Wi-Fi Power Analyzer

manual version 2.2

Contents

Wi-Fi Power Analyzer HARDWARE OPERATION..... 2

GETTING STARTED..... 2
LED STATUS INDICATORS..... 3
CONNECTION AND USE..... 3
BATTERY REPLACEMENT..... 3
STARTUP SCREEN/UNIT DATA..... 4
MAIN MENU SCREEN..... 4
802.11b/802.11a SUB-MENUS..... 4
SCAN BOTH BANDS..... 5
SCAN BAND..... 5
CHANNEL POWER..... 6
POWER PROFILE..... 6
SELECT CHANNEL..... 7
ADJUST CONTRAST..... 7
CABLE LOSS..... 7

Wi-Fi Power Analyzer OPTIONAL SOFTWARE OPERATION..... 8
PC SOFTWARE INSTALLATION
SCREEN COMPONENTS
PLAY, RECORD and MISCELLANEOUS CONTROLS
RECORDING Wi-Fi Power Analyzer MEASUREMENT DATA
PLAYBACK OF RECORDED Wi-Fi Power Analyzer DATA DISK FILES
SPECIAL REPLAY SWITCHES
TROUBLE SHOOTING

BATTERY TIPS..... 27
NETWORKING BASICS..... 28
GLOSSARY OF ACRONYMS..... 30
GENERAL SAFETY..... 31
ACCCESS POINT CONNECTOR GUIDE..... 33
Wi-Fi Power Analyzer DATA SHEET

Wi-Fi Power Analyzer™ is an instrument used to identify the frequency of an 802.11a,b or g Access Point (AP) or Network Interface Card (NIC). In addition, measurements can be used to verify the power output and the frequency vs. power spectrum of the AP or NIC under test.

Wi-Fi Power Analyzer is powered by 4 AA Ni-MH batteries for portability or via an external AC power supply. Data is displayed on a built in back-lit LCD display. The unit is controlled via a simple 4 button keypad that is used to navigate through the simple menus and to select measurements. The Wi-Fi Power Analyzer is connected directly to the AP or NIC under test using the supplied antenna connection kit.

Measurements can be displayed either as a graph or in large, easy to read text.

GETTING STARTED

Wi-Fi Power Analyzer is powered by 4 rechargeable Ni-MH cells and comes with 4 extra cells and a Ni-MH charger. Replacement AA cells must have at least 1500 mAh per cell. Ni-MH cells are recommended for best performance from your Wi-Fi Power Analyzer. See the charger's instructions and battery tips in this manual for more information. Wi-Fi Power Analyzer may also be powered with it's supplied DC transformer for locations near an AC power outlet.

Wi-Fi Power Analyzer's display is a 128 x 64 blue, backlit LCD capable of adjustable contrast.

Wi-Fi Power Analyzer connects to access points through it's SMA male connector. An adapter kit is included to ensure compatibility with many access points.

Wi-Fi Power Analyzer is powered on and off through its green rocker switch.

Wi-Fi Power Analyzer operation is all done through the 4-button keypad. The top and bottom buttons scroll through menu options and set threshold levels. The left button selects the highlighted menu option. The right button returns to the previous screen.

At the top of the Wi-Fi Power Analyzer rest the power switch and antenna connector. The power switch is a simple two way toggle switch. The antenna connector (middle) is an SMA Female 50 ohm. The provided antenna easily screws and unscrews from this connector. Be sure to unscrew antenna when transporting the Wi-Fi Power Analyzer.

LED STATUS INDICATORS

Power LED indicates when the unit is ON.

Measurement LED indicates when measuring (Bar or Line graph screen). LED is OFF when in Select Screen

Low Battery indicates when the batteries need a charge or replacement.

CONNECTION AND USE

Connect the AP to be tested using the supplied SMA connection kit to the Wi-Fi Power Analyzer RF input connector, the SMA connector on the top of the Wi-Fi Power Analyzer. Make sure both the AP and the Wi-Fi Power Analyzer are on If not already displayed, select either the bar or line graph measurement. If the current RF power indicated by the text display in the lower left of the display is –40 dbm and never changes, check the connection between the AP and Wi-Fi Power Analyzer. If RF power is indicated by this portion of the display, but no bar or line is displayed, reduce the threshold using the Down key until the display becomes active.

BATTERY REPLACEMENT

When the battery low indicator comes on, the batteries must be replaced or recharged. To remove the batteries, disconnect the Wi-Fi Power Analyzer RF input and turn the power switch to the off position. Hold the Wi-Fi Power Analyzer with the bottom facing you, the SMA RF input facing upward. Locate the tab on the battery cover and using your finger, gently pull the tab toward

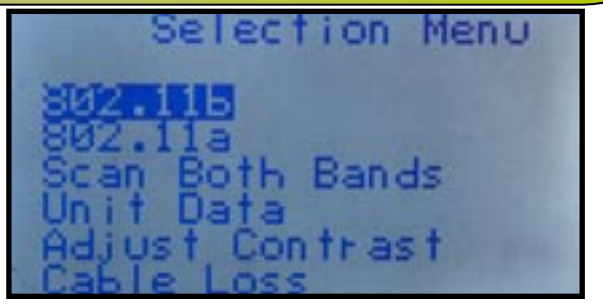
the bottom of the unit until the cover comes away from the unit. Remove the batteries and replace, observing the battery polarities marked on the plastic of the battery compartment. Replace the battery cover by positioning the tab on the bottom of the cover into the slot in the bottom of the battery compartment. Push on the cover until the tab on the top clicks back into position. The unit is now ready to resume use.

STARTUP SCREEN / UNIT DATA

When the user powers up the Wi-Fi Power Analyzer, this screen will appear briefly. The STARTUP SCREEN is followed by the MAIN MENU. This screen can be accessed anytime through the UNIT DATA screen.

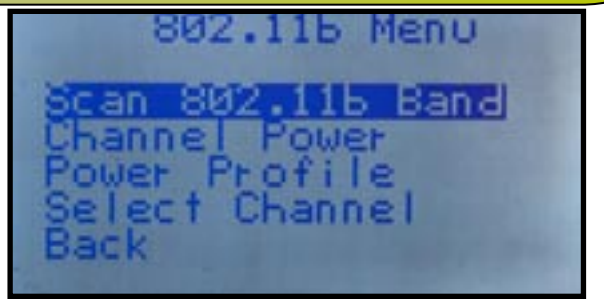
MAIN MENU

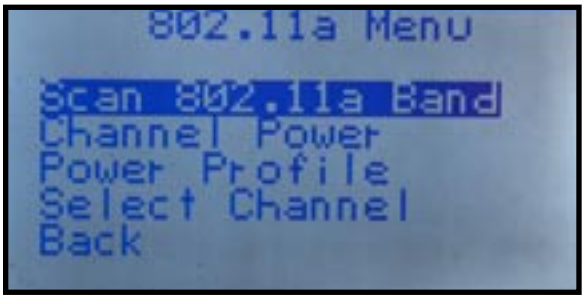
Use this screen to navigate through all of the options. Use the UP/DOWN ARROWs to scroll through the menu options. Select the desired option by pressing the LEFT ARROW button. Press the RIGHT ARROW button anytime to go back to the previous screen and return to the MAIN MENU.



802.11b/802.11a SUB-MENUS

Select 802.11b or 802.11a in the MAIN MENU to enter this screen. Use the UP/DOWN ARROWs to scroll through the menu options. Select the desired option by pressing the LEFT ARROW button. Press the RIGHT ARROW button anytime to go back to the previous screen and return to the MAIN MENU.



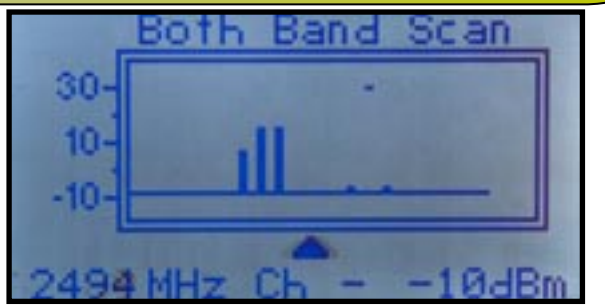


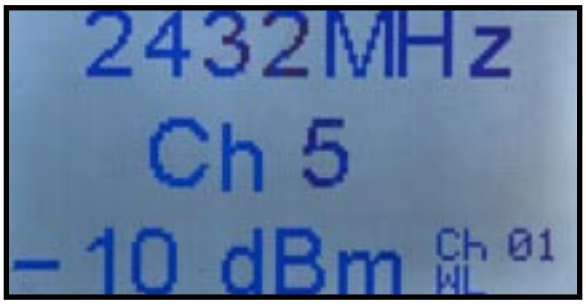
SCAN BOTH BANDS (802.11b and 802.11a)

Selected from the main menu, this measurement scans through all 802.11b and 802.11a channels and displays the resulting dBm vs. channel on an easy to read graph or in large text characters.

Access the text measurement display option anytime by pressing the LEFT ARROW button. Press the same button again to return to the graphical measurement display.

If the type of AP or NIC is unknown, this measurement can be used to identify the RF band. Once the band is identified, the frequency can be found using the Scan Band measurement.





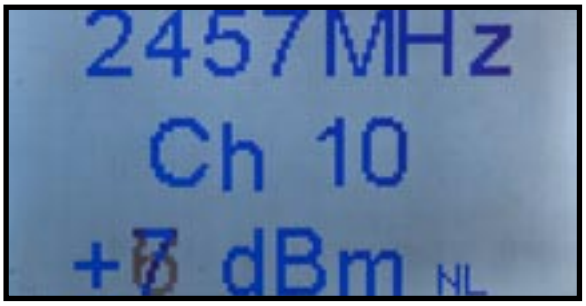
SCAN BAND (802.11b/802.11b)

Use this measurement to identify the frequency of the AP or NIC under test. The result of this measurement is displayed on an easy to read graph. The frequency identified is marked by an arrow and the channel number associated with the frequency is displayed in the upper left of the graph display.

The SCAN BAND measurement for the 2.4 GHz band is selected via the 802.11b menu. SCAN BAND for the 802.11a band is selected using the 802.11a menu.

The channel found by the SCAN BAND measurement is used by the CHANNEL POWER and POWER PROFILE measurements.

Access the text measurement display option anytime by pressing the LEFT ARROW button. Press the same button again to return to the graphical measurement display.

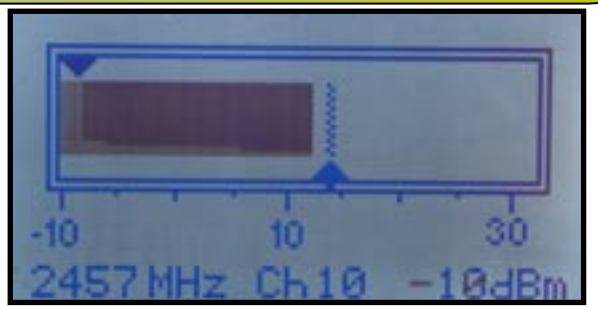


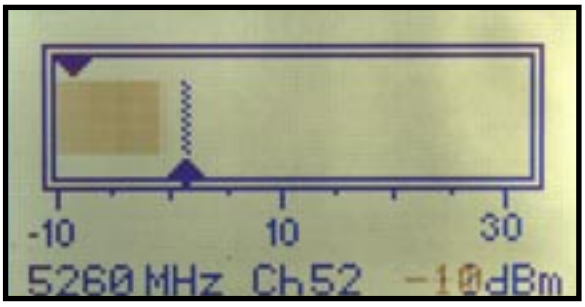
CHANNEL POWER

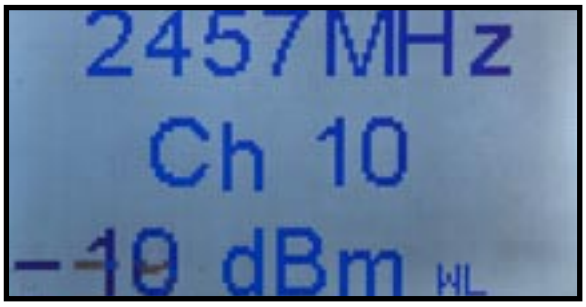
The channel power measurement displays the power of the channel found by SCAN BAND or a channel selected by the operator. Use this measurement to identify an AP or NIC that is not transmitting at the correct power level.

If you know exactly which channel you want, choose SELECT CHANNEL in the sub-menu.

Access the text measurement display option anytime by pressing the LEFT ARROW button. Press the same button again to return to the graphical measurement display.





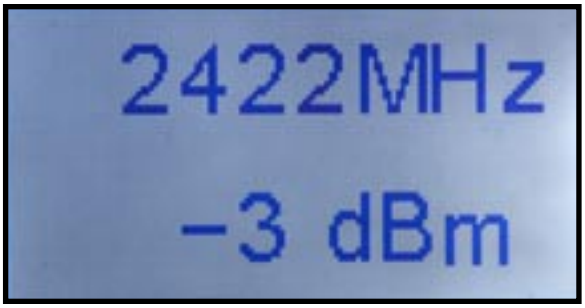


POWER PROFILE

Use the POWER PROFILE measurement to view the shape of the frequency vs. power characteristic of the AP or NIC under test.

As with the CHANNEL POWER measurement, this measurement analyzes the channel found by BAND SCAN or a channel selected by the operator. This measurement is used to identify an AP or NIC with a frequency response (filter) problem.

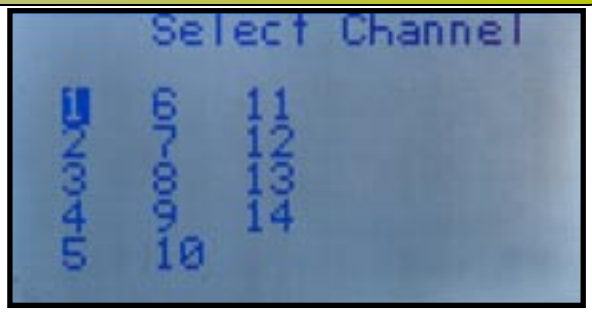
Access the text measurement display option anytime by pressing the LEFT ARROW button. Press the same button again to return to the graphical measurement display.

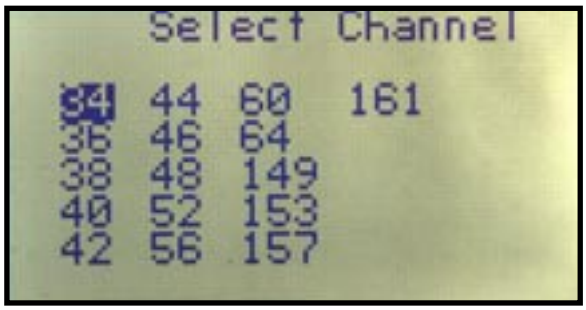


This Power Profile is an example of a poor or "wireless" connection to the measured access point. Basic AP verification can be made by placing the Wi-Fi Power Analyzer closely to the AP's antenna tip but for the most accurate measurements, ALWAYS connect directly to the access point using the supplied SMA connector kit. Be sure all SMA connectors/adapters are tightened completely.

SELECT CHANNEL

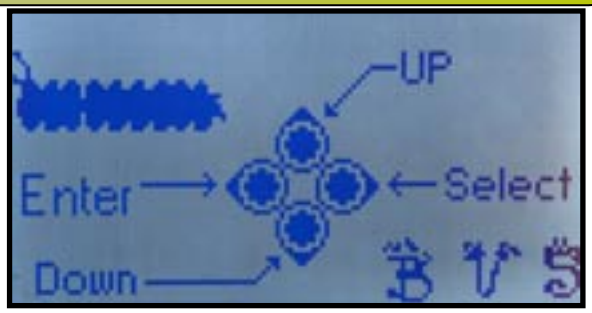
Select this menu screen to directly access the 802.11b or 802.11a channel to be measured. Use the UP/DOWN ARROW keys to scroll to the desired channel.





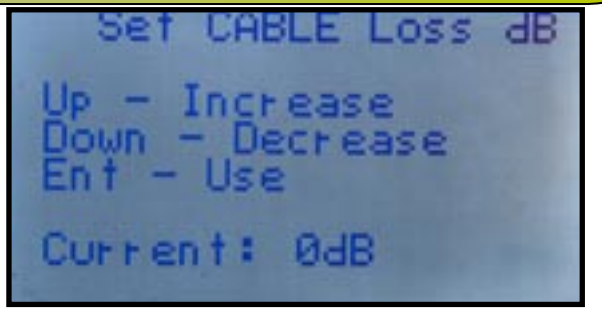
ADJUST CONTRAST

Select this screen to change the contrast adjustment. Use the UP/DOWN ARROWS to change the contrast and the LEFT/RIGHT ARROW buttons to return to the MAIN MENU.



CABLE LOSS

The CABLE LOSS selection can be used to compensate for a known cable loss between 0 and –6 dB. Use the UP and DOWN buttons to select the required cable loss compensation and press the Enter key to use. Entering a value of 0 dB for Cable Loss has no effect on the Wi-Fi Power Analyzer display. This is the shipped factory default value.



Wi-Fi Power Analyzer Manual For v1.20 PC Software (optional)

Software Installation

USB Driver

BEFORE installing the PC software, the USB driver for the Wi-Fi Power Analyzer must be installed. To install the USB driver:

1) Turn OFF the target PC.

2) Connect the supplied USB cable to the Wi-Fi Power Analyzer and turn on the Wi-Fi Power Analyzer. Select and run the "Scan 802.11b Band" measurement. Make sure the free end of the USB cable is NOT plugged into the target PC.

3) Turn on the target PC. When Windows 2000 or Windows XP is done starting up, place the supplied CD into the PC CD drive.

4) Now plug the free end of the USB cable into a USB socket on the target PC. Windows will display the wizard in Figure 1.

Figure 1

5) Click the "No, not this time" radio button.

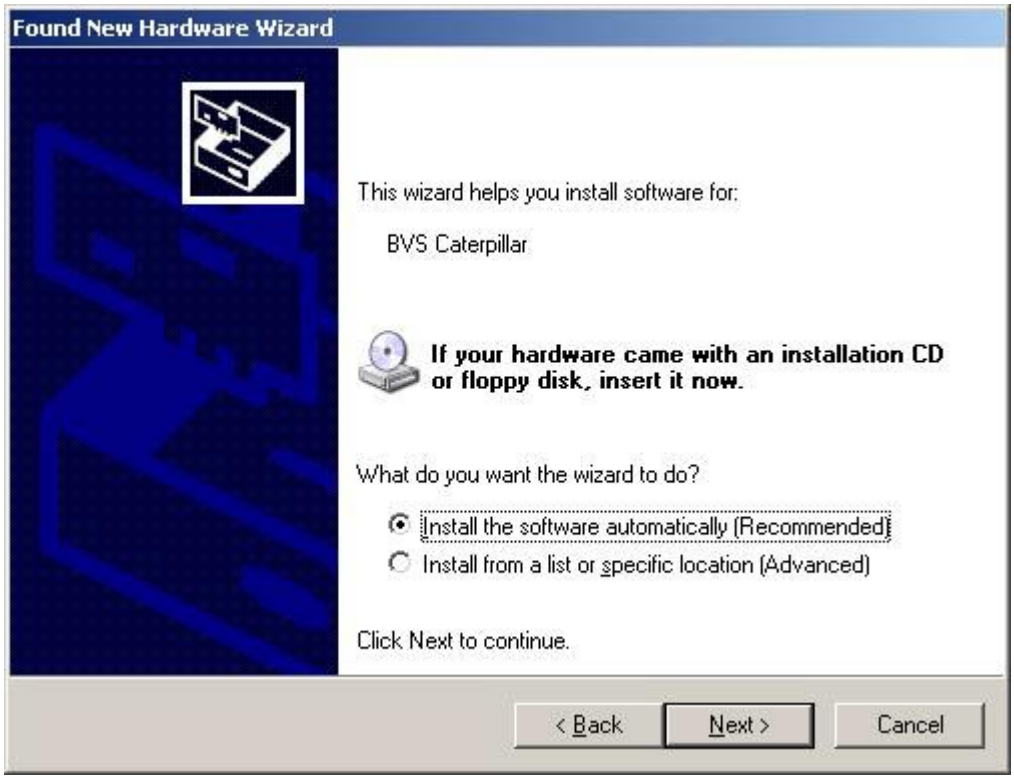


Figure 2

6) Click the "Next>" button on the wizard in figure 2 (make sure the first radio button is on, Recommended).

Figure 3

7) Click the "Continue Anyway" button when the wizard in figure 3 is displayed.

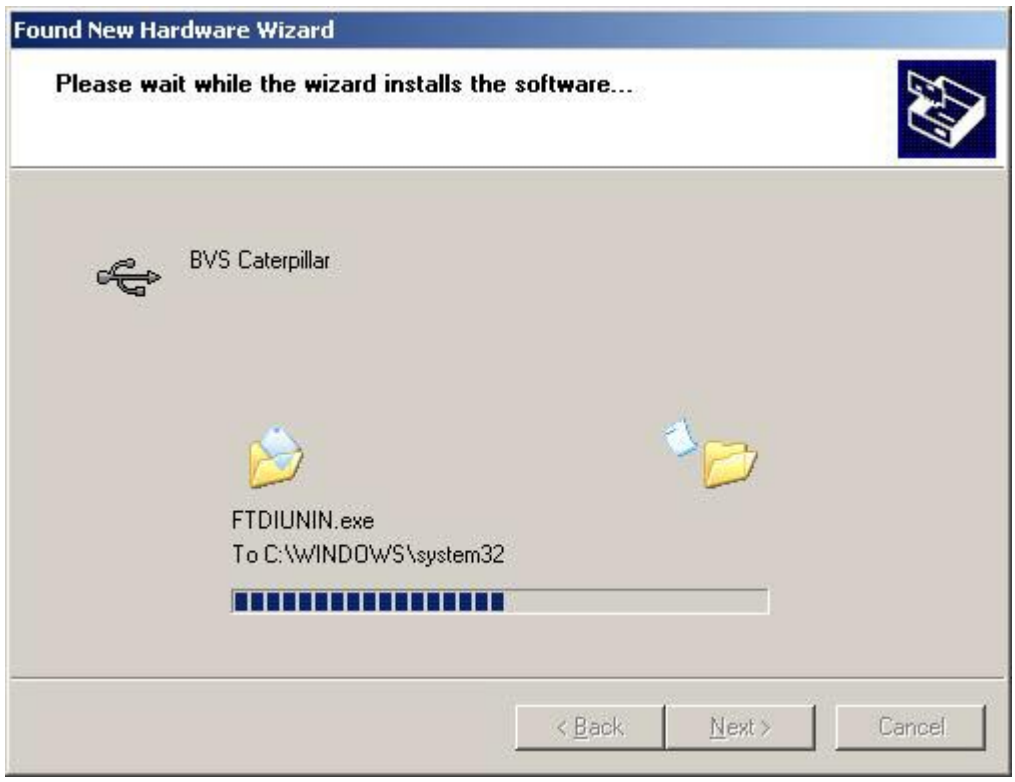


Figure 4

8) The USB driver software will be installed as shown in the wizard in figure 4.

Figure 5

9) When the wizard in figure 5 is displayed, click the “Finish” button.

This completes the USB driver installation. Next, the PC software must be installed.

PC Software

Double click the program Wi-Fi Power AnalyzerSetup.exe on the supplied CD. Click the Next button for the dialogs displayed and then the Finish button. The application will be installed in a folder “BVS” in the Program Files folder unless otherwise specified during installation.

PC SOFTWARE INSTALLATION

Figure 6

Double click the icon in figure 6 on the supplied installation CD. The screen in figure 7 will be displayed.

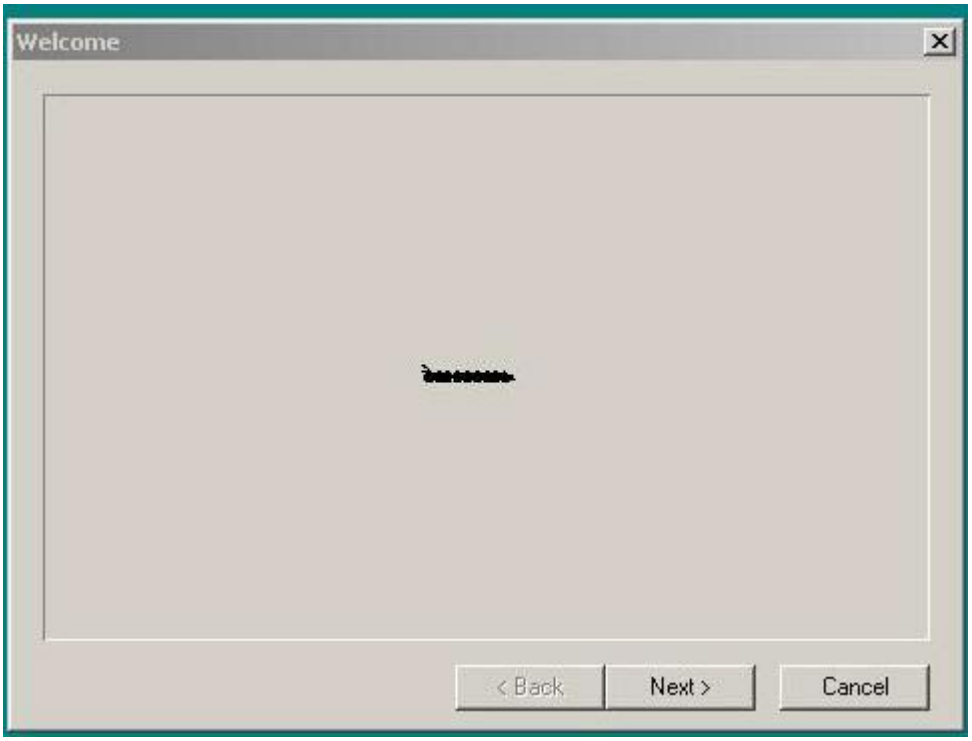


Figure 7

Click the “Next>” button for the screen in figure 8.

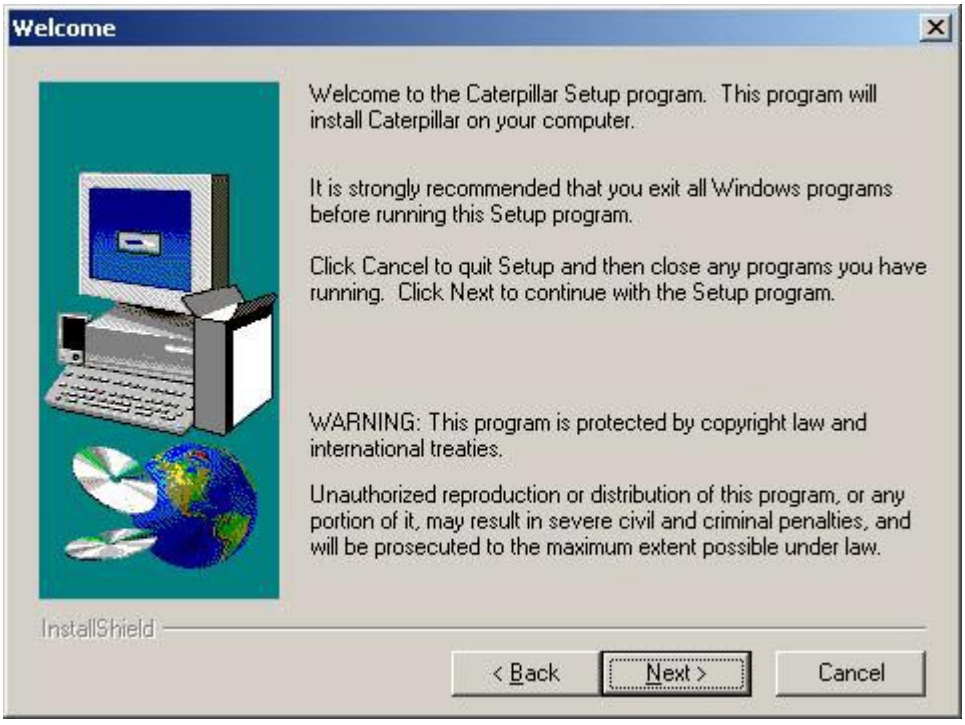


Figure 8

Exit all programs as suggested and click the “Next>” button for figure 9.

Figure 9

Do as requested and click the “Next>” button for figure 10.

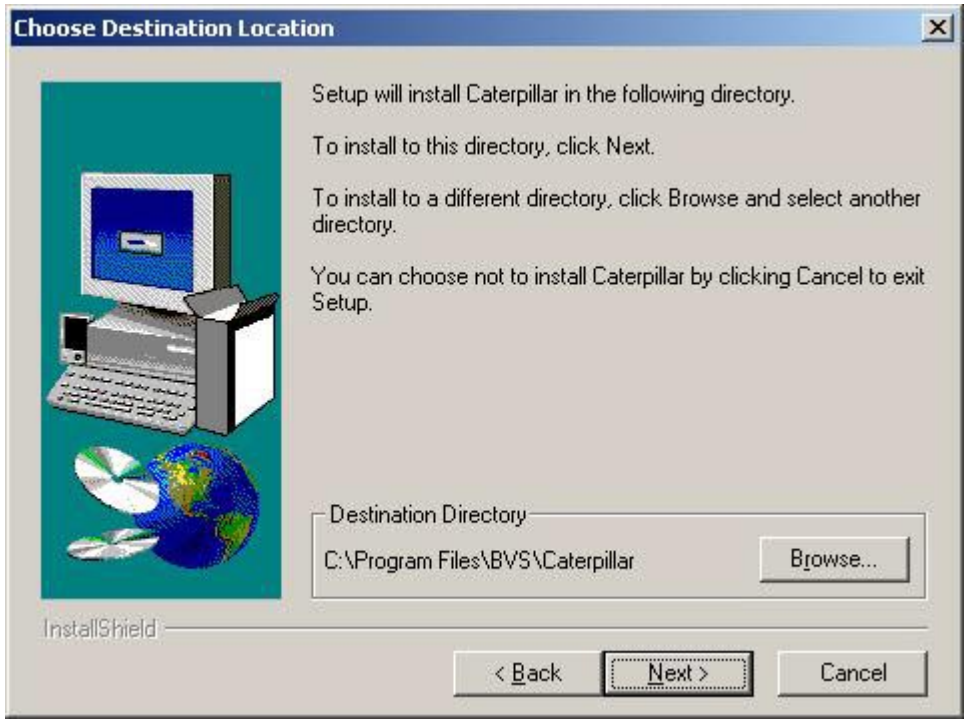


Figure 10

Modify the Destination if desired and click “Next>” for figure 11.

Figure 11

Modify the Program Folder if desired and click “Next>” for figure 12.

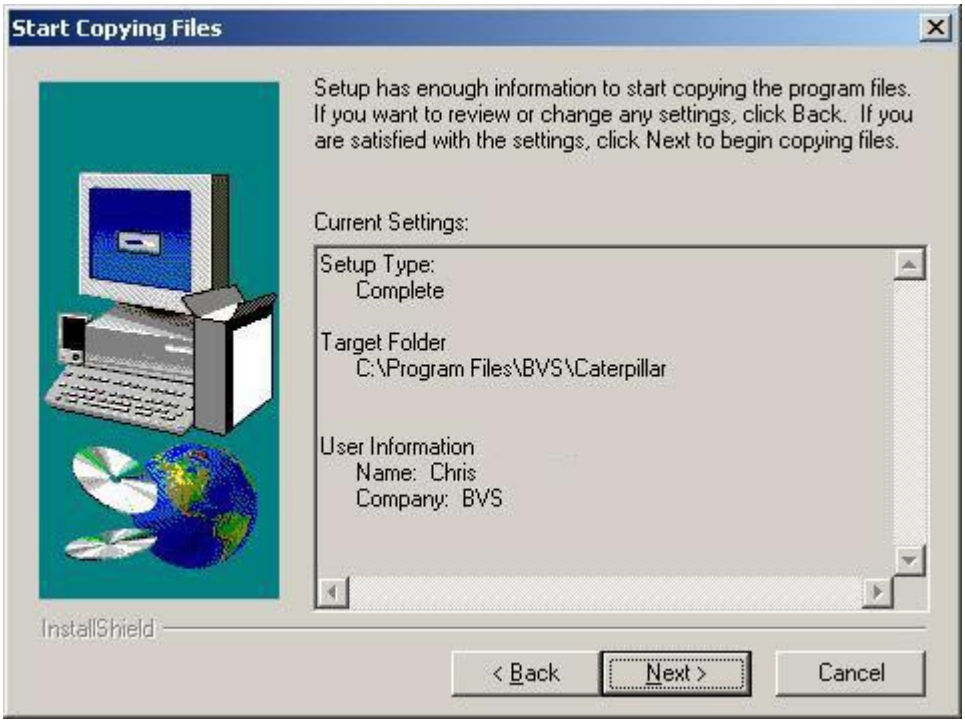


Figure 12

Click "Next>" for figure 13.

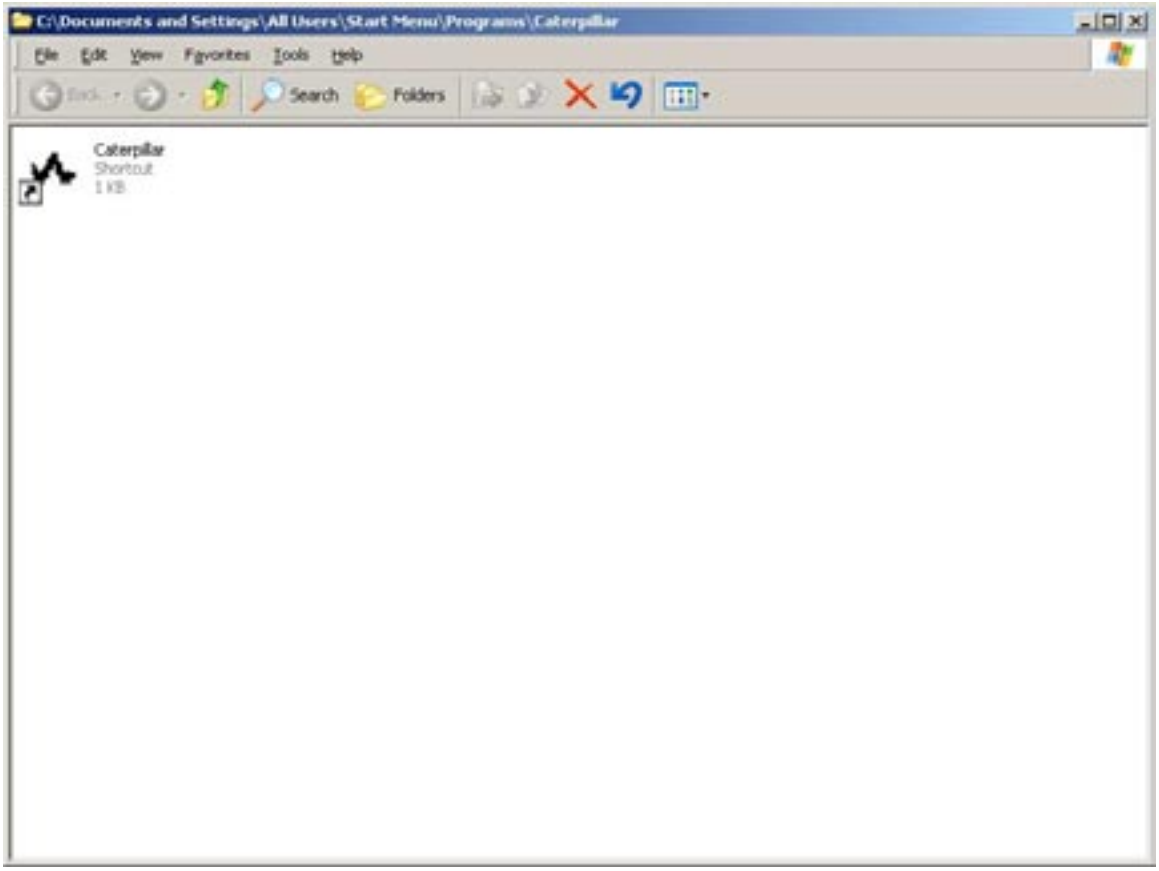


Figure 13

Close the figure 13 screen by clicking the X button. The screen in figure 14 is then displayed.

Figure 14

Click the "Finish"" button. The Wi-Fi Power Analyzer PC software is installed on the target computer and ready for use.

Run the PC application by double clicking the icon in figure 15.

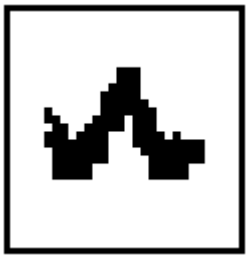


Figure 15

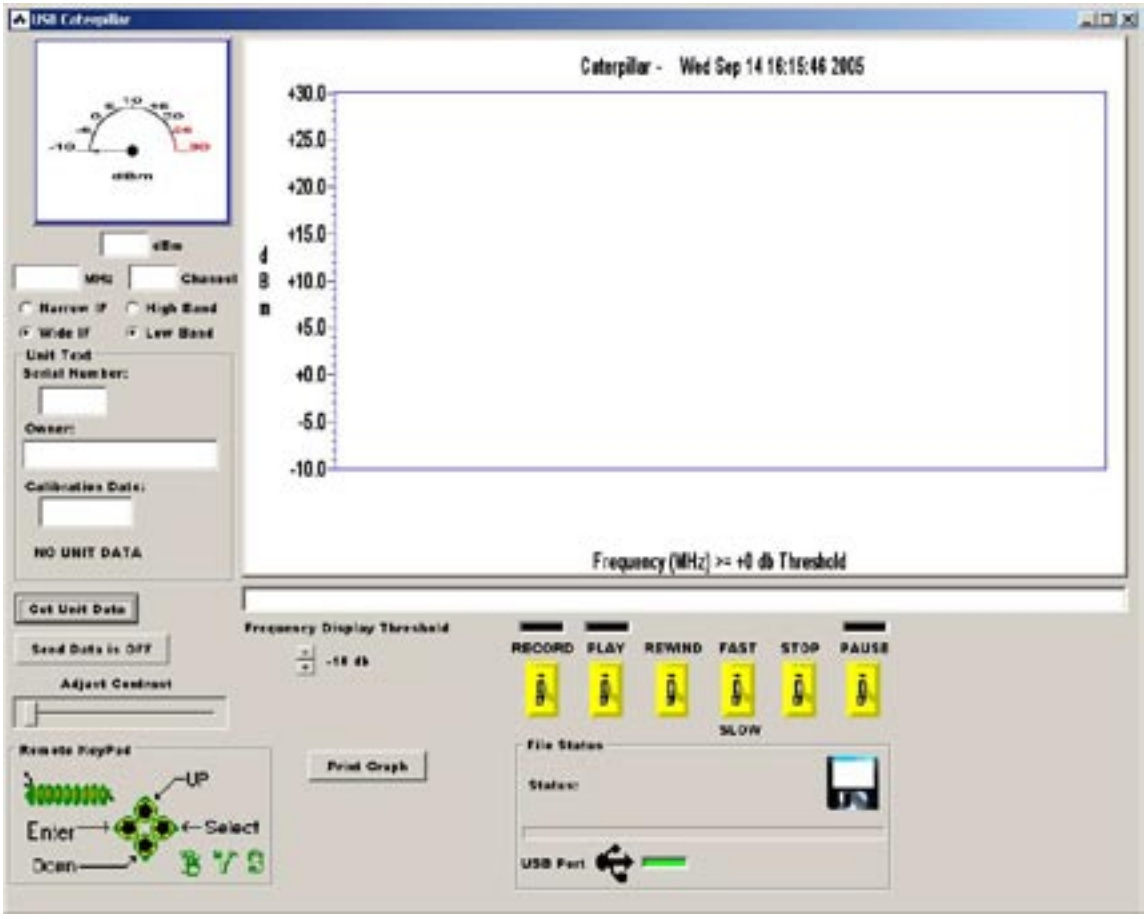


Figure 16

If the screen in Figure 16 is displayed, the Wi-Fi Power Analyzer is connected to the PC via USB (note the Green LED to the right of the USB Port symbol in the File Status Box), but the Wi-Fi Power Analyzer is not sending data (also note that the button above the contrast adjust slide bar indicates "Send Data is OFF". To remedy this situation, click the "Send Data" button and a screen similar to Figure 17 will be displayed:

Full Wi-Fi Power Analyzer PC Screen, No Unit Data

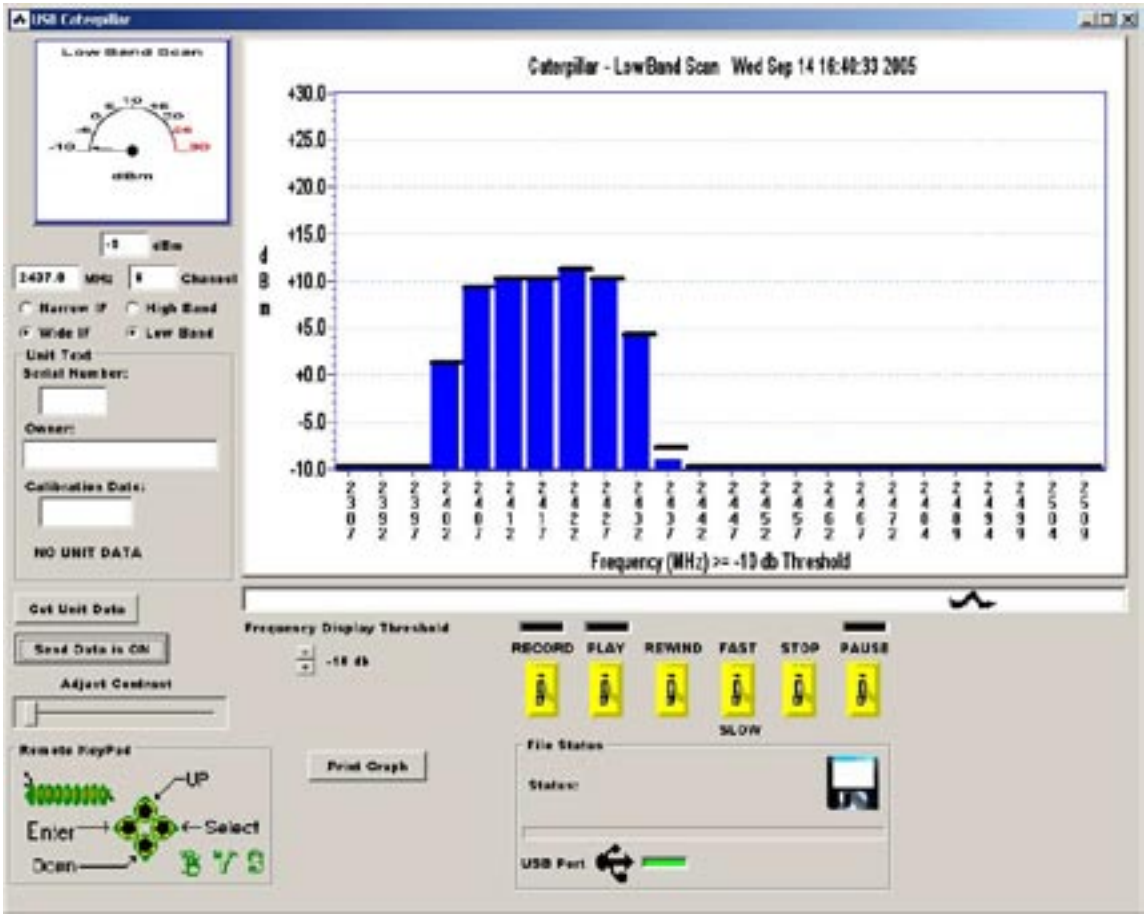


Figure 17

The screen in figure 17 is an example of the Wi-Fi Power Analyzer software display for the selected measurement, Low Band Scan without unit data.

If the response to double clicking the icon in figure 6 is the dialog in figure 18, click the "OK" button and the screen in figure 19 will be displayed. Note the USB LED in the File Status box is OFF indicating that the Wi-Fi Power Analyzer is NOT connected to the PC via USB. Since the driver has been installed successfully, there is some other serious problem. Please refer to the troubleshooting section of this manual.

Figure 18

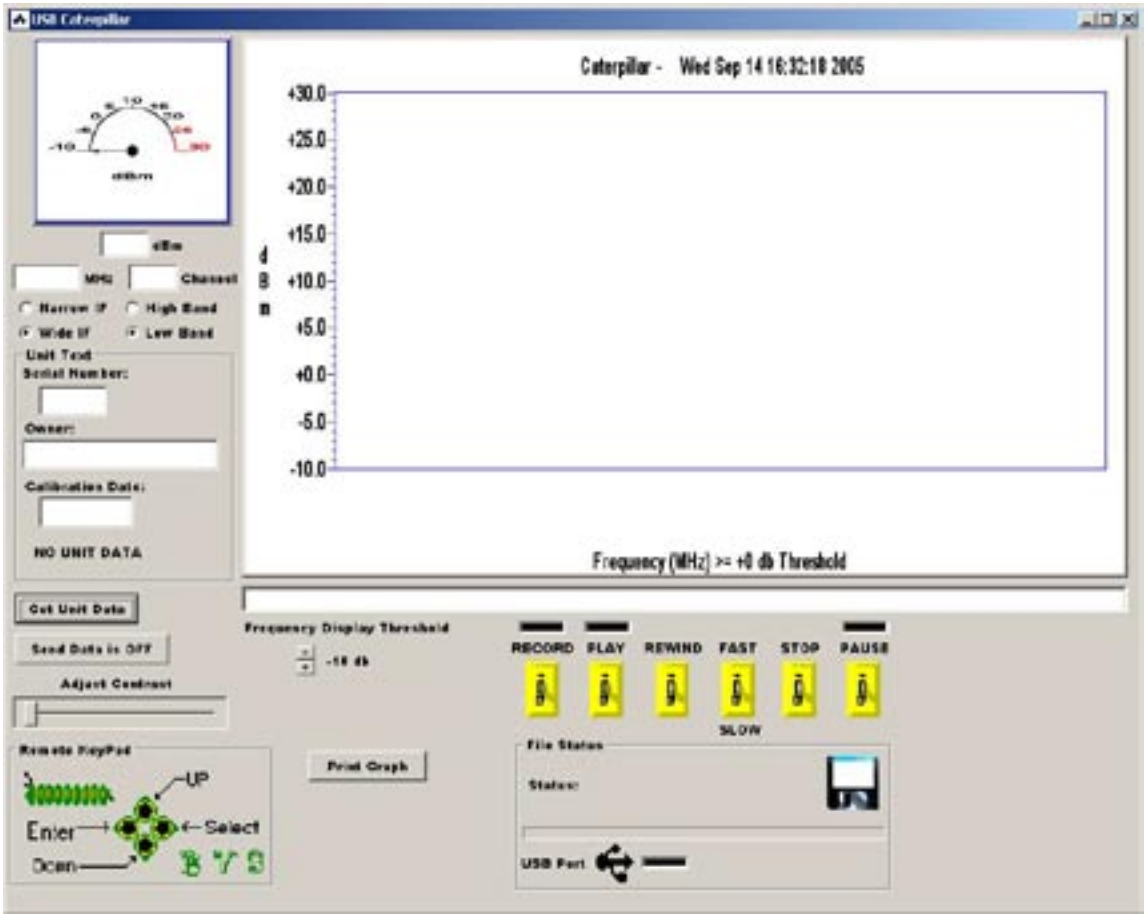


Figure 19

TROUBLE SHOOTING IS REQUIRED

To get the required unit data from the Wi-Fi Power Analyzer, click the "Get Unit Data" button and the unit data will be retrieved. The PC screen will be updated as in figure 20. Unit data is required when recording data or in the event it is necessary to contact the factory.

Full Wi-Fi Power Analyzer PC Screen, With Unit Data

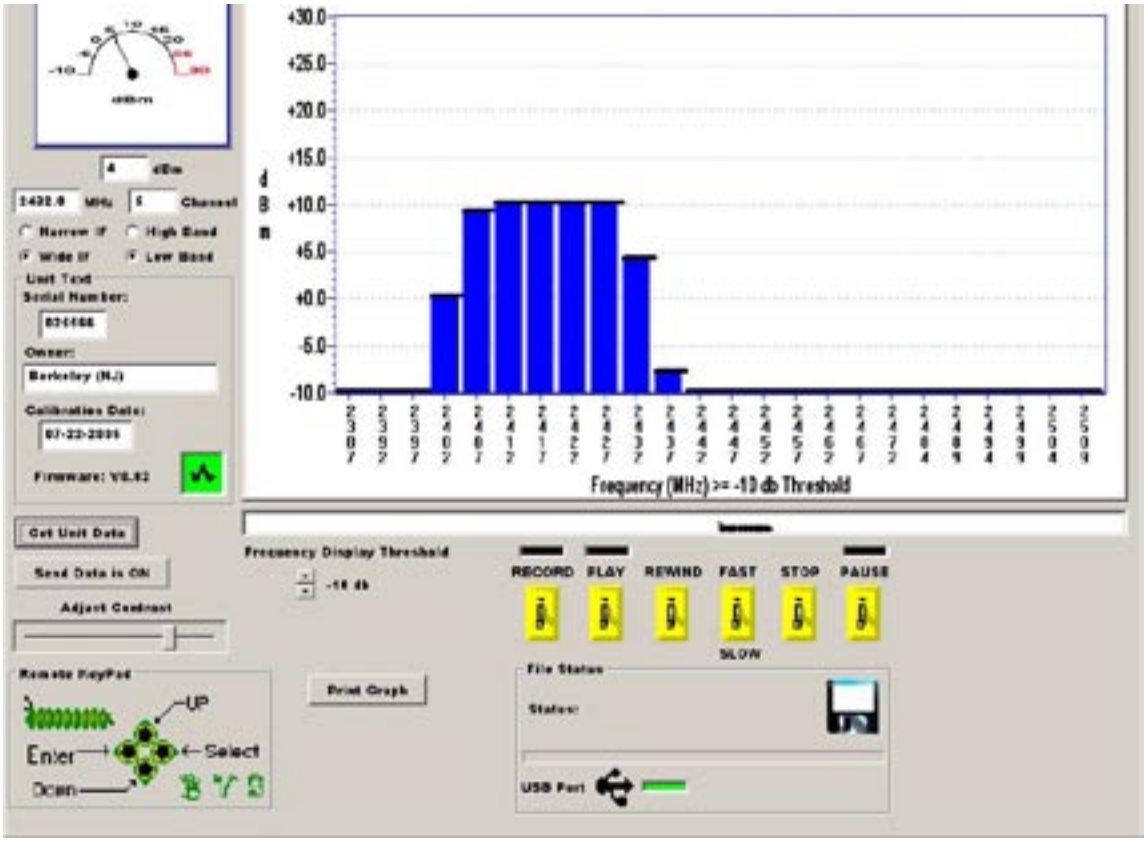


Figure 20

SCREEN COMPONENTS

Wi-Fi Power Analyzer Controls

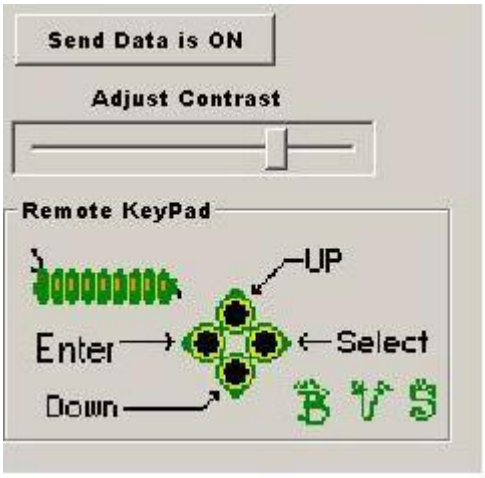


Figure 21

Click the "Send Data" button to turn on and off the Wi-Fi Power Analyzer data. The current status is indicated on the button face (ON or OFF).

Sliding the Adjust Contrast slider control has the same effect as adjusting the Wi-Fi Power Analyzer

LCD contrast using the Selection Menu “Adjust Contrast” function. When unit data is acquired from the Wi-Fi Power Analyzer, this control is set to the setting of the Wi-Fi Power Analyzer.

Use the Remote Keypad keys to simulate pressing the Wi-Fi Power Analyzer keypad. Clicking the UP, Select, Down or Enter remote key has the same effect as pressing the same key on the Wi-Fi Power Analyzer.

Measurement Gauge and Unit Data

Figure 22

The Gauge indicates the current dBm value being measured by the Wi-Fi Power Analyzer. The measurement being performed by the Wi-Fi Power Analyzer is displayed above the gauge dBm scale. Measurement dBm value is also displayed in a text box below the gauge along with the current frequency (MHz) and Channel number. If the frequency being measured is not associated with a channel number, this box displays the characters ‘—“.

The Low and High Band radio buttons indicate the current measurement band (low is 802.11b, high is 802.11a).

Narrow and Wide IF radio buttons indicate the IF filters being used by the current measurement.

Clicking these radio buttons has no effect as they are used only to display the current Wi-Fi Power Analyzer status.

The unit text portion displays the same information as the Wi-Fi Power Analyzer "Unit Data" Selection Menu entry. The square green Wi-Fi Power Analyzer LED is lit when unit data has been retrieved from the Wi-Fi Power Analyzer. To retrieve unit data from the Wi-Fi Power Analyzer, click the "Get Unit Data" button below the unit text box.
Measurement Graph

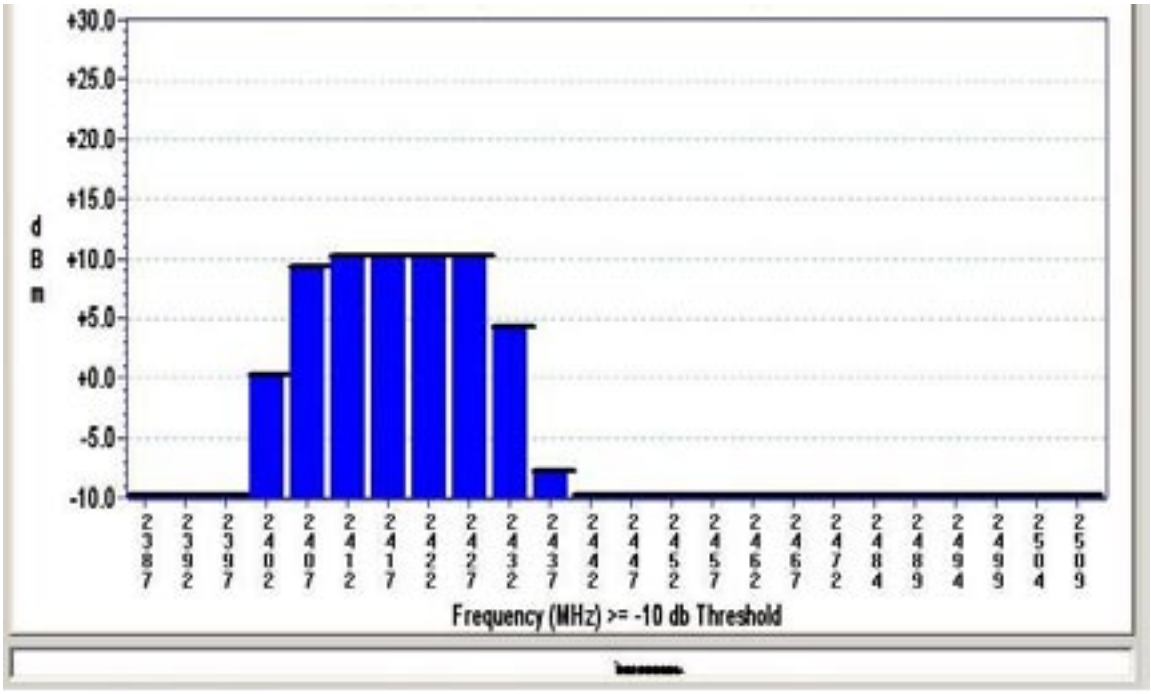


Figure 23

dBm data from all of the Wi-Fi Power Analyzer measurements is displayed in a bar graph as in figure 23. The Y axis is scaled by dBm while the X axis displays the frequency in MHz for each bar. This graph is filled in as the Wi-Fi Power Analyzer measures frequencies. Since the Wi-Fi Power Analyzer measures frequencies in an ascending order, the graph is built from right to left whenever a new measurement is started on the Wi-Fi Power Analyzer. The type of measurement being preformed by the Wi-Fi Power Analyzer along with the PC real time is displayed above the graph with the owner of the Wi-Fi Power Analyzer (from the unit data). The Wi-Fi Power Analyzer below the graph "crawls" each time the PC receives data from the Wi-Fi Power Analyzer or from a replay file. A threshold is used to display the frequencies along the X axis. This threshold can be adjusted using the up-down frequency display threshold control below the graph. If the PC is connected to a printer, the graph can be printed (in black and white) by clicking the "Print Graph" button.

PLAY, RECORD and MISCELLANEOUS CONTROLS

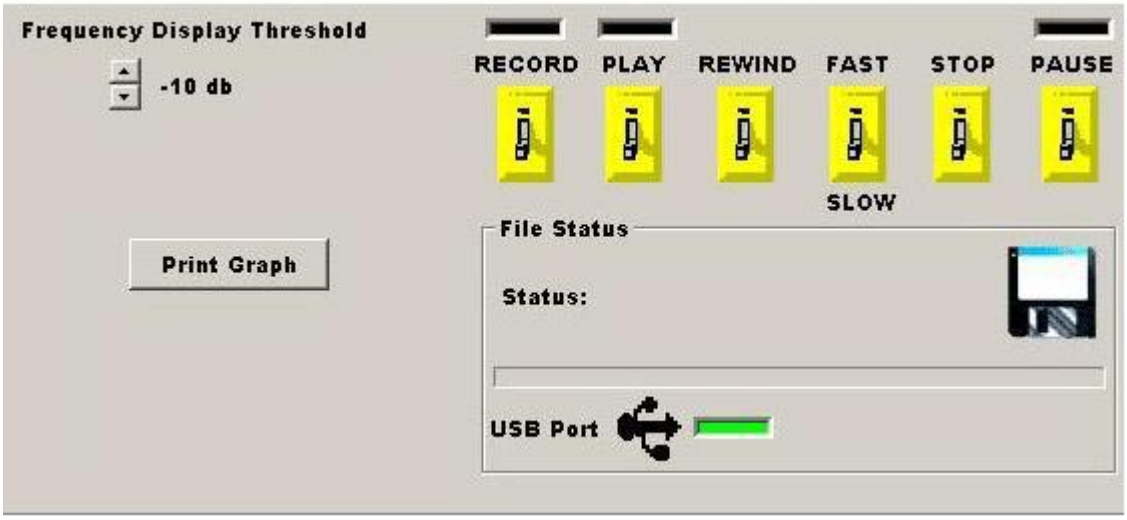


Figure 24

Click the Frequency Display Threshold up-down control to adjust the dBm value used to display a frequency on the X axis of the graph. The setting of this control has no effect on data being recorded, only on the data being displayed by the graph.

Click the "Print Graph" button to print the current graph in black and white on the PC printer. Clicking this button will result in the Windows Print wizard. Click "OK" to print, "Cancel" to not print. The "All, Selection and Print to file" controls have no effect on the printout.

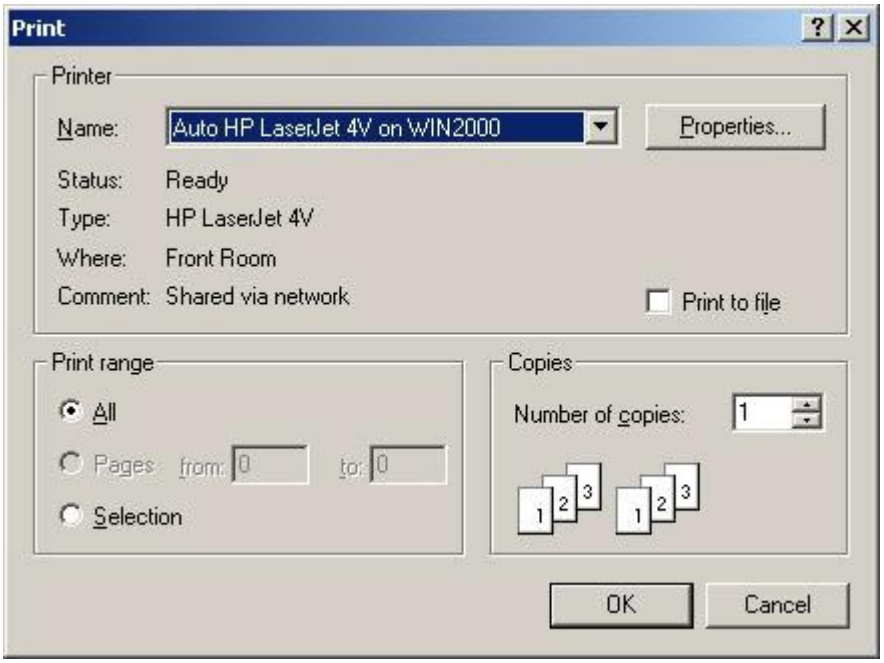


Figure 25

Switch Bank

The RECORD, PLAY, REWIND, FAST, STOP and PAUSE switches are used to control recording and

playback of data disk files created by the Wi-Fi Power Analyzer application. As shown in figure 24, the switches are all in the off position. Clicking a switch will turn it on as indicated by the switch in an up position. In addition, RECORD, PLAY and PAUSE switches have an associated LED that is lit whenever that switch is up (ON).

File Status Box

The file status box below the switch bank indicates recording and playback status. When recording, this status includes the name and current size of the record disk file. When playing a previously recorded file, status includes the name of the file being played and the relative amount of play back data in a progress bar. In addition, the floppy disk icon spins whenever the application is recording or playing back.

The USB Port icon and LED indicate USB connection status. When the LED is ON, the graph is the display of current Wi-Fi Power Analyzer real time data. If the LED is OFF, the graph is displaying data being played back from a previously recorded disk file.

RECORDING Wi-Fi Power Analyzer MEASUREMENT DATA

Click the RECORD switch and the dialog in figure 26 will appear. Enter the name of the file to contain the measurement data. Enter a file name (without extension or period) in the File name edit box. Use the "Save in" control to select a folder to put the data file in. All Wi-Fi Power Analyzer data files in the selected folder are displayed (extension = .cpd). DO NOT pick an existing file as it will be overwritten with new data. Always use a descriptive name for files so they are easy to find for later playback.

Click the "Save" button to begin recording, click the "Cancel" button to return without saving.

Select Record File Dialog

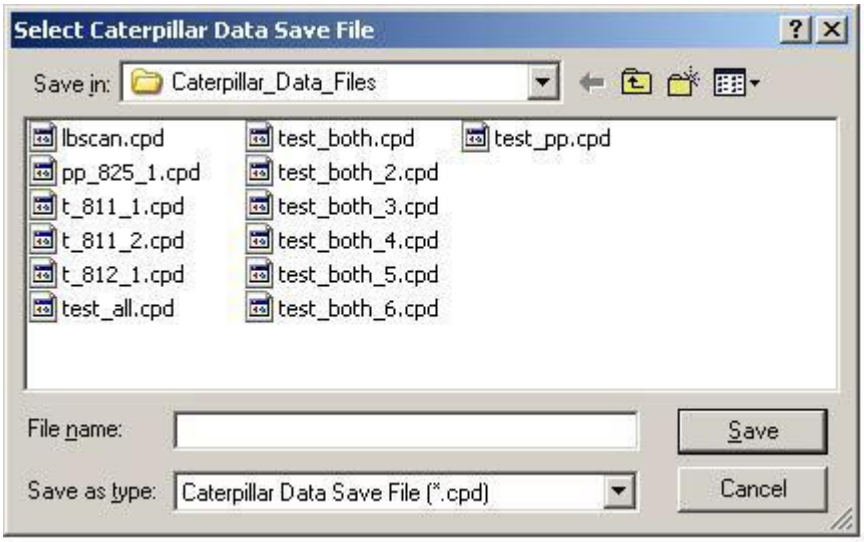


Figure 26

If the “Save” button was clicked, the File Status box will be as in figure 27 and the floppy disk will be spinning. To stop the recording, click the STOP or RECORD switch. The PLAY, REWIND, FAST and PAUSE switches have no effect while the RECORD LED is ON.

Figure 27

PLAYBACK OF RECORDED Wi-Fi Power Analyzer DATA DISK FILES

To play a recorded Wi-Fi Power Analyzer data file, click the PLAY switch and the dialog in figure 28 will be displayed.

Select Replay File Dialog

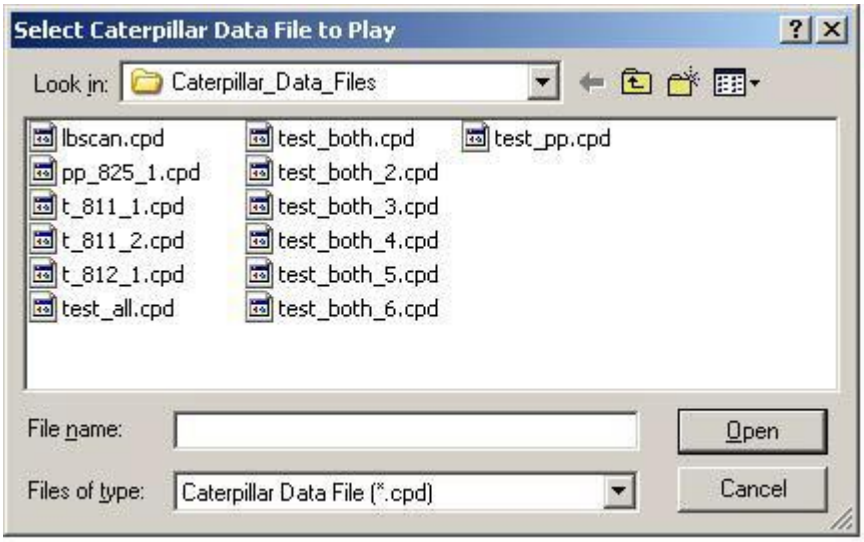


Figure 28

Pick the file to playback by clicking its name. The advantage of keeping all of the data in a single folder (as in this example “Wi-Fi Power Analyzer_Data_Files”) is the ease of finding them for later

playback. The name of the file can also be typed into the File Name edit box. Don't forget to add the extension .cpd when entering the playback file name in this way.

Figure 29 display shows how the File Status box and switches appear during a replay. Note that the USB LED is off indicating that the data displayed is not real time but recorded. Note also that the replay has been paused in figure 20. To resume, click the PAUSE switch again.

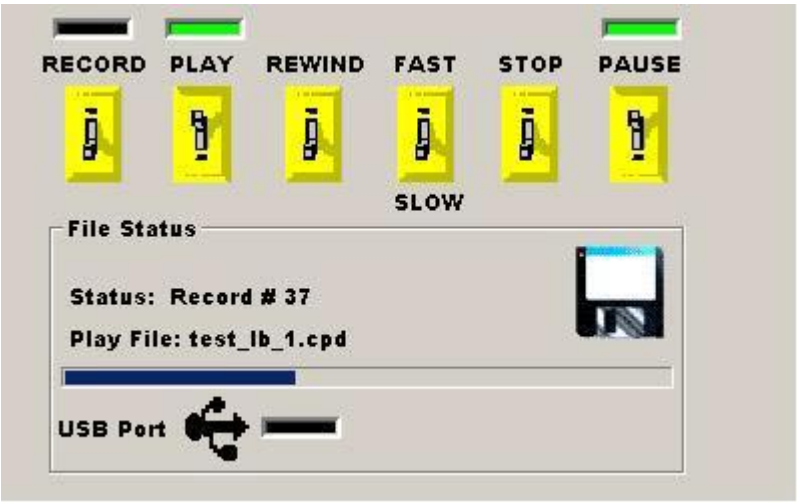


Figure 29

SPECIAL REPLAY SWITCHES

The FAST/SLOW switch is used to modify the speed of playback.

Click the REWIND switch to run the current playback file in reverse from the current position. Note the progress bar and the Wi-Fi Power Analyzer below the graph also change direction during REWIND.

Click the PLAY or STOP switch to stop the current replay. The application will reconnect to the USB and real time data displayed as before.

If a Wi-Fi Power Analyzer is NOT connected to the PC, the application can still be used to play recorded data files.

TROUBLE SHOOTING

Figure 30

If the figure 30 message box appears, the Wi-Fi Power Analyzer did no respond to a command request from the PC. Possible requests are Send data on/off, Unit data, Remote keypad or the Contrast slider. Check that the Wi-Fi Power Analyzer is ON, batteries are not low and the USB connection is intact.

Figure 31

If the application is started and can't connect to the Wi-Fi Power Analyzer the message box in figure 31 is displayed. This message box will appear if the application is started with the Wi-Fi Power Analyzer off or not connected to the USB port.

Please note that the application can be used to replay prerecorded data files without a Wi-Fi Power Analyzer being connected. If this is the desired use for the application, just click the OK button and proceed to replaying files.

BATTERY TIPS

1. Ni-MH batteries do not charge to full capacity the first time they are charged.
2. Ni-MH batteries do not charge to full capacity the first time they are charged after a long period of inactivity. or after a long period of non-use.

Cause:

When charging Ni-MH batteries for the first time after long-term storage, deactivation of reactants may lead to increased battery voltage and decreased capacity, (which causes premature termination of charging). Because batteries are chemical products involving internal chemical reactions, performance deteriorates with prolonged storage. This is normal in Ni-MH batteries.

Resolution:

Ni-MH batteries may not charge to full capacity the first time they are charged, or after a long period of inactivity.

The first-time charge of the Ni-MH Rechargeable Battery Pack should take approximately 2 hours. If the Receiver Dock light turns green, indicating a full charge, in less than 2 hours, repeat the charge cycle as follows:

First-time Charge:

1. To begin charging, place the instrument on the Charge Dock. Refer to your instrument's User Guide for details.
2. When the charge light turns green, remove the W-LAN Receiver from the dock and place back on the dock after several seconds.
3. Repeat steps 1 and 2 three or four times or until the combined charge time is 2 hours.

Subsequent charges of the W-LAN Ni-MH Battery Pack will not require multiple charging cycles unless left uncharged for a long period of time (greater than 2 months).

Networking Basics

Packets and traffic

Information travels across a network in chunks called "packets." Each packet has a header that tells where the packet is from and where it's going, similar to what you write on the envelope when you send a letter. The flow of all these packets on the network is called "traffic."

Hardware addresses

Your PC "listens" to all of the traffic on its local network and selects the packets that belong to it by checking for its hardware address in the packet header or MAC (Media Access Control). Every hardware product used for networking is required to have a unique hardware address permanently embedded in it.

IP addresses

Since the Internet is a network of networks (connecting millions of computers), hardware addresses alone are not enough to deliver information on the Internet. It would be impossible for your computer to find its packets in all the world's network traffic, and impossible for the Internet to move all traffic to every network, your PC also has an IP (Internet Protocol) address that defines exactly where and in what network it's located. IP addresses ensure that your local Ethernet network only
receives the traffic intended for it. Like the hierarchical system used to define zip codes, street names, and street numbers, IP addresses are created according to a set of rules, and their assignment is carefully administered.

Put another way, the hardware address is like your name; it uniquely and permanently identifies you. But it doesn't offer any clues about your location, so it's only helpful in a local setting. An IP address is like your street address, which contains the information that helps letters and packages find your house.

Rules for Sending Information (Protocols)

A protocol is a set of rules that define how communication takes place. For instance, a networking protocol may define how information is formatted and addressed, just as there's a standard way to address an envelope when you send a letter.

Networking Devices:

Bridges

A bridge joins two networks at the hardware level. This means that as far as other protocols are concerned, the two networks are the same.

Routers

A router connects two IP networks. In contrast to a bridge, which joins networks at the hardware level, a router directs network IP traffic based on information stored in its routing tables. A routing table matches IP addresses with hardware addresses. The router stamps each incoming IP packet with the hardware address that corresponds to that IP address. As a result, the packet can be picked up by the right computer on the hardware network.

DNS (Domain Name Server)

Networks (domains) on the Internet have names that correspond to their IP addresses. A Domain Name

Server maintains a list of domain names and their corresponding addresses. This is why you can go to Berkeley's Web site by entering www.bvsystems.com, instead of the IP address.

Networking Terms:

TCP/IP (Transport Control Protocol/Internet Protocol)

TCP/IP is a collection of protocols that underlies almost every form of communication on the Internet.

DHCP (Dynamic Host Control Protocol)

DHCP is a method of automatically assigning IP addresses. Instead of assigning addresses to individual users, addresses are assigned by the DHCP server when clients need them. This means that instead of entering several fields of long addresses, users need only to select DHCP as their configuration method for IP networking.

PPP (Point-to-Point Protocol)

PPP is the most common protocol for providing IP services over a modem.

NAT (Network Address Translation)

NAT is used to share one IP address among several computers. A device set up as a NAT router uses a collection of "private" IP addresses (in the range 10.0.1.2 to 10.0.1.254 for example) to allow several computers to access the Internet using one "public" IP address. When a computer using a private IP address requests information from the Internet, the NAT router keeps a record of the computer making the request, and sends the information to the Internet using its own IP address. When the response comes back from the Internet, the NAT router forwards the packet to the appropriate computer.

Glossary of Acronyms

AC	Alternating Current
A/D	Analog to Digital converter
AGC	Automatic Gain Control
AP	Access Point
Applet	a small Application
BER	Bit Error Rate
BPSK	Binary Phase Shift Keying
BSS	Basic Service Set
BW	Band Width
CDMA	Code Division Multiple Access (spread spectrum modulation)
DC	Direct Current
D/A	Digital to Analog
dB	decibel
dBm	decibels referenced to 1 milliwatt
DOS	Digital Operating System
DSP	Digital Signal Processing
DSSS	Direct Sequence Spread Spectrum
ESS	Extended Service Set
FIR	Finite Impulse Response
GHz	GigaHertz
IF	Intermediate Frequency
I and Q	In phase and Quadrature
IBBS	Independent Basic Service Set
kHz	kiloHertz
LCD	Liquid Crystal Display
LO	Local Oscillator
MAC	Medium Access Control
Mbits	Megabits
MHz	MegaHertz
NIC	Network Interface Card
OFDM	Orthogonal Frequency Domain Multiplexing (802.11a)
PC	Personal Computer
PCS	Personal Communications Service (1.8 to 2.1 GHz frequency band)
PER	Packet Error Rate
PN	Pseudo Noise
QPSK	Quaternary Phase Shift Keying, 4-level PSK
RF	Radio Frequency
RSSI	Receiver Signal Strength Indicator
SSID	Service Set IDentification
UCT	Universal Coordinated Time
VAC	Volts Alternating Current
VGA	Video graphic
WLAN	Wireless Local Area Network

IMPORTANT SAFETY INSTRUCTIONS

When using your telephone equipment, basic safety precautions should always be followed to reduce the risk of fire, electric shock and injury to persons, including the following:

1)Read and understand all instructions.

2)Follow all warnings and instructions marked on the product.

3)Unplug this product from the wall outlet before cleaning. Do not use liquid cleaners or aerosol cleaners. Use a damp cloth for cleaning.

4)Do not use this product near water, for example, near a bath tub, wash bowl, kitchen sink, or laundry tub, in a wet basement, or near a swimming pool.

5)Do not place this product on an unstable cart, stand, or table. The product may fall, causing serious damage to the product.

6)Slots and openings in the cabinet and the back or bottom are provided for ventilation, to protect it from overheating these openings must not be blocked or covered The openings should never be blocked by placing the product on the bed, sofa, rug or other similar surface. This product should never be placed near or over a radiator or heat register. This product should not be placed in a built-in installation unless proper ventilation is provided.

7) This product should be operated only from the type of power source indicated on the appliance. If you are not sure of the type of power supply to your home, consult your dealer or local power company.

8)Do not allow anything to rest on the power cord. Do not locate this product where the cord will be abused by persons walking on it.

9)Do not overload wall outlets and extension cords as this can result in the risk of fire or electric shock.

10)Never push objects of any kind into this product through cabinet slots as they may touch dangerous voltage points or short out parts that could result in a risk of fire or electric shock. Never spill liquid of any kind on the product.

11) To reduce the risk of electric shock, do not disassemble this product, but take it to a qualified service facil4 when some service or repair work is required. Opening or removing covers may expose you to dangerous voltages or other risks. Incorrect reassembly can cause electric shock when the appliance is subsequently used.

12) Unplug this product from the wall outlet and refer servicing to qualified service personnel under the following conditions:

A) When the power supply cord or plug is damaged or frayed. B) If liquid has been spilled into the prod-

uct.

C) If the product has been exposed to rain or water.

D) If the product does not operate normally by following the operating instructions. Adjust only those controls, that are covered by the operating instructions because improper adjustment of other controls may result in damage and will often require extensive work by a qualified technician to restore the product to normal operation.
E) If the product has been dropped or the cabinet has been damaged. F) If the product exhibits a distinct change in performance.
13)Avoid using the product during an electrical storm. There may be a remote risk of electric shock from lightning.
14)Do not use the telephone to report a gas leak in the vicinity of the leak.

INSTALLATION INSTRUCTIONS
1. Never install telephone wiring during a lightning storm.
2. Never install telephone jacks in wet locations unless the jack is specifically designed for wet locations.
3. Never touch uninsulated telephone wires or terminals unless the telephone line has been disconnected at the network interface.
4. Use caution when installing or modifying telephone lines.
INSTRUCTION FOR BATTERIES
CAUTION: To Reduce the Risk of Fire or Injury to Persons, Read and Follow these Instructions:

1. Use only the type and size of batteries mentioned in owner's manual.
2. Do not dispose of the batteries in a fire. The cells may explode. Check with local codes for possible special disposal instructions.
3. Do not open or mutilate the batteries. Released electrolyte is corrosive and may cause damage to the eyes or skin. It may be toxic if swallowed.
4. Exercise care in handling batteries in order not to short the battery with conducting materials such as rings, bracelets, and keys. The battery or conductor may overheat and cause burns.
5. Do not attempt to recharge the batteries provided with or identified for use with this product. The batteries may leak corrosive electrolyte or explode.
6. Do not attempt to rejuvenate the batteries provided with or identified for use with this product by heating them. Sudden release of the battery electrolyte may occur causing burns or irritation to eyes or skin.
7. When replacing batteries, all batteries should be replaced at the same time. Mixing fresh and discharged batteries could increase internal cell pressure and rupture the discharged batteries. (Applies to products employing more than one separately replaceable primary battery.)
8. When inserting batteries into this product, the proper polarity or direction must be observed. Reverse insertion of batteries can cause charging, and that may result in leakage or explosion. (Applies to product employing more than one separately replaceable primary battery.)
9. Remove the batteries from this product if the product will not be used for a long period of time (several months or more) since during this time the battery could leak in the product.

Access Point Connector Guide

3Com

Part No.	Description	Radio Connector
3CRWE80096A	3Com Access Point 8000	SMA
3CRWE90096A	3Com 11 Mbps Wireless LAN Building-to-Building Bridge	SMA

AeroComm

Part No.	Description	Radio Connector
SA3000	AeroComm Wireless Spectrum Analyzer	RP-SMA

Apple

Part No.	Description	Radio Connector
M8930LL/A	AirPort Extreme Base Station	MCX
M8799LL/A	AirPort Extreme Base Station	MCX
M7600LL/E	AirPort Card	MC

Belkin

Part No.	Description	Radio Connector
F5D6001	802.11b Wireless Desktop Network Card	RP-SMA

Breezecom/Alvarion

Part No.	Description	Radio Connector
AP-10	BreezeNET Pro.11 Access Point	proprietary
SA-10	BreezeNET Pro.11 Station Adapter	proprietary
WB-10D	BreezeNET Pro.11 Workgroup Bridge	proprietary

Buffalo

Part No.	Description	Radio Connector
WLI-CB-G54A	AirStation 54 Mbps Wireless Notebook Adapter with Antenna Interface	MC
WLI-USB-G54	AirStation 54 Mbps Wireless USB Adapter	MC

WLA-G54	AirStation 54 Mbps Standard Bridge Base Station	MMX
WLA-AWCG	AirStation Pro 11 Mbps Wireless Bridge Base Station	MC
WLMR-LI IG	AirStation Pro Plus Router 11 Mbps Access Point	MMX
WBR-G54	AirStation 54 Mbps Broadband Router Base Station	MMX
WBR-B11	AirStation 11 Mbps Broadband Router Base Station	MMX
WLMR-L11G	AirStation Pro Plus 11 Mbps Wireless Router Base Station	MC
WLI-PCI-G54	AirStation 54 Mbps Wireless PCI Card with Omni Antenna	MMX
WLI-USB-G54	AirStation 54 Mbps Wireless USB Adapter	MC
WLI-PCM-LI IGP	AirStation 11 Mbps Wireless Flat PCMCIA Card	MMX

Cisco

Part No.	Description	Radio Connector
AIR-AP352E2R-x-K9	Cisco Aironet Access Point 350	RP-TNC
	Cisco Aironet Access Point 1200	RP-TNC x 2
AIR-WGB352R	Cisco Aironet 350 Workgroup Bridge	RP-TNC x 2
	Cisco Aironet 350 Wireless Bridge	RP-TNC x 2
AIR-BR1410A-A-K9-N	Cisco Aironet 1400 Wireless Bridge	N
AIR-LMC352	Cisco Aironet 350 Wireless PC Card	MMCX x 2
AIR-PCI35x	Cisco Aironet 350 Client Adapter	RP-TNC

Clarion

Part No.	Description	Radio Connector
	Clarion M10	SMA Male

Compaq

Part No.	Description	Radio Connector
WL200	PCI Card	RP-SMA

Dell

Part No.	Description	Radio Connector
1150	Truemobile 1150 PC Card	MC

D-Link

Part No.	Description	Radio Connector
DI-624	AirPlus Xtreme G High Speed 2.4 GHz Wireless Router	RP-SMA x 2
DWL-G520	AirPlus Xtreme G High Speed 2.4 GHz Wireless PCI Adapter	RP-SMA

DI-774	Tri-Mode Dualband 4-Port Wireless Router	detachable
DWL-7000AP	AirXpert Tri-Mode Dualband 2.4/5.8 GHz Wireless Access Point	non-detachable
DI-714P+	AirPlus Enhanced 2.4 GHz Wireless Router Plus Print Server	RP-SMA x 2
DI-614+	AirPlus Enhanced 2.4 GHz Wireless Router	RP-SMA
DWL-810+	AirPlus Enhanced 2.4 GHz Ethernet-to-Wireless Bridge	RP-SMA
DWL-900AP+	AirPlus Enhanced 2.4 GHz Wireless Access Point	RP-SMA
DWL-520+	AirPlus Enhanced 2.4 GHz Wireless PCI Adapter	RP-SMA
DWL-900AP	Air Wireless 2.4 GHz Access Point	RP-SMA
DI-514	Air Wireless 2.4 GHz Router	RP-SMA
DWL-520	Air Wireless 2.4 GHz PCI Adapter	RP-SMA
DI-713P	Air Wireless 2.4 GHz Router Plus Print Server	RP-SMA x 2

EnGenius

Part No.	Description	Radio Connector
EL-2511 BG1 PLUS	EnGenius 2-Port Wireless Bridge/AP + Print Server (200mW)	TNC-type
EL-2511 BG PLUS	EnGenius Long Range Wireless Bridge	N
EL-2511CD PLUS EXT2	EnGenius Long Range Wireless PC Card with Two Antenna Jacks	MMCX female x 2

Enterasys

Part No.	Description	Radio Connector
CSICD-AW-128	RoamAbout Wireless PC Card	MC

GRE

Part No.	Description	Radio Connector
	GRE Gina	RP-SMA

IBM

Part No.	Description	Radio Connector
	IBM Wireless PC Card	MC
	IBM Wireless AP500	MC

Intel

Part No.	Description	Radio Connector
WPCI5000	Intel PRO/Wireless PCI Adapter	RP-SMA
WEAP2011BK	Intel PRO/Wireless Access Point	RP-BNC

Linksys

Part No.	Description	Radio Connector

WAP11	Wireless Network Access Point	RP-TNC x 2
BEFW11S4	Wireless Access Point Router with 4-Port Switch	RP-TNC x 2
WRT54G	Wireless-G Broadband Router	RP-TNC x 2
WAP54G	Wireless-G Access Point	RP-TNC x 2
WET11	Wireless Ethernet Bridge	RP-SMA
WMP11	Wirless PCI Card	RP-SMA

Netgear

Part No.	Description	Radio Connector
All Access Points		RP-SMA
MR814	802.11b Cable/DSL Wireless Router	non-removeable

Nokia

Part No.	Description	Radio Connector
	Nokia PC Card	SMA Rev. Threaded

Orinoco

Part No.	Description	Radio Connector
8470-WD	Orinoco 11b/g PC Card Gold	MC
8471-WD	Orinoco 11b/g PC Card Silver	MC
8420-WD	Orinoco 11b Client Gold PC Card	MC
8421-WD	Orinoco 11b Client Silver PC Card	none
8480	Orinoco 11a/b/g ComboCard Gold	none
8481	Orinoco 11a/b/g ComboCard Gold	none

Proxim

Part No.	Description	Radio Connector
	Proxim RL/2 Bridge	RP-SMA
	Proxim RL/2 PC Card	MMCX
	Proxim Harmony 802.11 PC Card	RP-MMCX
	Proxim Harmony 802.11 PCI Card	Rev Thread SMA
	Proxim Harmony 802.11 AP	RP-TNC
	Proxim Stratum MP	RP-TNC

Samsung

Part No.	Description	Radio Connector
SWL-2100P	PCI Card	Rev Thread SMA-Female
SWL-2100E	PC Card	2 MMCX-Female connectors
SWL-3300AP	Access Point	Rev Thread SMA-Male
		Rev Thread SMA-

		Male
SWL-1000AN	5dBi Patch Antenna	Rev Thread SMA-Female

Siemens

Part No.	Description	Radio Connector
1024	Siemens Speedstream 1024 Wireless PCI Adapter	RP-SMA
2624	Siemens Speedstream 2624 Wireless DSL/Cable Router	RP-SMA
2623	Siemens Speedstream 2623 Wireless DSL/Cable Router	none

SMC

Part No.	Description	Radio Connector
SMC2802W	EZ Connect g 2.4 GHz 54 Mbps Wireless PCI Card	RP-SMA
SMC2402W	EZ Connect Turbo 802.11b 11/22 Mbps Wireless PCI Card	RP-SMA
SMC2602W	EZ Connect 802.11b Mbps Wireless PCI Card	RP-SMA
SMC2804WBR	Barricade g 2.4 GHz 54 Mbps Wireless Cable/DSL Broadband Router	RP-SMA x 2
SMC7004WFW	Barricade Plus Wireless Cable/DSL Broadband Router	RP-SMA
SMC2682W	EZ Connect 11 Mbps Wireless Access Point/Bridge	RP-SMA
SMC2655W	EZ Connect 11 Mbps Wireless Access Point	MCX Plug (Male)
SMC2482W	EZ Connect Turbo 2.4 GHz 11/22 Mbps Wireless Bridge	RP-SMA x 2
SMC2532W-B	EliteConnect 2.4 GHz 802.11b Wireless PC Card	MMCX reverse x 2
SMC2670W	EZ Connect 2.4 GHz 11 Mbps Wireless Ethernet Adapter	non-detachable

SonicWALL

Part No.	Description	Radio Connector
01-SSC-5361	SonicWALL SOHO TZW Wireless Internet Security Appliance	RP-TNC x 2

Symbol

Part No.	Description	Radio Connector
	Symbol AP	RP-BNC
WEAP2011BK	Symbol PC Card	MMCX

U.S. Robotics

Part No.	Description	Radio Connector
USR8054	US Robotics 802.11g Wireless Turbo Router	RP-SMA x 2
USR5450	US Robotics 802.11g Wireless Turbo Multi-Function Access Point	RP-SMA x 2
USR5416	US Robotics 802.11g Wireless Turbo PCI Adapter	RP-SMA
USR2216	US Robotics 22 Mbps Wireless PCI Adapter	RP-SMA
USR8022	US Robotics 22 Mbps Wireless Cable/DSL Router	RP-SMA x 2

WaveAccess

Part No.	Description	Radio Connector
	WaveAccess 132	RP-SMA

Wi-LAN

Part No.	Description	Radio Connector
	Wi-LAN AWE22/45	RP-TNC
	Wi-LAN AWE120-24	TNC-Male
	Wi-LAN AWE120-58	N-male

Zcomax

Part No.	Description	Radio Connector
XI-300	Type II PC Card	RP-MMCX x 2
XI-300B	Type II PC Card	Integrated Antenna
XI-305B	Type II PC Card	Integrated Antenna
XI-325	Type II PC Card	RP-MMCX x 2
XI-325H	Type II PC Card	RP-MMCX x 2
XI-325HP	Type II PC Card	RP-MMCX x 2
XI-600-XA	PCI Wireless NIC	RP-SMA
XI-1000	High-Speed Wireless Access Point	RP-MMCX
XI-1250	Access Point	Integrated Antenna
XI-1250A	Access Point	Integrated Antenna
XI-1450	Access Point	Integrated Antenna
XI-1500	AirRunner Wireless LAN Access Point	RP-SMA x 2
XI-1500H	AirRunner Wireless LAN Access Point	RP-SMA x 2
XI-1500HP	AirRunner Wireless LAN Access Point	RP-SMA x 2
XI-3000	Access Point	RP-SMA x 2
XG-1000	AirRunner 802.11b/g Access Point	RP-SMA x 2
XG-900	AirRunner 802.11b/g PCI Adapter	RP-SMA

ZoomAir

Part No.	Description	Radio Connector
4100	Wireless LAN PC Card 802.11b NIC	RP-SMA