

IEEE 802.11 a/b/g

Wireless LAN Mini-PCI Module



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CHAPTER 1: INTRODUCTION

IEEE 802.11 a/b/g Wireless LAN Network Adapter is a up to 54Mbps Cardbus PC Card. Being able to operate at both 5GHz and 2.4 GHz frequency band, the IEEE 802.11 a/b/g Wireless LAN Network Adapter can communicate with other mobile devices enabled for IEEE 802.11a, or 802.11b standard-based, and 802.11g standard wireless LAN connectivity. Using this card in conjunction with the Wireless Access Point of 802.11a, 802.11b or 802.11g, you can create a wireless network for sharing your broadband cable or DSL Internet access among multiple PCs in and around your home or office and enjoy amazing speed of 54Mbps (108Mbps Turbo Mode)!!!

Features and Benefits

- Delivers up to 108 Mbps speed rate (Turbo Mode). Wireless nodes negotiate to operate in the optimal data transfer rate. In a noisy environment or when the distance between the wireless nodes is far, the wireless nodes automatically adjusts to operate at the optimal speed.
- IEEE 802.11a, and IEEE 802.11b standard compliant, IEEE 802.11g standard compliant.
- Interoperable with IEEE 802.11a, IEEE 802.11b, and IEEE 802.11g wireless devices.
- Supports data encryption up to 152-bit shared key method.
- Quickly networks your employees without the time or expense of Ethernet cabling.
- Networks from any location in and around the home or office.
- Gives you constant access to corporate resources, e-mail and the intranet.
- IEEE 802.11b supports 1, 2, 5.5, 11 Mbps data rates. IEEE 802.11a/g supports 6, 9, 12, 18, 24, 36, 48, 54 Mbps data rates.
- Connects seamlessly to wired Ethernet and PC network LANs to augment existing networks quickly and easily.
- Provides greater flexibility to locate or move networked PCs.
- Plug and Play makes it easy to install.
- Supports multiple operating system platforms, including Microsoft Windows 98SE, Windows Me, Windows 2000 and Windows XP.

Applications

IEEE 802.11a/b/g Wireless LAN Network Adapter offers a fast, reliable, cost-effective solution for wireless client access to the network in applications like these:

1. **Remote access to corporate network information**
E-mail, file transfer and Intranet access.
2. **Difficult-to-wire environments**
Historical or old buildings, asbestos installations, and open areas where wiring is difficult to deploy
3. **Frequently changing environments**
Retailers, manufacturers, and those who frequently rearrange the workplace or change locations
4. **Database access**
Doctors, nurses, retailers needing mobile database access while in the hospital, retail store or office campus

5. SOHO (Small Office and Home Office) users

SOHO users needing easy and quick installation of a small computer network

Package Contents

The product package should contain:

- IEEE 802.11a/b/g Wireless LAN Network Adapter
- Product CD (Driver and Utility and Manual inside)
- Quick Installation Guide

If any of the above items are not included or damaged, please contact your local vendor for support.

CHAPTER 2: Install IEEE 802.11a/b/g Wireless LAN Network Adapter

System Requirements

Before installing the IEEE 802.11a/b/g Wireless LAN Network Adapter, please make sure that these equipments have been met:

1. A computer with a Cardbus slot.
2. Windows 98SE/ME/2000/XP (Have the Windows Installation CD-ROM ready for use during installation.
3. There should be at least 5Mbytes disk space for installing driver and utility program.

LED Indicators

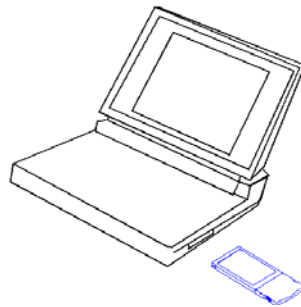
The Wireless LINK LED on the IEEE 802.11a/b/g Wireless LAN Network Adapter indicates the wireless link condition of the station with another wireless node or the associated access point.

LED: Two Green LEDs

- **Fast-rate Blink on both LEDs:** Both LEDs blink fast-rate when the client card is receiving or transmitting data.
- **Slow-rate Blink on both LEDs:** Connected to the Access Point or 802.11 Ad-Hoc wireless workstation.
- **Alternate Blink on both LEDs:** Looking for network association.
- **Both LEDs off:** Power off.

Windows 98SE/ME/2000/XP Installation

1. Turn on the computer.
2. With the LED indicators facing up, properly insert the IEEE 802.11a/b/g Wireless LAN Network Adapter into the Cardbus slot on your computer as shown below.



3. The Windows will automatically detect the IEEE802.11a/b/g Wireless LAN Network Adapter and the Found New Hardware Wizard dialog box appears for the driver (only applies to Windows 98SE, Me, 2000 and XP).
4. Follow the on-screen instructions to install the driver for the IEEE 802.11a/b/g Wireless LAN Network Adapter.
5. For Windows 98SE/ME, once the [Please insert the disk labeled "Windows 98SE/ME CD-ROM", and then click OK] window appears, enter the path corresponding to the appropriate drives and click OK. Usually these files can be found at C:\Windows or C:\Windows\system.
6. For Windows 2000, a Digital Signature Not Found message may appear. Click Yes to proceed.
7. For Windows XP, a Windows Logo Testing Not Found dialog box may appear. Click Continue Anyway to proceed.
8. Click **Finish** to complete the installation.

Verifying Driver Installation

Verifying Driver Installation under Windows 98SE

1. From the Windows 98SE desktop, double-click My Computer.
2. Double-click Control Panel. Double-click the System icon.
3. Click on the Device Manager folder tab.
4. Double-click Network Adapter. There should be no yellow exclamation mark or red cross-sign on the IEEE 802.11a/b/g Wireless LAN Network Adapter selection.
5. Double-click IEEE 802.11a/b/g Wireless LAN Network Adapter. The Device Status windows should indicate that the PC Card is working properly.

The installation of the IEEE 802.11a/b/g Wireless LAN Network Adapter driver in Windows 98SE is complete. Proceed to Chapter 4: Wireless LAN Configuration.

Verifying Driver Installation under Windows ME

1. From the Windows Me desktop, double-click My Computer.
2. Double-click Control Panel. Double-click the System icon.
3. Click on the Device Manager folder tab.
4. Double-click Network Adapter. There should be no yellow exclamation mark or red cross-sign on the IEEE 802.11a/b/g Wireless LAN Network Adapter selection.
5. Double-click IEEE 802.11a/b/g Wireless LAN Network Adapter. The Device Status windows should indicate that the PC Card is working properly.

The installation of the IEEE 802.11a/b/g Wireless LAN Network Adapter driver in Windows ME is complete. Proceed to Chapter 4: Wireless LAN Configuration.

Verifying Driver Installation under Windows 2000

1. From the Windows 2000 desktop, double-click My Computer.
2. Double-click Control Panel. Double-click the System icon.
3. Click on the Hardware folder tab. Click the Device Manager button.
4. Double-click Network Adapter. There should be no yellow exclamation mark or red cross-sign on the IEEE 802.11a/b/g Wireless LAN Network Adapter selection.
5. Double-click IEEE 802.11a/b/g Wireless LAN Network Adapter. The Device Status windows should indicate that the IEEE 802.11a/b/g Wireless LAN Network Adapter is working properly.

The installation of the IEEE 802.11a/b/g Wireless LAN Network Adapter driver in Windows 2000 is complete. Proceed to Chapter 4: Wireless LAN Configuration.

Verifying Driver Installation under Windows XP

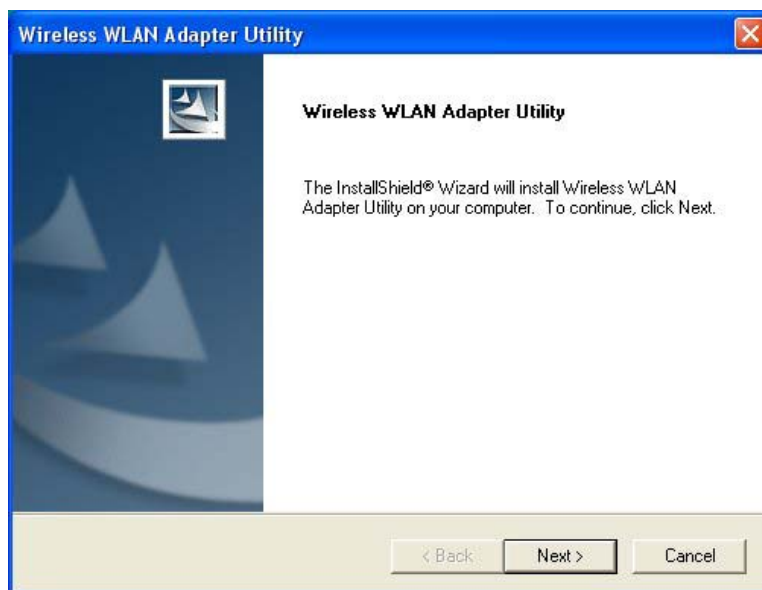
1. From the Windows XP desktop, double-click My Computer.
2. Double-click Control Panel. Double-click the System icon.
3. Click on the Hardware folder tab. Click the Device Manager button.
4. Double-click Network Adapter. There should be no yellow exclamation mark or red cross-sign on the IEEE 802.11a/b/g Wireless LAN Network Adapter selection.
5. Double-click IEEE 802.11a/b/g Wireless LAN Network Adapter. The Device status window should indicate that the PC Card is working properly.

The installation of the IEEE 802.11a/b/g Wireless LAN Network Adapter driver in Windows XP is complete. Proceed to Chapter 4: Wireless LAN Configuration.

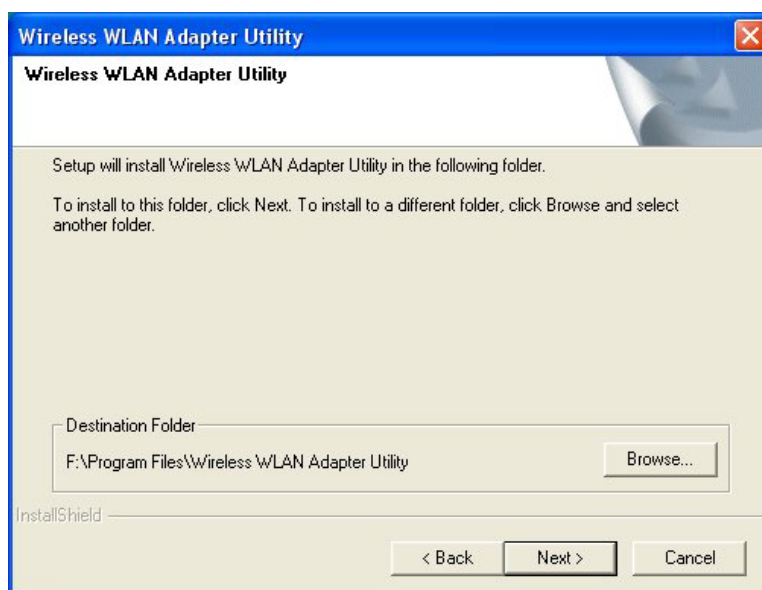
Important: By default, Windows XP uses its own utility to configure your wireless network settings; if you prefer to use the IEEE 802.11a/b/g Wireless LAN Network Adapter configuration utility, please change this setting in the Wireless Networks tab in Wireless Network Connection Properties.

CHAPTER 3: Install the Utility for Windows98SE/ME/2000/XP

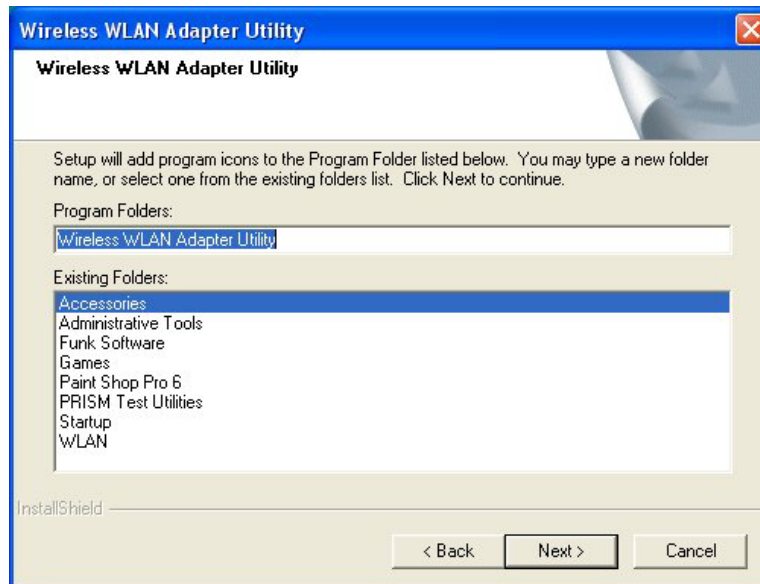
1. Power ON your computer. Insert the Driver and Utility CD into the CD-ROM drive. Click **Start**, **Run** and type '**d:\utility**' if 'd' is the designation of your CD drive Then double-click the file to execute the installation procedures.
2. When the Welcome screen appears, click **Next**.



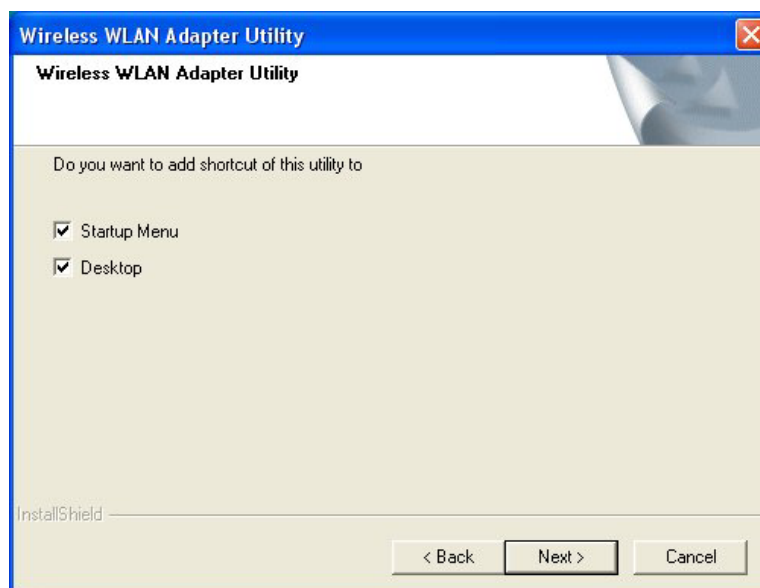
3. The Choose Destination Location screen displays the default Destination Folder. If you want to change the default folder, you can click **Browse** and choose a different destination folder. Click **Next** to go to the next screen.



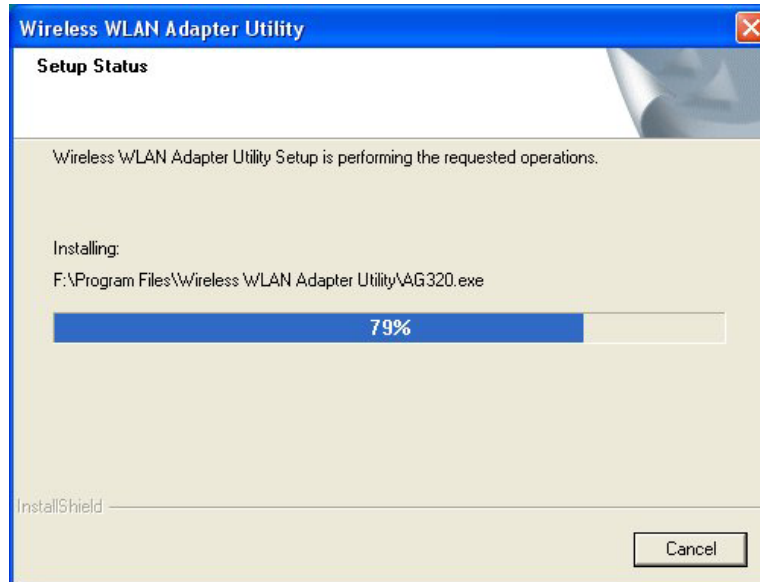
4. The Select Program Folder screen appears. Accept or change the default folder name and click **Next** to continue.



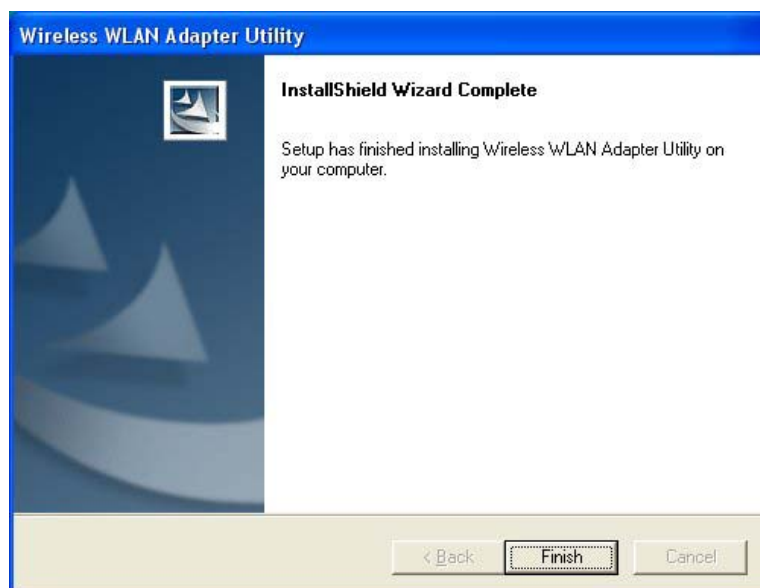
5. Accept to add shortcut of this utility and click **Next** to continue.



6. The windows will find “**Wireless WLAN Adapter Utility**” and start copying corresponding files into the system.



7. Completing the utility installation.



The IEEE 802.11a/b/g Wireless LAN Network Adapter Configuration Utility installation is now complete. Proceed to configuring the wireless parameters.

CHAPTER 4: Wireless LAN Configuration

WLAN Configuration Utility

A wireless LAN configuration utility program is provided to give you information on your wireless network such as signal quality and link conditions, and to let you modify the various configurable wireless parameters.

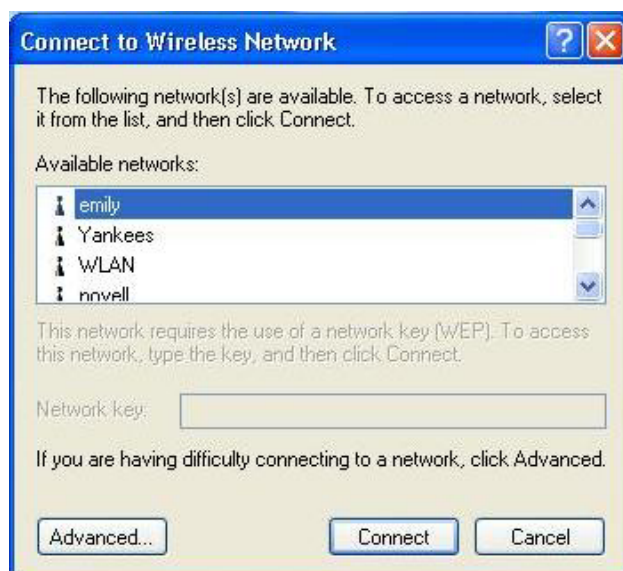
Important: By default, Windows XP uses its own utility to configure your wireless network settings; if you prefer to use the Wireless LAN Adapter Utility, please change this setting in the Wireless Networks tab in Wireless Network Connection Properties.

For Windows XP Users

After installing the IEEE 802.11a/b/g Wireless LAN Network Adapter, Windows XP will display a Wireless Network Connection # message.

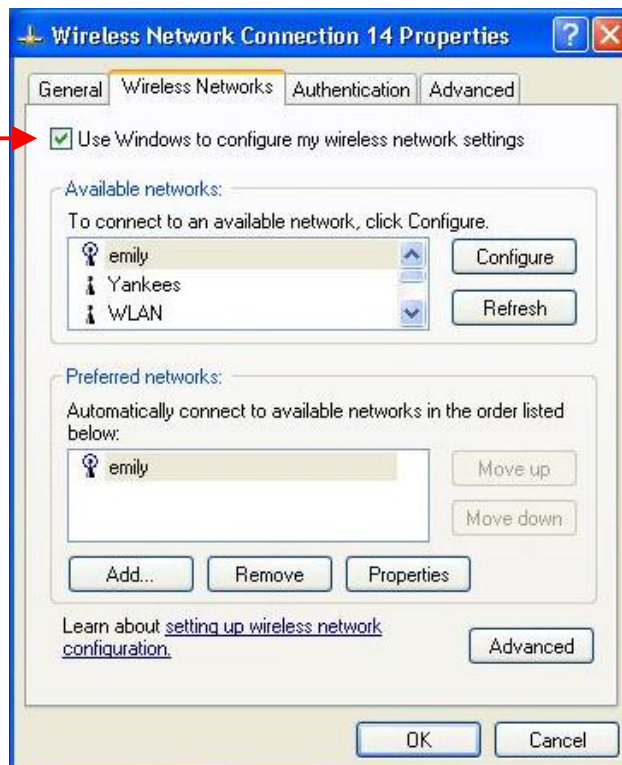


Click on the message and the XP Connect to Wireless Network dialog box will appear. Click on an available wireless infrastructure network (Access Point), as seen in the Connect to Wireless Network dialog box. You may click on the **Advanced** button to perform advanced configuration.



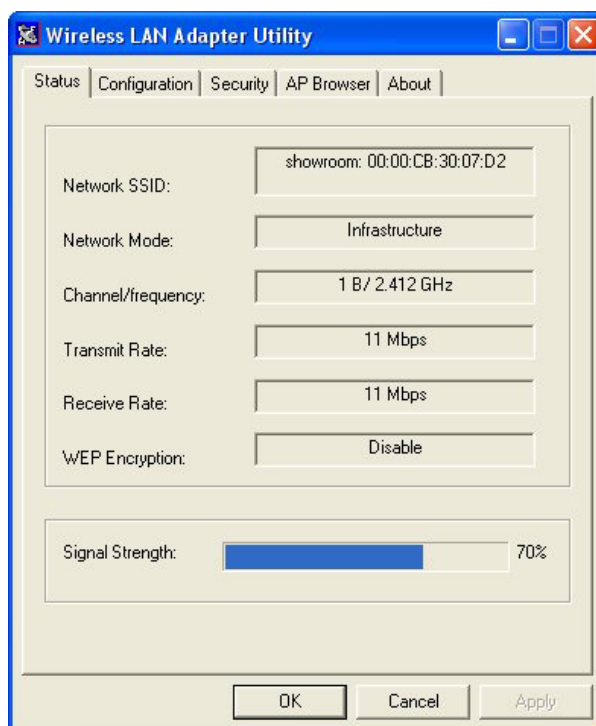
For more information on using the XP Wireless Network Configuration utility please refer to Windows XP **Help** file.

If you desire to use WLAN Configuration Utility, you need to disable the Windows XP Automatic Wireless Network Configuration first by unchecking this check box.



WLAN Utility Parameter Modification

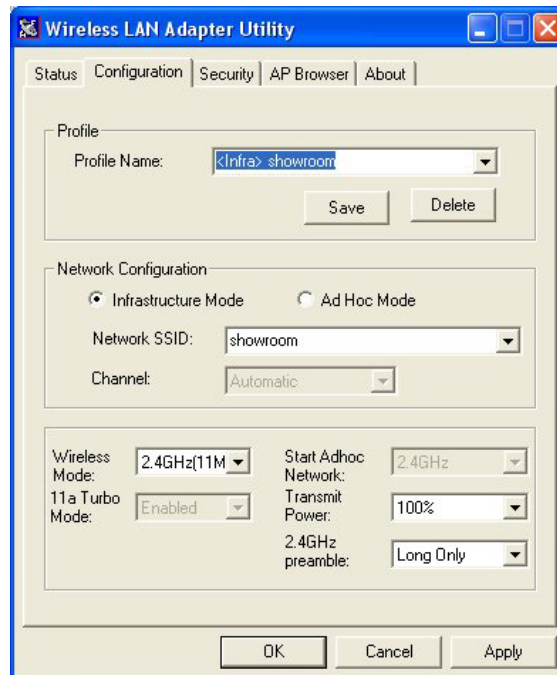
Go to Program Files -> MY_FOLDER_NAME and click the Wireless LAN Adapter Utility. You can click on any of the folder tabs in the Wireless LAN Adapter Utility dialog box to modify the operational parameters.



Status	
Network SSID	Indicates the SSID and MAC address of the associated access point when the IEEE 802.11a/b/g Wireless LAN Network Adapter is configured in Infrastructure mode.
Network Mode	Indicates the network mode of the IEEE 802.11a/b/g Wireless LAN Network Adapter (Infrastructure or 802.11 Ad-hoc).
Channel/frequency	Indicates the channel and frequency on which the connection is used.
Transmit Rate	Indicates the data transfer rate between the wireless node and the device it is communicating with.
Receive Rate	Indicates the data receive rate between the wireless node and the device it is communicating with.
WEP Encryption	Indicates whether the security of this device is enable or disable.
Signal Strength	Indicates the signal strength of the radio frequency signal received by this wireless node.

Configuration

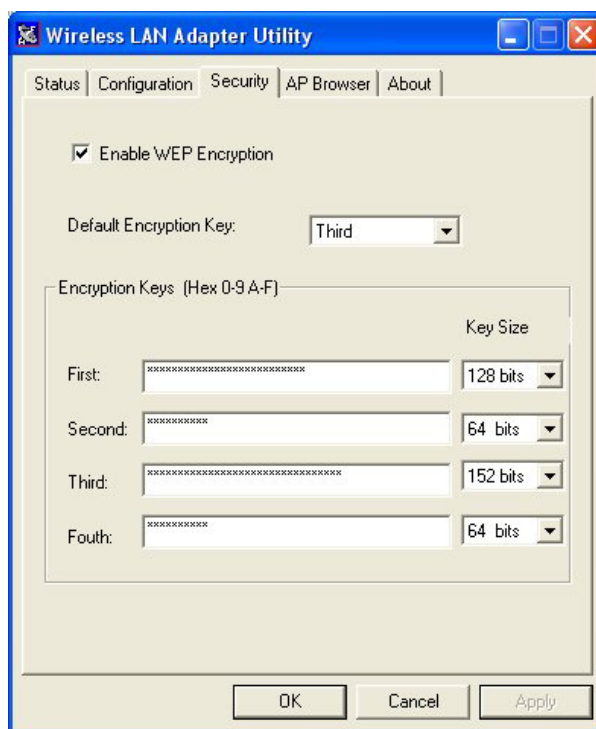
The Configuration item allows you to modify the configuration parameters for the IEEE 802.11a/b/g Wireless LAN Network Adapter such as **Profile**, **Network Configuration**, **Wireless Mode**, **Start Adhoc Network**, **Transmit Power**, and **2.4GHz preamble** setting.



Configuration	
Profile	The Profile field allows you to set values for all parameters by selecting a previously defined profile. To create a profile, go to the Profile field, type in a Profile Name . After changing parameters, Save the profile and click the Apply button to put it into effect. If one of the profiles is no longer used, you may remove it by clicking the Delete button. You can have multiple profiles and modify a profile at any time. Furthermore, you may monitor the current Profile status of the IEEE 802.11a/b/g Wireless LAN Network Adapter.
Network Configuration	Configurable between IEEE802.11 Ad-hoc and Infrastructure modes. In IEEE802.11 Ad-hoc mode, the wireless nodes form their own local network where the end nodes communicate peer-to-peer without an access point. In Infrastructure mode, the wireless searches all available wireless channels to associate with an access point.
Network SSID	Enter a 32-character (maximum) Service Set ID in this field; the characters are case sensitive. When the wireless node is operating in Ad-hoc mode, this field operates as the Basic Service Set ID (BSSID). All wireless nodes in the same network should use the same BSSID. When in Infrastructure mode, this field defines the Extended Service Set ID (ESSID). The ESSID assigned to the wireless node is required to match the access point ESSID for the wireless node to communicate with the access point.
Channel	Select the wireless channel currently in use. Only valid in AdHoc Mode.
Radio Band	Specifies 802.11a, or 802.11b/g operation.
Wireless Mode	Specifies 5GHz(802.11a), 2.4GHz(802.11b), or Auto operation. Auto allows the use of both IEEE802.11a and IEEE802.11b modes.
Start AdHoc Network	Specifies a band to establish an ad hoc network if no matching SSID is found after scanning all available modes.
11g Turbo Mode	When you enable the Turbo Mode, the maximum data rate can up to 108 mbps. However, this function is only used to our company's AP or STA.
Transmit Power	Selects 100%, 50%, 25%, 12.5%, or Lowest power.
2.4GHz preamble	The preamble defines the length of the CRC block for communication between the Access Point and a roaming Network Card. A long transmit preamble allows the receiver to lock into the received bit patterns more easily. A auto transmit preamble provides better performance. The default value is Long Tx Preamble.

Security (WEP)

To prevent unauthorized wireless stations from accessing data transmitted over the network, the Wireless LAN Adapter Utility offers highly secure data encryption, known as WEP, making your data transmission over air more secure.



To activate the WEP Encryption, check the **Enable WEP Encryption** check box. An Encryption window, as shown above, will appear. The instructions are as follows:

1. **Check** the box in Enable WEP Encryption (WEP Key)
2. Pull down the **Encryption Length** list and select either **64-bit** or **128-bit** or **152-bit** encryption method.
3. Specify the WEP keys by typing Encryption Keys, as described below:

For 64-bit encryption:

- **Hexadecimal: 10 hexadecimal digits** in the range of "A-F", "a-f" and "0-9" (e.g. 11AA22BB33)

For 128-bit encryption:

- **Hexadecimal: 26 hexadecimal digits** in the range of "A-F", "a-f" and "0-9" (e.g. 00112233445566778899AABBCC).

For 152-bit encryption:

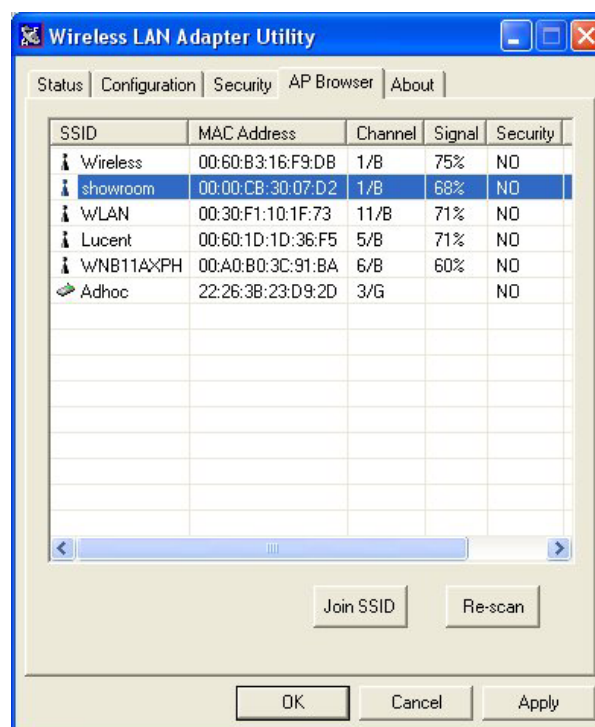
- **Hexadecimal: 32 hexadecimal digits** in the range of "A-F", "a-f" and "0-9" (e.g. 00112233445566778899AABBCCDDEEFF).

After entering the WEP keys in the key field, click the **Apply** button and then click the **OK** button to make the setting take effect.

Important: The WEP key must be set up exactly the same on the Wireless LAN stations as they are on the wireless Access Points.

Security	
Enable WEP Encryption	Enables the data encryption for the wireless node. To disable the data encryption (by unchecking the box) is to not use any encryption; this is also called Open System data encryption. To enable encryption is to use the Shared Key data encryption method.
Key Length	The key length must be the same between all wireless nodes and access points in the same network. The possible values for the data encryption level are 64 bits and 128 bits. The 64-bit data encryption is also called 40-bit data encryption by some vendors.
First Second Third Fourth	Keys used to encrypt/decrypt wireless data. When set to 64-bit (also called 40-bit) or 128-bit data encryption mode, you may specify up to four different keys to encrypt wireless data.

AP Browser

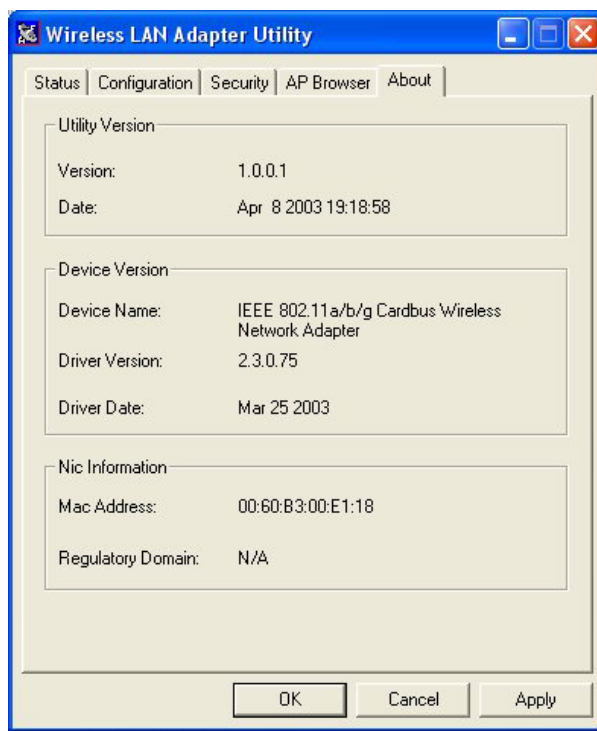


By clicking the **Re-scan** button, the AP Browser can display Access Points around the working environment. Besides showing the SSID and MAC Address of each Access Point, it also displays Channel, Signal, Security and Mode.

To join any of the displayed Access Points, highlight the Access Point you desire to connect and then click the **Join SSID**. Furthermore, you also could monitor the Scanning status.

About

The **About** item shows the versions of the Wireless LAN Utility, driver, firmware of the IEEE 802.11a/b/g Wireless LAN Network Adapter. Also, the MAC address and frequency domain are displayed.



About	
About	Indicates the release information of the wireless LAN configuration utility software, and driver.

CHAPTER 5: WIRELESS NETWORK FUNDAMENTALS

Wireless Network Configuration

Ad-hoc Mode (Peer-to-Peer Workgroup)

The Institute of Electrical and Electronics Engineers (IEEE) standard for wireless LANs (WLANs), 802.11, offers two methods for configuring a wireless network — ad-hoc and infrastructure. In an ad-hoc network, computers are brought together as needed; thus, there is no structure, nor are there fixed points to the network — each node can generally communicate with any other node. There is no access point involved in this configuration. It enables you to quickly set up a small wireless workgroup and allows workgroup members to exchange data or share printers as supported by Microsoft Networking in the various Windows operating systems. Some vendors also refer to ad-hoc networking as Peer-to-Peer group networking.

In this configuration, network packets are directly sent and received by the intended transmitting and receiving stations. As long as the stations are within range of one another, this is the easiest and least expansive way to set up a wireless network.

To set up an ad-hoc workgroup operating with standard protocols, do the following:

- Set all stations to connect in Ad-hoc mode (or Peer-to-Peer workgroup mode).
- Set all stations to use the same network name (or SSID).
- Set all stations to either (1) use no WEP encryption key or (2) use an identical WEP encryption key.
- Set all stations to use the same wireless channel for communication.

Infrastructure Mode

With a wireless access point, you can put the wireless LAN into the Infrastructure mode. It provides wireless connectivity to multiple wireless network devices within a fixed range or area of coverage, interacting with a wireless node via an antenna.

In the Infrastructure mode, the wireless access point converts airwave data into wired Ethernet data, acting as a bridge between the wired LAN and wireless clients. Connecting multiple access points via a wired Ethernet backbone can further extend the wireless network coverage. As a mobile computing device moves out of the range of one access point, it moves into the range of another. As a result, wireless clients can freely roam from one Access Point domain to another and still maintain seamless network connection.

To set up an infrastructure network operating with standard protocols, do the following:

- Set all wireless stations to connect in Infrastructure mode.
- Set all stations to use the same network name (or SSID).
- Set all wireless access points to use the same network name (or ESSID).
- Set all stations to either (1) use no WEP encryption key or (2) an identical WEP encryption key.
- Set up wireless channels used by individual access points. (It is not necessary to set channels on the stations as the stations will automatically scan through all channels for the nearest access point.)

Service Set Identification (SSID)

The Service Set Identification (SSID) is a thirty-two alphanumeric character (maximum) string identifying the wireless local area network. Some vendors refer to the SSID as network name. For stations to communicate with each other, all stations must be configured with the same SSID.

A wireless LAN consisting of nodes operating in ad-hoc configuration without an access point is called a Basic Service Set (BSS). All nodes in a BSS must use the same Basic Service Set ID (BSSID).

In an infrastructure configuration with access points, multiple BSS can be configured to form an Extended Service Set (ESS). In this configuration, the access points are configured with the same Extended Service Set ID (ESSID). Wireless clients configured with the same ESSID can freely roam from one Access Point domain to another and still maintain seamless connection to the network.

Authentication and WEP Encryption

The absence of a physical connection between nodes makes the wireless links vulnerable to information theft. To provide a certain level of security, IEEE 802.11 standard has defined two types of authentication methods, Open System and Shared Key. Open System authentication is a null algorithm. Shared Key authentication is an algorithm where both the transmitting node and the receiving node share an authentication key to perform a checksum on the original message. By default, IEEE 802.11 wireless devices operate in an open system network.

Wired Equivalent Privacy (WEP) data encryption is utilized when the wireless nodes or access points are configured to operate in Shared Key authentication mode. There are two shared key methods implemented in most commercially available products, 40-bit WEP data encryption and 128-bit WEP data encryption.

The 40-bit WEP data encryption method, allows for a five-character (40-bit) input. Additionally, 24 factory-set bits are added to the 40-bit input to generate a 64-bit encryption key. (The 24 factory-set bits are not user configurable.) This encryption key will be used to encrypt/decrypt all data transmitted via the wireless interface. Some vendors may refer to the 40-bit WEP data encryption as 64-bit WEP data encryption since the actual encryption key used in the encryption process is 64 bits wide.

The 128-bit WEP data encryption method consists of 104 configurable bits. Similar to the 40-bit WEP data encryption method, the remaining 24 bits are factory set and not user configurable. Some vendors allow passphrases to be entered instead of the cryptic hexadecimal characters to ease encryption key entry.

Encryption Key Size	# of Hexadecimal Digits	Example of Hexadecimal Key Content
64-bit (24+40)	10	4C72F08AE1
128-bit (24+104)	26	4C72F08AE19D57A3FF6B260037
152-bit (24+128)	32	4C72F08AE19D57A3FF6B2600376B9C6E

Regulatory Compliance Information

Radio Frequency Interference Requirements

This device is restricted to indoor use due to its operation in the 5.15 to 5.25 GHz frequency range.

High power radars are allocated as primary users of the 5.25 to 5.35 GHz bands.

These radar stations can cause interference with and/or damage this device.

DECLARATION OF CONFORMITY

We declare under our sole responsibility that the product IEEE 802.11a/b/g Wireless LAN Network Adapter complies with Part 15 of FCC rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Modifications made to the product, unless expressly approved by us, could void the user's authority to operate the equipment.

FCC Statements:

1. This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions:
 - (1) This device may not cause harmful interference, and
 - (2) This device must accept any interference received, including interference that may cause undesired operation.
2. This device and its antenna(s) must not be co-located or operating in conjunction with any other antenna or transmitter.
3. Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user authority to operate the equipment.
4. This device is for OEM installation only, the End User manual shall not contain information about how to install the module.
5. This compliance to FCC radiation exposure limits for an uncontrolled environment, and minimum of 20 cm separation between antenna and body.
6. Only the type of antenna tested may be used.
7. The end product must carry a label stating "Contains TX FCC ID:M4Y-0AG621".

Information for OEM integrator:

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the users manual of the end product which integrate this module.

The users manual for OEM integrators end users must include the following information in a prominent location

IMPORTANT NOTE: To comply with FCC RF exposure compliance requirements, the antenna used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

If the end product integrating this module is going to be operated in 5.15 ~5.25GHz frequency range, the warning statement in the user manual of the end product should include the restriction of operating this device in indoor could void the user's authority to operate the equipment.