use M_Marker1 or M_Marker2.[3]
		Despread or FFT	
		On(N)	Displays pre-analysis data of modulation.[3,4]
		Off(F)	Displays post-analysis data of modulation.[3,4]

Table 2-1: Menu Bar Items (cont.)

Main	Sub			Function
		Normalization(N)		
			On(N)	Applies normalization to the constellation display.[3]
			Off(F)	Excludes normalization from the constellation display.[3]
		Normalization Factor (F)		In the constellation display, you can select the modulation format for normalization. These buttons are exclusive.[3]
			AUTO (A)	
			BPSK (B)	
			QPSK (Q)	
			8PSK (8)	
			16QAM (1)	
			64QAM (6)	
		Vector(L)		
			On(N)	Activates vector between symbols in the constellation display.[3]
			Off(F)	Inactivates vector between symbols in the constellation display.[3]
		Symbol Table(T)		
			Hex(H)	Displays symbol table values as hexadecimal.[3]
			Bin(B)	Displays symbol table values as binary.[3]
		Select View(S)		Specifies View1, View2, View3, or Main View.
			Main View (M)	
			View1 (1)	
			View2 (2)	
			View3 (3)	
Tool (T)	WCA300 Factory Reset(W)...			Resets WCA300 series instrument to the factory shipping conditions.
	Ethernet Setup(E)...			Opens Ethernet Setup dialog box. See Figure 2-2.
	Folder Setup(F)...			Opens Folder Setup dialog box. See Figure 2-3.
	Set Default(D)			Restore the setting file (*.ini) to the initial conditions.
Help (H)	Help (H)...			Opens WCA11G Help system.
	Version Information(V)...			Displays version information of WCA11G software.

1. Pan, Zoom, and View Reset are not available when you select Symbol Table.

2. **M_Marker1 and M_Marker2 are exclusive. You cannot use M_Marker1 or M_Marker2 when you specify one of the following formats for a View screen:**
   Constellation
   Symbol Constellation
   Segment Constellation
   Constellation Analysis Display
   Symbol Table

3. **This submenu is not available when you select Main View.**

4. **You cannot use Despread or FFT when you specify one of the following formats for a View screen:**
   Constellation
   Symbol Constellation
   Segment Constellation
   Constellation Analysis Display
   Flatness
   Center Frequency Error
   OFDM Linearity
   Symbol Table
   Spectrum Mask
   Transmit Power On
   Transmit Power Off

Ethernet Setup dialog box. When you select Ethernet Setup (E) in the Tool (T) menu, the Ethernet Setup dialog box appears.

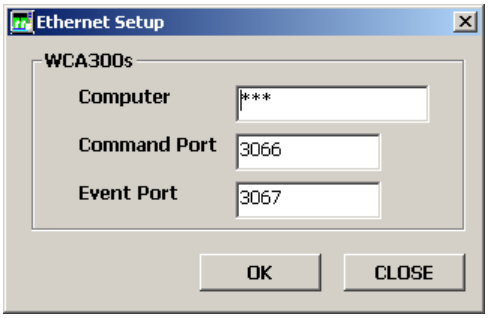


Figure 2-2: Ethernet Setup dialog box

In this dialog box, you can set the Ethernet connection parameters as follows:

- Computer: Enter the Computer Name that you used in step 9 on page 1-12.
- Command Port: Displays the TCP/IP command port number.
- Event port: Displays the TCP/IP event port number.

Folder Setup dialog box. When you select Folder Setup (D) in the Tool (T) menu, the Folder Setup dialog box appears.

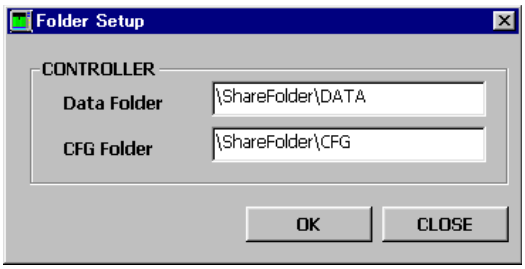
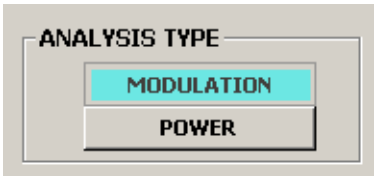


Figure 2-3: Folder Setup dialog box

- Data Folder: Displays the path name of the sharing folder DATA.
- CFG Folder: Displays the path name of the sharing folder CFG.

Analysis Type buttons

You can start the measurement by selecting the Analysis Type buttons located at the upper right of the screen. By clicking these buttons, you can toggle the parameter setting window. Two types of analysis buttons are provided as shown below:



MODULATION button. Click this button to activate the modulation analysis setting window. In this setting window, you can set the various parameters such as the WCA300 control parameters and the analysis processing parameters, or you can change the analyzed graph display.

POWER button. Click this button to activate the power analysis setting window. In this setting window, you can set the WCA300 control parameters, or you can change the analyzed graph display.

Graph Frame

Displays the analysis and measurement results in this area. For details on the modulation analysis view formats, refer to page 3-2. For the power analysis view formats, refer to page 3-29.

Modulation Analysis Setting Window

The setting window for the modulation analysis allows you to set the following menus:

- SETUP menu, page 2-6
- VIEW menu, page 2-13

Table 2-2 lists the modulation analysis **SETUP** menu. The SETUP parameters become available when you push the START button to start the analysis.

The SETUP parameters for currently displayed data are displayed in the RESULT INFORMATION field.

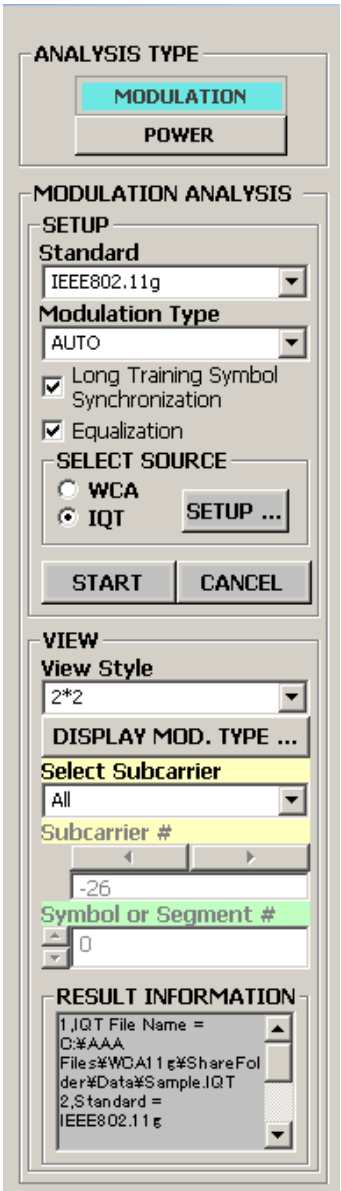


Table 2-2: Modulation Analysis SETUP Parameters

Menu item	Option	Description
Standard		Selects the wireless LAN standard type.
	IEEE802.11a	Analyzes IEEE802.11a modulation.
	IEEE802.11b	Analyzes IEEE802.11b modulation.
	IEEE802.11g	Analyzes IEEE802.11g modulation.
Modulation Type	See Table 2-3.	Selects the modulation type (data transmission rate) from the pull-down menu.
Long Training Symbol Synchronization		Check this box to apply the synchronization function to long training symbol during the analysis.
Equalization		Check this box to apply the data correction to long training symbol during the analysis.
SELECT SOURCE		Selects the analysis method.
	WCA	Check this radio button to set up the WCA300 series parameters. Select **WCA** and then click the **SETUP...** button to open Read From WCA dialog box. This dialog box enables you to set the analyzer parameters, acquire the data (IQT files), and create a graphical display. See Figure 2-4 on page 2-8.
	IQT	Check this radio button to select the IQT files. Select **IQT** and then click the **SETUP...** button to open Read From WCA dialog box, where you can perform the analysis and create a graphical display from IQT files. See Figure 2-5 on page 2-12.
	SETUP...	Click this button to open Read From WCA dialog box.
START		Click to start the analysis. After specifying the analysis method from the **SELECT SOURCE** menu, you can use this button.
CANCEL		Click to stop the analysis.

Table 2-3 shows the modulation type for the IEEE802.11a/b/g standards. You must specify the modulation type before you start an analysis.

Table 2-3: Modulation types

Standard	Modulation Type	Data Rate	Modulation First/Second	Encoding Rate	Note
IEEE802.11a	OFDM.BPSK (6 Mbps)	6 Mbps	BPSK/OFDM	1/2	
	OFDM.BPSK (9 Mbps)	9 Mbps	BPSK/OFDM	3/4	
	OFDM.QPSK (12 Mbps)	12 Mbps	QPSK/OFDM	1/2	
	OFDM.QPSK (18 Mbps)	18 Mbps	QPSK/OFDM	3/4	
	OFDM.16QAM (24 Mbps)	24 Mbps	16QAM/OFDM	1/2	
	OFDM.16QAM (36 Mbps)	36 Mbps	16QAM/OFDM	3/4	
	OFDM.64QAM (48 Mbps)	48 Mbps	64QAM/OFDM	2/3	
	OFDM.64QAM (54 Mbps)	54 Mbps	64QAM/OFDM	3/4	
	AUTO	Auto	Auto		
IEEE802.11b	DSSS.DBPSK (1 Mbps)	1 Mbps	DBPSK/DSSS		LongPLCP
	DSSS.DQPSK (2 Mbps)	2 Mbps	DQPSK/DSSS		LongPLCP or ShortPLCP
	CCK (5.5 Mbps)	5.5 Mbps	CCK		
	CCK (11 Mbps)	11 Mbps	CCK		
	PBCC.BPSK (5.5 Mbps)	5.5 Mbps	BPSK/PBCC		
	PBCC.QPSK (11 Mbps)	11 Mbps	QPSK/PBCC		
	AUTO	Auto	Auto		
IEEE802.11g	DSSS.DBPSK (1 Mbps)	1 Mbps	DBPSK/ERP_DSSS		LongPLCP
	DSSS.DQPSK (2 Mbps)	2 Mbps	DQPSK/ERP_DSSS		LongPLCP or ShortPLCP
	CCK (5.5 Mbps)	5.5 Mbps	CCK		
	CCK (11 Mbps)	11 Mbps	CCK		
	PBCC.BPSK (5.5 Mbps)	5.5 Mbps	BPSK/ERP_PBCC		
	PBCC.QPSK (11 Mbps)	11 Mbps	QPSK/ERP_PBCC		
	PBCC.8PSK (22 Mbps)	22 Mbps	8PSK/ER_PBCC		
	PBCC.8PSK (33 Mbps)	33 Mbps	8PSK/ER_PBCC		
	OFDM.BPSK (6 Mbps)	6 Mbps	BPSK/DSSS_OFDM	1/2	
	OFDM.BPSK (9 Mbps)	9 Mbps	BPSK/DSSS_OFDM	3/4	
	OFDM.QPSK (12 Mbps)	12 Mbps	BPSK/DSSS_OFDM	1/2	
	OFDM.QPSK (18 Mbps)	18 Mbps	BPSK/DSSS_OFDM	3/4	
	OFDM.16QAM (24 Mbps)	24 Mbps	16QAM/DSSS_OFDM	1/2	
	OFDM.16QAM (36 Mbps)	36 Mbps	16QAM/DSSS_OFDM	3/4	
	OFDM.64QAM (48 Mbps)	48 Mbps	64QAM/DSSS_OFDM	2/3	
	OFDM.64QAM (54 Mbps)	54 Mbps	64QAM/DSSS_OFDM	3/4	
	AUTO	Auto	Auto		

Table 2-3: Modulation types (cont.)

Standard	Modulation Type	Data Rate	Modulation First/Second	Encoding Rate	Note
IEEE802.11g	OFDM.BPSK (6 Mbps)	6 Mbps	BPSK/ERP_OFDM	1/2	UltraShortPLCP
	OFDM.BPSK (9 Mbps)	9 Mbps	BPSK/ERP_OFDM	3/4	
	OFDM.QPSK (12 Mbps)	12 Mbps	QPSK/ERP_OFDM	1/2	
	OFDM.QPSK (18 Mbps)	18 Mbps	QPSK/ERP_OFDM	3/4	
	OFDM.16QAM (24 Mbps)	24 Mbps	16QAM/ERP_OFDM	1/2	
	OFDM.16QAM (36 Mbps)	36 Mbps	16QAM/ERP_OFDM	3/4	
	OFDM.64QAM (48 Mbps)	48 Mbps	64QAM/ERP_OFDM	2/3	
	OFDM.64QAM (54 Mbps)	54 Mbps	64QAM/ERP_OFDM	3/4	
	AUTO	Auto	Auto		

SELECT SOURCE. The following information describes the details about the SELECT SOURCE menu on the modulation analysis setting window.

Select the **WCA** radio button and then click the **SETUP...** button in the SELECT SOURCE field to open the Read From WCA dialog box as shown in Figure 2-4. In this dialog box, you can set the analyzer parameters.

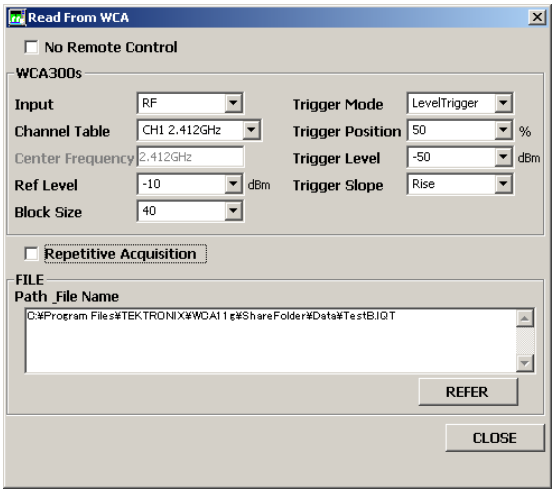


Figure 2-4: Read From WCA dialog box

Table 2-4 shows the parameters you can set in the Read From WCA dialog box.

Table 2-4: Read From WCA dialog box parameters

Items	Option	Description
No Remote Control		Click this box to use local settings. It makes the WCA300s parameters inactive. This selection is available when you check the WCA radio button in the SELECT SOURCE.
WCA300s		
Input	IQ RF	Specifies the input (IQ or RF) for the analyzer.
Channel Table		Selects the channel from the pull-down menu. See Table 2-5.
Center Frequency		Sets the center frequency of the analyzer. Available when you specify VALUE for Channel Table.
Ref Level	30, 20, 10, 0, -10, -20, -30, -40, -50	Selects the reference level of the analyzer.
Block Size	2000, 1000, 400, 200, 100, 40, 20, 10, 1	Selects the block size of the analyzer.
Trigger Mode	Manual ExtTrigger LevelTrigger	Specifies the trigger mode of the analyzer.
Trigger Position	100, 50, 10, 0	Selects the trigger position of the analyzer. Available when the Trigger Mode is set to either ExtTrigger or LevelTrigger.
Trigger Level	30, 20, 10, 0, -10, -20, -30, -40, -50, -60, -70, -80, -90, -100, -110, -120, -130, -140, -150	Selects the trigger level of the analyzer. Available when the Trigger Mode is set to LevelTrigger.
Trigger Slope	Rise Fall	Selects the trigger slope of the analyzer. Available when the Trigger Mode is set to LevelTrigger.
REPETITIVE ACQUISITION		Click this box to perform repetitive acquisition.
FILE		
Path File Name field	Text input	Enters text to specify the file name and destination.
REFER button		Opens the dialog box to specify the file name.
CLOSE		Exits the Read From WCA dialog box.

In the Channel Table, you can select the channel from the following channel list.

Table 2-5: Channel list

Standard	Channel number	Carrier frequency [GHz]	Note
IEEE802.11a	34	5.170	
	36	5.180	
	38	5.190	
	40	5.200	
	42	5.210	
	44	5.220	
	46	5.230	
	48	5.240	
	52	5.260	
	56	5.280	
	60	5.300	
	64	5.320	
	100	5.500	
	104	5.520	
	108	5.540	
	112	5.560	
	116	5.580	
	120	5.600	
	124	5.620	
	128	5.640	
	132	5.660	
	136	5.680	
	140	5.700	
	149	5.745	
	153	5.765	
	157	5.785	
	161	5.805	
	VALUE	Center Frequency	Inputs a value for center frequency.

Table 2-5: Channel list (cont.)

Standard	Channel number	Carrier frequency [GHz]	Note
IEEE802.11b and IEEE802.11g	1	2.412	
	2	2.417	
	3	2.422	
	4	2.427	
	5	2.432	
	6	2.437	
	7	2.442	
	8	2.447	
	9	2.452	
	10	2.457	
	11	2.462	
	12	2.467	
	13	2.472	
	14	2.484	
	VALUE	Center Frequency	Inputs a value for center frequency.

Select the **IQT** radio button and then click the **SETUP...** button in the SELECT SOURCE field to open the Read From WCA dialog box as shown in Figure 2-5. In this dialog box, you can specify the files to be analyzed (IQT files).

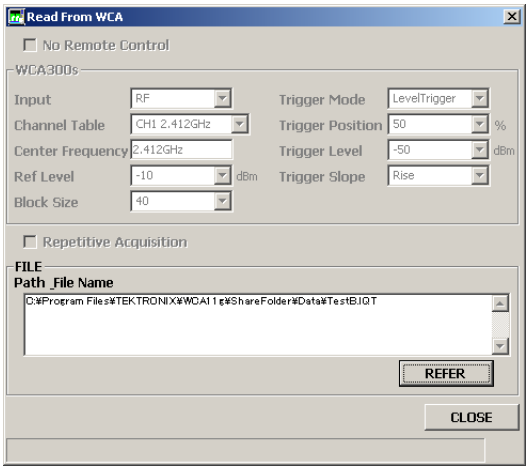


Figure 2-5: Read From WCA dialog box (IQT file)

Table 2-6 shows the parameters you can set in the Read From WCA dialog box.

Table 2-6: Read From WCA dialog box (IQT) parameters

Items	Option	Description
No Remote Control		Not available when you check the IQT radio button in the SELECT SOURCE.
WCA300s		
Input		
Channel Table		
Center Frequency		
Ref Level		
Block Size		
Trigger Mode		
Trigger Position		
Trigger Level		
Trigger Slope		
REPETITIVE ACQUISITION		
FILE		
Path File Name field	Text input	Enters text to specify the file name and destination.
REFER button		Opens the dialog box to specify the file name.
CLOSE		Exits the Read From WCA dialog box.

Table 2-7 lists the **VIEW** menus of the modulation analysis setting window.

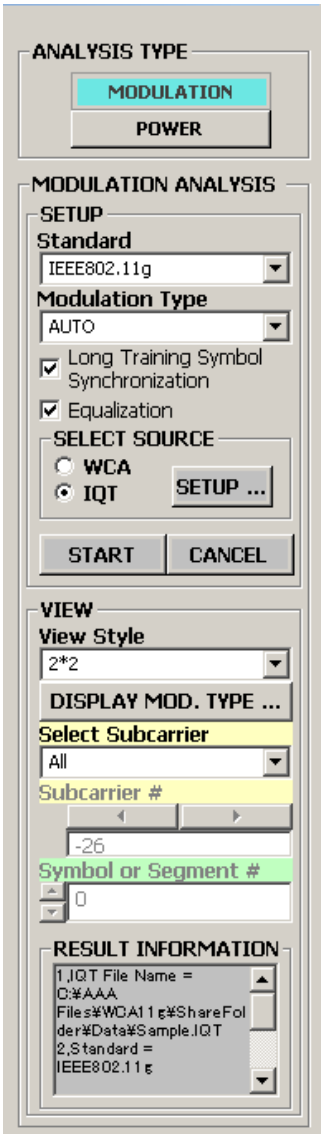


Table 2-7: Modulation Analysis VIEW Parameters

Menu item	Option	Description
View Style	1 *1	Displays one graph on the screen.
	2 * 2	Displays four graphs on the screen.
DISPLAY MOD. TYPE...		Click this button to open DISPLAY MOD. TYPE dialog box. See Figure 2-6 on page 2-16.
Select Subcarrier		Selects subcarrier(s) from the pull-down list for a displayed line graph.
	All Data	Displays only Data.
	All Pilot	Displays only Pilot.
	All	Displays Data + Pilot.
	Single Subcarrier	Displays the subcarrier wave specified by **Subcarrier #**.
		This menu item is available when you specify one of the following formats for a View screen.
		Average Power vs. Time Average EVM vs. Time Average MagErr vs. Time Average PhaseErr vs. Time Constellation Center Frequency
Subcarrier #		Specifies the subcarrier number from the list. [-26 to -1, +1 to +26]
		The **Subcarrier #** is available when you specify **Single Subcarrier** for Select Subcarrier.
Symbol or Segment #		Specifies the symbol number or segment number. See page 2-15 for details on segment.
		This menu item is available when you specify one of the following format for a View screen.
		Power vs. SC_No EVM vs. SC_No MagErr vs. SC_No PhaseErr vs. SC_No Symbol Constellation Power vs. Time EVM vs. Time MagErr vs. Time PhaseErr vs. Time Segment Constellation Power Analysis Display EVM Analysis Display MagErr Analysis Display PhaseErr Analysis Display Constellation Analysis Display

Table 2-7: Modulation Analysis VIEW Parameters (cont.)

Menu item	Option	Description
RESULT INFORMATION		Displays the setting parameters when you performed an analysis for the currently selected signal. The following parameters are displayed: IQT File Name Standard Modulation Type Long Training Symbol Synchronization On/Off Equalization On/Off.

Segment and Modulation Analysis. In Modulation Analysis, it is important to calculate average values of RMS voltage or center frequency error for the enough length of time in order to get good analysis results. The length of signal to calculate the RMS voltage or center frequency error is called “segment” in the WCA11G software. For example, frequency error by the segment is displayed on the Center Frequency Error view format.

The following view formats display the averaged values by the segment for power, EVM, magnitude error, and phase error, respectively.

- Average Power vs. Time, page 3-3
- Average EVM vs. Time, page 3-15
- Average MagErr vs. Time, page 3-19
- Average PhaseErr vs. Time, page 3-23

The length of segment is different depending on the modulation type as follows:

- Data part
  - OFDM: 80 sample points (1 symbol)
  - DSSS: 88 chips (8 symbols)
  - CCK: 80 chips (10 symbols)
  - PBCC: 80 symbols
- Preamble, Header part
  - Short OFDM training symbol:16 sample points
  - Long OFDM training symbol:160 sample points
  - PLCP preamble:1584 chips (144 symbols)
  - Short PLCP preamble:792 chips (72 symbols)
  - PLCP Header:528 chips (48 symbols)
  - Short PLCP Header:264 chips (24 symbols)

The following view formats display the detailed analysis data of power, EVM, magnitude error, and phase error for each symbol, chip, or subcarrier wave contained in one segment.

IEEE802.11a	IEEE802.11b	IEEE802.11g
Power vs. SC_No	Power vs. Time	Power Analysis Display
EVM vs. SC No	EVM vs. Time	EVM Analysis Display
MagErr vs. SC_No	MagErr vs. Time	MagErr Analysis Display
PhaseErr vs. SC_No	PhaseErr vs. Time	PhaseErr Analysis Display

Display Modulation Type dialog box. Click the **DISPLAY MOD. TYPE** button on the setting window to open the Display Modulation Type dialog box as shown in Figure 2-6, where you can select the modulation type by clicking each desired box.

Only the checked modulation type signals have an effect on the graph display except for the Main View. Unchecked modulation type signals are ignored.

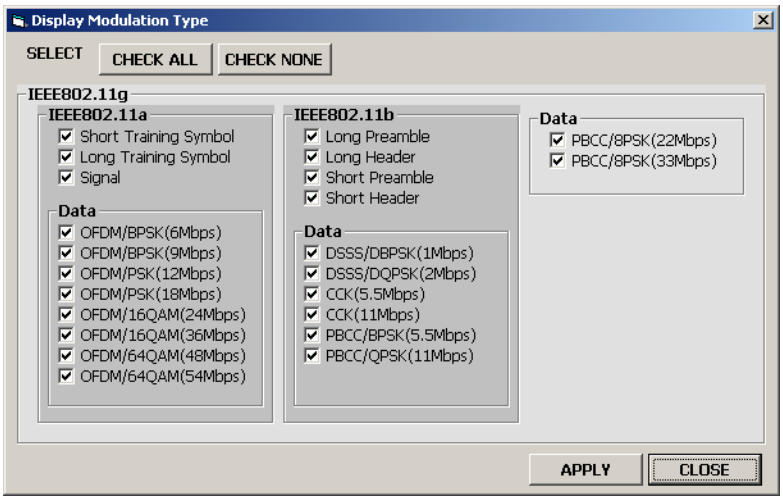


Figure 2-6: Display Modulation Type dialog box

Do the following steps to use the Display Modulation Type dialog box:

1. Select a standard you want to analyze from the **Standard** pull-down list on the **SETUP** menu in the Modulation Analysis setting window. Refer to page 2-6.
2. Click the **DISPLAY MOD. TYPE** button on the **VIEW** menu of the setting window.
3. Select the desired individual modulation type(s) or select **CHECK ALL**.
   - CHECK ALL: Click this button to check all the boxes.
   - CHECK NONE: Click this button to deselect all the boxes.
4. Click the **APPLY** button to apply the selected type(s) to the measurement data, and then display the graph for the modulation type(s) specified.
5. Click the **CLOSE** button to close the dialog box.

Power Analysis Setting Window

The setting window for power analysis allows you to access the SETUP menu.

Table 2-8 lists the power analysis **SETUP** menus.

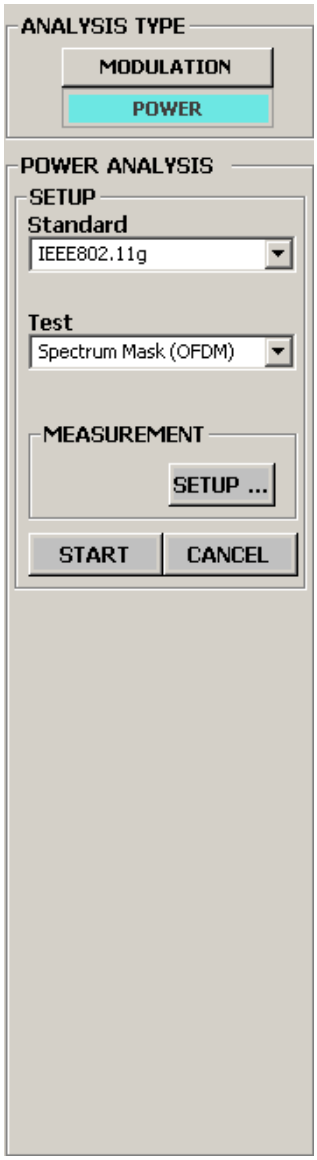


Table 2-8: Power Analysis SETUP Parameters

Menu item	Option	Description
Standard		Selects the wireless LAN standard type.
	IEEE802.11a	Analyzes IEEE802.11a power.
	IEEE802.11b	Analyzes IEEE802.11b power.
	IEEE802.11g	Analyzes IEEE802.11g power.
Test	See Table 2-9.	Selects the test item.
MEASUREMENT		Specifies the analysis parameters.
	SETUP...	Click this button to open the Read From WCA dialog box, where you can set the analyzer parameters.
START		Click to start the analysis. After specifying the analysis method from the MEASUREMENT menu, you can use this button.
CANCEL		Click to stop the analysis.

Power Analysis Test Items. Table 2-9 lists the power analysis test items.

Table 2-9: Power Analysis Test Items

Standard	Test Items	Description
IEEE802.11a	Spectrum Mask	Displays spectrum waveform and mask in a line graph under PeakHold condition. The vertical axis represents power [dBm], and the horizontal axis represents frequency [Hz].
IEEE802.11b or IEEE802.11g	Spectrum Mask	Displays spectrum waveform and mask in a line graph under PeakHold condition. The vertical axis represents power [dBm], and the horizontal axis represents frequency [Hz].
	Transmit Power On	Displays the transmit power on ramp in a line graph. The vertical axis represents power [W], and the horizontal axis represents time [ms].
	Transmit Power Off	Displays the transmit power down ramp in a line graph. The vertical axis represents power [W], and the horizontal axis represents time [ms].

Graph Window Pane

Analysis and measurement results are displayed as a graph in this area. You can select either 1 * 1 or 2 * 2 display format by selecting **View Style** in the **SETUP** menu in the modulation analysis setting window. For power analysis, the graph display is fixed to 1 * 1 format.

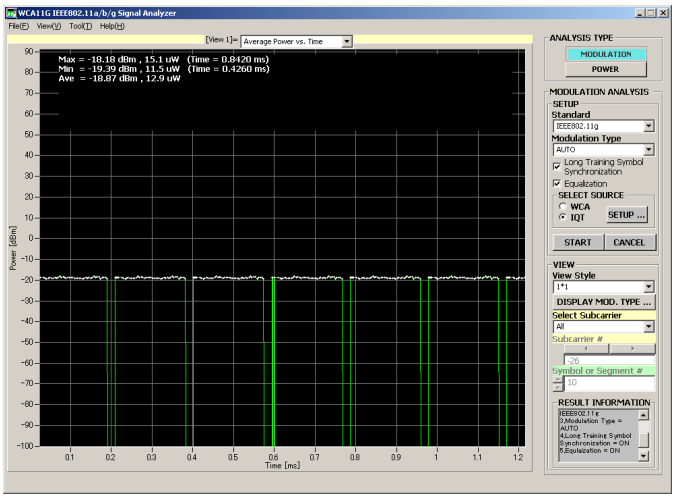


Figure 2-7: 1 * 1 screen display

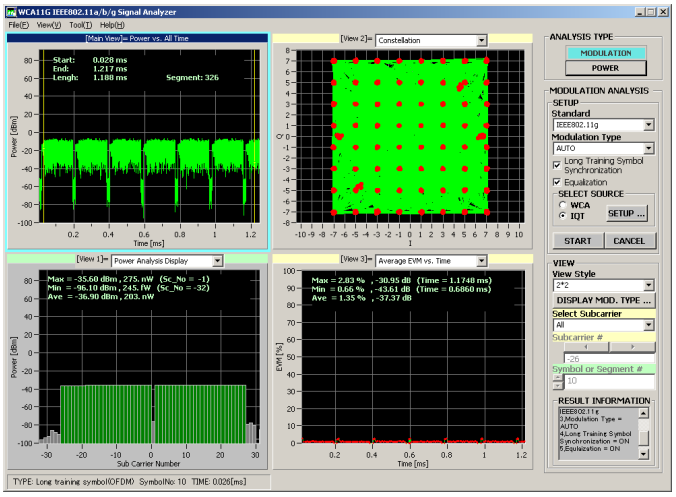


Figure 2-8: 2 * 2 screen display

In the modulation analysis 1 * 1 view style, you can toggle the view screen by double-clicking on the screen. The screen display changes in the order of Main View > View 1 > View 2 > View 3 > Main View.

D_Marker1 and D_Marker2. In the Main View screen, D_Marker1 and D_Marker2 are displayed in yellow. You can specify the display range for a View screen by using these Markers.

These Marker readouts are displayed in the Main View screen:

- Start: Time data of D_Marker1
- Length: D_Marker2 - D_Marker1
- End: Time data of D_Marker2

View Function

You can specify a graphical view format for each of the three View screens from the pull-down list located at the top of each View screen. See Figure 2-9.

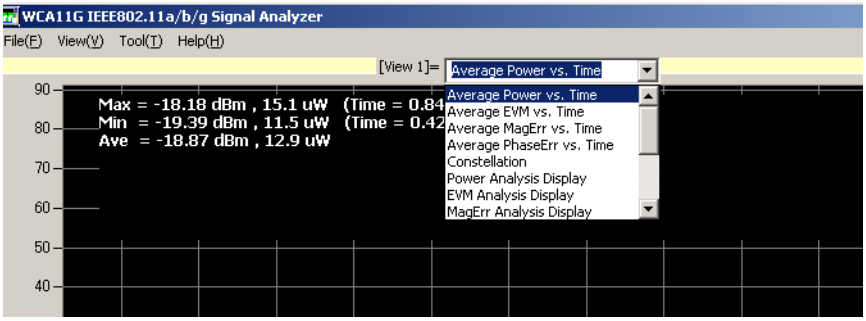


Figure 2-9: View format pull-down list

View Format. Table 2-10 lists the view formats for the IEEE802.11a standard.

Table 2-10: View format - IEEE802.11a signals

Item	Description
Average Power vs. Time	Displays power of one or all subcarriers in a line graph. The vertical axis represents power [dBm], and the horizontal axis represents time [ms].
Power vs. SC_No	Displays each subcarrier wave power as a symbol in a bar graph. The vertical axis represents power [dBm], and the horizontal axis represents subcarrier wave number [-26 to +26].
Flatness	Displays each subcarrier wave flatness in a bar graph. The vertical axis represents average energy deviation power [dB], and the horizontal axis represents subcarrier wave number [-26 to +26].
Constellation	Displays constellation of one or all subcarriers in a rectangular coordinates graph. The vertical axis represents Q, and the horizontal axis represents I.
Symbol Constellation	Displays constellation as a symbol in a rectangular coordinates graph. The vertical axis represents Q, and the horizontal axis represents I.

Table 2-10: View format - IEEE802.11a signals (cont.)

Item	Description
Average EVM vs. Time	Displays EVM of one or all subcarriers in a line graph. The vertical axis represents EVM [%], and the horizontal axis represents time [ms].
EVM vs. SC_No	Displays EVM as a symbol in a bar graph. The vertical axis represents EVM [%], and the horizontal axis represents subcarrier wave number [-26 to +26].
Average MagErr vs. Time	Displays magnitude error of one or all subcarriers in a line graph. The vertical axis represents magnitude error [%], and the horizontal axis represents time [ms].
MagErr vs. SC_No	Displays magnitude error as a symbol in a bar graph. The vertical axis represents magnitude error [%], and the horizontal axis represents subcarrier number [-26 to +26].
Average PhaseErr vs. Time	Displays phase error of one or all subcarriers in a line graph. The vertical axis represents phase error [Degree], and the horizontal axis represents time [ms].
PhaseErr vs. SC_No	Displays phase error as a symbol in a bar graph. The vertical axis represents phase error [Degree], and the horizontal axis represents subcarrier number [-26 to +26].
Center Frequency Error	Displays carrier wave frequency deviation as a symbol in a line graph. The vertical axis represents deviation [kHz], and the horizontal axis represents time [ms].
OFDM Linearity	Displays linearity of OFDM modulation in a line graph. The vertical axis represents actual measurement values [mW], and the horizontal axis represents ideal values [mW].
Symbol Table	Displays a table of symbol values (hexadecimal and binary).
Spectrum Mask	Displays spectrum waveform and mask in a line graph under PeakHold condition. The vertical axis represents power [dBm], and the horizontal axis represents frequency [Hz].

Table 2-11 lists the view format for the IEEE802.11b standard.

Table 2-11: View format - IEEE802.11b signals

Item	Description
Average Power vs. Time	Displays power of carriers in a line graph. The vertical axis represents power [dBm], and the horizontal axis represents time [ms].
Power vs. Time	Displays power of carriers by the segment in a bar graph. The vertical axis represents power [dBm], and the horizontal axis represents time [ms].
Constellation	Displays constellation of carriers in a rectangular coordinates graph. The vertical axis represents Q, and the horizontal axis represents I.
Segment Constellation	Displays constellation of carriers by the segment in a rectangular coordinates graph. The vertical axis represents Q, and the horizontal axis represents I.

Table 2-11: View format - IEEE802.11b signals (cont.)

Item	Description
Average EVM vs. Time	Displays EVM of carriers in a line graph. The vertical axis represents EVM [%], and the horizontal axis represents time [ms].
EVM vs. Time	Displays EVM of carriers by the segment in a bar graph. The vertical axis represents EVM [%], and the horizontal axis represents time [ms].
Average MagErr vs. Time	Displays magnitude error of carriers in a line graph. The vertical axis represents magnitude error [%], and the horizontal axis represents time [ms].
MagErr vs. Time	Displays magnitude error of carriers by the segment in a bar graph. The vertical axis represents magnitude error [%], and the horizontal axis represents time [ms].
Average PhaseErr vs. Time	Displays phase error of carriers in a line graph. The vertical axis represents phase error [Degree], and the horizontal axis represents time [ms].
PhaseErr vs. Time	Displays phase error of carriers by the segment in a bar graph. The vertical axis represents phase error [Degree], and the horizontal axis represents time [ms].
Center Frequency Error	Displays carrier wave frequency deviation in a line graph. The vertical axis represents deviation [kHz], and the horizontal axis represents time [ms].
Symbol Table	Displays a table of symbol values (hexadecimal and binary).
Spectrum Mask	Displays spectrum waveform and mask in a line graph under PeakHold condition. The vertical axis represents power [dBm], and the horizontal axis represents frequency [Hz].
Transmit Power On	Displays the transmit power on ramp in a line graph. The vertical axis represents power [W], and the horizontal axis represents time [ms].
Transmit Power Off	Displays the transmit power down ramp in a line graph. The vertical axis represents power [W], and the horizontal axis represents time [ms].

Table 2-12 lists the view format for the IEEE802.11g standard.

Table 2-12: View format - IEEE802.11g signals

Item	Description
Average Power vs. Time	Displays power of carriers, or one or all subcarriers in a line graph. The vertical axis represents power [dBm], and the horizontal axis represents time [ms].
Power Analysis Display	Displays each subcarrier wave power as an OFDM symbol, or power by the segment in a bar graph. The vertical axis represents power [dBm], and the horizontal axis represents subcarrier wave number [-26 to +26] or time [ms].

Table 2-12: View format - IEEE802.11g signals (cont.)

Item	Description
Flatness	Displays each subcarrier wave flatness in a bar graph. The vertical axis represents average energy deviation power [dB], and the horizontal axis represents subcarrier wave number [-26 to +26].
Constellation	Displays constellation of carriers, or constellation of one or all subcarriers in a rectangular coordinates graph. The vertical axis represents Q, and the horizontal axis represents I.
Constellation Analysis Display	Displays constellation of each subcarrier as an OFDM symbol, constellation by the segment in a rectangular coordinates graph. The vertical axis represents Q, and the horizontal axis represents I.
Average EVM vs. Time	Displays EVM of carriers, or one or all subcarriers in a line graph. The vertical axis represents EVM [%], and the horizontal axis represents time [ms].
EVM Analysis Display	Displays EVM as an OFDM symbol, or EVM by the segment in a bar graph. The vertical axis represents EVM [%], and the horizontal axis represents subcarrier wave number [-26 to +26] or time [ms].
Average MagErr vs. Time	Displays magnitude error of carriers, or one or all subcarriers in a line graph. The vertical axis represents magnitude error [%], and the horizontal axis represents time [ms].
MagErr Analysis Display	Displays magnitude error as an OFDM symbol, or magnitude error by the segment in a bar graph. The vertical axis represents magnitude error [%], and the horizontal axis represents subcarrier number [-26 to +26] or time [ms].
Average PhaseErr vs. Time	Displays phase error of carriers, or one or all subcarriers in a line graph. The vertical axis represents phase error [Degree], and the horizontal axis represents time [ms].
PhaseErr Analysis Display	Displays phase error as an OFDM symbol, or phase error by the segment in a bar graph. The vertical axis represents phase error [Degree], and the horizontal axis represents subcarrier number [-26 to +26] or time [ms].
Center Frequency Error	Displays carrier wave frequency deviation as an OFDM symbol in a line graph. The vertical axis represents deviation [kHz], and the horizontal axis represents time [ms].
Symbol Table	Displays a table of symbol values (hexadecimal and binary).
OFDM Linearity	Displays linearity of OFDM modulation in a line graph. The vertical axis represents actual measurement values [mW], and the horizontal axis represents ideal values [mW].
Spectrum Mask	Displays spectrum waveform and mask in a line graph under PeakHold condition. The vertical axis represents power [dBm], and the horizontal axis represents frequency [Hz].
Transmit Power On	Displays the transmit power on ramp in a line graph. The vertical axis represents power [W], and the horizontal axis represents time [ms].
Transmit Power Off	Displays the transmit power down ramp in a line graph. The vertical axis represents power [W], and the horizontal axis represents time [ms].

Scale Adjustment

You can change the scale of a View screen by the following steps:

1. In the view in which you want to change the scale, double-click the start or end point of the horizontal (or vertical) axis.

   The scale input box appears as shown in Figure 2-10.

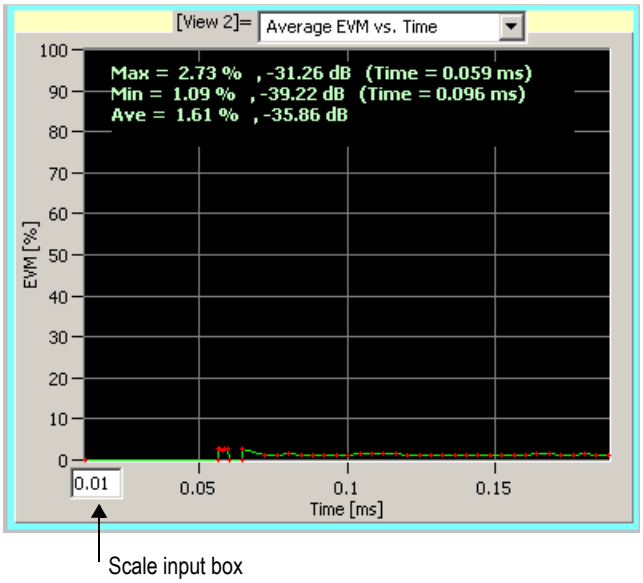


Figure 2-10: Scale input box

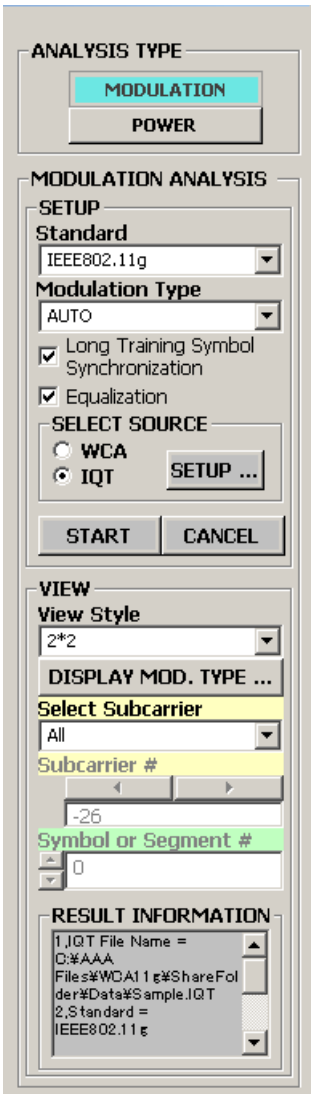
2. Input t a new value in the box, and then press the **Enter** key to change the scale.

If you want to change the vertical scale, double-click the start or end point of the vertical axis, repeating the same steps above.

Modulation Analysis

This section provides information about the view formats of the WCA11G IEEE802.11a/b/g Signal Analysis Software. The view format descriptions are divided into two subsections: Modulation Analysis and Power Analysis.

Modulation Analysis Test Procedure



Do the following steps to perform the modulation analysis:

1. Confirm that **MODULATION** is selected as the ANALYSIS TYPE.

   The modulation analysis setting window becomes available.

2. Use the SETUP menu to input analysis parameters.

   a. Specify the standard you want to test from the **Standard** pull-down list.

   b. Select the modulation type (data rate) or specify **AUTO** from the Modulation Type pull-down list.

   c. Select or clear the **Long Training Symbol Synchronization** and **Equalization** options as necessary.

3. Click either the **WCA** or the **IQT** radio button in the SELECT SOURCE to open the Read From WCA dialog box. Refer to page 2-8 for the details on the **SELECT SOURCE** menu and the Read From WCA dialog box.

   Set the parameters in the Read From WCA dialog box, and then close the dialog box.

4. Click the **START** button to start the analysis.

   Click the **CANCEL** button if you want to cancel the analysis.

5. Use the **View** menu to modify the displayed graph.

6. If you want to change the view format, use the pull-down list on the View screen as shown in Figure 2-9 on page 2-19.

Modulation Analysis View Formats

This subsection describes each modulation analysis view format.

Power vs. All Time

This display shows the power in a line graph as shown in Figure 3-1. The vertical axis represents power [dBm], and the horizontal axis represents time [ms].

The Main View (upper left window in 2 x 2 view style) is fixed to Power vs. All Time view format, and D_Marker1 and D_Marker2 are always displayed.

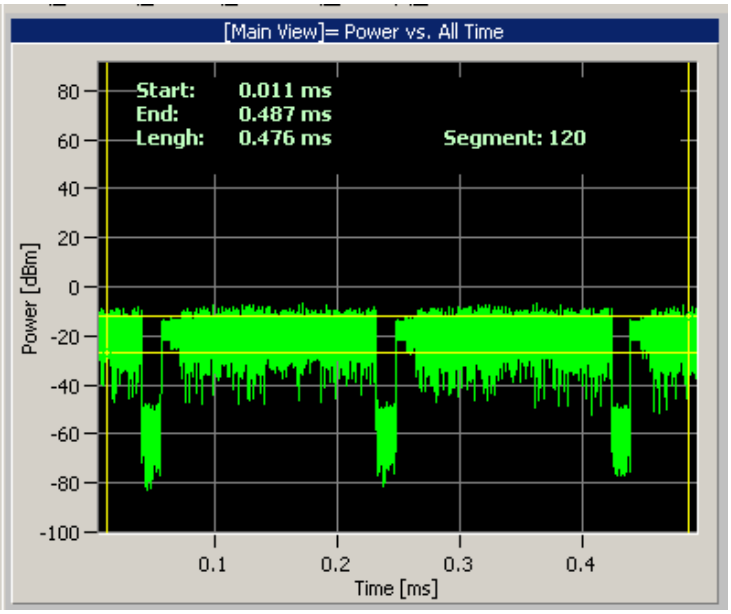


Figure 3-1: Power vs. All Time display

Setup Parameters. In the Power vs. All Time display, you can set the parameters listed in Table 3-1.

Table 3-1: Power vs. All Time parameters

Standard	Item	Description
IEEE802.11a/b/g	D_Marker1 D_Marker2	Two markers (D_Marker1 and D_Marker2) are displayed in the Main View. You can use these markers to specify the display range for View1, View2, or View3.
	Start	Time data of D_Marker1
	End	Time data of D_Marker2
	Length	D_Marker2 - D_Marker1

Average Power vs. Time

This display shows the power in a line graph as shown in Figure 3-2. The vertical axis represents power [dBm], and the horizontal axis represents time [ms].

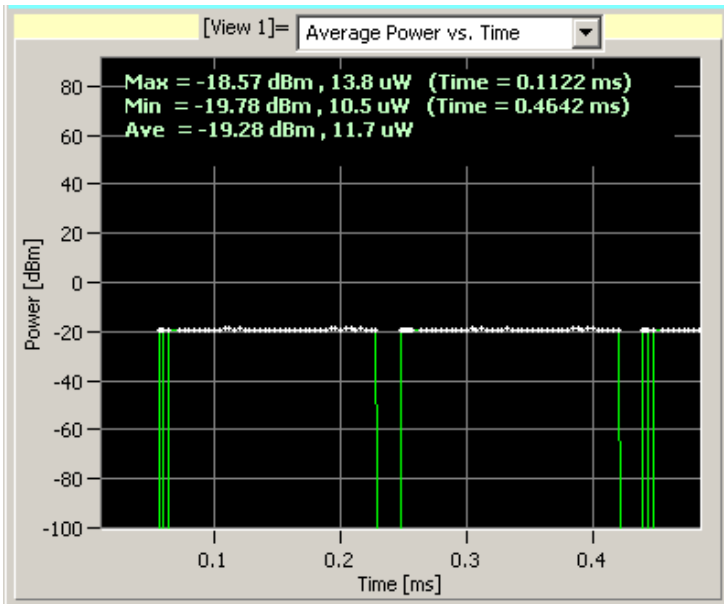


Figure 3-2: Average Power vs. Time

Table 3-2 lists the setup parameters for this view format.

Table 3-2: Average Power vs. Time setup parameters

Standard	Parameter	Description
IEEE802.11a	Select Subcarrier	Specify the data format. Available options are All Data, All Pilot, All, and Single Subcarrier.
	Subcarrier #	Sets the subcarrier number when Single Subcarrier is selected for Select Subcarrier (-26 to 26).
IEEE802.11b	Select Subcarrier	These parameters are not available.
	Subcarrier #	
IEEE802.11g (OFDM)	Select Subcarrier	Specify the data format. Available options are All Data, All Pilot, All, and Single Subcarrier.
	Subcarrier #	Sets the subcarrier number when Single Subcarrier is selected for Select Subcarrier (-26 to 26).
IEEE802.11g (DSSS)	Select Subcarrier	These parameters are not available.
	Subcarrier #	

Table 3-3 shows the initial measurement items. The measurement results are recalculated for each symbol or segment.

Table 3-3: Average Power vs. Time measurements

Standard	Readout	Description
IEEE802.11a	Max	Displays the maximum power [W] and [dBm] of one or all subcarriers.
	Min	Displays the minimum power [W] and [dBm] of one or all subcarriers.
	Ave	Displays the average power [W] and [dBm] of one or all subcarriers.
IEEE802.11b	Max	Displays the maximum power [W] and [dBm] of carriers.
	Min	Displays the minimum power [W] and [dBm] of carriers.
	Ave	Displays the average power [W] and [dBm] of carriers.
IEEE802.11g	Max	Displays the maximum power [W] and [dBm] of carriers, or one or all subcarriers.
	Min	Displays the minimum power [W] and [dBm] of carriers, or one or all subcarriers.
	Ave	Displays the average power [W] and [dBm] of carriers, or one or all subcarriers.

Power Analysis Display

This analysis display is the same as one of the following view formats depending on the modulation signal. If you select Power Analysis Display, the displayed graph automatically toggles depending on the modulation format.

- If the displayed data is OFDM, refer to *Power vs. SC_No* on page 3-5.
- If the displayed data is DSSS, refer to *Power vs. Time* on page 3-6.

Power vs. SC_No

This bar graph shows the power in each subcarrier of one OFDM symbol; designates the symbol in the setting window by setting the Symbol or Segment #. The vertical axis represents Power [dBm], and the horizontal axis represents subcarrier number (-26 to +26).

Figure 3-3: Power vs. SC_No display

Table 3-4 lists the setup parameters for this view format.

Table 3-4: Power vs. SC_No parameter

Standard	Parameter	Description
IEEE802.11a	Symbol or Segment #	Specifies or changes the symbol number for the currently displayed bar graph.

The following list shows the initial measurement items.

Readout	Description
Max	Displays the maximum power [W] and [dBm], and its subcarrier number.
Min	Displays the minimum power [W] and [dBm], and its subcarrier number.
Ave	Displays the average power of all subcarrier [W] and [dBm].

Power vs. Time

The Power vs. Time display shows the power of carriers by the segment in a bar graph, as shown in Figure 3-4. The vertical axis represents power [dBm], and the horizontal axis represents time [ms].

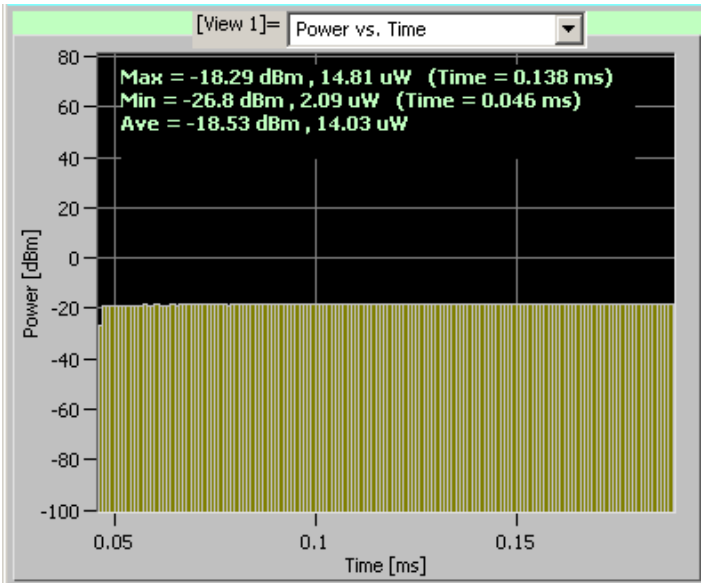


Figure 3-4: Power vs. Time

The following table shows the setup parameters for this view format.

Standard	Parameter	Description
IEEE802.11b	Symbol or Segment #	Specifies or changes the segment number for the currently displayed bar graph.

The following list shows the initial measurement items.

Readout	Description
Max	Displays [W] and [dBm] of maximum power.
Min	Displays [W] and [dBm] of minimum power.
Ave	Displays [W] and [dBm] of average power.

Flatness

This display shows each subcarrier wave flatness in a bar graph, as shown in Figure 3-5. The vertical axis represents average energy deviation power [dB], and the horizontal axis represents subcarrier wave number [-26 to +26].

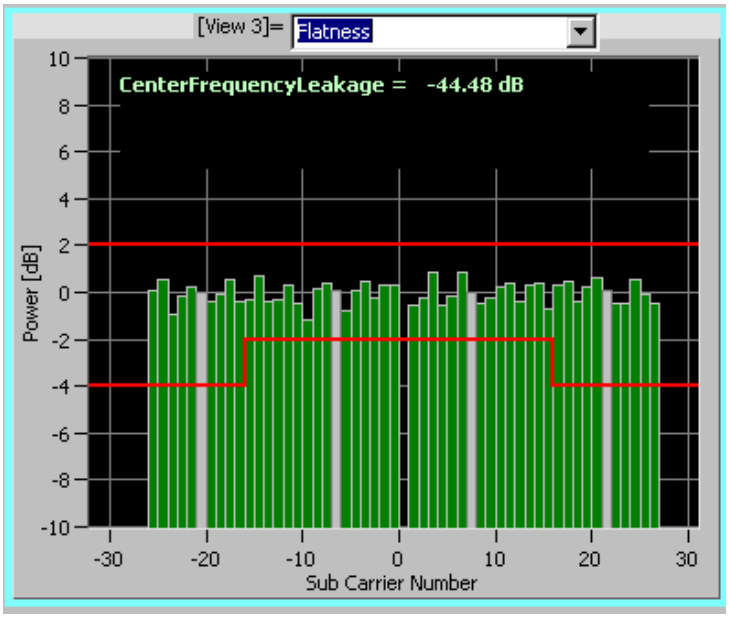


Figure 3-5: Flatness measurement

Verify that the measurement results (bar graph) fall within the threshold level (two red lines).

The following list shows the initial measurement item.

Readout	Description
Center Frequency Leakage	Displays the carrier leakage power [dB] (<2 dB in IEEE802.11a standard).

Constellation Analysis Display

This analysis display is the same as one of the following view formats depending on the modulation signal. If you select Constellation Analysis Display, the displayed graph automatically toggles depending on the modulation format.

- If the displayed data is OFDM, refer to *Constellation/Symbol Constellation* on page 3-8.
- If the displayed data is DSSS, refer to *Constellation/Segment Constellation* on page 3-11.

Constellation/Symbol Constellation

The Constellation display shows constellation of one or all subcarriers in a rectangular coordinates graph, as shown in Figure 3-6. The vertical axis represents I, and the horizontal axis represents Q.

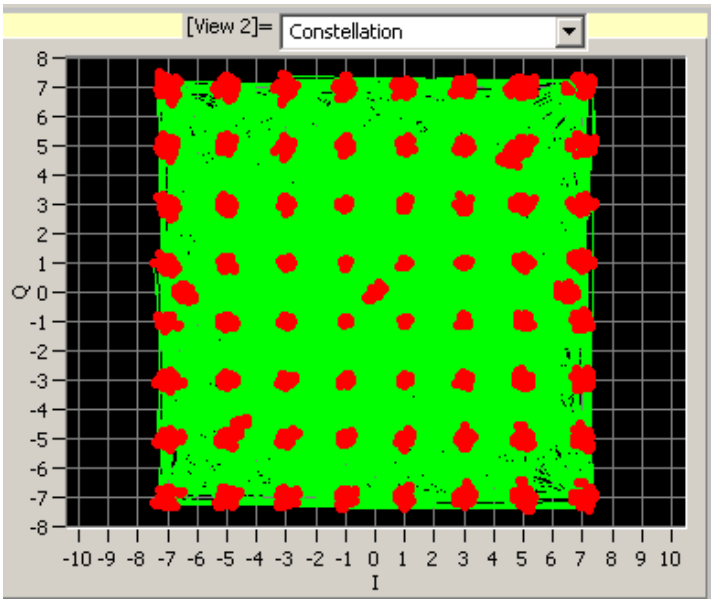


Figure 3-6: Constellation display

Table 3-5 lists the setup parameters for the Constellation and Symbol Constellation view formats.

Table 3-5: Setup parameters

Standard	View Format	Item	Description
IEEE802.11a	Constellation	Select Subcarrier	Specify the data format. Available options are All Data, All Pilot, All, and Single Subcarrier.
		Subcarrier #	Sets the subcarrier number when Single Subcarrier is selected for Select Subcarrier (-26 to 26).
	Symbol Constellation	Symbol or Segment #	Specifies or changes the symbol number for the currently displayed data.

The Symbol Constellation display shows constellation as a symbol in a rectangular coordinates graph, as shown in Figure 3-7. The vertical axis represents I, and the horizontal axis represents Q.

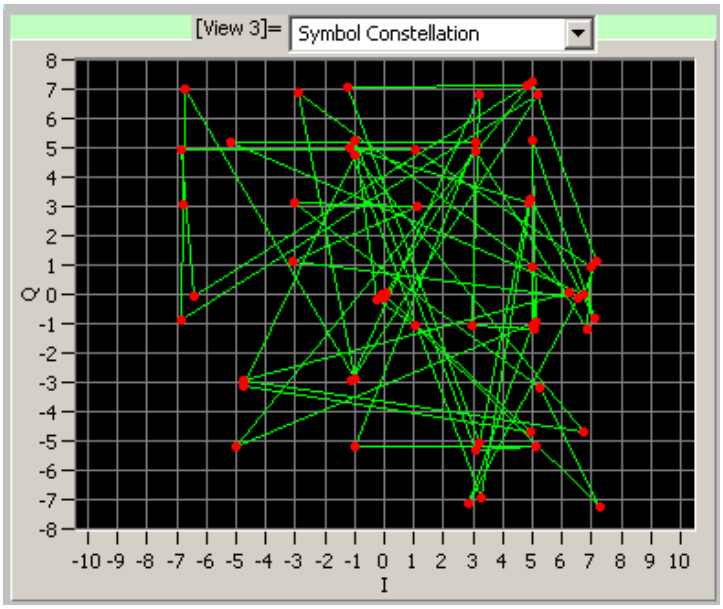


Figure 3-7: Symbol Constellation display

Pop-up View Menu. Table 3-6 lists the View menu items from the Menu bar. You can also set up these parameters with pop-up menus on each of the View screens. Right-click the view screen to display the pop-up menus. See Figure 3-8.

Table 3-6: View menu setup parameters

Main/Sub menu	Option		Description
View/Main	Normalization	On	Applies normalization to the constellation display.
		Off	Excludes normalization from the constellation display.
	Normalization Factor	AUTO	Selects modulation format for normalization. These selections are exclusive.
		BPSK	
		QPSK	
		8PSK	
		16QAM	
		64QAM	
	Vector	On	Activates vector between symbols.
		Off	Inactivates vector between symbols.

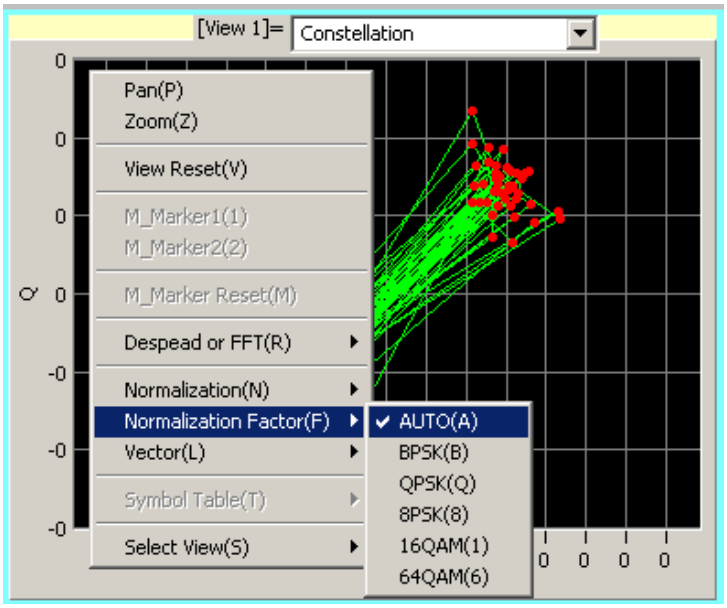


Figure 3-8: Pop-up View menu

Constellation/Segment Constellation

This display shows a constellation of carriers in a rectangular coordinates graph, as shown in Figure 3-9. The vertical axis represents I, and the horizontal axis represents Q.

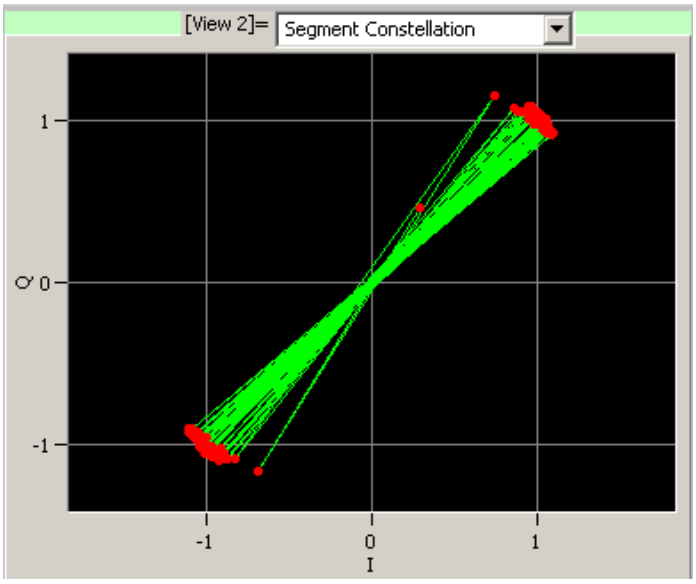


Figure 3-9: Segment Constellation display

Table 3-7 lists the setup parameters for the Constellation and Segment Constellation view formats.

Table 3-7: Segment Constellation setup parameters

Standard	View Format	Item	Description
IEEE802.11b	Constellation		None
	Segment Constellation	Symbol or Segment #	Specifies or changes the segment number for the currently displayed data.

Table 3-6 on page 3-10 lists the View menu items from the Menu bar. You can also set up these parameters with the pop-up menus on each View screen, as shown in Figure 3-8.

Average EVM vs. Time

This display shows the EVM of carriers, or one or all subcarriers in a line graph, as shown in Figure 3-10. The vertical axis represents EVM [%], and the horizontal axis represents time [ms].

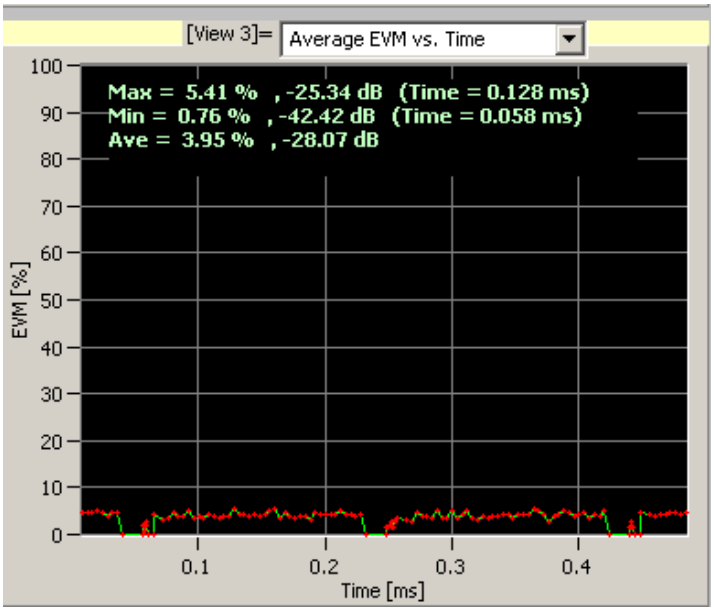


Figure 3-10: Average EVM vs. Time display

Table 3-8 lists the setup parameters for this view format.

Table 3-8: Average EVM vs. Time setup parameters

Standard	Parameter	Description
IEEE802.11a/g	Select Subcarrier	Specify the data format. Available options are All Data, All Pilot, All, and Single Subcarrier.
	Subcarrier #	Sets the subcarrier number when Single Subcarrier is selected for Select Subcarrier (-26 to 26).
IEEE802.11b	Select Subcarrier	These parameters are not available.
	Subcarrier #	

Table 3-9 shows the initial measurement items. The measurement results are recalculated.

Table 3-9: Average EVM vs. Time measurements

Readout	Description
Max	Displays the maximum value of EVM.
Min	Displays the minimum value of EVM.
Ave	Displays the average value of EVM.

EVM Analysis Display

This analysis display is the same as one of the following view formats depending on the modulation signal. If you select EVM Analysis Display, the displayed graph automatically toggles depending on the modulation format.

- If the displayed data is OFDM, refer to *EVM vs. SC_No* on page 3-13.
- If the displayed data is DSSS, refer to *EVM vs. Time* on page 3-15.

EVM vs. SC_No

This bar graph shows the EVM in each subcarrier of one OFDM symbol designated with the Symbol or Segment # in the setting window. The vertical axis represents EVM [%], and the horizontal axis represents subcarrier number (-26 to +26).

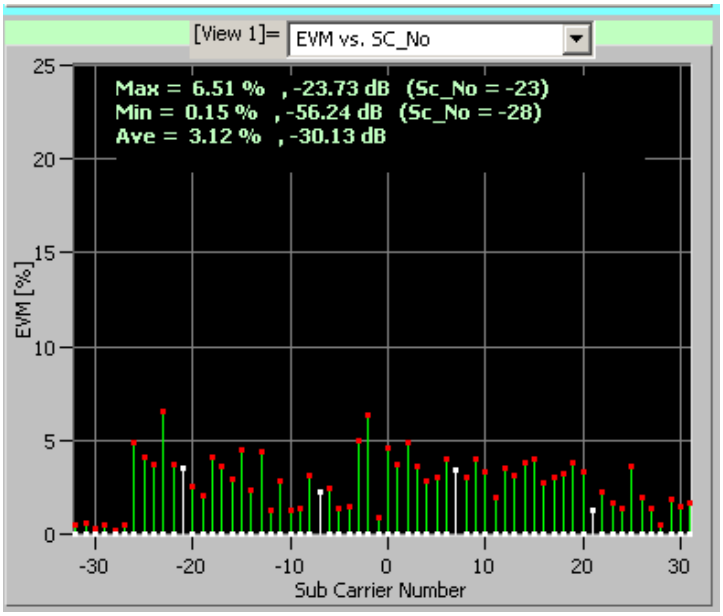


Figure 3-11: EVM vs. SC_No display

The following table lists the setup parameters for this view format.

Standard	Parameter	Description
IEEE802.11a	Symbol or Segment #	Specifies or changes the symbol number for the currently displayed bar graph.

Table 3-10 shows the initial measurement items. The measurement results are recalculated.

Table 3-10: EVM vs. SC_No measurements

Readout	Description
Max	Displays the maximum value of EVM.
Min	Displays the minimum value of EVM.
Ave	Displays the average value of EVM.

Table 3-11 lists the allowed relative constellation error versus data rate.

Table 3-11: EVM allowable value for IEEE802.11a

Data rate [Mb/s]	Allowable EVM [dB]
6	-5
9	-8
12	-10
18	-13
24	-16
36	-19
48	-22
54	-25

EVM vs. Time

This display shows the EVM of carriers by the segment in a bar graph, as shown in Figure 3-12. The vertical axis represents EVM [%], and the horizontal axis represents time [ms].

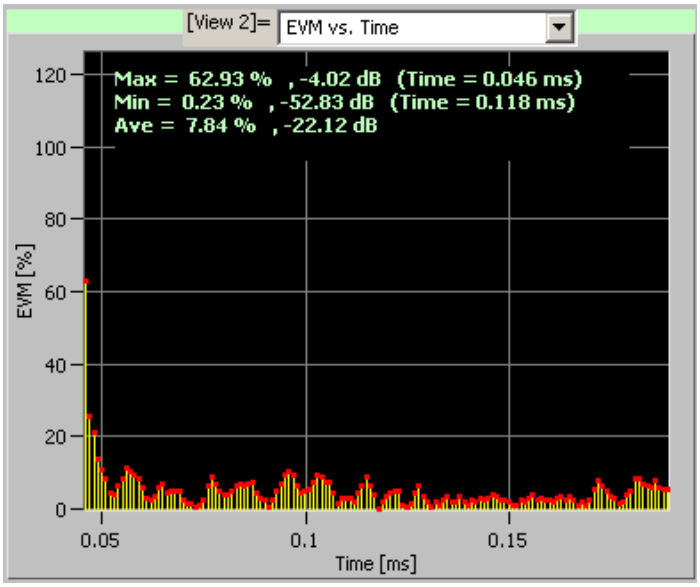


Figure 3-12: EVM vs. Time display

The following table shows the setup parameter for this view format.

Standard	Parameter	Description
IEEE802.11b	Symbol or Segment #	Specifies or changes the segment number for the currently displayed bar graph.

The following list shows the initial measurement items.

Readout	Description
Max	Displays the maximum value of magnitude EVM.
Min	Displays the minimum value of magnitude EVM.
Ave	Displays the average value of magnitude EVM.

Average MagErr vs Time

This display shows the magnitude error of carriers, or one or all subcarriers in a line graph, as shown in Figure 3-13. The vertical axis represents magnitude error [%], and the horizontal axis represents time [ms].

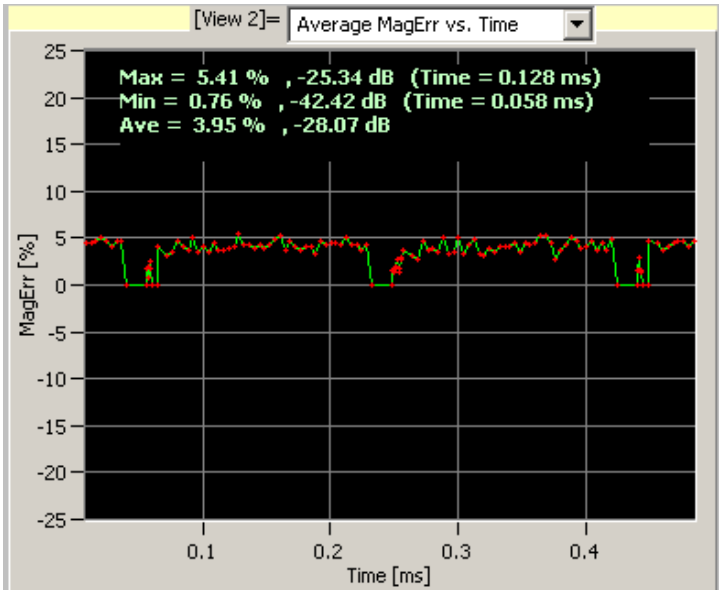


Figure 3-13: Average MagErr vs. Time

Table 3-12 lists the setup parameters for this view format.

Table 3-12: Average MagErr vs. Time setup parameters

Standard	Parameter	Description
IEEE802.11a/g	Select Subcarrier	Specify the data format. Available options are All Data, All Pilot, All, and Single Subcarrier.
	Subcarrier #	Sets the subcarrier number when Single Subcarrier is selected for Select Subcarrier (-26 to 26).
IEEE802.11b	Select Subcarrier	These parameters are not available.
	Subcarrier #	

Table 3-13 shows the initial measurement items. The measurement results are recalculated.

Table 3-13: Average MagErr vs. Time measurements

Readout	Description
Max	Displays the maximum value of magnitude error.
Min	Displays the minimum value of magnitude error.
Ave	Displays the average value of magnitude error.

MagErr Analysis Display

This analysis display is the same as one of the following view formats depending on the modulation signal. If you select MagErr Analysis Display, the displayed graph automatically toggles depending on the modulation format.

- If the displayed data is OFDM, refer to *MagErr vs. SC_No* 3-18.
- If the displayed data is DSSS, refer to *MagErr vs. Time* on page 3-19.

MagErr vs. SC_No

This display shows the magnitude error of each OFDM symbol in a bar graph, as shown in Figure 3-14. The vertical axis represents magnitude error [%], and the horizontal axis represents the subcarrier wave number (-26 to +26).

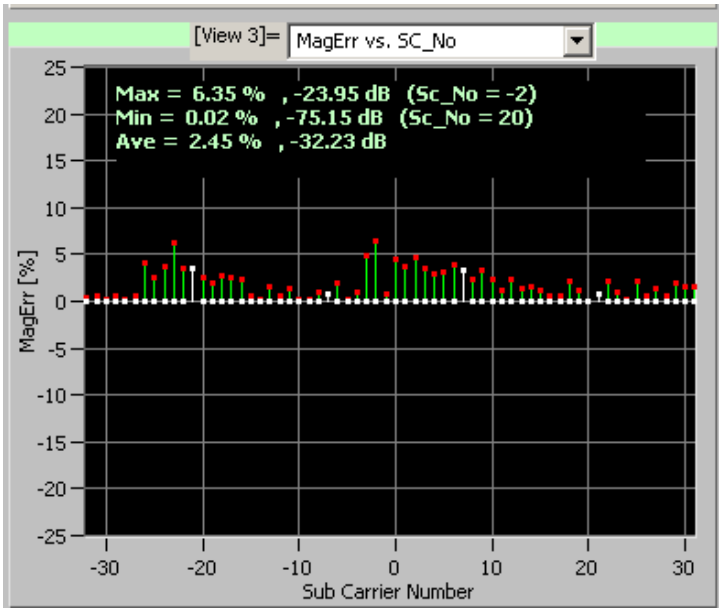


Figure 3-14: MagErr vs. SC_No display

The following table lists the setup parameters for this view format.

Standard	Parameter	Description
IEEE802.11a	Symbol or Segment #	Specifies or changes the symbol number for the currently displayed bar graph.

The following table shows the initial measurement items. The measurement results are recalculated for each symbol.

Readout	Description
Max	Displays the maximum value of magnitude error.
Min	Displays the minimum value of magnitude error.
Ave	Displays the average value of magnitude error.

MagErr vs. Time

This display shows the magnitude error of carriers by the segment in a bar graph, as shown in Figure 3-15. The vertical axis represents magnitude error [%], and the horizontal axis represents time [ms].

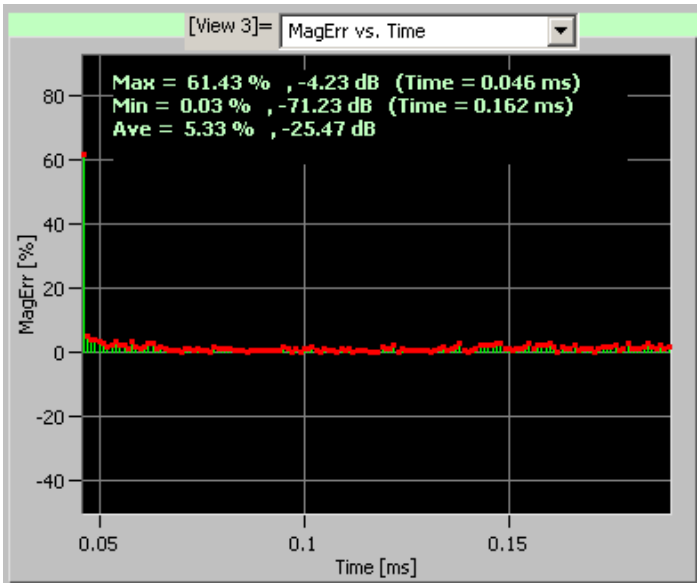


Figure 3-15: MagErr vs. Time

The following table shows the setup parameter for this view format.

Standard	Parameter	Description
IEEE802.11b	Symbol or Segment #	Specifies or changes the segment number for the currently displayed bar graph.

The following list shows the initial measurement items.

Readout	Description
Max	Displays the maximum value of magnitude error.
Min	Displays the minimum value of magnitude error.
Ave	Displays the average value of magnitude error.

Average PhaseErr vs Time

This display shows the Phase Error of carriers, or one or all subcarriers in a line graph, as shown in Figure 3-16. The vertical axis represents phase error [Degree], and the horizontal axis represents time [ms].

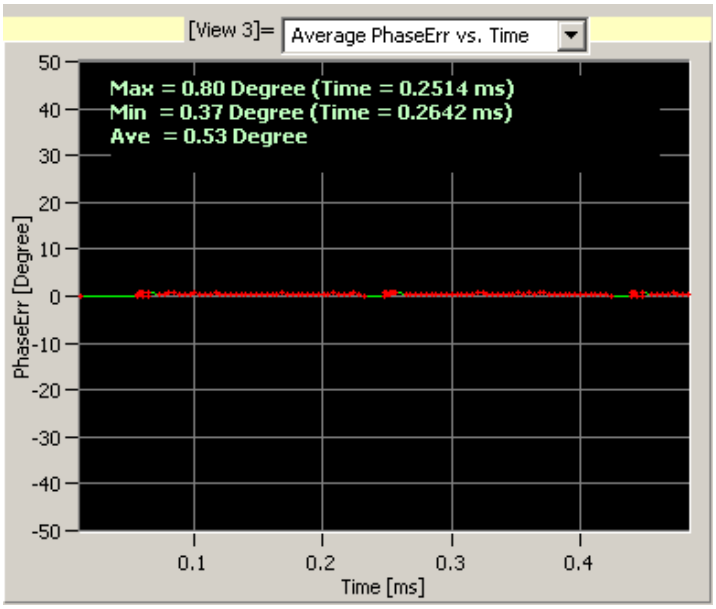


Figure 3-16: Average PhaseErr vs. Time display

Table 3-14 lists the setup parameters for this view format.

Table 3-14: Average PhaseErr vs. Time setup parameters

Standard	Parameter	Description
IEEE802.11a/g	Select Subcarrier	Specify the data format. Available options are All Data, All Pilot, All, and Single Subcarrier.
	Subcarrier #	Sets the subcarrier number when Single Subcarrier is selected for Select Subcarrier (-26 to 26).
IEEE802.11b	Select Subcarrier	These parameters are not available.
	Subcarrier #	

Table 3-15 shows the initial measurement items. The measurement results are recalculated.

Table 3-15: Average PhaseErr vs. Time measurements

Readout	Description
Max	Displays the maximum value of phase error.
Min	Displays the minimum value of phase error.
Ave	Displays the average value of phase error.

PhaseErr Analysis Display

This analysis display is the same as the following view format depending on the modulation signal. If you select PhaseErr Analysis Display, the displayed graph automatically toggles depending on the modulation format.

- If the displayed data is OFDM, refer to *PhaseErr vs. SC_No* on page 3-22.
- If the displayed data is DSSS, refer to *PhaseErr vs. Time* on page 3-23.

PhaseErr vs SC_No

This display shows the Phase Error of each OFDM symbol in a line graph, as shown in Figure 3-17. The vertical axis represents phase error [Degree], and the horizontal axis represents the subcarrier wave number (-26 to +26).

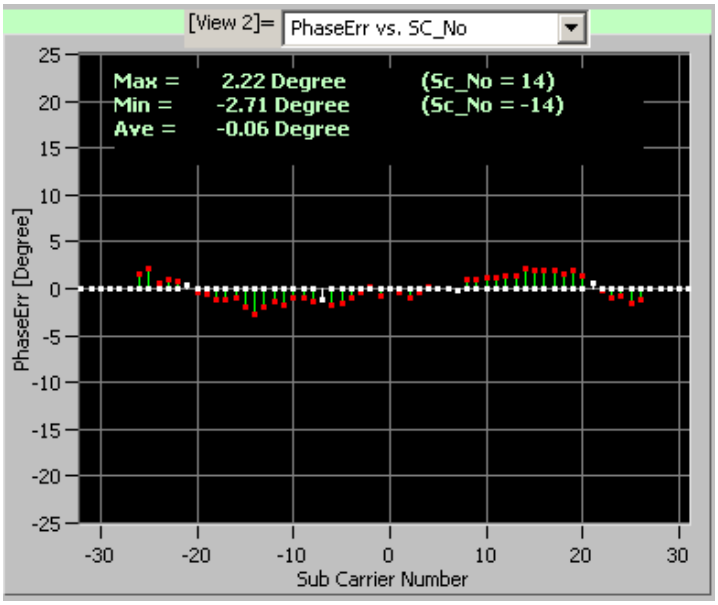


Figure 3-17: PhaseErr vs. SC_No display

The following list shows the setup parameter for this view format.

Standard	Parameter	Description
IEEE802.11a	Symbol or Segment #	Specifies or changes the symbol number for the currently displayed bar graph.

The following list shows the initial measurement items. The measurement results are recalculated for each symbol.

Readout	Description
Max	Displays the maximum value of phase error.
Min	Displays the minimum value of phase error.
Ave	Displays the average value of phase error.

PhaseErr vs Time

This display shows Phase Error of carriers by the segment in a bar graph, as shown in Figure 3-18. The vertical axis represents phase error [Degree], and the horizontal axis represents time [ms].

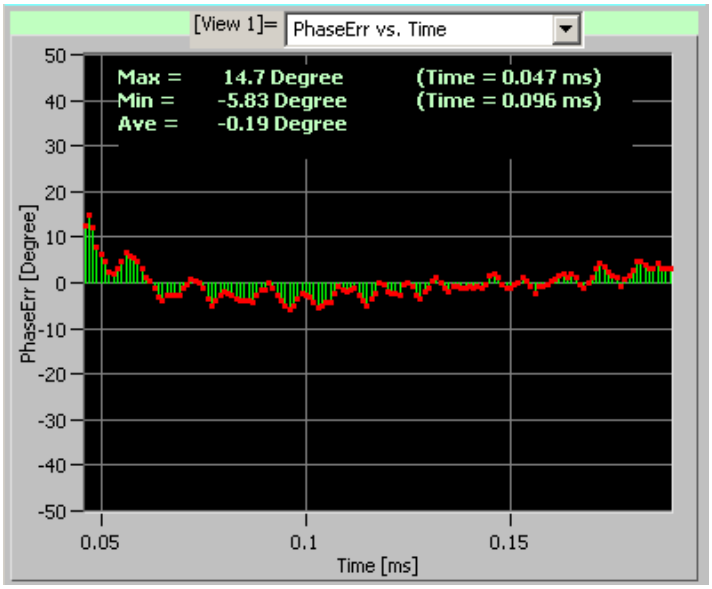


Figure 3-18: PhaseErr vs. Time display

The following table shows the setup parameter for this view format.

Standard	Parameter	Description
IEEE802.11b	Symbol or Segment #	Specifies or changes the segment number for the currently displayed bar graph.

The following list shows the initial measurement items.

Readout	Description
Max	Displays the maximum value of phase error.
Min	Displays the minimum value of phase error.
Ave	Displays the average value of phase error.

Center Frequency Error

This display shows the center frequency error versus time in a line graph, as shown in Figure 3-19. The vertical axis represents frequency error [kHz], and the horizontal axis represents time [ms].

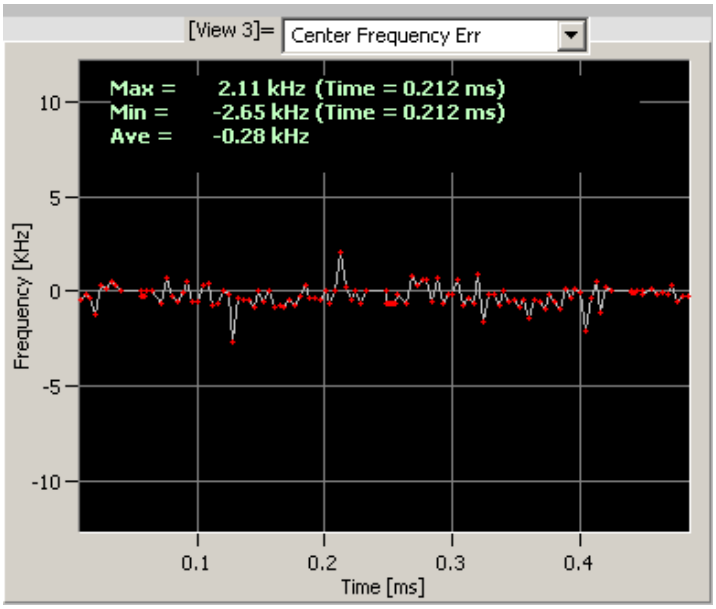


Figure 3-19: Center frequency error display

Table 3-16 shows the initial measurement items.

Table 3-16: Center frequency error measurements

Readout	Description
Max	Displays the maximum frequency error and its time.
Min	Displays the minimum frequency error and its time.
Ave	Displays the average frequency error.

OFDM Linearity

This display shows the linearity of OFDM modulation in a line graph, as shown in Figure 3-20, where the vertical axis represents actual measurement values [mW], and the horizontal axis represents the ideal values [mW].

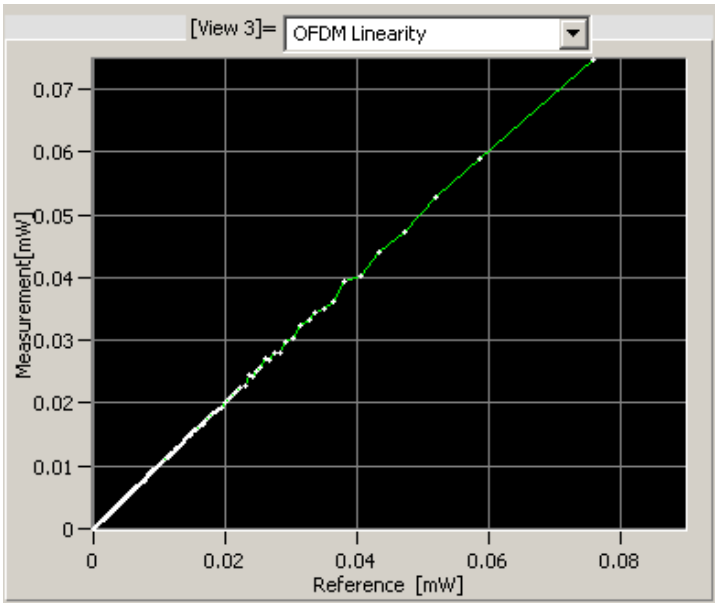


Figure 3-20: OFDM Linearity display

This view does not display the measurement readouts.

Symbol Table

This display shows the symbol tables, as shown in Figure 3-21 and Figure 3-22. The tables can be displayed with hexadecimal digits (Hex) or binary (Bin).

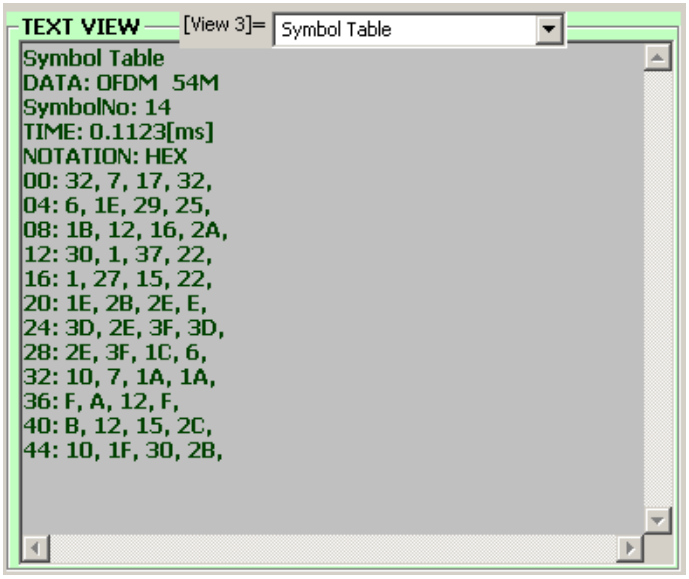


Figure 3-21: Symbol table (Hex)

.

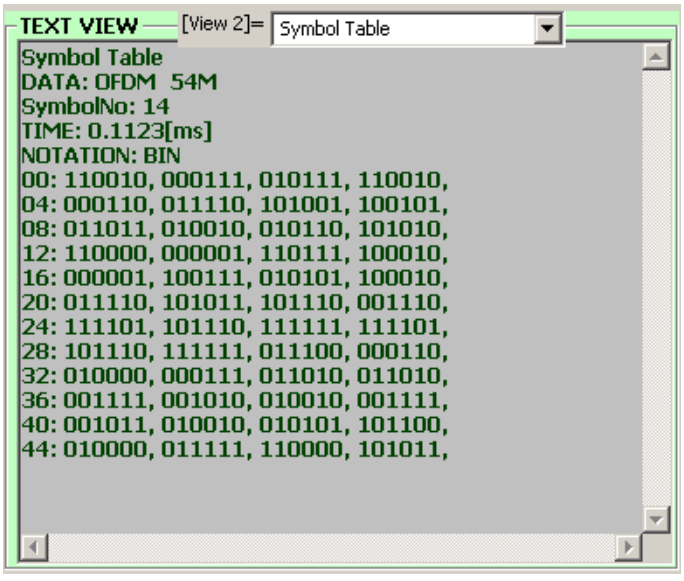


Figure 3-22: Symbol table (Bin)

File (F) Menu. If you want to save the symbol table in text format, select **File** from the Menu bar, and then select **Save SymbolTable**. You can select the format (Hex or Bin) in the displayed dialog box.

Table 3-17 lists the setup parameters for this view format.

Table 3-17: Symbol Table parameter

Standard	Parameter	Description
IEEE802.11a/b/g	Symbol or Segment #	Specifies or changes the symbol number for the currently displayed table.

Table 3-18 lists the setup parameters from the Menu bar. You can also use the pop-up View menus on each View screen, as shown in Figure 3-8 on page 3-10.

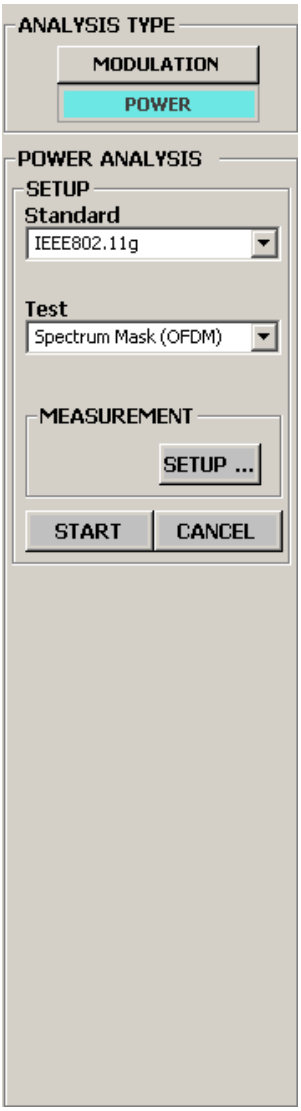
Table 3-18: Menu bar setup parameters for Symbol Table

Main/Sub menu	Option		Description
View/Main	Symbol Table	Hex	Displays symbol table values as hexadecimal.
		Bin	Displays symbol table values as bin.
File	SaveSymbolTable		Saves the symbol table as a text file.

Power Analysis

The power analysis consists of Spectrum Mask, Transmit Power On, and Transmit Power Off.

Power Analysis Test Procedure



Do the following steps to perform the power measurement:

1. Confirm that **POWER** is selected as the ANALYSIS TYPE.

   The power analysis setting window becomes active.

2. Use the SETUP menu to set the following parameters:

   a. Specify the standard you want to test from the **Standard** pull-down list.

   b. Select the test item from the **Test** pull-down list.

3. Click the **SETUP...** button in the MEASUREMENT field to open the Read From WCA dialog box.

   Use the Read From WCA dialog box to set the parameters as necessary.

4. Click the **START** button to start the analysis.

   Click the **CANCEL** button if you want to cancel the analysis.

Power Analysis View Formats

This subsection describes each view format for the power analysis.

Spectrum Mask (OFDM)

This display shows the spectrum waveform and mask in a line graph under PeakHold condition, as shown in Figure 3-23. The vertical axis represents power [dBm], and the horizontal axis represents frequency [Hz].

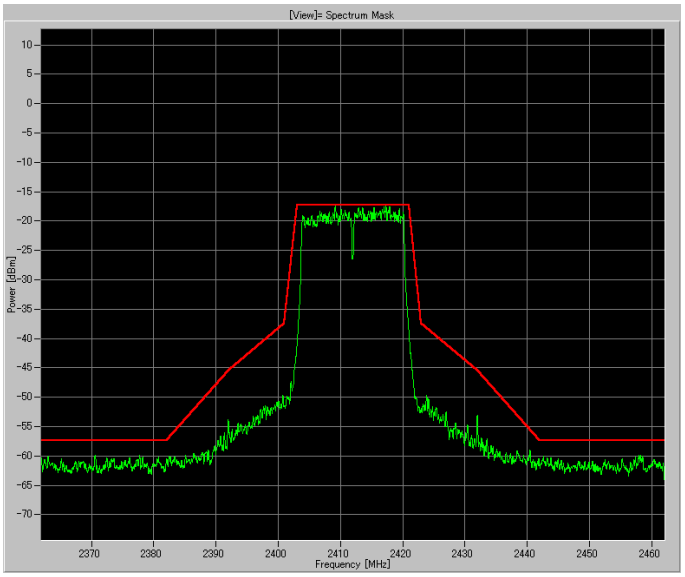


Figure 3-23: Spectrum mask (OFDM)

Verify that the measurement results (line graph) fall within the threshold level. This view does not display the measurement readouts.

Figure 3-24 shows the IEEE802.11a standard for Spectrum Mask.

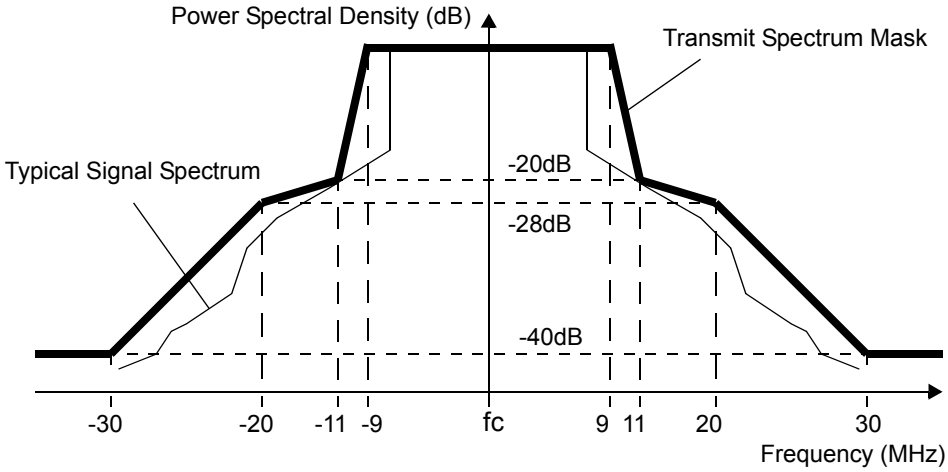


Figure 3-24: IEEE802.11a spectrum mask

Spectrum Mask (DSSS)

This display shows the spectrum waveform and mask in a line graph under PeakHold condition, as shown in Figure 3-25. The vertical axis represents power [dBm], and the horizontal axis represents frequency [Hz].

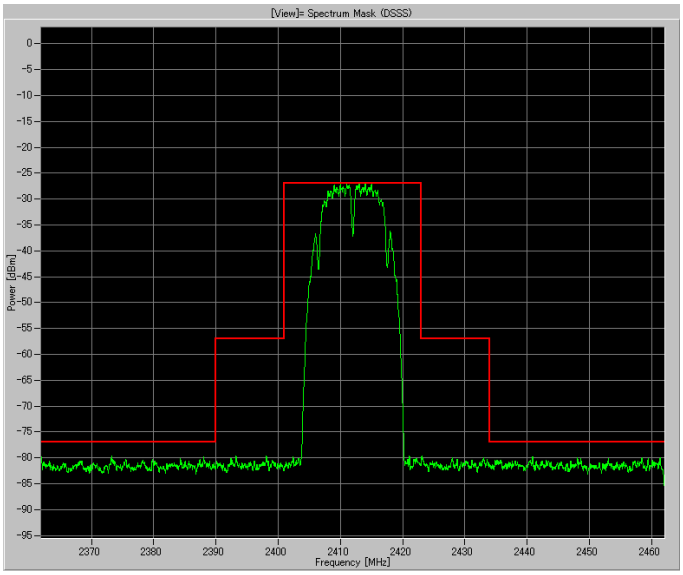


Figure 3-25: Spectrum mask (DSSS)

Verify that the measurement results (line graph) fall within the threshold level. This view does not display the measurement readouts.

Figure 3-26 shows the IEEE802.11b standard for Spectrum Mask.

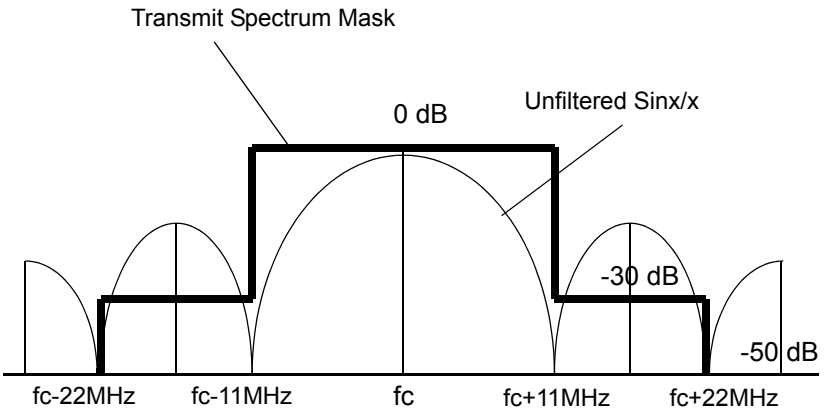


Figure 3-26: IEEE802.11b spectrum mask

Transmit Power On

This display shows the transmit power on ramp in a line graph. The vertical axis represents power [W], and the horizontal axis represents time [s].

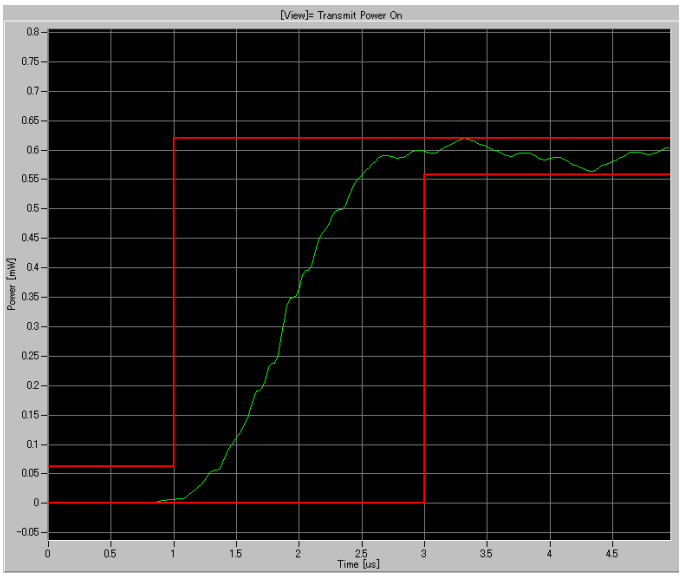


Figure 3-27: Transmit Power On display

Verify that the measurement results (line graph) fall within the threshold level. This view does not display the measurement readouts.

Figure 3-28 shows the IEEE802.11b standard for the transmit power-on ramp.

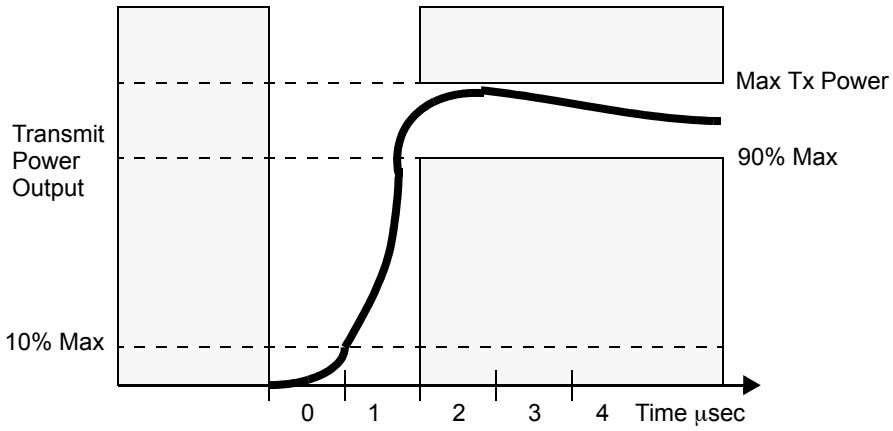


Figure 3-28: IEEE802.11b Transmit power-on ramp

Transmit Power Off

This display shows the transmit power down ramp in a line graph. The vertical axis represents power [W], and the horizontal axis represents time [s].

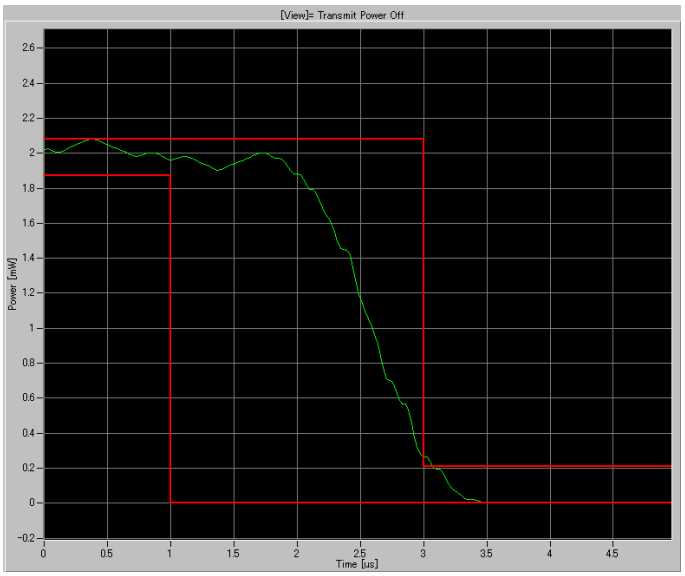


Figure 3-29: Transmit Power Off display

Verify that the measurement results (line graph) fall within the threshold level. This view does not display the measurement readouts.

Figure 3-30 shows the IEEE802.11b standard for the transmit power-down ramp.

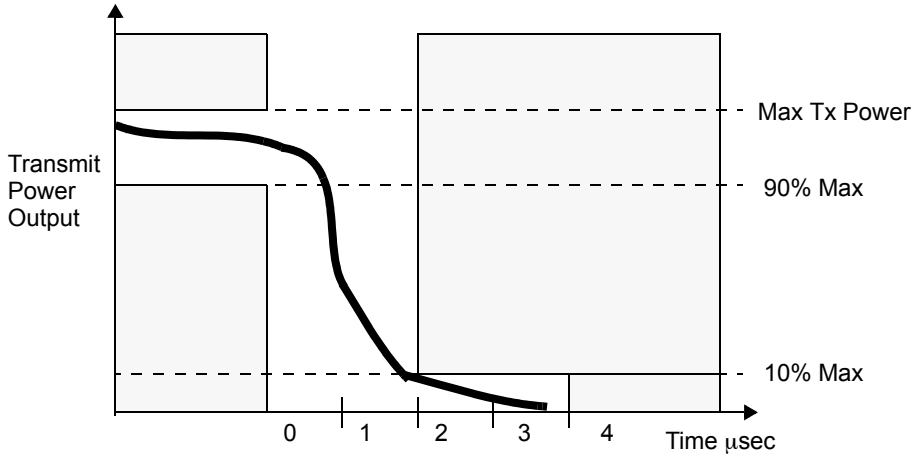


Figure 3-30: IEEE802.11b Transmit power-down ramp

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