Reference Manual for the Model CG814W Wireless Cable Modem Gateway

NETGEAR

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This is to certify that the CG814W Wireless Cable Modem Gateway is shielded against the generation of radio interference in accordance with the application of Council Directive 89/336/EEC, Article 4a. Conformity is declared by the application of EN 55 022 Class B (CISPR 22).

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Es wird hiermit bestätigt, daß das CG814W Wireless Cable Modem Gateway gemäß der im BMPT-AmtsblVfg 243/1991 und Vfg 46/1992 aufgeführten Bestimmungen entstört ist. Das vorschriftsmäßige Betreiben einiger Geräte (z.B. Testsender) kann jedoch gewissen Beschränkungen unterliegen. Lesen Sie dazu bitte die Anmerkungen in der Betriebsanleitung.

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Federal Office for Telecommunications Approvals has been notified of the placing of this equipment on the market and has been granted the right to test the series for compliance with the regulations.

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This equipment is in the second category (information equipment to be used in a residential area or an adjacent area thereto) and conforms to the standards set by the Voluntary Control Council for Interference by Data Processing Equipment and Electronic Office Machines aimed at preventing radio interference in such residential areas.

When used near a radio or TV receiver, it may become the cause of radio interference.

Read instructions for correct handling.

Technical Support

Thank you for choosing Time Warner Cable "Wireless Road Runner" Service and Netgear product(s). Please register online and take advantage of the technical support resources such as Netgear online knowledge base. Technical support is available twenty-four hours a day, seven days a week; please call your local Time Warner Cable office.

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About This Manual

Thank your for purchasing the NETGEAR™ CG814W Wireless Cable Modem Gateway.

This manual describes the features of the gateway and provides installation and configuration instructions.

Audience

This reference manual assumes that the reader has basic to intermediate computer and Internet skills. However, basic computer network, Internet, firewall, and PC networking technologies tutorial information is provided in the Appendices.

Typographical Conventions

This guide uses the following typographical conventions:

italics	Media titles, UNIX files, commands, URLs, and directory names.
bold times roman	User input
Internet Protocol (IP)	First time an abbreviated term is used.
`courier font`	Screen text, user-typed command-line entries.
[Enter]	Named keys in text are shown enclosed in square brackets. The notation [Enter] is used for the Enter key and the Return key.
[Ctrl]+C	Two or more keys that must be pressed simultaneously are shown in text linked with a plus (+) sign.
ALL CAPS	DOS file and directory names.

Special Message Formats

This guide uses the following formats to highlight special messages:

	Note: This format is used to highlight information of importance or special interest.

	Warning: This format is used to highlight information about the possibility of injury or equipment damage.

	Danger: This format is used to alert you that there is the potential for incurring an electrical shock if you mishandle the equipment.

Technical Support

For help with any technical issues, contact Customer Support at 1-888-NETGEAR, or visit us on the Web at www.NETGEAR.com. The NETGEAR Web site includes an extensive knowledge base, answers to frequently asked questions, and a means for submitting technical questions online.

Chapter 1
Introduction

This chapter describes the features of the NETGEAR CG814W Wireless Cable Modem Gateway.

About the CG814W Gateway

The NETGEAR CG814W Wireless Cable Modem Gateway connects directly to the wide area network (WAN) using its built-in cable modem. It has multiple options to connect to your local area network (LAN), including a 4-port 10/100 Mbps Ethernet switch, a USB port and an 802.11b wireless Access Point.

The CG814W Gateway is a complete security solution that protects your network from attacks and intrusions. Unlike simple Internet sharing routers that rely on Network Address Translation (NAT) for security, the CG814W Gateway uses Stateful Packet Inspection for Denial of Service (DoS) attack protection and intrusion detection. The CG814W Gateway provides highly reliable Internet access for up to 253 users.

Key Features

The CG814W Gateway offers the following features.

Built-in Cable Modem

The CG814W Gateway connects directly the WAN using an integrated cable modem. The modem is DOCSIS 1.0 compliant and upgradable to DOCSIS 1.1, guaranteeing that it will work with your local cable service provider.

A Powerful, True Firewall

Unlike simple Internet sharing NAT routers, the CG814W Gateway is a true firewall, using stateful packet inspection to defend against hacker attacks. Its firewall features include:

- Denial of Service (DoS) protection
  Automatically detects and thwarts Denial of Service (DoS) attacks such as Ping of Death, SYN Flood, LAND Attack and IP Spoofing.
- Configurable Port Forwarding, Port Blocking, Port Triggering and DMZ provide enough flexibility for most applications.
- Blocks access from your LAN to Internet locations or services that you specify as off-limits.
- Logs security incidents
  The CG814W Gateway will log security events such as blocked incoming traffic, port scans, attacks, and administrator logins. You can configure the gateway to email the log to you whenever a significant event occurs.

Content Filtering

With its content filtering feature, the CG814W Gateway prevents objectionable content from reaching your PCs. The gateway allows you to control access to Internet content by screening for keywords within Web addresses. You can configure the gateway to log and report attempts to access objectionable Internet sites.

802.11b Standards-based Wireless Networking

The CG814W Gateway includes an 802.11b-compliant wireless access point, providing continuous, high-speed 11 Mbps access between your wireless and Ethernet devices. The access point provides:

- 802.11b Standards-based wireless networking at up to 11 Mbps
- 64-bit and 128-bit WEP encryption security
- WEP keys can be generated manually or by passphrase
- Wireless access can be restricted by MAC address.

Configurable Auto Uplink™ Ethernet Connection

With its internal 4-port 10/100 switch, the CG814W Gateway can connect to either a 10 Mbps standard Ethernet network or a 100 Mbps Fast Ethernet network. Both the local LAN and the Internet WAN interfaces are autosensing and capable of full-duplex or half-duplex operation.

The gateway incorporates Auto Uplink™ technology. Each LOCAL Ethernet port will automatically sense whether the Ethernet cable plugged into the port should have a 'normal' connection such as to a PC or an 'uplink' connection such as to a switch or hub. That port will then configure itself to the correct configuration. This feature also eliminates the need to worry about crossover cables, as Auto Uplink will accommodate either type of cable to make the right connection.

USB Port

A USB connection for your computer eliminates the need for installing an Ethernet card.

Protocol Support

The CG814W Gateway supports the Transmission Control Protocol/Internet Protocol (TCP/IP). Appendix B, "Networks, Routing, and Firewall Basics" provides further information on TCP/IP.

- IP Address Sharing by NAT
  The CG814W Gateway allows several networked PCs to share an Internet account using only a single IP address, which may be statically or dynamically assigned by your Internet service provider (ISP). This technique, known as Network Address Translation (NAT), allows the use of an inexpensive single-user ISP account.
- Automatic Configuration of Attached PCs by DHCP
  The CG814W Gateway dynamically assigns network configuration information, including IP, gateway, and domain name server (DNS) addresses, to attached PCs on the LAN using the Dynamic Host Configuration Protocol (DHCP). This feature greatly simplifies configuration of PCs on your local network.
- DNS Relay
  When DHCP is enabled and no DNS addresses are specified, the gateway provides its own address as a DNS server to the attached PCs. The gateway obtains actual DNS addresses from the ISP during connection setup and forwards DNS requests from the LAN.

Easy Installation and Management

You can install, configure, and operate the CG814W Gateway within minutes after connecting it to the network. The following features simplify installation and management tasks:

- Browser-based management
  Browser-based configuration allows you to easily configure your gateway from almost any type of personal computer, such as Windows, Macintosh, or Linux. A user-friendly Setup Wizard is provided and online help documentation is built into the browser-based Web Management Interface.
- Diagnostic functions
  The gateway incorporates built-in diagnostic functions such as Ping, DNS lookup, and remote reboot. These functions allow you to test Internet connectivity and reboot the gateway. You can use these diagnostic functions directly from the CG814W Gateway when your are connect on the LAN or when you are connected over the Internet via the remote management function.
- Visual monitoring
  The gateway’s front panel LEDs provide an easy way to monitor its status and activity.

What's in the Box?

The product package should contain the following items:

- CG814W Wireless Cable Modem Gateway
- AC power adapter
- Category 5 (CAT5) Ethernet cable
- USB cable
- *Resource CD*, including:
  - — This manual
  - — Application Notes, Tools, and other helpful information

If any of the parts are incorrect, missing, or damaged, contact your NETGEAR dealer. Keep the carton, including the original packing materials, in case you need to return the product for repair.

The Gateway's Front Panel

The front panel of the CG814W Gateway (Figure 1-1) contains status LEDs.

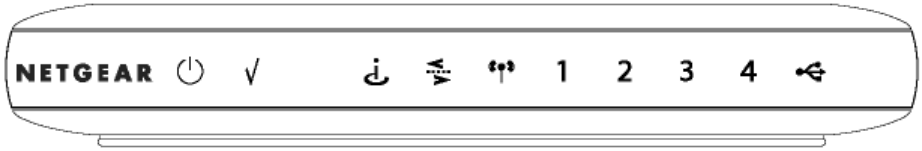


Figure 1-1: CG814W Gateway Front Panel

You can use some of the LEDs to verify connections. Table 1-1 lists and describes each LED on the front panel of the CG814W Gateway. These LEDs are green when lit.

Table 1-1. LED Descriptions

Label	Activity	Description
Power	On Off	Power is supplied to the gateway. Power is not supplied to the gateway.

Table 1-1. LED Descriptions

Test	On Off	A system failure has occurred. Reboot the gateway. Normal operation.
Cable Link Cable Traffic	On (Green) Off On Off	Configuration of the cable interface by your cable service provider is complete. Configuration of the cable interface is still in progress. Data is being transmitted or received on the cable interface. The cable interface is idle.
Wireless	On Blink	Indicates that the wireless Access Point is operating normally. Data is being transmitted or received on the wireless interface.
Local (Local Area Network) 4	On (Green) Blink (Green) On (Yellow) Blink (Yellow) Off	The Local port has detected link with a 100 Mbps device. Data is being transmitted or received at 100 Mbps. The Local port has detected link with a 10 Mbps device. Data is being transmitted or received at 10 Mbps. No link is detected on this port.
USB	On (Green) Blink (Green) Off	The Local port has detected link with a USB device. Data is being transmitted or received through USB. No link is detected on the USB port.

The Gateway's Rear Panel

The rear panel of the CG814W Gateway (Figure 1-2) contains the connections identified below.

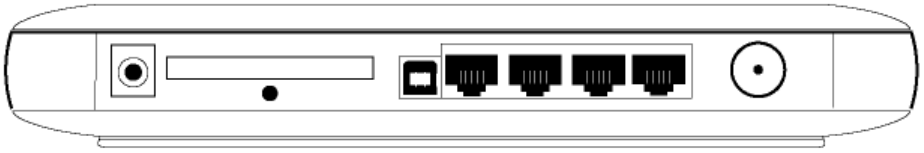


Figure 1-2: CG814W Gateway Rear Panel

Viewed from left to right, the rear panel contains the following elements:

- AC power adapter input
- 802.11b Wireless antenna
- Factory Default Reset push button
- USB port for connecting the gateway to a local computer
- Four Ethernet RJ-45 ports for connecting the gateway to local computers
- Coaxial F-type connector for connecting the gateway to your cable service provider

Chapter 2
Connecting the Gateway to the Internet

This chapter describes how to set up the CG814W Gateway on your Local Area Network (LAN), connect to the Internet and perform basic configuration.

What You Will Need Before You Begin

You need to prepare these three things before you can connect your gateway to the Internet:

1. A computer properly connected to the gateway as explained below.
2. Active Data Over Cable Internet service provided by cable modem account.
3. The Internet Service Provider (ISP) configuration information for your cable modem account.

Hardware Requirements

The CG814W Gateway connects to your LAN using either its twisted-pair Ethernet, USB or 802.11b wireless port.

To use the CG814W Gateway on your network, each computer must have either an installed Ethernet Network Interface Card (NIC), USB Host port or 802.11b wireless adapter. If the computer will connect to your network at 100 Mbps, you must use a Category 5 (CAT5) cable such as the one provided with your gateway.

LAN Configuration Requirements

For the initial connection to the Internet and configuration of your gateway, you will need to connect a computer to the gateway which is set to automatically get its TCP/IP configuration from the gateway via DHCP.

Note: Please refer to Appendix C, "Preparing Your Network" for assistance with DHCP configuration.

Internet Configuration Requirements

Depending on how your ISP set up your Internet account, you will need one or more of these configuration parameters to connect your gateway to the Internet:

- Host and Domain Names
- ISP Domain Name Server (DNS) Addresses
- Fixed or Static IP Address
- MAC Address of the PC you used to first connect to the cable modem service

Where Do I Get the Internet Configuration Parameters?

If you already have cable Internet service and are replacing a cable modem, you may need these parameters.

- CG814W Gateway Cable and Device MAC Address, that can be found on the bottom of your gateway, or on the Basic Settings page.
- The MAC Address of the PC that you use to access the internet.

There are several ways you can gather the required Internet connection information.

- Your ISP should have provided you with all the information needed to connect to the Internet. If you cannot locate this information, you can ask your ISP to provide it or you can try one of the options below.
- If you have a computer already connected using the active Internet access account, you can gather the configuration information from that computer.
    - For Windows 95/98/ME, open the Network control panel, select the TCP/IP entry for the Ethernet adapter, and click Properties.
    - For Windows 2000/XP, open the Local Area Network Connection, select the TCP/IP entry for the Ethernet adapter, and click Properties.
    - For Macintosh computers, open the TCP/IP or Network control panel.

Once you locate your Internet configuration parameters, you may want to record them on the page below.

Record Your Internet Connection Information

Print this page. Fill in the configuration parameters from your Internet Service Provider (ISP).

Host and Domain Names: Some ISPs use a specific host or domain name like **CCA7324-A** or **attbi**. If you haven't been given host or domain names, use the following examples as a guide:

- If your main e-mail account with your ISP is **aaa@yyy.com**, then use **aaa** as your host name. Your ISP might call this your account, user, host, computer, or system name.
- If your ISP's mail server is **mail.xxx.yyy.com**, then use **xxx.yyy.com** as the domain name.

ISP Host Name: _____ ISP Domain Name: _____

Fixed or Static IP Address: If you have a static IP address, record the following information. For example, 169.254.141.148 could be a valid IP address.

Fixed or Static Internet IP Address: _____ . _____ . _____ . _____

Subnet Mask: _____ . _____ . _____ . _____

Gateway IP Address: _____ . _____ . _____ . _____

ISP DNS Server Addresses: If you were given DNS server addresses, fill in the following:

Primary DNS Server IP Address: _____ . _____ . _____ . _____

Secondary DNS Server IP Address: _____ . _____ . _____ . _____

MAC Addresses of CG814W Gateway and PC: If you have existing cable internet service and are replacing your cable modem you may need to notify your cable service provider of the MAC Address (often called Hardware Address) and/or Device Address of your CG814W Gateway. The Device Address is the equivalent of a PC behind the cable modem, and can be "cloned". Cloning allows you to specify the MAC address of the packets the gateway sends to the internet. If you clone the MAC Address of your PC you will not have to register the Device Address of your gateway.

Cable Modem MAC (listed on the bottom of your gateway): _____

Device MAC (listed on the bottom of your gateway): _____

PC MAC Address (listed on the Basic Settings page): _____

Connecting the CG814W Gateway

Before using your gateway, you need to do the following:

- Connect to your computer, using either Ethernet, USB or wireless.
- Connect the line from your cable service provider to the cable connector of the gateway.
- Connect the power adapter.

Your computer will attach to either the Ethernet, USB or wireless ports on the CG814W Gateway.

1. Connect the Gateway.

a. Turn off your computer.

b. Using the coaxial cable provided by your cable company, connect the CG814W Gateway cable port (A**)** to your cable line splitter or outlet.

Figure 2-1: Connect the gateway to the cable network.

c. Connect the gateway to you computer.

— If you will connect with the Ethernet cable, follow the instructions below.

— If you will connect with the USB cable, skip to step d below.

	Note: Set up the CG814W Gateway using either an Ethernet or USB connection to your computer first, then configure the wireless settings. Detailed instructions on configuring your wireless devices for TCP/IP networking are provided in the next chapter.

Connect the gateway to you computer using the Ethernet cable included in the box from your CG814W Gateway's LAN port (B**)** to the Ethernet adapter in your computer.

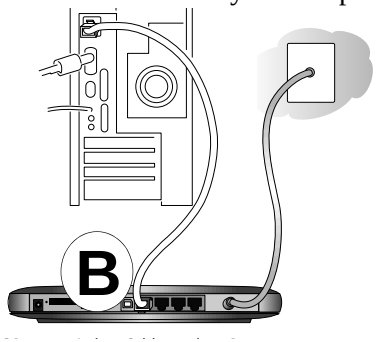


Figure 2-2: Connect a PC to the gateway

The CG814W Gateway incorporates Auto Uplink™ technology. Each LOCAL Ethernet port will automatically sense whether the cable plugged into the port should have a 'normal' connection (e.g. connecting to a PC) or an 'uplink' connection (e.g. connecting to a switch or hub). That port will then configure itself to the correct configuration. This feature also eliminates the need to worry about crossover cables, as Auto Uplink will accommodate either type of cable to make the right connection.

d. To connect your computer to the modem via USB involves installing the USB driver.Insert the CD which came with your gateway into the CD drive of your computer.

	Note: The USB connection option is only available for Windows PCs. Also, Windows 95 does not support USB without special operating system upgrades and patches.

Install the USB driver.

– Connect the USB cable to your modem and plug in the AC power for the gateway.

– Use the USB cable to connect your computer to the gateway.

– The found new hardware Windows installation wizard will prompt you for the drivers.

Figure 2-3: Found New Hardware Wizard window

Browse to the CD and install the USB driver by clicking through the Windows wizard prompts.

e. Plug in your CG814W Gateway and wait about 30 seconds for the lights to stop blinking.

f. Now, turn on your computer. If software usually logs you in to your Internet connection, do not run that software or cancel it if it starts automatically.

g. Verify the following:

The power light is lit after turning on the gateway.

The cable link light is solid green, indicating a link has been established to the cable network.

4 The local lights are lit for any connected computers.

2. Log in to the Gateway.

Note: To connect to the gateway, your computer needs to be configured to obtain an IP address automatically via DHCP. For instructions on how to do this, please see Appendix C, "Preparing Your Network".

a. Using the computer you first used to access your cable modem Internet service, connect to the gateway by typing *http://192.168.0.1* in the address field of Internet Explorer or Netscape® Navigator.

A login window opens as shown in Figure 2-4 below:

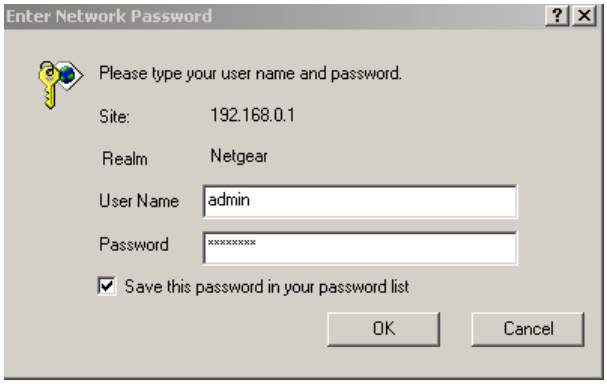


Figure 2-4: Login window

b. For security reasons, the gateway has its own user name and password. When prompted, enter **admin** for the user name and **password** for the password, both in lower case letters.

c. After logging in, you will see the Basic Settings shown in Figure 2-5 below.

	Note: If you were unable to connect to the gateway, please refer to "Basic Functions" on page 6-1.

3. Connect to the Internet.

a. You are now connected to the gateway. Click the Basic Settings link on the upper left of the main menu. You are now connected to the gateway's *Basic Settings* page, shown below.

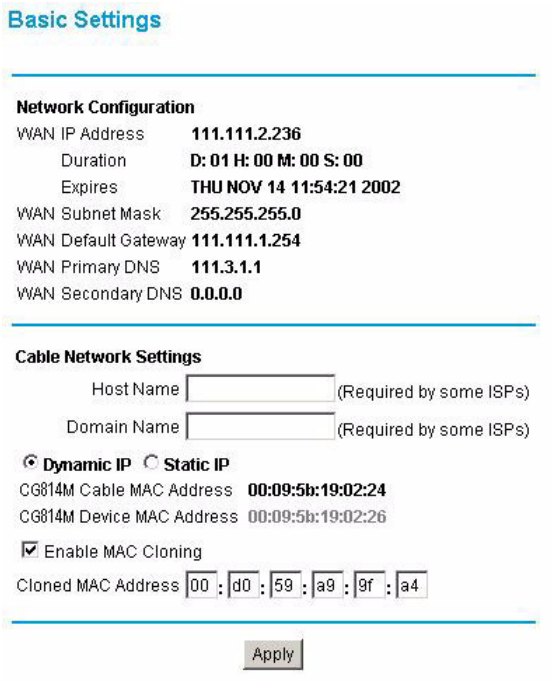


Figure 2-5: Basic Settings page

You are ready to configure your gateway to connect to the Internet.

Unless your ISP assigns your configuration automatically via DHCP, you will need the ISP configuration parameters you recorded in "Record Your Internet Connection Information" on page 2-3.

b. Your current WAN IP address information is shown on this page.

If you have set your configuration for Dynamic IP, below, then an IP address information shown here is an indication that you have successfully received an IP address from your service provider.

If you have set your configuration to Static IP, below, then the IP address information you entered will be shown here.

For Dynamic IP, the Duration and time of Expiration of the IP address are shown. The IP address is renewed automatically using DHCP.

c. Enter your Host Name and Domain Name.
These parameters may be necessary to access your ISP's services such as mail or news servers.
If your ISP does not provide a Host and Domain name, you can use the following example: If your main e-mail account with your ISP is **aaa@yyy.com**, then use **aaa** as your host name and **yyy.com** as the domain name.

d. Select Dynamic or Static IP Address:

If your service provider assigns your IP address automatically through DHCP, select "Dynamic IP". If your service provider has assigned you a permanent, fixed (static) IP address for your PC, select "Static IP".

If you select Static IP, enter the IP address that your ISP assigned. Also enter the Static IP Mask (also known as netmask), Gateway IP address and Domain Name Server (DNS) Address.

– The Gateway is the ISP's router to which your gateway will connect.

– A DNS server is a host on the Internet that translates Internet names (such as www.netgear.com) to numeric IP addresses. Typically your ISP transfers the IP address of one or two DNS servers to your gateway during login. If the ISP does not transfer an address, you must obtain it from the ISP and enter it manually here. If you enter an address here, you should reboot your PCs after configuring the gateway.

e. The CG814W Gateway Cable MAC address is for the built-in cable modem. The CG814W Gateway Device MAC address is for the built-in router. MAC cloning lets you substitute a different MAC address for the CG814W Gateway's built-in router address.

Note: Some cable Internet companies will require you to notify them when you replace the original cable modem or PC so that they can register the MAC address of one or both of these devices.

- MAC cloning lets you substitute a different MAC address for the CG814W Gateway's built-in router address.

  The first time you log in to the CG814W Gateway, it automatically fills in the Cloned MAC Address with the MAC address from the PC which is logged in to the CG814W Gateway.

- Click Apply to accept these settings.

Chapter 3
Wireless Configuration

This chapter describes how to configure the wireless features of your CG814W Wireless Cable Modem Gateway.

	Note: If you are configuring the gateway from a wireless PC and you change the gateway's SSID, channel, or WEP settings, you will lose your wireless connection when you click on Apply. You must then change the wireless settings of your PC to match the gateway's new settings.

Considerations For A Wireless Network

In planning your wireless network, you should consider the level of security required. You should also select the physical placement of your gateway in order to maximize the network speed. For further information on wireless networking, refer to "Wireless Networking Overview" in Appendix B, "Networks, Routing, and Firewall Basics"."

Implement Appropriate Security

Unlike wired network data, your wireless data transmissions can extend beyond your walls and can be received by anyone with a compatible adapter. For this reason, use the security features of your wireless equipment. Restricting access by MAC address filtering adds an obstacle to unwanted users joining your network. To hinder a determined eavesdropper, you should use one of Wired Equivalent Privacy (WEP) data encryption options.

Observe Placement and Range Guidelines

The operating distance or range of your wireless connection can vary significantly based on the physical placement of the wireless gateway.

	Note: Failure to follow these guidelines can result in significant performance degradation or inability to wirelessly connect to the router.

For best results, place your gateway:

- Near the center of the area in which your PCs will operate.
- In an elevated location such as a high shelf.
- Away from potential sources of interference, such as PCs, microwaves, and 2.4 GHz cordless phones.
- Away from large metal surfaces.

Configuring Wireless Settings

To configure the Wireless interface of your gateway, click on the Wireless Settings heading in the Setup section of the browser interface. The Wireless Settings menu will appear, as shown below:

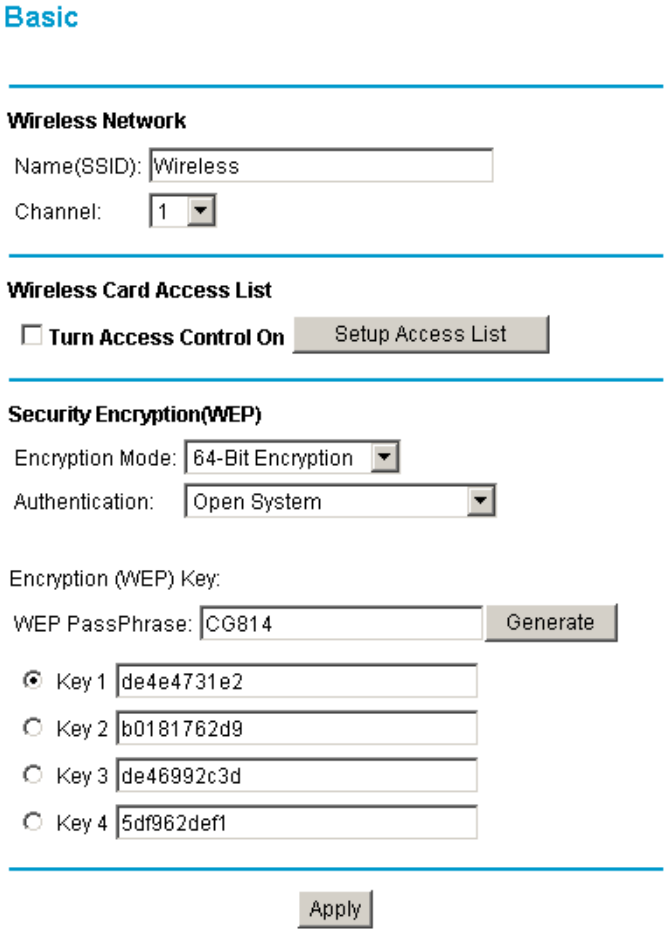


Figure 3-1: Wireless Settings menu

Wireless Network Settings

In the Wireless Settings section are the following parameters:

- Name (SSID)
  Enter a Service Set ID (SSID) value of up to 32 alphanumeric characters. The same SSID must be assigned to all wireless devices in your network. The default SSID is **Wireless**, but NETGEAR strongly recommends that you change your network's SSID to a different value.
- Channel
  This field determines which operating frequency will be used. It should not be necessary to change the wireless channel unless you notice interference problems with another nearby access point.

Restricting Wireless Access by MAC Address

By default, any wireless PC that is configured with the correct SSID will be allowed access to your wireless network. For increased security, you can restrict access to the wireless network to only allow specific PCs based on their MAC addresses.

Check the Turn Access Control On box to restrict access to you network to computers in the Access Control List.

To access the Access List, click the Setup Access List button.

	Note: If the **Turn Access Control On** is enabled and the Access Control List is blank; then all wireless PCs will be unable to connect to your wireless network.

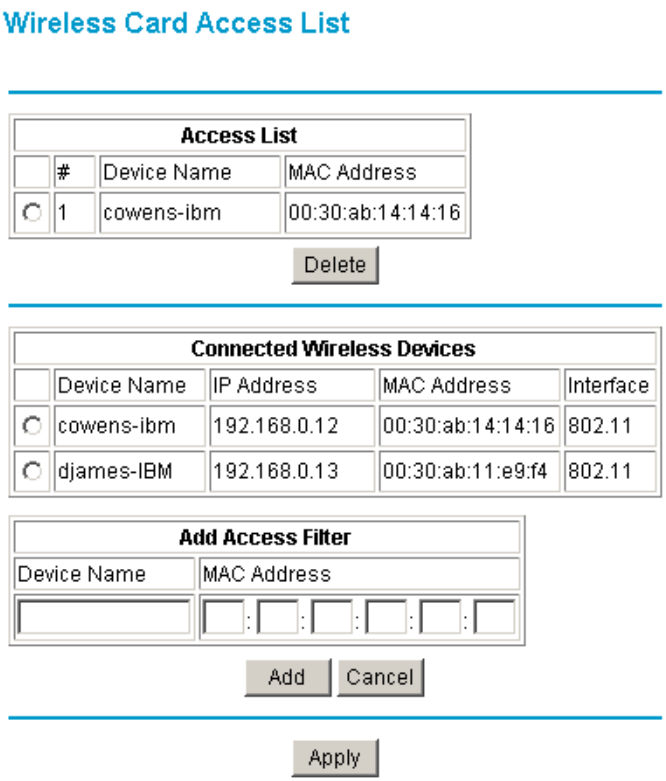


Figure 3-2: Wireless Access List menu

The Access List displays a list of MAC addresses that will be allowed to connect to the gateway. These PCs must also have the correct SSID and WEP settings. You can add MAC addresses to the Access List by either selecting form the list of Connected Wireless Devices, or by manual entering MAC addresses

To restrict access based on MAC addresses:

1. For your convenience, this menu displays a list of currently Connected Wireless Devices and their MAC addresses. Select a device from the list that you want to allow to access your network.
2. If the desired PC does not appear in the list, you can manually enter the MAC address of the authorized PC.
   The MAC address is usually printed on the wireless card.

3. If no Device Name appears, you can type a descriptive name for the PC that you are adding.
4. Click Add.
5. When you have finished entering MAC addresses, click Apply to save the Access List and return to the Wireless Settings menu.

To delete a MAC address from the table, click on it to select it, then click the Delete button.

Configuring Wired Equivalent Privacy (WEP)

In the Wireless Settings menu you can configure WEP data encryption using the following parameters:

- Encryption Mode
  Select the WEP Encryption level:
  - Off - no data encryption (Open System)
  - 64-bit (sometimes called 40-bit) encryption
  - 128-bit encryption
- Authentication Type
  Select the appropriate value - "Open System" or "Shared Key." Check your wireless card's documentation to see what method to use.
- Encryption (WEP) Key
  If WEP is enabled, you can manually or automatically program the four data encryption keys. These values must be identical on all PCs and Access Points in your network.
  - Automatic - Enter a word or group of printable characters in the WEP PassPhrase box and click the Generate button. The four key boxes will be automatically populated with key values.
  - Manual - Enter ten hexadecimal digits (any combination of 0-9, a-f, or A-F)
    Select which of the four keys will be active.

Be sure to click Apply to save your settings in this menu.

Chapter 4
Protecting Your Network

This chapter describes how to use the firewall features of the CG814W Wireless Cable Modem Gateway to protect your network.

Protecting Access to Your CG814W Gateway

For security reasons, the gateway has its own user name and password. Also, after a period of inactivity for a set length of time, the administrator login will automatically disconnect. When prompted, enter **admin** for the gateway User Name and **password** for the gateway Password. You can use procedures below to change the gateway's password and the amount of time for the administrator's login timeout.

Note: The user name and password are not the same as any user name or password your may use to log in to your Internet connection.

NETGEAR recommends that you change this password to a more secure password. The ideal password should contain no dictionary words from any language, and should be a mixture of both upper and lower case letters, numbers, and symbols. Your password can be up to 30 characters.

Procedure 4-1: Changing the Built-In Password

1. Log in to the gateway at its default LAN address of *http://192.168.0.1* with its default User Name of **admin**, default password of **password**, or using whatever Password and LAN address you have chosen for the gateway.

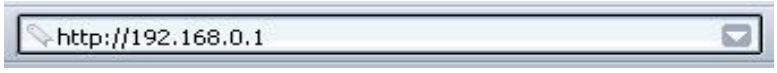


Figure 4-1: Log in to the gateway

2. From the Main Menu of the browser interface, under the Maintenance heading, select Set Password to bring up the menu shown in Figure 4-2.

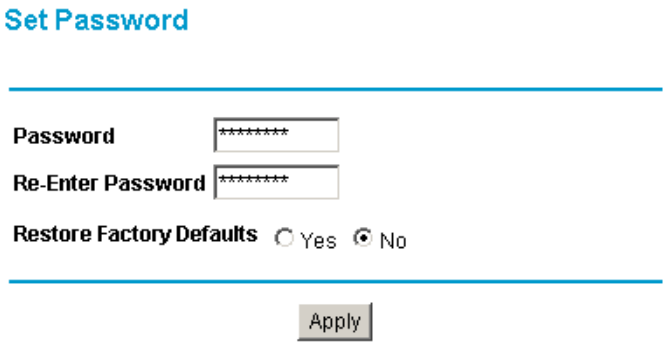


Figure 4-2: Set Password menu

3. To change the password, first enter the old password, and then enter the new password twice.
4. If you would like to reset your gateway to its factory default settings select Yes for Restore Factory Defaults. This will remove all configuration information you have entered.
5. Click Apply to save your changes.

Note: After changing the password, you will be required to log in again to continue the configuration. If you have backed up the gateway settings previously, you should do a new backup so that the saved settings file includes the new password.

Blocking Keywords, Sites, and Services

The gateway provides a variety of options for blocking Internet based content and communications services. With its content filtering feature, the CG814W Gateway prevents objectionable content from reaching your PCs. The CG814W allows you to control access to Internet content by screening for keywords within Web addresses. It also has the capability to block access to all sites except those that are explicitly allowed. Key content filtering options include:

- Blocking access from your LAN to Internet locations that contain keywords that your specify.
- Blocking access to web sites that you specify as off-limits.

- Allowing access to only web sites that you specify as allowed.

The section below explains how to configure your gateway to perform these functions.

Procedure 4-2: Blocking Keywords and Domains

The CG814W Gateway allows you to restrict access to Internet content based on functions such as web address keywords and web domains.

> A domain name is the name of a particular web site. For example, for the address www.NETGEAR.com, the domain name is NETGEAR.com.

1. Log in to the gateway at its default LAN address of *http://192.168.0.1* with its default User Name of **admin**, default password of **password**, or using whatever Password and LAN address you have chosen for the gateway.
2. Click on the Block Sites link of the Content Filtering menu.

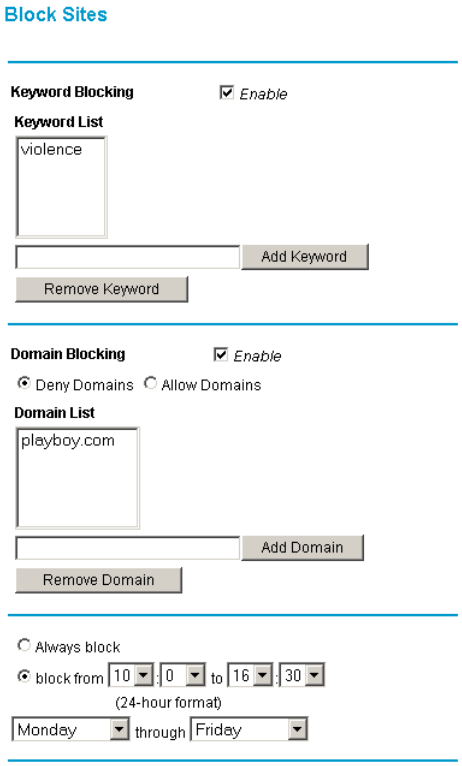


Figure 4-3: Block Sites menu

3. To enable keyword blocking or Domain Blocking, check the appropriate Enable box.
4. Enter Keywords into the Keyword List by typing then in the Add Keyword box, then, click Add Keyword.

   Some examples of Keyword applications follow:

   - If the keyword “XXX” is specified, the URL <http://www.badstuff.com/xxx.html> is blocked.
   - If the keyword “.com” is specified, only websites with other domain suffixes (such as .edu or .gov) can be viewed.
   - Enter the keyword “.” to block all Internet browsing access.

   Up to 8 entries are supported in the Keyword list.
5. Enter Domains into the Domain List by typing then in the Add Domain box, then, click Add Domain.

   If the domain “badstuff.com” is specified, the URL <http://www.badstuff.com/xxx.html> is blocked, along with all other urls in the badstuff.com site.

   Up to 8 entries are supported in the Keyword list.
6. To block access to the domains in the Domain List, select Deny Domains.

   To allow access to only the domains in the Domain List, select Allow Domains. If the domain “goodstuff.com” is specified, you will be able to access only sites on the goodstuff site.
7. To delete a keyword or domain, select it from the list, click Remove Keyword or Remove Domain.
8. Configure the times when access rules apply in the Schedule section.
9. Click Apply to save your settings.

Using Port Blocking

Firewall rules are used to block or allow specific traffic passing through from one side to the other. Inbound rules (WAN to LAN) restrict access by outsiders to private resources, selectively allowing only specific outside users to access specific resources. Instructions for setting up inbound rules can be found in “Port Forwarding“ on page -6. Outbound rules (LAN to WAN) determine what outside resources local users can have access to. This section describes how to set up outbound rules.

A firewall has two default rules, one for inbound traffic and one for outbound. The default rules of the CG814W Gateway are:

- Inbound: Block all access from outside except responses to requests from the LAN side.
- Outbound: Allow all access from the LAN side to the outside.

You may define additional rules that will specify exceptions to the default rules. By adding custom rules, you can block or allow access based on the service or application, source or destination IP addresses, and time of day.

To configure outbound rules on the CG814W Gateway, click the Port Blocking link on the Advanced section of the main menu.

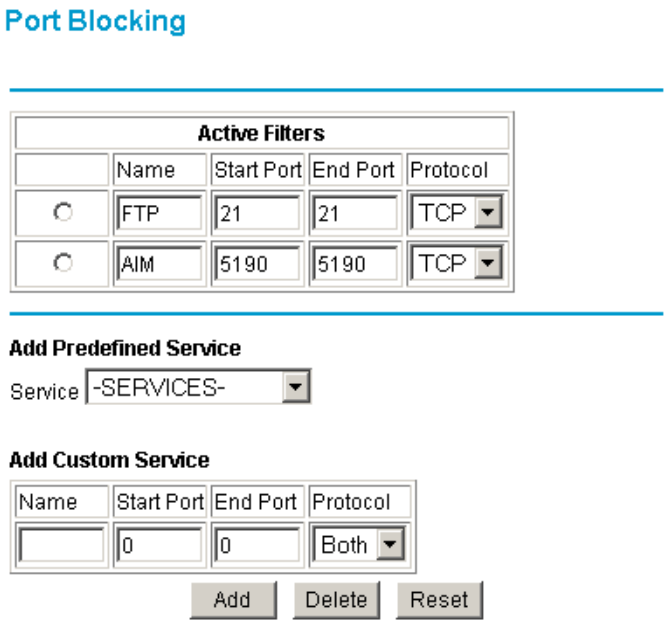


Figure 4-4: Port Blocking menu

- To block outbound traffic, select the service you would like to block from the drop-down list of predefined services. Click Add.

- If the service you would like to block is not in the predefined list, you can add a custom service. Enter the range of ports you would like to block and select whether the ports are TCP, UDP or Both. Click Add.
- To delete an existing rule, select its button on the left side of the table and click Delete.

Port Forwarding

Because the CG814W Gateway uses Network Address Translation (NAT), your network presents only one IP address to the Internet, and outside users cannot directly address any of your local computers. However, by defining an inbound rule you can make a local server (for example, a web server or game server) visible and available to the Internet. The rule tells the gateway to direct inbound traffic for a particular service to one local server based on the destination port number. This is also known as Port Forwarding.

	Note: Some residential broadband ISP accounts do not allow you to run any server processes (such as a Web or FTP server) from your location. Your ISP may periodically check for servers and may suspend your account if it discovers any active services at your location. If you are unsure, refer to the Acceptable Use Policy of your ISP.

Considerations for Port Forwarding

- If the IP address of the local server PC is assigned by DHCP, it may change when the PC is rebooted. To avoid this, you can assign a static IP address to your server outside the range that is assigned by DHCP, but in the same subnet as the rest of your LAN. By default, the IP addresses in the range of 192.168.0.2 through 192.168.0.9 are reserved for this.
- Local PCs must access the local server using the PCs' local LAN address (192.168.0.XXX, by default). Attempts by local PCs to access the server using the external WAN IP address will fail.

Remember that allowing inbound services opens holes in your firewall. Only enable those ports that are necessary for your network.

The following are two application examples of inbound rules.

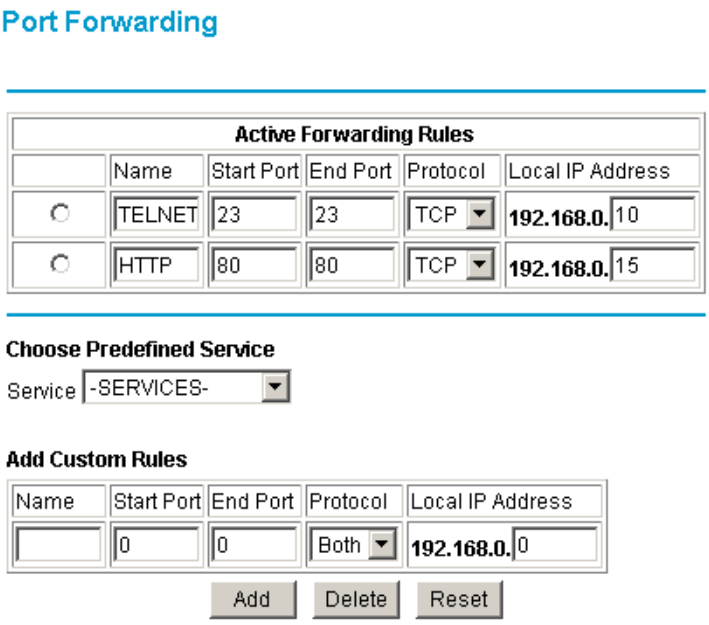


Figure 4-5: Port Forwarding menu

- To forward inbound traffic:
  1. Select the service you would like to forward from the drop-down list of predefined services.

     If the service you would like to forward is not in the predefined list, you can add a custom service. Enter the range of ports you would like to forward and select whether the ports are TCP, UDP or Both.
  2. Enter the IP address of the computer on your network to which you would like to direct the inbound traffic
  3. Click Add.
  4. To access the local computer from the Internet, you must use the WAN address of your gateway, which can be found on the Basic Settings page.
- To delete an existing rule, select its button on the left side of the table and click Delete.

Using Port Triggering

Port Triggering is an advanced feature that allows you to dynamically open inbound ports based on outbound traffic on different ports. This is an advanced feature that can be used for gaming and other internet applications.

Port Forwarding can typically be used to enable similar functionality, but it is static and has some limitations. Ports will be open to traffic from the internet until the port forwarding rule is removed. Additionally, port forwarding does not work well for some applications when your WAN IP address is assigned by DHCP, and is changed frequently. Port Triggering opens in incoming port temporarily and can does not require the server on the internet to track your IP address if it is changed.

Port Triggering monitors outbound traffic. When the gateway detects traffic on the specified outbound port, it remembers the IP address of the computer that sent the data and “triggers” the incoming port. Incoming traffic on the triggered port is then forwarded to the triggering computer.

An example of Port Triggering for Internet Relay Chat (IRC) is shown in Figure 4-6. When you connect to an IRC server, the server tries to connect back on port 113 to do an Ident lookup. Unless you have configured Port Forwarding to open port 113, the traffic will be blocked. In this example, the initial login to the server in the range of ports 6660 to 6670 will be detected. This will trigger

the gateway to temporarily forward port 113 to the PC that initiated the login.l

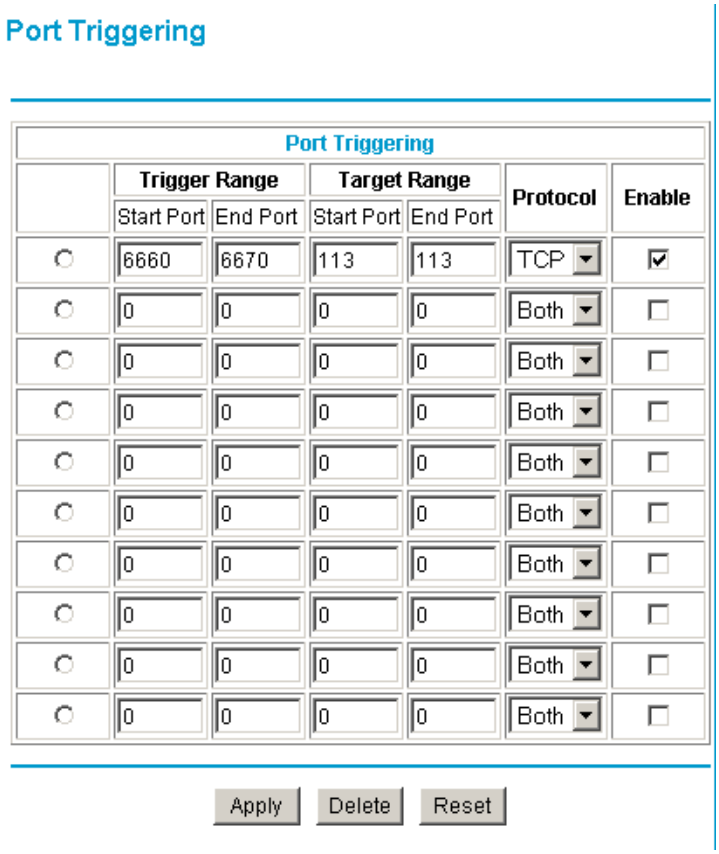


Figure 4-6: Port Triggering menu, with IRC example.

To configure Port Triggering:

1. In the Trigger Range, enter the outbound ports that will be monitored for activity. This will be the “trigger”.
2. In the Target Range, enter the inbound ports that should be forwarded when the trigger occurs.
3. Select the appropriate protocol: TCP, UDP or Both.
4. Check the Enable box
5. Click Apply

To clear a Port Triggering rule, you can either remove the check from the Enable box, to

temporarily disable the rule, or you can select the rule and click Delete.

Setting Up A Default DMZ Host

The Default DMZ Server feature is helpful when using some online games and videoconferencing applications that are incompatible with NAT. The gateway is programmed to recognize some of these applications and to work properly with them, but there are other applications that may not function well. In some cases, one local PC can run the application properly if that PC's IP address is entered as the Default DMZ Host.

	Note: For security, you should avoid using the Default DMZ Server feature. When a computer is designated as the Default DMZ Server, it loses much of the protection of the firewall, and is exposed to many exploits from the Internet. If compromised, the computer can be used to attack your network.

Incoming traffic from the Internet is normally discarded by the gateway unless the traffic is a response to one of your local computers or a service that you have configured in the Port Forwarding or Port Triggering menu. Instead of discarding this traffic, you can have it forwarded to one computer on your network. This computer is called the Default DMZ Host.

To assign a computer or server to be a DMZ Host, from the Main Menu, under Advanced, select DMZ Host. Enter the IP address of the computer you would like to assign as a DMZ Host and click Apply. To disable the DMZ Host, enter "0" and click Apply.

Respond to Ping on Internet WAN Port

If you want the gateway to respond to a 'ping' from the Internet, click the 'Respond to Ping on WAN Port' check box. This should only be used as a diagnostic tool, since it allows your gateway to be discovered. Don't check this box unless you have a specific reason to do so.

Chapter 5
Managing Your Network

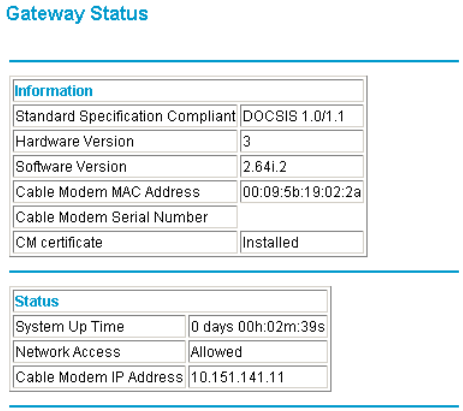
This chapter describes how to perform network management tasks with your CG814W Wireless Cable Modem Gateway.

Network Status Information

The CG814W provides a variety of status and usage information which is discussed below.

Viewing Gateway Status

From the Main Menu, under Maintenance, select Gateway Status to view the screen in Figure 5-1.



Gateway Status

Information	
Standard Specification Compliant	DOCSIS 1.0/1.1
Hardware Version	3
Software Version	2.64i.2
Cable Modem MAC Address	00:09:5b:19:02:2a
Cable Modem Serial Number	
CM certificate	Installed

Status	
System Up Time	0 days 00h:02m:39s
Network Access	Allowed
Cable Modem IP Address	10.151.141.11

Figure 5-1: Gateway Status screen

This screen shows the following parameters:

Table 5-1. Menu 3.2 - Router Status Fields

Field	Description
Information	
Standard Specification Compliant	The specification to which the gateway's cable interface is compatible.
Hardware Version	The hardware version of the gateway.
Software Version	The software version of the gateway.
Cable Modem MAC Address	The MAC address being used by the Cable Modem port of the gateway. This MAC address may need to be registered with your Cable Service Provider.
Device MAC Address	The MAC address of the router side of the gateway. This is the equivalent of your PC when connected to a cable modem. You can use the MAC Cloning feature to replace this MAC address with another address when sending packets to the WAN.
Cable Modem Serial Number	The serial number of the gateway hardware.
CM Certificate	If the Cable Modem certificate is Installed, it is possible for the service provider to upgrade your Data Over Cable service securely.
Status	
System Up Time	This is the time since the gateway has registered with your cable service provider.
Network Access	This field will change to Allowed when the registration with your cable service provider is complete.
Cable Modem IP Address	The IP address of you gateway, as seen from the Internet.

Connection Status

From the Main Menu, under Maintenance, select Connection to view the screen in Figure 5-2.

Connection

Startup Procedure		
Procedure	**Status**	**Comment**
Acquire Downstream Channel		Locked
Connectivity State	OK	Operational
Boot State	OK	Operational
Configuration File		
Security	Disabled	Disabled

Downstream Channel			
Lock Status	Locked	Modulation	QAM64
Channel ID	1	Symbol rate	5056941
Downstream Frequency		Downstream Power	15.9 dBmV
SNR	37.9 dB		

Upstream Channel			
Lock Status	Locked	Modulation	QPSK
Channel ID	1	Symbol rate	1280 Ksym/sec
Upstream Frequency		Upstream Power	11.0 dBmV

Current System Time:THU APR 19 22:36:09 2001

Figure 5-2: Connection screen

This screen shows detailed information about the status of the connection to your cable service provider that can be used for troubleshooting. The gateway goes through the following steps to be provisioned

1. Acquire and lock Downstream Channel
2. Acquire upstream parameters and range.
3. Lock Upstream Channel
4. Acquire IP Address through DHCP

Current System Time

The date and time is acquired from your cable service provider as part of the registration procedure.

Configuring LAN IP Settings

The LAN IP Setup menu allows configuration of LAN IP services such as the IP address of the gateway and DHCP. These features can be found under the Advanced heading in the Main Menu in the LAN IP menu.

LAN IP Setup

The LAN IP Setup menu is shown in Figure 5-3.0

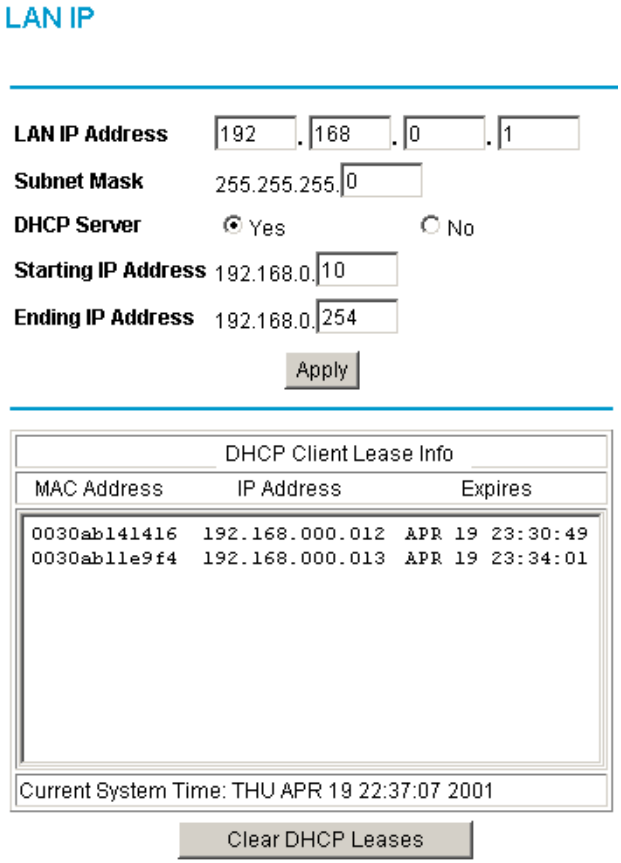


Figure 5-3: LAN IP setup screen.

The gateway is shipped preconfigured to use private IP addresses on the LAN side, and to act as a DHCP server. The gateway's default LAN IP configuration is:

- LAN IP addresses—192.168.0.1
- Subnet mask—255.255.255.

These addresses are part of the IETF-designated private address range for use in private networks, and should be suitable in most applications. If your network has a requirement to use a different IP addressing scheme, you can make those changes in this menu.

The LAN TCP/IP Setup parameters are:

- LAN IP Address
  This is the IP address of the gateway.
- Subnet Mask
  This is the LAN Subnet Mask of the gateway. Combined with the IP address, the Subnet Mask allows a device to know which other addresses are local to it, and which must be reached through a gateway or router

Note: If you change the LAN IP address of the gateway while connected through the browser, you will be disconnected. You must then open a new connection to the new IP address and log in again.

Using the Gateway as a DHCP Server

By default, the gateway will function as a DHCP (Dynamic Host Configuration Protocol) server, allowing it to assign IP, DNS server, and default gateway addresses to all computers connected to the router's LAN. The assigned default gateway address is the LAN address of the gateway. IP addresses will be assigned to the attached PCs from a pool of addresses specified in this menu. Each pool address is tested before it is assigned to avoid duplicate addresses on the LAN.

For most applications, the default DHCP and TCP/IP settings of the gateway are satisfactory. See "IP Configuration by DHCP" on page B-10" for an explanation of DHCP and information about how to assign IP addresses for your network.

If another device on your network will be the DHCP server, or if you will manually configure the network settings of all of your computers, select NO for the DHCP Server, otherwise leave Yes selected.

Specify the pool of IP addresses to be assigned by setting the Starting IP Address and Ending IP Address. These addresses should be part of the same IP address subnet as the gateway's LAN IP address. Using the default addressing scheme, you should define a range between 192.168.0.10 and 192.168.0.253. The range of IP addresses between 192.168.0.2 and 192.168.0.9 can be used for devices with fixed addresses.

The gateway will deliver the following parameters to any LAN device that requests DHCP:

- An IP Address from the range you have defined
- Subnet Mask
- Gateway IP Address is the gateway's LAN IP address
- Primary DNS Server, if you entered a Primary DNS address in the Basic Settings menu; otherwise, the gateway's LAN IP address
- Secondary DNS Server, if you entered a Secondary DNS address in the Basic Settings menu.

Note: The gateway implements a DNS Relay function. When it receives a DNS request on the LAN, it passes it to the DNS server specified on the WAN. It then relays the response back to the original requesting PC.

DHCP Client Lease Info

The DHCP Client Lease Info table lists information about each PC that has been assigned a DHCP lease by the gateway. The MAC address of the PC, IP address assigned and the expiration time of the DHCP lease are listed.

You can manually revoke the DHCP leases by clicking Clear DHCP Leases.

Viewing and Emailing Logged Information

The gateway will log security-related events such as denied incoming service requests and hacker probes. You can enable e-mail notification to receive these logs in an e-mail message. Log entries are described in Table 5-4

Table 5-4: Security Log entry descriptions

Field	Description
Description	The type of event and what action was taken if any.
Count	This is a reference number for each event.
Last Occurrence	The date and time the log entry was recorded.
Target	The name or IP address of the destination device or website.
Source	The IP address of the initiating device for this log entry.

Enabling Logs Event E-mail Notification

In order to receive logs and alerts by e-mail, you must provide your e-mail information in the E-Mail section of the Logs menu:

- In the Contact Email Address, type the e-mail address to which the logs will be sent. Use a full e-mail address (for example, ChrisXY@myISP.com).
- In the SMTP Server Name box, type the outgoing SMTP mail server of your ISP (for example, mail.myISP.com). You may be able to find this information in the configuration menu of your e-mail program. If you leave this box blank, no alerts or logs will be sent.
- Check the E-mail Alerts Enable box.
- Click E-mail Log to send the log immediately.
- Click Apply

Erasing Configuration

The configuration settings of the CG814W Gateway are stored in a configuration file in the gateway. This file can be reverted to factory default settings. The procedures below explain how to do these tasks.

It is sometimes desirable to restore the gateway to the factory default settings. This can be done by using the Erase function.

1. To erase the configuration, from the Main Menu, under Maintenance select Set Password. Select Yes for Restore Factory Defaults and click Apply.
2. The gateway will then reboot automatically.

   After an erase, the gateway's password will be **password**, the LAN IP address will be 192.168.0.1, and the router's DHCP client will be enabled.

Note: To restore the factory default configuration settings without knowing the login password or IP address, you must use the Default Reset button on the rear panel of the gateway.

1. Using a paper clip, depress and hold the Default Reset Button. All the numbered Ethernet LEDs will illuminate green.
2. Continue to depress the button for at least 5 seconds.
3. The gateway will reboot and clear its configuration information.

Running Diagnostic Utilities

The CG814W Gateway has a diagnostics feature. You can use the diagnostics menu to test connectivity to PC using the Ping command:

From the Main Menu of the browser interface, under the Maintenance heading, select the Diagnostics menu, shown in Figure 5-5.

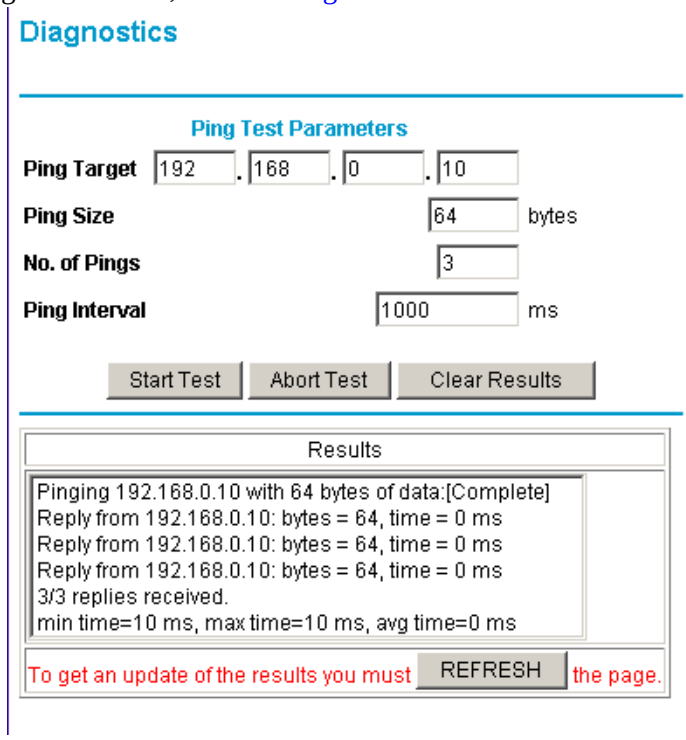


Figure 5-5: Diagnostics menu

To perform a Ping test

1. In the Ping Target section, enter the IP address of the PC you would like to ping.
2. If you would like to specify additional details, you can set the Ping Size, No. of Ping and Ping Interval.
3. Click Start Test.
4. Click REFRESH to see the results of the Ping test.

Chapter 6
Troubleshooting

This chapter gives information about troubleshooting your CG814W Wireless Cable Modem Gateway. For the common problems listed, go to the section indicated.

- Is the gateway on?
- Have I connected the gateway correctly?

  Go to "Basic Functions" on page 6-1.
- I can't access the gateway's configuration with my browser.

  Go to "Troubleshooting the Web Configuration Interface" on page 6-3.
- I've configured the gateway but I can't access the Internet.

  Go to "Troubleshooting the ISP Connection" on page 6-4.
- I can't remember the gateway's configuration password.
- I want to clear the configuration and start over again.

  Go to "Erasing Configuration" on page 5-8.

Basic Functions

After you turn on power to the gateway, the following sequence of events should occur:

1. When power is first applied, verify that the Power LED is on.
2. Verify that the numbered ethernet LEDs come on momentarily.
3. After approximately 30 seconds, verify that:

   f. The Local port Link LEDs are lit for any local ports that are connected.

   g. The Test LED is not lit.

h. The Internet Link port LED is lit.

If any of these conditions does not occur, refer to the appropriate following section.

Power LED Not On

If the Power and other LEDs are off when your gateway is turned on:

- Make sure that the power cord is properly connected to your gateway and that the power supply adapter is properly connected to a functioning power outlet.
- Check that you are using the 12VDC power adapter supplied by NETGEAR for this product.

If the error persists, you have a hardware problem and should contact technical support.

Test LED Stays On

If the Test LED stays on continuously, there is a fault within the gateway.

If you experience problems with the Test LED:

- Cycle the power to see if the gateway recovers and the LED goes off
- If all LEDs including the Test LED are still on one minute after power up, clear the gateway's configuration to factory defaults. This will set the gateway's IP address to 192.168.0.1. This procedure is explained in "Erasing Configuration" on page 5-8.

If the error persists, you might have a hardware problem and should contact technical support.

Local Link LEDs Not On

If the Local Port Link LEDs do not light when the Ethernet connection is made, check the following:

- Make sure that the Ethernet cable connections are secure at the gateway and at the hub or PC.
- Make sure that power is turned on to the connected hub or PC.
- Be sure you are using the correct cable:
  - When connecting the gateway's Internet port to a cable or DSL modem, use the cable that was supplied with the cable or DSL modem. This cable could be a standard straight-through Ethernet cable or an Ethernet crossover cable.

Cable Link LED Not On

If the Cable Link LED does not light when connected to your cable television cable, check the following:

- Make sure that the coaxial cable connections are secure at the gateway and at the wall jack.
- Make sure that your cable internet service has been provisioned by your cable service provider. Your provider should verify that the signal quality is good enough for cable modem service.
- Remove any excessive splitters you may have on your cable line. It may be necessary to run a "home run" back to the point where the cable enters your home.

Troubleshooting the Web Configuration Interface

If you are unable to access the gateway's Web Configuration interface from a PC on your local network, check the following:

- Check the Ethernet connection between the PC and the gateway as described in the previous section.
- Make sure your PC's IP address is on the same subnet as the gateway. If you are using the recommended addressing scheme, your PC's address should be in the range of 192.168.0.10 to 192.168.0.254. Refer to "Verifying TCP/IP Properties" on page C-6 or "Configuring the Macintosh for TCP/IP Networking" on page C-17 to find your PC's IP address. Follow the instructions in Appendix C to configure your PC.

  Note: If your PC's IP address is shown as 169.254.x.x:
  Recent versions of Windows and MacOS will generate and assign an IP address if the computer cannot reach a DHCP server. These auto-generated addresses are in the range of 169.254.x.x. If your IP address is in this range, check the connection from the PC to the gateway and reboot your PC.
- If your gateway's IP address has been changed and you don't know the current IP address, clear the gateway's configuration to factory defaults. This will set the gateway's IP address to 192.168.0.1. This procedure is explained in "Erasing Configuration" on page 5-8.
- Make sure your browser has Java, JavaScript, or ActiveX enabled. If you are using Internet Explorer, click Refresh to be sure the Java applet is loaded.
- Try quitting the browser and launching it again.

- Make sure you are using the correct login information. The factory default login name is **admin** and the password is **password**. Make sure that CAPS LOCK is off when entering this information.

If the gateway does not save changes you have made in the Web Configuration Interface, check the following:

- When entering configuration settings, be sure to click the APPLY button before moving to another menu or tab, or your changes are lost.
- Click the Refresh or Reload button in the Web browser. The changes may have occurred, but the Web browser may be caching the old configuration.

Troubleshooting the ISP Connection

If your gateway is unable to access the Internet and your Cable Link LED is on, you may need to register the Cable MAC Address and/or Device MAC Address of you gateway with your cable service provider. This is described in "Connecting the CG814W Gateway" on page 2-4.

Additionally, your PC may not have the gateway configured as its TCP/IP gateway. If your PC obtains its information from the gateway by DHCP, reboot the PC and verify the gateway address as described in "DHCP Configuration of TCP/IP in Windows 2000 " on page C-11.

Troubleshooting a TCP/IP Network Using a Ping Utility

Most TCP/IP terminal devices and routers contain a ping utility that sends an echo request packet to the designated device. The device then responds with an echo reply. Troubleshooting a TCP/IP network is made easier by using the ping utility in your PC or workstation.

Testing the LAN Path to Your Gateway

You can ping the gateway from your PC to verify that the LAN path to your gateway is set up correctly.

To ping the gateway from a PC running Windows 95 or later:

1. From the Windows toolbar, click on the Start button and select Run.
2. In the field provided, type Ping followed by the IP address of the gateway, as in this example:

```
ping 192.168.0.1
```

3. Click on OK.

   You should see a message like this one:

   Pinging <IP address> with 32 bytes of data

   If the path is working, you see this message:

   Reply from < IP address >: bytes=32 time=NN ms TTL=xxx

   If the path is not working, you see this message:

   Request timed out

   If the path is not functioning correctly, you could have one of the following problems:

   - Wrong physical connections
     - — Make sure the LAN port LED is on. If the LED is off, follow the instructions in "Local Link LEDs Not On" on page 6-2.
     - — Check that the corresponding Link LEDs are on for your network interface card and for the hub ports (if any) that are connected to your workstation and gateway.
   - Wrong network configuration
     - — Verify that the Ethernet card driver software and TCP/IP software are both installed and configured on your PC or workstation.
     - — Verify that the IP address for your gateway and your workstation are correct and that the addresses are on the same subnet.

Testing the Path from Your PC to a Remote Device

After verifying that the LAN path works correctly, test the path from your PC to a remote device. From the Windows run menu, type:

PING -n 10 *<IP address>*

where *<IP address>* is the IP address of a remote device such as your ISP's DNS server.

If the path is functioning correctly, replies as in the previous section are displayed. If you do not receive replies:

— Check that your PC has the IP address of your gateway listed as the default gateway. If the IP configuration of your PC is assigned by DHCP, this information will not be visible in your PC's Network Control Panel. Verify that the IP address of the gateway is listed as the default gateway as described in "DHCP Configuration of TCP/IP in Windows 2000 " on page C-11.

— Check to see that the network address of your PC (the portion of the IP address specified by the netmask) is different from the network address of the remote device.

— Check that your Cable Link LED is on.

— If your ISP assigned a host name to your PC, enter that host name as the Account Name in the Basic Settings menu.

— Your ISP could be rejecting the Device MAC Address of your gateway because it does not match the MAC Address of the PC you previously used to connect to a cable modem. In this case you will need to clone your PCs MAC Address. Refer to "Connecting the CG814W Gateway" on page 2-4.

Appendix A
Technical Specifications

This appendix provides technical specifications for the CG814W Wireless Cable Modem Gateway.

Network Protocol and Standards Compatibility	
Data and Routing Protocols:	TCP/IP DHCP server and client DNS relay NAT (many-to-one) TFTP client VPN pass through (IPSec, L2TP)
Power Adapter	
North America (input):	120V, 60 Hz, input
All regions (output):	12 V DC @ 1.25A output, 20W maximum
Physical Specifications	
Dimensions:	255 by 169 by 34 mm 10.0 by 6.7 by 1.3 in.
Weight:	0.54 kg 1.2 lb.
Environmental Specifications	
Operating temperature:	32°-140° F (0° to 40° C)
Operating humidity:	90% maximum relative humidity, noncondensing
Electromagnetic Emissions	
Meets requirements of:	FCC Part 15 Class B
Interface Specifications	

Local:	10BASE-T or 100BASE-Tx, RJ-45 USB 1.1 Function 802.11b Wireless Access Point
Internet:	DOCSIS 1.0, upgradable to DOCSIS 1.1

Appendix B
Networks, Routing, and Firewall Basics

This chapter provides an overview of IP networks, routing, and firewalls.

Related Publications

As you read this document, you may be directed to various RFC documents for further information. An RFC is a Request For Comment (RFC) published by the Internet Engineering Task Force (IETF), an open organization that defines the architecture and operation of the Internet. The RFC documents outline and define the standard protocols and procedures for the Internet. The documents are listed on the World Wide Web at *www.ietf.org* and are mirrored and indexed at many other sites worldwide.

Basic Router Concepts

Large amounts of bandwidth can be provided easily and relatively inexpensively in a local area network (LAN). However, providing high bandwidth between a local network and the Internet can be very expensive. Because of this expense, Internet access is usually provided by a slower-speed wide-area network (WAN) link such as a cable or DSL modem. In order to make the best use of the slower WAN link, a mechanism must be in place for selecting and transmitting only the data traffic meant for the Internet. The function of selecting and forwarding this data is performed by a router.

What is a Router?

A router is a device that forwards traffic between networks based on network layer information in the data and on routing tables maintained by the router. In these routing tables, a router builds up a logical picture of the overall network by gathering and exchanging information with other routers in the network. Using this information, the router chooses the best path for forwarding network traffic.

Routers vary in performance and scale, number of routing protocols supported, and types of physical WAN connection they support. The CG814W Wireless Cable Modem Gateway is a small office router that routes the IP protocol over a single-user broadband connection.

Routing Information Protocol

One of the protocols used by a router to build and maintain a picture of the network is the Routing Information Protocol (RIP). Using RIP, routers periodically update one another and check for changes to add to the routing table.

The CG814W Gateway supports both the older RIP-1 and the newer RIP-2 protocols. Among other improvements, RIP-2 supports subnet and multicast protocols. RIP is not required for most home applications.

IP Addresses and the Internet

Because TCP/IP networks are interconnected across the world, every machine on the Internet must have a unique address to make sure that transmitted data reaches the correct destination. Blocks of addresses are assigned to organizations by the Internet Assigned Numbers Authority (IANA). Individual users and small organizations may obtain their addresses either from the IANA or from an Internet service provider (ISP). You can contact IANA at www.iana.org.

The Internet Protocol (IP) uses a 32-bit address structure. The address is usually written in dot notation (also called dotted-decimal notation), in which each group of eight bits is written in decimal form, separated by decimal points.

For example, the following binary address:

```
11000011  00100010  00001100  00000111
```

is normally written as:

```
195.34.12.7
```

The latter version is easier to remember and easier to enter into your computer.

In addition, the 32 bits of the address are subdivided into two parts. The first part of the address identifies the network, and the second part identifies the host node or station on the network. The dividing point may vary depending on the address range and the application.

There are five standard classes of IP addresses. These address classes have different ways of determining the network and host sections of the address, allowing for different numbers of hosts on a network. Each address type begins with a unique bit pattern, which is used by the TCP/IP software to identify the address class. After the address class has been determined, the software can correctly identify the host section of the address. The follow figure shows the three main address classes, including network and host sections of the address for each address type.

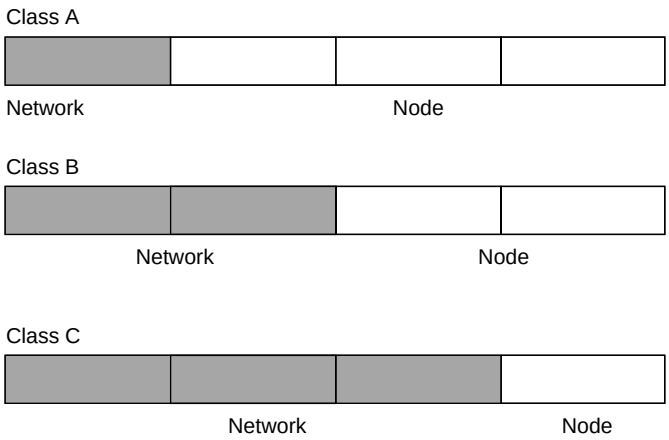


Figure 6-1: Three Main Address Classes

The five address classes are:

- Class A
  Class A addresses can have up to 16,777,214 hosts on a single network. They use an eight-bit network number and a 24-bit node number. Class A addresses are in this range:

  `1.x.x.x to 126.x.x.x.`

- Class B
  Class B addresses can have up to 65,354 hosts on a network. A Class B address uses a 16-bit network number and a 16-bit node number. Class B addresses are in this range:

  `128.1.x.x to 191.254.x.x.`

- Class C
  Class C addresses can have 254 hosts on a network. Class C addresses use 24 bits for the network address and eight bits for the node. They are in this range:

  `192.0.1.x to 223.255.254.x.`

- Class D
  Class D addresses are used for multicasts (messages sent to many hosts). Class D addresses are in this range:

  `224.0.0.0 to 239.255.255.255.`

- Class E
  Class E addresses are for experimental use.

This addressing structure allows IP addresses to uniquely identify each physical network and each node on each physical network.

For each unique value of the network portion of the address, the base address of the range (host address of all zeros) is known as the network address and is not usually assigned to a host. Also, the top address of the range (host address of all ones) is not assigned, but is used as the broadcast address for simultaneously sending a packet to all hosts with the same network address.

Netmask

In each of the address classes previously described, the size of the two parts (network address and host address) is implied by the class. This partitioning scheme can also be expressed by a netmask associated with the IP address. A netmask is a 32-bit quantity that, when logically combined (using an AND operator) with an IP address, yields the network address. For instance, the netmasks for Class A, B, and C addresses are 255.0.0.0, 255.255.0.0, and 255.255.255.0, respectively.

For example, the address 192.168.170.237 is a Class C IP address whose network portion is the upper 24 bits. When combined (using an AND operator) with the Class C netmask, as shown here, only the network portion of the address remains:

```
11000000  10101000  10101010  11101101 (192.168.170.237)
```

combined with:

```
11111111  11111111  11111111  00000000 (255.255.255.0)
```

Equals:

```
11000000  10101000  10101010  00000000 (192.168.170.0)
```

As a shorter alternative to dotted-decimal notation, the netmask may also be expressed in terms of the number of ones from the left. This number is appended to the IP address, following a backward slash (/), as “/n.” In the example, the address could be written as 192.168.170.237/24, indicating that the netmask is 24 ones followed by 8 zeros.

Subnet Addressing

By looking at the addressing structures, you can see that even with a Class C address, there are a large number of hosts per network. Such a structure is an inefficient use of addresses if each end of a routed link requires a different network number. It is unlikely that the smaller office LANs would have that many devices. You can resolve this problem by using a technique known as subnet addressing.

Subnet addressing allows us to split one IP network address into smaller multiple physical networks known as subnetworks. Some of the node numbers are used as a subnet number instead. A Class B address gives us 16 bits of node numbers translating to 64,000 nodes. Most organizations do not use 64,000 nodes, so there are free bits that can be reassigned. Subnet addressing makes use of those bits that are free, as shown below.

Figure 6-2: Example of Subnetting a Class B Address

A Class B address can be effectively translated into multiple Class C addresses. For example, the IP address of 172.16.0.0 is assigned, but node addresses are limited to 255 maximum, allowing eight extra bits to use as a subnet address. The IP address of 172.16.97.235 would be interpreted as IP network address 172.16, subnet number 97, and node number 235. In addition to extending the number of addresses available, subnet addressing provides other benefits. Subnet addressing allows a network manager to construct an address scheme for the network by using different subnets for other geographical locations in the network or for other departments in the organization.

Although the preceding example uses the entire third octet for a subnet address, note that you are not restricted to octet boundaries in subnetting. To create more network numbers, you need only shift some bits from the host address to the network address. For instance, to partition a Class C network number (192.68.135.0) into two, you shift one bit from the host address to the network address. The new netmask (or subnet mask) is 255.255.255.128. The first subnet has network number 192.68.135.0 with hosts 192.68.135.1 to 129.68.135.126, and the second subnet has network number 192.68.135.128 with hosts 192.68.135.129 to 192.68.135.254.

Note: The number 192.68.135.127 is not assigned because it is the broadcast address of the first subnet. The number 192.68.135.128 is not assigned because it is the network address of the second subnet.

The following table lists the additional subnet mask bits in dotted-decimal notation. To use the table, write down the original class netmask and replace the 0 value octets with the dotted-decimal value of the additional subnet bits. For example, to partition your Class C network with subnet mask 255.255.255.0 into 16 subnets (4 bits), the new subnet mask becomes 255.255.255.240.

Table 6-1. Netmask Notation Translation Table for One Octet

Number of Bits	Dotted-Decimal Value
1	128
2	192
3	224
4	240
5	248
6	252
7	254
8	255

The following table displays several common netmask values in both the dotted-decimal and the mask length formats.

Table 6-2. Netmask Formats

Dotted-Decimal	Masklength
255.0.0.0	/8
255.255.0.0	/16

Table 6-2. Netmask Formats

255.255.255.0	/24
255.255.255.128	/25
255.255.255.192	/26
255.255.255.224	/27
255.255.255.240	/28
255.255.255.248	/29
255.255.255.252	/30
255.255.255.254	/31
255.255.255.255	/32

NETGEAR strongly recommends that you configure all hosts on a LAN segment to use the same netmask for the following reasons:

- So that hosts recognize local IP broadcast packets

  When a device broadcasts to its segment neighbors, it uses a destination address of the local network address with all ones for the host address. In order for this scheme to work, all devices on the segment must agree on which bits comprise the host address.

- So that a local router or bridge recognizes which addresses are local and which are remote

Private IP Addresses

If your local network is isolated from the Internet (for example, when using NAT), you can assign any IP addresses to the hosts without problems. However, the IANA has reserved the following three blocks of IP addresses specifically for private networks:

```
10.0.0.0 - 10.255.255.255
172.16.0.0 - 172.31.255.255
192.168.0.0 - 192.168.255.255
```

NETGEAR recommends that you choose your private network number from this range. The DHCP server of the CG814W Gateway is preconfigured to automatically assign private addresses.

Regardless of your particular situation, do not create an arbitrary IP address; always follow the guidelines explained here. For more information about address assignment, refer to RFC 1597, *Address Allocation for Private Internets*, and RFC 1466, *Guidelines for Management of IP Address Space*. The Internet Engineering Task Force (IETF) publishes RFCs on its Web site at www.ietf.org.

Single IP Address Operation Using NAT

In the past, if multiple PCs on a LAN needed to access the Internet simultaneously, you had to obtain a range of IP addresses from the ISP. This type of Internet account is more costly than a single-address account typically used by a single user with a modem, rather than a router. The CG814W Gateway employs an address-sharing method called Network Address Translation (NAT). This method allows several networked PCs to share an Internet account using only a single IP address, which may be statically or dynamically assigned by your ISP.

The router accomplishes this address sharing by translating the internal LAN IP addresses to a single address that is globally unique on the Internet. The internal LAN IP addresses can be either private addresses or registered addresses. For more information about IP address translation, refer to RFC 1631, *The IP Network Address Translator (NAT)*.

The following figure illustrates a single IP address operation.

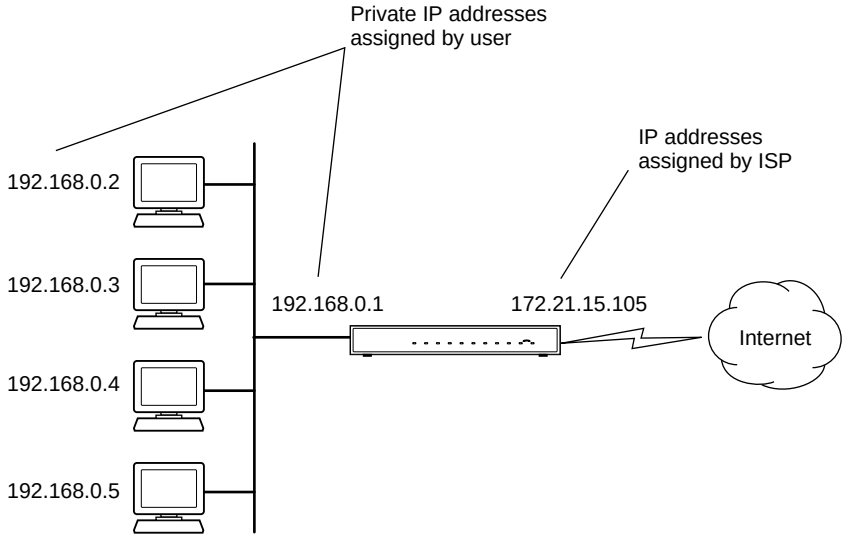


Figure 6-3: Single IP Address Operation Using NAT

This scheme offers the additional benefit of firewall-like protection because the internal LAN addresses are not available to the Internet through the translated connection. All incoming inquiries are filtered out by the router. This filtering can prevent intruders from probing your system. However, using port forwarding, you can allow one PC (for example, a Web server) on your local network to be accessible to outside users.

MAC Addresses and Address Resolution Protocol

An IP address alone cannot be used to deliver data from one LAN device to another. To send data between LAN devices, you must convert the IP address of the destination device to its media access control (MAC) address. Each device on an Ethernet network has a unique MAC address, which is a 48-bit number assigned to each device by the manufacturer. The technique that associates the IP address with a MAC address is known as address resolution. Internet Protocol uses the Address Resolution Protocol (ARP) to resolve MAC addresses.

If a device sends data to another station on the network and the destination MAC address is not yet recorded, ARP is used. An ARP request is broadcast onto the network. All stations on the network receive and read the request. The destination IP address for the chosen station is included as part of the message so that only the station with this IP address responds to the ARP request. All other stations discard the request.

Related Documents

The station with the correct IP address responds with its own MAC address directly to the sending device. The receiving station provides the transmitting station with the required destination MAC address. The IP address data and MAC address data for each station are held in an ARP table. The next time data is sent, the address can be obtained from the address information in the table.

For more information about address assignment, refer to the IETF documents RFC 1597, *Address Allocation for Private Internets*, and RFC 1466, *Guidelines for Management of IP Address Space*.

For more information about IP address translation, refer to RFC 1631, *The IP Network Address Translator (NAT)*.

Domain Name Server

Many of the resources on the Internet can be addressed by simple descriptive names such as *www.NETGEAR.com*. This addressing is very helpful at the application level, but the descriptive name must be translated to an IP address in order for a user to actually contact the resource. Just as a telephone directory maps names to phone numbers, or as an ARP table maps IP addresses to MAC addresses, a domain name system (DNS) server maps descriptive names of network resources to IP addresses.

When a PC accesses a resource by its descriptive name, it first contacts a DNS server to obtain the IP address of the resource. The PC sends the desired message using the IP address. Many large organizations, such as ISPs, maintain their own DNS servers and allow their customers to use the servers to look up addresses.

IP Configuration by DHCP

When an IP-based local area network is installed, each PC must be configured with an IP address. If the PCs need to access the Internet, they should also be configured with a gateway address and one or more DNS server addresses. As an alternative to manual configuration, there is a method by which each PC on the network can automatically obtain this configuration information. A device on the network may act as a Dynamic Host Configuration Protocol (DHCP) server. The DHCP server stores a list or pool of IP addresses, along with other information (such as gateway and DNS addresses) that it may assign to the other devices on the network. The CG814W Gateway has the capacity to act as a DHCP server.

The CG814W Gateway also functions as a DHCP client when connecting to the ISP. The gateway can automatically obtain an IP address, subnet mask, DNS server addresses, and a gateway address if the ISP provides this information by DHCP.

Internet Security and Firewalls

When your LAN connects to the Internet through a router, an opportunity is created for outsiders to access or disrupt your network. A NAT router provides some protection because by the very nature of the Network Address Translation (NAT) process, the network behind the NAT router is shielded from access by outsiders on the Internet. However, there are methods by which a determined hacker can possibly obtain information about your network or at the least can disrupt your Internet access. A greater degree of protection is provided by a firewall router.

What is a Firewall?

A firewall is a device that protects one network from another, while allowing communication between the two. A firewall incorporates the functions of the NAT router, while adding features for dealing with a hacker intrusion or attack. Several known types of intrusion or attack can be recognized when they occur. When an incident is detected, the firewall can log details of the attempt, and can optionally send email to an administrator notifying them of the incident. Using information from the log, the administrator can take action with the ISP of the hacker. In some types of intrusions, the firewall can fend off the hacker by discarding all further packets from the hacker's IP address for a period of time.

Stateful Packet Inspection

Unlike simple Internet sharing routers, a firewall uses a process called stateful packet inspection to ensure secure firewall filtering to protect your network from attacks and intrusions. Since user-level applications such as FTP and Web browsers can create complex patterns of network traffic, it is necessary for the firewall to analyze groups of network connection "states." Using Stateful Packet Inspection, an incoming packet is intercepted at the network layer and then analyzed for state-related information associated with all network connections. A central cache within the firewall keeps track of the state information associated with all network connections. All traffic passing through the firewall is analyzed against the state of these connections in order to determine whether or not it will be allowed to pass through or rejected.

Denial of Service Attack

A hacker may be able to prevent your network from operating or communicating by launching a Denial of Service (DoS) attack. The method used for such an attack can be as simple as merely flooding your site with more requests than it can handle. A more sophisticated attack may attempt to exploit some weakness in the operating system used by your router or gateway. Some operating systems can be disrupted by simply sending a packet with incorrect length information.

Wireless Networking Overview

The CG814W Gateway conforms to the Institute of Electrical and Electronics Engineers (IEEE) 802.11b standard for wireless LANs (WLANs). On an 802.11b wireless link, data is encoded using direct-sequence spread-spectrum (DSSS) technology and is transmitted in the unlicensed radio spectrum at 2.5GHz. The maximum data rate for the wireless link is 11 Mbps, but it will automatically back down from 11 Mbps to 5.5, 2, and 1 Mbps when the radio signal is weak or when interference is detected.

The 802.11b standard is also called Wireless Ethernet or Wi-Fi by the Wireless Ethernet Compatibility Alliance (WECA, see *http://www.wi-fi.net*), an industry standard group promoting interoperability among 802.11b devices. The 802.11b standard offers two methods for configuring a wireless network - ad hoc and infrastructure.

Infrastructure Mode

With a wireless Access Point, you can operate the wireless LAN in the infrastructure mode. This mode provides wireless connectivity to multiple wireless network devices within a fixed range or area of coverage, interacting with wireless nodes 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.

Ad Hoc Mode (Peer-to-Peer Workgroup)

In an ad hoc network, computers are brought together as needed; thus, there is no structure or fixed points to the network - each node can generally communicate with any other node. There is no Access Point involved in this configuration. This mode 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 expensive way to set up a wireless network.

Network Name: Extended Service Set Identification (ESSID)

The Extended Service Set Identification (ESSID) is one of two types of Service Set Identification (SSID). In an ad hoc wireless network with no access points, the Basic Service Set Identification (BSSID) is used. In an infrastructure wireless network that includes an access point, the ESSID is used, but may still be referred to as SSID.

An SSID is a thirty-two character (maximum) alphanumeric key identifying the name of the wireless local area network. Some vendors refer to the SSID as network name. For the wireless devices in a network to communicate with each other, all devices must be configured with the same SSID.

Authentication and WEP

The absence of a physical connection between nodes makes the wireless links vulnerable to eavesdropping and information theft. To provide a certain level of security, the IEEE 802.11 standard has defined two types of authentication methods, Open System and Shared Key. With Open System authentication, a wireless PC can join any network and receive any messages that are not encrypted. With Shared Key authentication, only those PCs that possess the correct authentication key can join the network. By default, IEEE 802.11 wireless devices operate in an Open System network.

Wired Equivalent Privacy (WEP) data encryption is used when the wireless devices are configured to operate in Shared Key authentication mode. There are two shared key methods implemented in most commercially available products, 64-bit and 128-bit WEP data encryption.

802.11b Authentication

The 802.11b standard defines several services that govern how two 802.11b devices communicate. The following events must occur before an 802.11b Station can communicate with an Ethernet network through an access point such as the one built in to the CG814W Gateway:

1. Turn on the wireless station.
2. The station listens for messages from any access points that are in range.
3. The station finds a message from an access point that has a matching SSID.
4. The station sends an authentication request to the access point.
5. The access point authenticates the station.

6. The station sends an association request to the access point.
7. The access point associates with the station.
8. The station can now communicate with the Ethernet network through the access point.

An access point must authenticate a station before the station can associate with the access point or communicate with the network. The IEEE 802.11b standard defines two types of authentication: Open System and Shared Key.

- Open System Authentication allows any device to join the network, assuming that the device SSID matches the access point SSID. Alternatively, the device can use the “ANY” SSID option to associate with any available Access Point within range, regardless of its SSID.
- Shared Key Authentication requires that the station and the access point have the same WEP Key to authenticate. These two authentication procedures are described below.

Open System Authentication

The following steps occur when two devices use Open System Authentication:

1. The station sends an authentication request to the access point.
2. The access point authenticates the station.
3. The station associates with the access point and joins the network.

This process is illustrated in below.

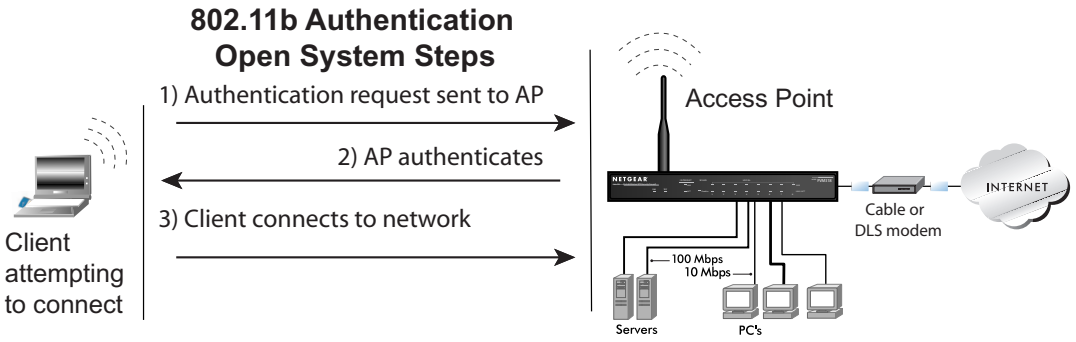


Figure 6-4: 802.11b open system authentication

Shared Key Authentication

The following steps occur when two devices use Shared Key Authentication:

1. The station sends an authentication request to the access point.
2. The access point sends challenge text to the station.
3. The station uses its configured 64-bit or 128-bit default key to encrypt the challenge text, and sends the encrypted text to the access point.
4. The access point decrypts the encrypted text using its configured WEP Key that corresponds to the station's default key. The access point compares the decrypted text with the original challenge text. If the decrypted text matches the original challenge text, then the access point and the station share the same WEP Key and the access point authenticates the station.
5. The station connects to the network.

If the decrypted text does not match the original challenge text (i.e., the access point and station do not share the same WEP Key), then the access point will refuse to authenticate the station and the station will be unable to communicate with either the 802.11b network or Ethernet network.

This process is illustrated in below.

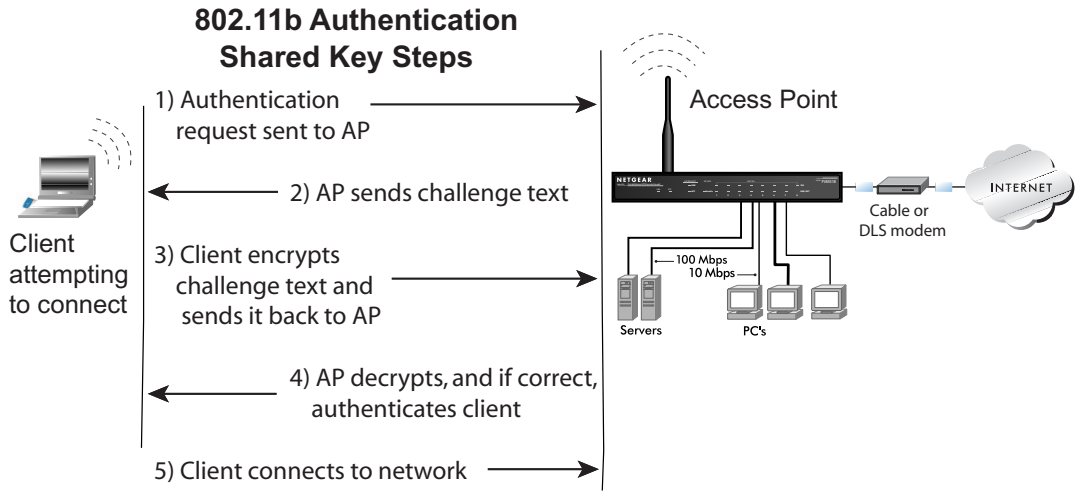


Figure 6-5: 802.11b shared key authentication

Overview of WEP Parameters

Before enabling WEP on an 802.11b network, you must first consider what type of encryption you require and the key size you want to use. Typically, there are three WEP Encryption options available for 802.11b products:

1. **Do Not Use WEP:** The 802.11b network does not encrypt data. For authentication purposes, the network uses Open System Authentication.

2. **Use WEP for Encryption:** A transmitting 802.11b device encrypts the data portion of every packet it sends using a configured WEP Key. The receiving 802.11b device decrypts the data using the same WEP Key. For authentication purposes, the 802.11b network uses Open System Authentication.

3. **Use WEP for Authentication and Encryption:** A transmitting 802.11b device encrypts the data portion of every packet it sends using a configured WEP Key. The receiving 802.11b device decrypts the data using the same WEP Key. For authentication purposes, the 802.11b network uses Shared Key Authentication.

Note: Some 802.11b access points also support **Use WEP for Authentication Only** (Shared Key Authentication without data encryption).

Key Size

The IEEE 802.11b standard supports two types of WEP encryption: 40-bit and 128-bit.

The 64-bit WEP data encryption method, allows for a five-character (40-bit) input. Additionally, 24 factory-set bits are added to the forty-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 refer to the 64-bit WEP data encryption as 40-bit WEP data encryption since the user-configurable portion of the encryption key is 40 bits wide.

The 128-bit WEP data encryption method consists of 104 user-configurable bits. Similar to the forty-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.

128-bit encryption is stronger than 40-bit encryption, but 128-bit encryption may not be available outside of the United States due to U.S. export regulations.

When configured for 40-bit encryption, 802.11b products typically support up to four WEP Keys. Each 40-bit WEP Key is expressed as 5 sets of two hexadecimal digits (0-9 and A-F). For example, “12 34 56 78 90” is a 40-bit WEP Key.

When configured for 128-bit encryption, 802.11b products typically support four WEP Keys but some manufacturers support only one 128-bit key. The 128-bit WEP Key is expressed as 13 sets of two hexadecimal digits (0-9 and A-F). For example, “12 34 56 78 90 AB CD EF 12 34 56 78 90” is a 128-bit WEP Key.

Note: Typically, 802.11b access points can store up to four 128-bit WEP Keys but some 802.11b client adapters can only store one. Therefore, make sure that your 802.11b access and client adapters configurations match.

WEP Configuration Options

The WEP settings must match on all 802.11b devices that are within the same wireless network as identified by the SSID. In general, if your mobile clients will roam between access points, then all of the 802.11b access points and all of the 802.11b client adapters on the network must have the same WEP settings.

Note: Whatever keys you enter for an AP, you must also enter the same keys for the client adapter in the same order. In other words, WEP key 1 on the AP must match WEP key 1 on the client adapter, WEP key 2 on the AP must match WEP key 2 on the client adapter, etc.

Note: The AP and the client adapters can have different default WEP Keys as long as the keys are in the same order. In other words, the AP can use WEP key 2 as its default key to transmit while a client adapter can use WEP key 3 as its default key to transmit. The two devices will communicate as long as the AP’s WEP key 2 is the same as the client’s WEP key 2 and the AP’s WEP key 3 is the same as the client’s WEP key 3.

Wireless Channels

IEEE 802.11 wireless nodes communicate with each other using radio frequency signals in the ISM (Industrial, Scientific, and Medical) band between 2.4 GHz and 2.5 GHz. Neighboring channels are 5 MHz apart. However, due to spread spectrum effect of the signals, a node sending signals using a particular channel will utilize frequency spectrum 12.5 MHz above and below the center channel frequency. As a result, two separate wireless networks using neighboring channels (for example, channel 1 and channel 2) in the same general vicinity will interfere with each other. Applying two channels that allow the maximum channel separation will decrease the amount of channel cross-talk, and provide a noticeable performance increase over networks with minimal channel separation.

The radio frequency channels used are listed in Table 6-1:

Table 6-1. 802.11 Radio Frequency Channels

Channel	Center Frequency	Frequency Spread
1	2412 MHz	2399.5 MHz - 2424.5 MHz
2	2417 MHz	2404.5 MHz - 2429.5 MHz
3	2422 MHz	2409.5 MHz - 2434.5 MHz
4	2427 MHz	2414.5 MHz - 2439.5 MHz
5	2432 MHz	2419.5 MHz - 2444.5 MHz
6	2437 MHz	2424.5 MHz - 2449.5 MHz
7	2442 MHz	2429.5 MHz - 2454.5 MHz
8	2447 MHz	2434.5 MHz - 2459.5 MHz
9	2452 MHz	2439.5 MHz - 2464.5 MHz
10	2457 MHz	2444.5 MHz - 2469.5 MHz
11	2462 MHz	2449.5 MHz - 2474.5 MHz
12	2467 MHz	2454.5 MHz - 2479.5 MHz
13	2472 MHz	2459.5 MHz - 2484.5 MHz

Note: The available channels supported by the wireless products in various countries are different.

The preferred channel separation between the channels in neighboring wireless networks is 25 MHz (5 channels). This means that you can apply up to three different channels within your wireless network. There are only 11 usable wireless channels in the United States. It is recommended that you start using channel 1 and grow to use channel 6, and 11 when necessary, as these three channels do not overlap.

Ethernet Cabling

Although Ethernet networks originally used thick or thin coaxial cable, most installations currently use unshielded twisted pair (UTP) cabling. The UTP cable contains eight conductors, arranged in four twisted pairs, and terminated with an RJ45 type connector. A normal "straight-through" UTP Ethernet cable follows the EIA568B standard wiring as described in Table 6-2.

Table 6-2. UTP Ethernet cable wiring, straight-through

Pin	Wire color	Signal
1	Orange/White	Transmit (Tx) +
2	Orange	Transmit (Tx) -
3	Green/White	Receive (Rx) +
4	Blue	
5	Blue/White	
6	Green	Receive (Rx) -
7	Brown/White	
8	Brown	

Uplink Switches and Crossover Cables

In the wiring table, the concept of transmit and receive are from the perspective of the PC. For example, the PC transmits on pins 1 and 2. At the hub, the perspective is reversed, and the hub receives on pins 1 and 2. When connecting a PC to a PC, or a hub port to another hub port, the transmit pair must be exchanged with the receive pair. This exchange is done by one of two mechanisms. Most hubs provide an Uplink switch which will exchange the pairs on one port, allowing that port to be connected to another hub using a normal Ethernet cable. The second method is to use a crossover cable, which is a special cable in which the transmit and receive pairs are exchanged at one of the two cable connectors. Crossover cables are often unmarked as such, and must be identified by comparing the two connectors. Since the cable connectors are clear plastic, it is easy to place them side by side and view the order of the wire colors on each. On a straight-through cable, the color order will be the same on both connectors. On a crossover cable, the orange and blue pairs will be exchanged from one connector to the other.

Cable Quality

A twisted pair Ethernet network operating at 10 Mbits/second (10BASE-T) will often tolerate low quality cables, but at 100 Mbits/second (10BASE-Tx) the cable must be rated as Category 5, or "Cat 5", by the Electronic Industry Association (EIA). This rating will be printed on the cable jacket. A Category 5 cable will meet specified requirements regarding loss and crosstalk. In addition, there are restrictions on maximum cable length for both 10 and 100 Mbits/second networks.

Appendix C
Preparing Your Network

This appendix describes how to prepare your network to connect to the Internet through the CG814W Wireless Cable Modem Gateway and how to verify the readiness of broadband Internet service from an Internet service provider (ISP).

	Note: If an ISP technician configured your computer during the installation of a broadband modem, or if you configured it using instructions provided by your ISP, you may need to copy the current configuration information for use in the configuration of your gateway. Write down this information before reconfiguring your computers. Refer to "Obtaining ISP Configuration Information for Windows Computers" on page C-20 or "Obtaining ISP Configuration Information for Macintosh Computers" on page C-21 for further information.

Preparing Your Computers for TCP/IP Networking

Computers access the Internet using a protocol called TCP/IP (Transmission Control Protocol/ Internet Protocol). Each computer on your network must have TCP/IP installed and selected as its networking protocol. If a Network Interface Card (NIC) is already installed in your PC, then TCP/ IP is probably already installed as well.

Most operating systems include the software components you need for networking with TCP/IP:

- Windows® 95 or later includes the software components for establishing a TCP/IP network.
- Windows 3.1 does not include a TCP/IP component. You need to purchase a third-party TCP/ IP application package such as NetManage Chameleon.
- Macintosh Operating System 7 or later includes the software components for establishing a TCP/IP network.
- All versions of UNIX or Linux include TCP/IP components. Follow the instructions provided with your operating system or networking software to install TCP/IP on your computer.

In your IP network, each PC and the gateway must be assigned a unique IP addresses. Each PC must also have certain other IP configuration information such as a subnet mask (netmask), a domain name server (DNS) address, and a default gateway address. In most cases, you should install TCP/IP so that the PC obtains its specific network configuration information automatically from a DHCP server during bootup. For a detailed explanation of the meaning and purpose of these configuration items, refer to Appendix B, “Networks, Routing, and Firewall Basics.”

The CG814W Gateway is shipped preconfigured as a DHCP server. The gateway assigns the following TCP/IP configuration information automatically when the PCs are rebooted:

- PC or workstation IP addresses—192.168.0.2 through 192.168.0.254
- Subnet mask—255.255.255.0
- Gateway address (the gateway)—192.168.0.1

These addresses are part of the IETF-designated private address range for use in private networks.

Configuring Windows 95, 98, and Me for TCP/IP Networking

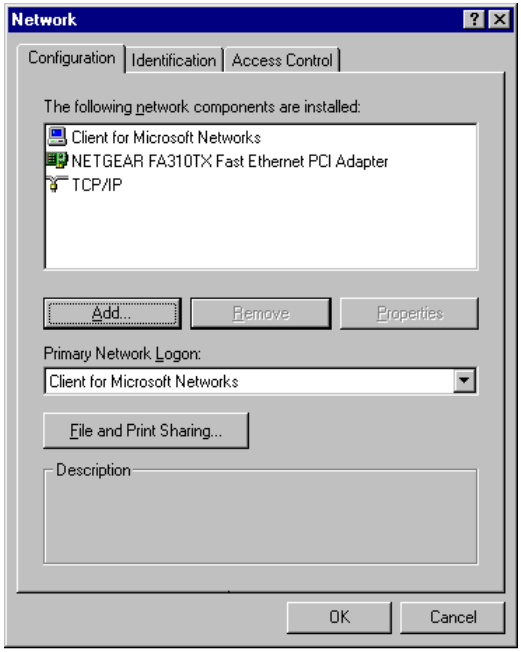
As part of the PC preparation process, you need to manually install and configure TCP/IP on each networked PC. Before starting, locate your Windows CD; you may need to insert it during the TCP/IP installation process.

Install or Verify Windows Networking Components

To install or verify the necessary components for IP networking:

1. On the Windows taskbar, click the Start button, point to Settings, and then click Control Panel.
2. Double-click the Network icon.

   The Network window opens, which displays a list of installed components:



You must have an Ethernet adapter, the TCP/IP protocol, and Client for Microsoft Networks.

	Note: It is not necessary to remove any other network components shown in the Network window in order to install the adapter, TCP/IP, or Client for Microsoft Networks.

If you need to install a new adapter, follow these steps:

a. Click the Add button.

b. Select Adapter, and then click Add.

c. Select the manufacturer and model of your Ethernet adapter, and then click OK.

If you need TCP/IP:

a. Click the Add button.

b. Select Protocol, and then click Add.

c. Select Microsoft.

d. Select TCP/IP, and then click OK.

If you need Client for Microsoft Networks:

a. Click the Add button.

b. Select Client, and then click Add.

c. Select Microsoft.

d. Select Client for Microsoft Networks, and then click OK.

3. Restart your PC for the changes to take effect.

Enabling DHCP in Windows 95B, 98, and Me

After the TCP/IP protocol components are installed, each PC must be assigned specific information about itself and resources that are available on its network. The simplest way to configure this information is to allow the PC to obtain the information from a DHCP server in the network.

You will find there are many similarities in the procedures for different Windows systems when using DHCP to configure TCP/IP.

The following steps will walk you through the configuration process for each of these versions of Windows.

1

Locate your **Network Neighborhood** icon.

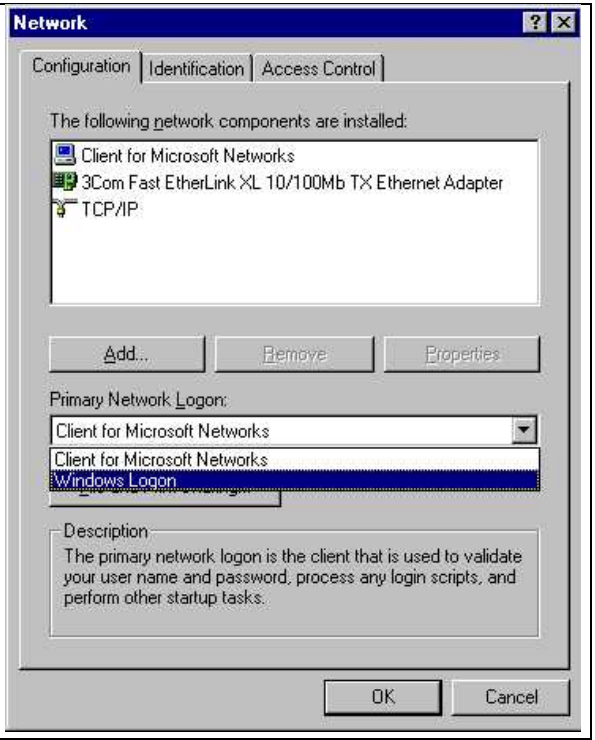
- If the Network Neighborhood icon is on the Windows desktop, position your mouse pointer over it and right-click your mouse button.
- If the icon is not on the desktop,
  - — Click **Start** on the task bar located at the bottom left of the window.
  - — Choose **Settings**, and then **Control Panel**.
  - — Locate the **Network Neighborhood** icon and click on it. This will open the Network panel as shown below.

2

Verify the following settings as shown:

- Client for Microsoft Network exists
- Ethernet adapter is present
- TCP/IP is present
- **Primary Network Logon** is set to Windows logon

Click on the **Properties** button. The following TCP/IP Properties window will display.

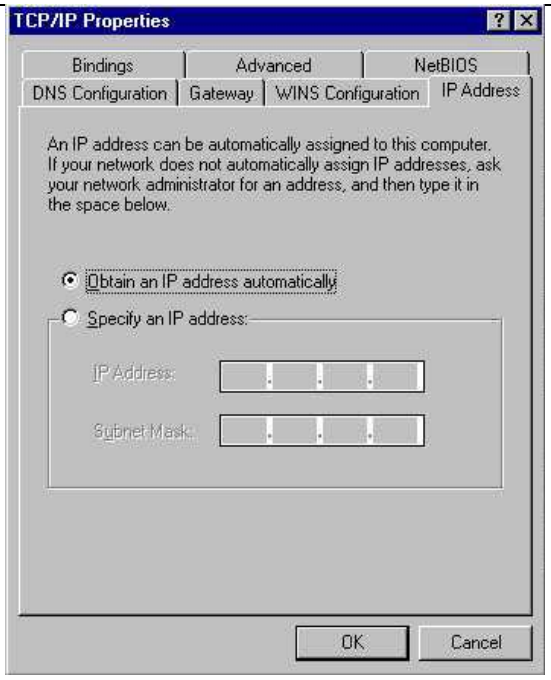


3

By default, the **IP Address** tab is open on this window. Verify the following:

- **Obtain an IP address automatically** is selected. If not selected, click in the radio button to the left of it to select it. This setting is required to enable the DHCP server to automatically assign an IP address.
- Click **OK** to continue.
- Restart the PC.

Repeat these steps for each PC with this version of Windows on your network.



Selecting Windows' Internet Access Method

1. On the Windows taskbar, click the Start button, point to Settings, and then click Control Panel.
2. Double-click the Internet Options icon.
3. Select "I want to set up my Internet connection manually" or "I want to connect through a Local Area Network" and click Next.
4. Select "I want to connect through a Local Area Network" and click Next.
5. Uncheck all boxes in the LAN Internet Configuration screen and click Next.
6. Proceed to the end of the Wizard.

Verifying TCP/IP Properties

After your PC is configured and has rebooted, you can check the TCP/IP configuration using the utility *winipcfg.exe*:

1. On the Windows taskbar, click the Start button, and then click Run.

2. Type **`winipcfg`**, and then click OK.

   The IP Configuration window opens, which lists (among other things), your IP address, subnet mask, and default gateway.

3. From the drop-down box, select your Ethernet adapter.

   The window is updated to show your settings, which should match the values below if you are using the default TCP/IP settings that NETGEAR recommends for connecting through a router or gateway:

   - The IP address is between 192.168.0.2 and 192.168.0.254
   - The subnet mask is 255.255.255.0
   - The default gateway is 192.168.0.1

Configuring Windows NT4, 2000 or XP for IP Networking

As part of the PC preparation process, you may need to install and configure TCP/IP on each networked PC. Before starting, locate your Windows CD; you may need to insert it during the TCP/IP installation process.

Install or Verify Windows Networking Components

To install or verify the necessary components for IP networking:

1. On the Windows taskbar, click the Start button, point to Settings, and then click Control Panel.
2. Double-click the Network and Dialup Connections icon.
3. If an Ethernet adapter is present in your PC, you should see an entry for Local Area Connection. Double-click that entry.
4. Select Properties.
5. Verify that ‘Client for Microsoft Networks’ and ‘Internet Protocol (TCP/IP)’ are present. If not, select Install and add them.
6. Select ‘Internet Protocol (TCP/IP)’, click Properties, and verify that “Obtain an IP address automatically is selected.
7. Click OK and close all Network and Dialup Connections windows.
8. Then, restart your PC.

DHCP Configuration of TCP/IP in Windows XP, 2000, or NT4

You will find there are many similarities in the procedures for different Windows systems when using DHCP to configure TCP/IP.

The following steps will walk you through the configuration process for each of these versions of Windows.

DHCP Configuration of TCP/IP in Windows XP

1

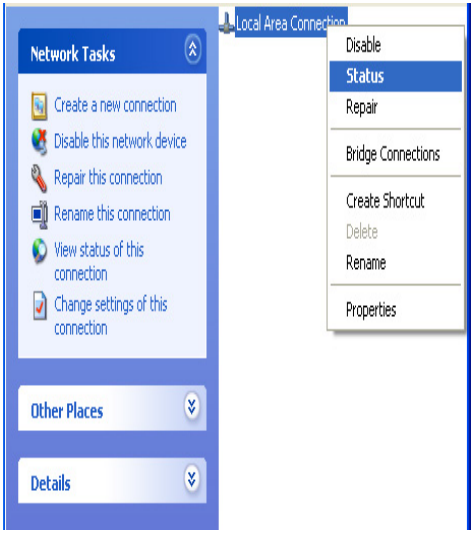
Locate your **Network Neighborhood** icon.

- Select **Control Panel** from the Windows XP new Start Menu.
- Select the **Network Connections** icon on the Control Panel. This will take you to the next step.

2

Now the Network Connection window displays. The Connections List that shows all the network connections set up on the PC, located to the right of the window.

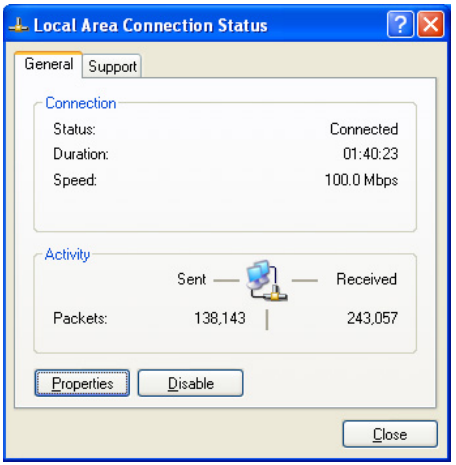
- Right-click on the **Connection with the wireless icon** and choose **Status**.



3

Now you should be at the Local Area Network Connection Status window. This box displays the connection status, duration, speed, and activity statistics.

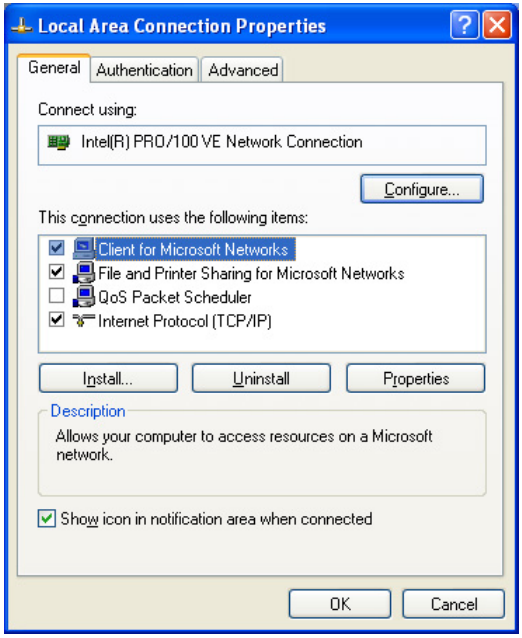
- Administrator logon access rights are needed to use this window.
- Click the **Properties button** to view details about the connection.



4

The TCP/IP details are presented on the Support tab page.

- Select **Internet Protocol,** and click **Properties** to view the configuration information**.**



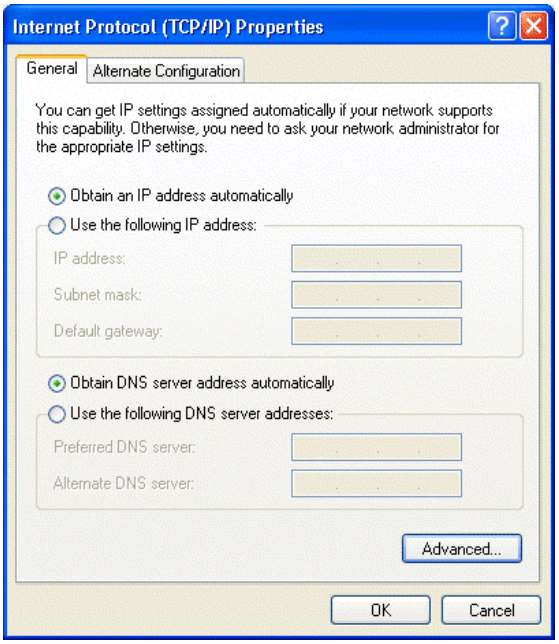
5

Verify that the **Obtain an IP address automatically** radio button is selected.

- Verify that **Obtain DNS server address automatically** radio button is selected.
- Click the **OK** button.

This completes the DHCP configuration of TCP/IP in Windows XP.

Repeat these steps for each PC with this version of Windows on your network.



DHCP Configuration of TCP/IP in Windows 2000

Once again, after you have installed the network card, TCP/IP for Windows 2000 is configured. TCP/IP should be added by default and set to DHCP without your having to configure it. However, if there are problems, you may need to know how to do it manually. Remember, Cox only sets up TCP/IP dynamically, (i.e., it uses DHCP to obtain TCP/IP settings). Following are the steps to configure TCP/IP with DHCP for Windows 2000.

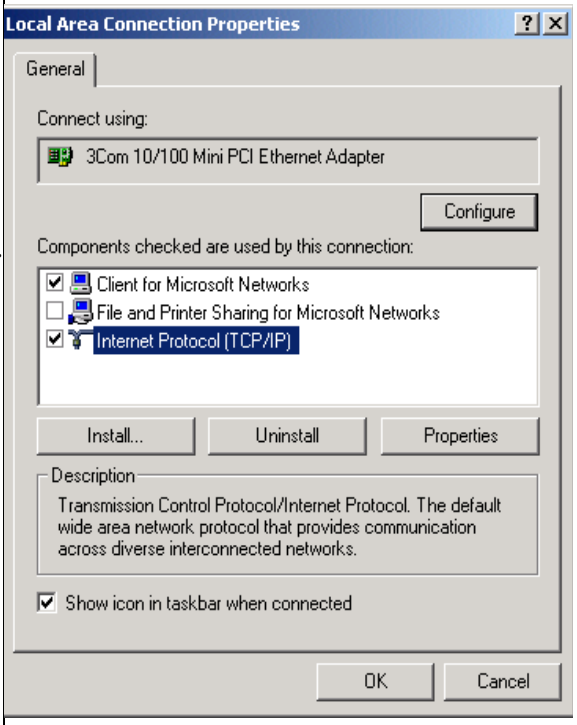
1

- Click on the **My Network Places** icon on the Windows desktop. This will bring up a window called Network and Dial-up Connections.
- Right click on **Local Area Connection** and select **Properties**.

2

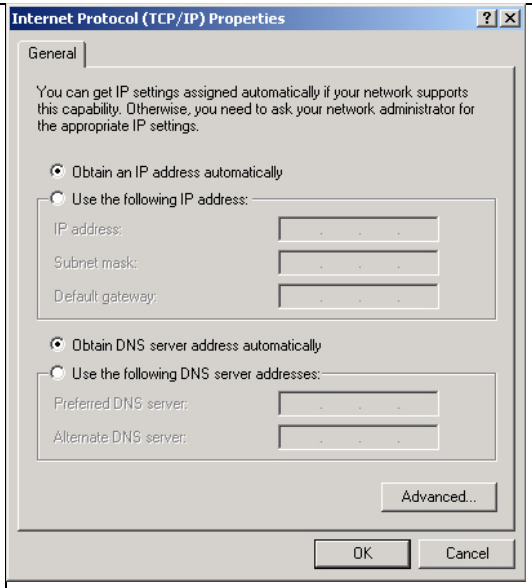
The **Local Area Connection Properties** dialog box appears.

- Verify that you have the correct Ethernet card selected in the **Connect using:** box.
- Verify that at least the following two items are displayed and selected in the box of "Components checked are used by this connection:"
  - — Client for Microsoft Networks and
  - — Internet Protocol (TCP/IP)
- Click **OK**.



3

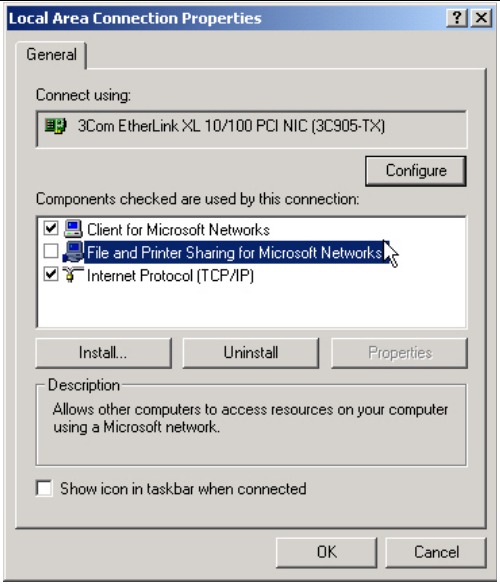
- With Internet Protocol (TCP/IP) selected, click on **Properties** to open the Internet Protocol (TCP/IP) Properties dialogue box. Verify that
  - **Obtain an IP address automatically** is selected.
  - **Obtain DNS server address automatically** is selected.
- Click **OK** to return to Local Area Connection Properties.



4

- Click **OK** again to complete the configuration process for Windows 2000.
- Restart the PC.

Repeat these steps for each PC with this version of Windows on your network.



DHCP Configuration of TCP/IP in Windows NT4

Once you have installed the network card, you need to configure the TCP/IP environment for Windows NT 4.0. Again, remember Cox only sets up TCP/IP dynamically (i.e., it uses DHCP to obtain TCP/IP settings).

Following are the procedures you use to configure TCP/IP with DHCP in Windows NT 4.0.

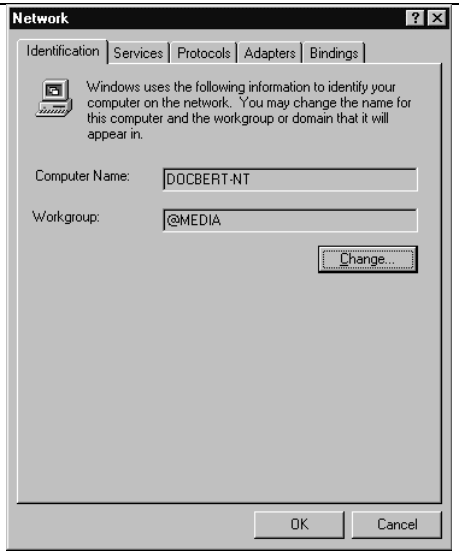
1

- Choose **Settings** from the Start Menu, and then select **Control Panel**.
  This will display Control Panel window.

2

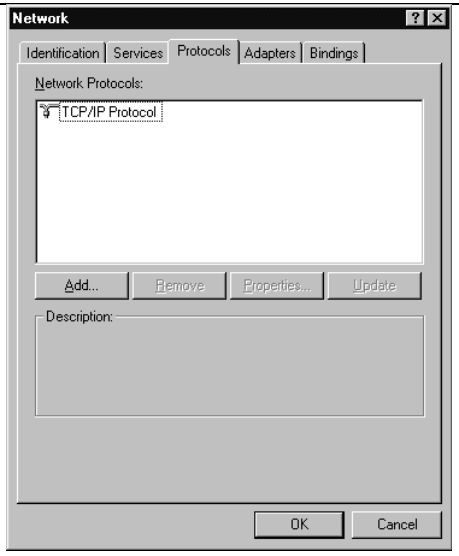
- Double-click the **Network** icon in the Control Panel window.

  The Network panel will display.
- Select the **Protocols** tab to continue.



3

- Highlight the **TCP/IP Protocol** in the **Network Protocols** box, and click on the **Properties** button.



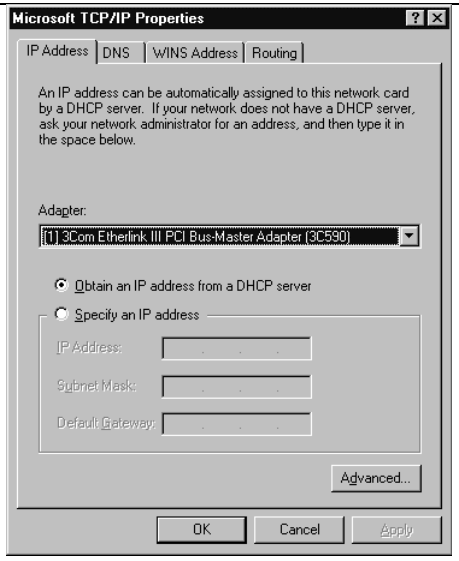
4

The **TCP/IP Properties** dialog box now displays.

- Click the **IP Address** tab**.**
- Select the radio button marked **Obtain an IP address from a DHCP server.**
- Click **OK**. This completes the configuration of TCP/IP in Windows NT.

Restart the PC.

Repeat these steps for each PC with this version of Windows on your network.



Verifying TCP/IP Properties for Windows XP, 2000, and NT4

To check your PC's TCP/IP configuration:

1. On the Windows taskbar, click the Start button, and then click Run.

   The Run window opens.

2. Type **`cmd`** and then click OK.

   A command window opens

3. Type **`ipconfig /all`**

   Your IP Configuration information will be listed, and should match the values below if you are using the default TCP/IP settings that NETGEAR recommends for connecting through a router or gateway:

   - The IP address is between 192.168.0.2 and 192.168.0.254
   - The subnet mask is 255.255.255.0

- The default gateway is 192.168.0.1

4. Type **`exit`**

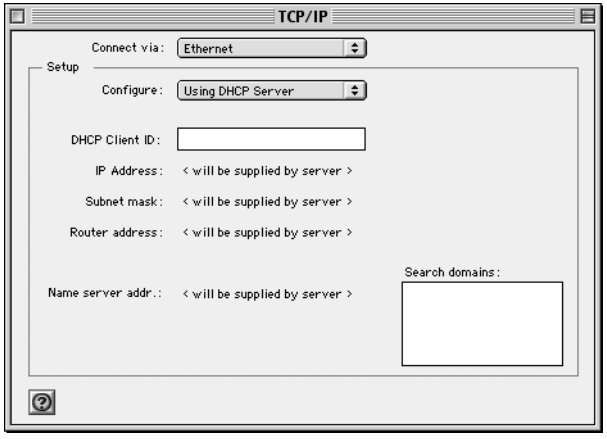
Configuring the Macintosh for TCP/IP Networking

Beginning with Macintosh Operating System 7, TCP/IP is already installed on the Macintosh. On each networked Macintosh, you will need to configure TCP/IP to use DHCP.

MacOS 8.6 or 9.x

1. From the Apple menu, select Control Panels, then TCP/IP.

   The TCP/IP Control Panel opens:



2. From the “Connect via” box, select your Macintosh’s Ethernet interface.
3. From the “Configure” box, select Using DHCP Server.

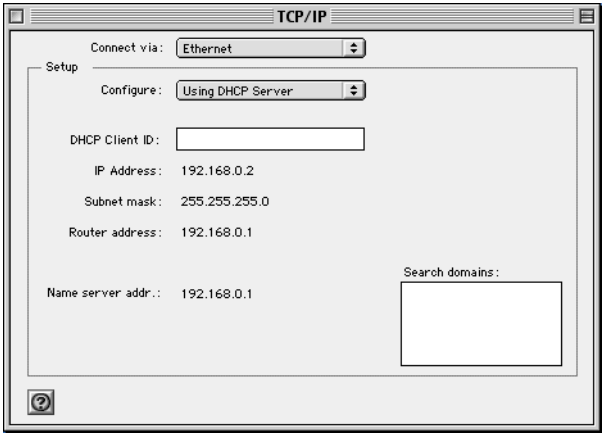
   You can leave the DHCP Client ID box empty.
4. Close the TCP/IP Control Panel.
5. Repeat this for each Macintosh on your network.

MacOS X

1. From the Apple menu, choose System Preferences, then Network.
2. If not already selected, select Built-in Ethernet in the Configure list.
3. If not already selected, Select Using DHCP in the TCP/IP tab.
4. Click Save.

Verifying TCP/IP Properties for Macintosh Computers

After your Macintosh is configured and has rebooted, you can check the TCP/IP configuration by returning to the TCP/IP Control Panel. From the Apple menu, select Control Panels, then TCP/IP.



The panel is updated to show your settings, which should match the values below if you are using the default TCP/IP settings that NETGEAR recommends:

- The IP Address is between 192.168.0.2 and 192.168.0.254
- The Subnet mask is 255.255.255.0
- The Router address is 192.168.0.1

If you do not see these values, you may need to restart your Macintosh or you may need to switch the “Configure” setting to a different option, then back again to “Using DHCP Server”.

Verifying the Readiness of Your Internet Account

For broadband access to the Internet, you need to contract with an Internet service provider (ISP) for a single-user Internet access account using a cable modem or DSL modem. This modem must be a separate physical box (not a card) and must provide an Ethernet port intended for connection to a Network Interface Card (NIC) in a computer. Your gateway does not support a USB-connected broadband modem.

For a single-user Internet account, your ISP supplies TCP/IP configuration information for one computer. With a typical account, much of the configuration information is dynamically assigned when your PC is first booted up while connected to the ISP, and you will not need to know that dynamic information.

In order to share the Internet connection among several computers, your gateway takes the place of the single PC, and you need to configure it with the TCP/IP information that the single PC would normally use. When the gateway's Internet port is connected to the broadband modem, the gateway appears to be a single PC to the ISP. The gateway then allows the PCs on the local network to masquerade as the single PC to access the Internet through the broadband modem. The method used by the gateway to accomplish this is called Network Address Translation (NAT) or IP masquerading.

Are Login Protocols Used?

Some ISPs require a special login protocol, in which you must enter a login name and password in order to access the Internet. If you normally log in to your Internet account by running a program such as WinPOET or EnterNet, then your account uses PPP over Ethernet (PPPoE).

When you configure your router, you will need to enter your login name and password in the router's configuration menus. After your network and gateway are configured, the gateway will perform the login task when needed, and you will no longer need to run the login program from your PC. It is not necessary to uninstall the login program.

What Is Your Configuration Information?

More and more, ISPs are dynamically assigning configuration information. However, if your ISP does not dynamically assign configuration information but instead used fixed configurations, your ISP should have given you the following basic information for your account:

- An IP address and subnet mask
- A gateway IP address, which is the address of the ISP's router
- One or more domain name server (DNS) IP addresses
- Host name and domain suffix

  For example, your account's full server names may look like this:

  `mail.xxx.yyy.com`

  In this example, the domain suffix is `xxx.yyy.com`.

If any of these items are dynamically supplied by the ISP, your gateway automatically acquires them.

If an ISP technician configured your PC during the installation of the broadband modem, or if you configured it using instructions provided by your ISP, you need to copy the configuration information from your PC's Network TCP/IP Properties window or Macintosh TCP/IP Control Panel before reconfiguring your PC for use with the gateway. These procedures are described next.

Obtaining ISP Configuration Information for Windows Computers

As mentioned above, you may need to collect configuration information from your PC so that you can use this information when you configure the CG814W Gateway. Following this procedure is only necessary when your ISP does not dynamically supply the account information.

To get the information you need to configure the gateway for Internet access:

1. On the Windows taskbar, click the Start button, point to Settings, and then click Control Panel.
2. Double-click the Network icon.

   The Network window opens, which displays a list of installed components.
3. Select TCP/IP, and then click Properties.

   The TCP/IP Properties dialog box opens.
4. Select the IP Address tab.

   If an IP address and subnet mask are shown, write down the information. If an address is present, your account uses a fixed (static) IP address. If no address is present, your account uses a dynamically-assigned IP address. Click "Obtain an IP address automatically".
5. Select the Gateway tab.

If an IP address appears under Installed Gateways, write down the address. This is the ISP's gateway address. Select the address and then click Remove to remove the gateway address.

6. Select the DNS Configuration tab.

   If any DNS server addresses are shown, write down the addresses. If any information appears in the Host or Domain information box, write it down. Click Disable DNS.

7. Click OK to save your changes and close the TCP/IP Properties dialog box.

   You are returned to the Network window.

8. Click OK.

9. Reboot your PC at the prompt. You may also be prompted to insert your Windows CD.

Obtaining ISP Configuration Information for Macintosh Computers

As mentioned above, you may need to collect configuration information from your Macintosh so that you can use this information when you configure the CG814W Gateway. Following this procedure is only necessary when your ISP does not dynamically supply the account information.

To get the information you need to configure the gateway for Internet access:

1. From the Apple menu, select Control Panels, then TCP/IP.

   The TCP/IP Control Panel opens, which displays a list of configuration settings. If the "Configure" setting is "Using DHCP Server", your account uses a dynamically-assigned IP address. In this case, close the Control Panel and skip the rest of this section.

2. If an IP address and subnet mask are shown, write down the information.

3. If an IP address appears under Router address, write down the address. This is the ISP's gateway address.

4. If any Name Server addresses are shown, write down the addresses. These are your ISP's DNS addresses.

5. If any information appears in the Search domains information box, write it down.

6. Change the "Configure" setting to "Using DHCP Server".

7. Close the TCP/IP Control Panel.

Restarting the Network

Once you've set up your computers to work with the gateway, you must reset the network for the devices to be able to communicate correctly. Restart any computer that is connected to the firewall.

After configuring all of your computers for TCP/IP networking and restarting them, and connecting them to the local network of your CG814W Gateway, you are ready to access and configure the gateway.

Glossary

10BASE-T	IEEE 802.3 specification for 10 Mbps Ethernet over twisted pair wiring.
100BASE-Tx	IEEE 802.3 specification for 100 Mbps Ethernet over twisted pair wiring.
802.11b	IEEE specification for wireless networking at 11 Mbps using direct-sequence spread-spectrum (DSSS) technology and operating in the unlicensed radio spectrum at 2.5GHz.
Denial of Service attack	DoS. A hacker attack designed to prevent your computer or network from operating or communicating.
DHCP	*See* Dynamic Host Configuration Protocol.
DNS	*See* Domain Name Server.
domain name	A descriptive name for an address or group of addresses on the Internet. Domain names are of the form of a registered entity name plus one of a number of predefined top level suffixes such as .com, .edu, .uk, etc. For example, in the address mail.NETGEAR.com, mail is a server name and NETGEAR.com is the domain.
DOCSIS	Data Over Cable Service Interface Specification. Defines interface requirements for cable modems involved in high-speed data distribution over cable television system networks
Domain Name Server	A Domain Name Server (DNS) resolves descriptive names of network resources (such as www.NETGEAR.com) to numeric IP addresses.
Dynamic Host Configuration Protocol	DHCP. An Ethernet protocol specifying how a centralized DHCP server can assign network configuration information to multiple DHCP clients. The assigned information includes IP addresses, DNS addresses, and gateway (router) addresses.

Gateway	A local device, usually a router, that connects hosts on a local network to other networks.
IETF	Internet Engineering Task Force. An open international community of network designers, operators, vendors, and researchers concerned with the evolution of the Internet architecture and the smooth operation of the Internet. Working groups of the IETF propose standard protocols and procedures for the Internet, which are published as RFCs (Request for Comment) at www.ietf.org.
IP	Internet Protocol. The main internetworking protocol used in the Internet. Used in conjunction with the Transfer Control Protocol (TCP) to form TCP/IP.
IP Address	A four-position number uniquely defining each host on the Internet. Ranges of addresses are assigned by Internic, an organization formed for this purpose. Usually written in dotted-decimal notation with periods separating the bytes (for example, 134.177.244.57).
IPSec	Internet Protocol Security. IPSec is a series of guidelines for securing private information transmitted over public networks. IPSec is a VPN method providing a higher level of security than PPTP.
ISP	Internet service provider.
LAN	*See* local area network.
local area network	LAN. A communications network serving users within a limited area, such as one floor of a building. A LAN typically connects multiple personal computers and shared network devices such as storage and printers. Although many technologies exist to implement a LAN, Ethernet is the most common for connecting personal computers.
MAC address	Media Access Control address. A unique 48-bit hardware address assigned to every Ethernet node. Usually written in the form 01:23:45:67:89:ab.
Mbps	Megabits per second.
MSB	*See* Most Significant Bit or Most Significant Byte.
MTU	*See* Maximum Transmit Unit.
Maximum Transmit Unit	The size in bytes of the largest packet that can be sent or received.
Most Significant Bit or Most Significant Byte	The portion of a number, address, or field that is farthest left when written as a single number in conventional hexadecimal ordinary notation. The part of the number having the most value.

NAT	*See* Network Address Translation.
netmask	A number that explains which part of an IP address comprises the network address and which part is the host address on that network. It can be expressed in dotted-decimal notation or as a number appended to the IP address. For example, a 28-bit mask starting from the MSB can be shown as 255.255.255.192 or as /28 appended to the IP address.
Network Address Translation	A technique by which several hosts share a single IP address for access to the Internet.
packet	A block of information sent over a network. A packet typically contains a source and destination network address, some protocol and length information, a block of data, and a checksum.
PPP	*See* Point-to-Point Protocol.
PPTP	Point-to-Point Tunneling Protocol. A method for establishing a virtual private network (VPN) by embedding Microsoft's network protocol into Internet packets.
Point-to-Point Protocol	PPP. A protocol allowing a computer using TCP/IP to connect directly to the Internet.
RFC	Request For Comment. Refers to documents published by the Internet Engineering Task Force (IETF) proposing standard protocols and procedures for the Internet. RFCs can be found at www.ietf.org.
RIP	*See* Routing Information Protocol.
router	A device that forwards data between networks. An IP router forwards data based on IP source and destination addresses.
Routing Information Protocol	A protocol in which routers periodically exchange information with one another so that they can determine minimum distance paths between sources and destinations.
subnet mask	*See* netmask.
URL	Universal Resource Locator, the global address of documents and other resources on the World Wide Web.
UTP	Unshielded twisted pair. The cable used by 10BASE-T and 100BASE-Tx Ethernet networks.

VPN	Virtual Private Network. A method for securely transporting data between two private networks by using a public network such as the Internet as a connection.
WAN	*See* wide area network.
WEP	Wired Equivalent Privacy. WEP is a data encryption protocol for 802.11b wireless networks. All wireless nodes and access points on the network are configured with a 64-bit or 128-bit Shared Key for data encryption.
wide area network	WAN. A long distance link used to extend or connect remotely located local area networks. The Internet is a large WAN.
Windows Internet Naming Service	WINS. Windows Internet Naming Service is a server process for resolving Windows-based computer names to IP addresses. If a remote network contains a WINS server, your Windows PCs can gather information from that WINS server about its local hosts. This allows your PCs to browse that remote network using Network Neighborhood.
WINS	*See* Windows Internet Naming Service.

ASUS WLAN mini-PCI card

WL-120

User Manual

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Welcome

The ASUS WLAN mini-PCI card is designed to be fully compliant with the IEEE 802.11b wireless local area network (Wireless LAN) standard. The ASUS WLAN mini-PCI card comes with two antenna connectors, which are individually connected to the built-in antennas in your notebook. The two antennas allow your notebook to have the best communication when you are enjoying the wireless link.

Verifying the TCP/IP Protocol

Windows 98/Me

Right-click **My Network Place** on the desktop and select **properties.** Scroll down and look for "TCP/IP -> ASUS 802.11b Network Adapter". Make sure that the TCP/IP protocal parameters (IP adress, gateway, and subnet mask) are set correctly.

Windows 2K/XP

Open the **Control Panel** through the **Start** menu. Double-click **Network Connection** icon. Right click " ASUS 802.11b Network Adapter" and select **Properties.** Look for "Internet Protocal (TCP/IP)". Make sure that the TCP/IP protocal parameters (IP adress, gateway, and subnet mask) are set correctly.

Installing the WLAN mini-PCI card Utilities

After you have installed the WLAN mini-PCI card driver, you can install WLAN mini-PCI card utilities. Refer to the User's manual for detailed information.

1. Insert the ASUS WLAN mini-PCI card support CD and an autorun menu will appear. If your autorun is disabled, double click **SETUP.EXE** in the root directory of the support CD.
2. From the autorun menu, click Install **ASUS WLAN mini-PCI card Utilities.**
3. Follow the on-screen instructions to complete the installation.

Software Reference

1. Overview

The ASUS WLAN mini-PCI card software includes five groups of utilities.

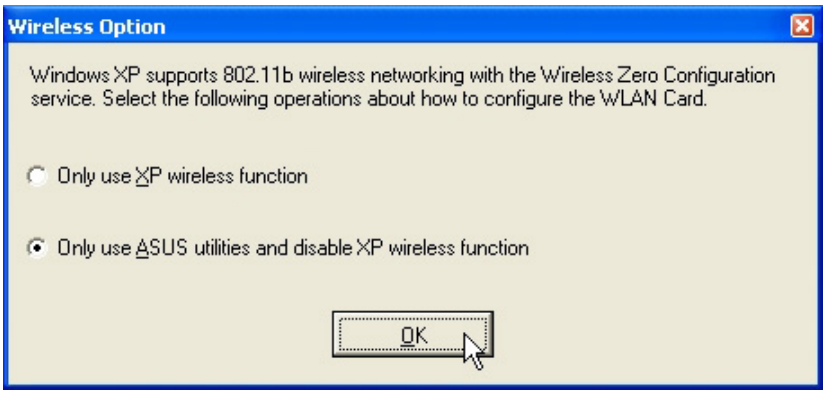
- **Control Center** – Makes it easy to launch applications and activate network location settings.
- **Wireless Settings** – Allows users to control the ASUS WLAN mini-PCI card.
- **Mobile Manager** – A convenient tool to setup and manage network location settings.
- **Site Monitor** – Measures the signal-to-noise (SNR) values of all wireless networks. This tool is used for determining the best placement of Access Points to provide the most efficient coverage in a wireless network.
- **Live Update** – Provides automatic driver and firmware update through the Internet.

2. Windows XP Wireless Options

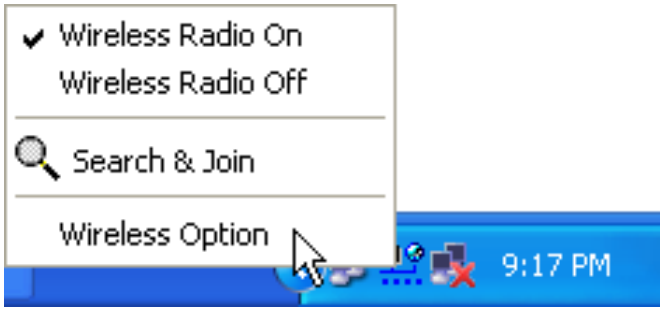
The wireless options shown below is only available for Windows XP. The first time you run the Control Center utility, it will automatically show. Select one of the radio buttons to decide your Windows XP wireless networking environment.

Only use XP wireless function – Only use Windows XP wireless network settings to configure the ASUS WLAN mini-PCI card.

Only use ASUS utilities and disable XP wireless function – Only use ASUS WALN mini-PCI card utilities to configure the ASUS mini-PCI card.



You can return to the Wireless Option setting at any time by left clicking the control center icon and choosing “Wireless Option”.



3. Control Center

Control Center is an application that makes it easy to launch applications and activate network location settings. Control Center starts automatically when the system boots. Whenever Control Center is running, you will see a Control Center icon displayed on the Windows taskbar.

Starting the Control Center manually

- Click the Windows **Start** button, select **Programs**, select **ASUS Utility**, select **WLAN Card**, and click **ASUS WLAN Control Center**.

or

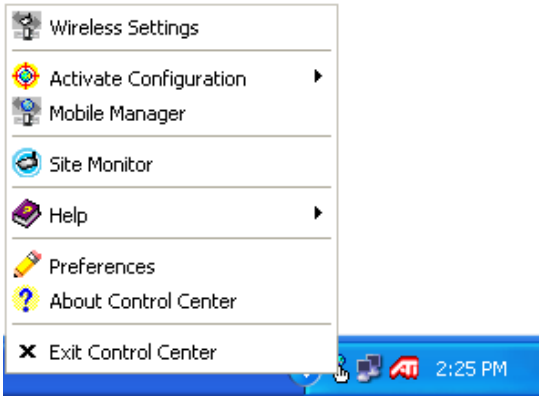
- Double click the **Control Center icon** on the desktop.

Using the Control Center Taskbar

1. The Control Center Taskbar menu display the following information:
   - The link quality of the ASUS WLAN mini-PCI card (Excellent, Good, Fair, Poor, Not Linked)
   - Whether the ASUS WLAN mini-PCI card is connected to the Internet (Blue: Connected, Gray: Not Connected)

Taskbar Icon and Status

Taskbar Left-Click Menu



Taskbar Right-Click Menu

Wireless Status Icons (on the taskbar)

Excellent link quality and **connected to Internet** (Infrastructure)

Good link quality and **connected to Internet** (Infrastructure)

Fair link quality and **connected to Internet** (Infrastructure)

Poor link quality and **connected to Internet** (Infrastructure)

Not linked but **connected to Internet** (Infrastructure)

Excellent link quality but **not connected to Internet** (Infrastructure)

Good link quality but **not connected to Internet** (Infrastructure)

Fair link quality but **not connected to Internet** (Infrastructure)

Poor link quality but **not connected to Internet** (Infrastructure)

Not linked and **not connected to Internet** (Infrastructure)

Linked (Ad Hoc)

Not Linked (Ad Hoc)

Connected to Internet

2. Right-clicking the taskbar icon shows the following menu:
   - **Wireless Settings** – Launches Wireless Settings application.
   - **Activate Configuration** – Allows you to set which profile to use.
   - **Mobile Manager** – Launches Mobile Manager application.
   - **AP Manager** – Launches AP Manager application installed with the Wireless LAN Utilities.
   - **Preferences** – Customizes the way the Control Center program behaves. You can create a Control Center shortcut on the desktop. You can also set whether Control Center starts up with Windows.
   - **Exit** – Closes the Control Center program.

3. Left-clicking the taskbar icon shows the following menu:
   - **Wireless Radio On** – Turns the wireless radio ON.
   - **Wireless Radio Off** – Turns the wireless radio OFF.
   - **Search and Join** – View the properties of available Access Points within range.
   - **Wireless Option** (Windows XP only) – Sets your Windows XP wireless networking environment.
4. Double-clicking the taskbar icon:
   - Launches the Wireless Settings application.

4. Wireless Settings

Wireless Settings is an application that allows you to control your ASUS WLAN mini-PCI card. Use Wireless Settings to View or Modify the configuration settings and monitor the operational status of your PC Card. Once Wireless Settings is launched, you can see the tabbed property sheet. This property sheet is composed of tabbed “pages”, each with its own group of feature-specific settings.

Starting Wireless Settings

- Open the Windows **Control Panel**, and then double-click the icon **ASUS WLAN Card Settings** icon.

or

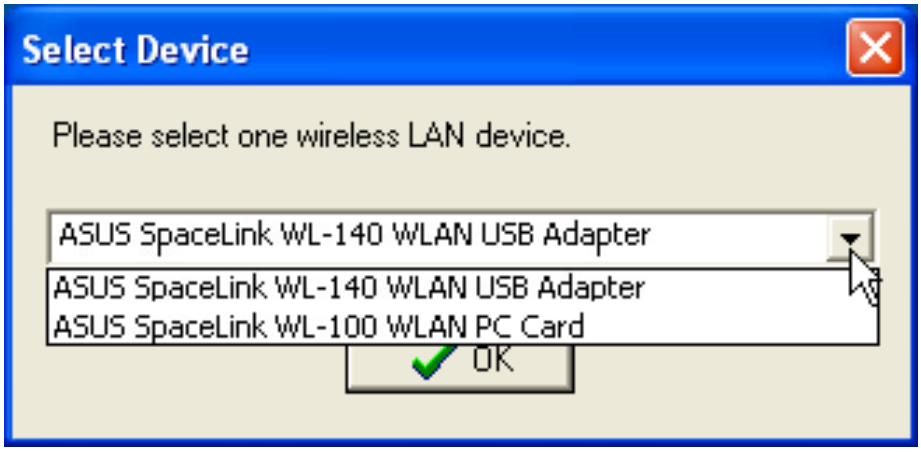
- Click the Windows **Start** button, select **Programs**, select **ASUS Utility**, select **WLAN Card**, and then click **Wireless Settings**.

or

- Click the **Control Center icon** on the Windows taskbar, a popup menu appears, and then click **Wireless Settings**.

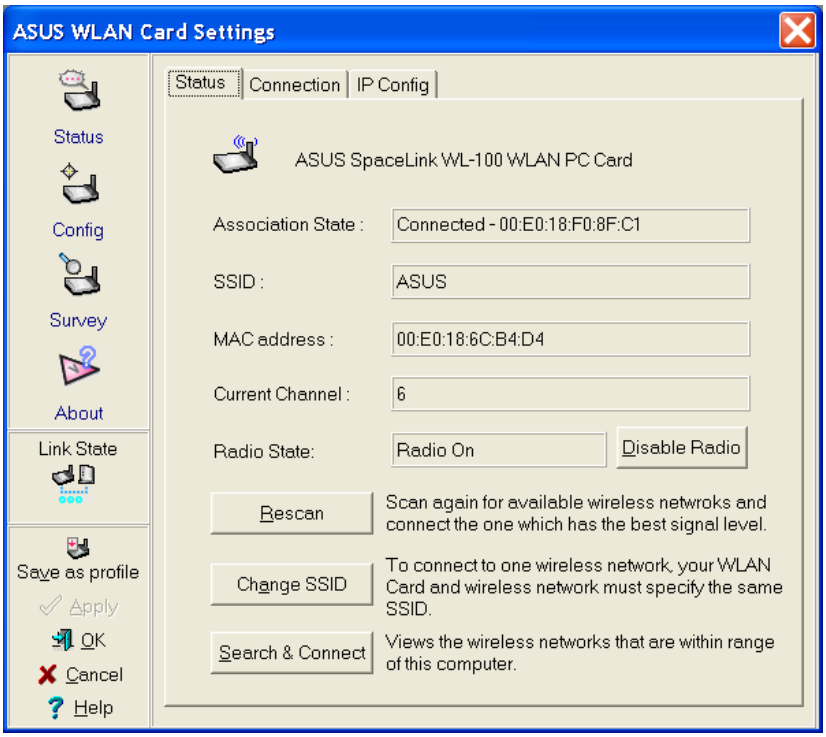
More than one ASUS WLAN Card

If you have more than one ASUS WLAN Card. You will be given a device selection window when you launch the “Wireless Settings” utility.



4.1 Status - Status Tab

You can view the information about the ASUS WLAN mini-PCI card from the general menu. These fields are blank if the ASUS WLAN mini-PCI card does not exist.



Association State

Shows the ASUS WLAN mini-PCI card association status as follows:

Connected – The station is now associated with one wireless LAN device. Also, indicates the MAC address of this device.

Scanning... – The station is now attempting to authenticate and associate with the desired Access Point.

Disconnected – If the link is connected and no beacon received, then the set adapter is no longer connected.

INT_TEST_FAIL – Interrupt test failed.

NOT_AVAILABLE – Cannot get PC Card status.

SSID

Shows the SSID that the ASUS WLAN mini-PCI card is currently using.

MAC address

Indicates the hardware address of the ASUS WLAN mini-PCI card. MAC address is a unique identifier for networking devices (typically written as twelve hexadecimal digits 0 through 9 and A through F, six hexadecimal numbers separated by colons, i.e. 00:01:24:F0:05:C0). This parameter is read-only and unique.

Current Channel

Shows the radio channel that the ASUS WLAN mini-PCI card is currently using.

Radio State

Shows whether the wireless radio is ON or OFF.

When the wireless radio is turned OFF, the following icon appears in the upper left of the “Settings” property page.

When the wireless radio is turned ON, the following icon appears in the upper left of the “Settings” property page.

Button

Enable Radio/Disable Radio – You can click the Disable Radio button to turn OFF the wireless radio. When you click this button, the Radio State field indicates that the radio has been turned OFF and the remaining fields in this window display either a “0” or “Not Applicable”. Click this button again to turn the radio back ON.

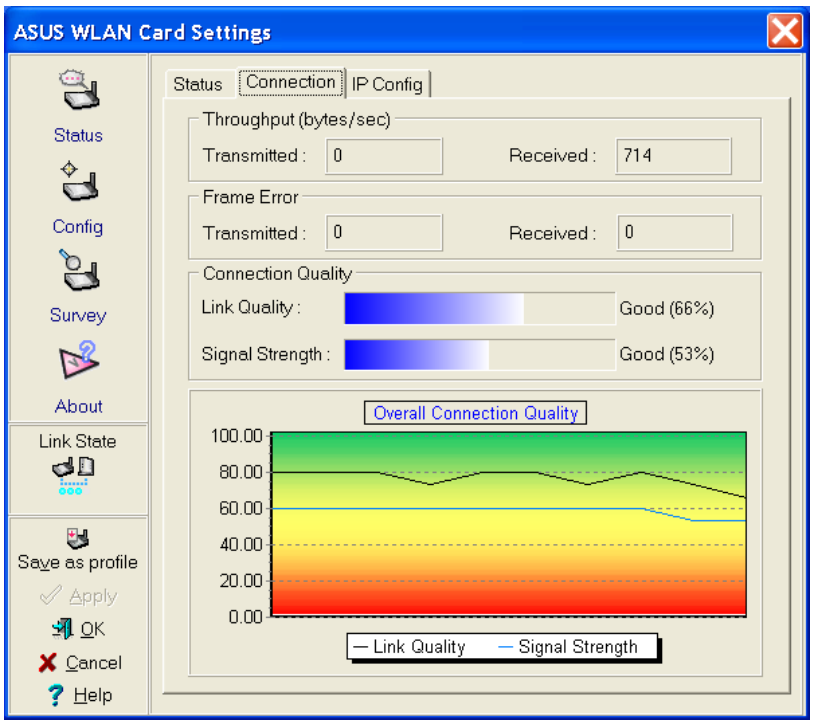
Rescan – Force the radio to rescan all available channels. If your link quality or signal strength is poor, rescanning can be used to push the radio OFF a weak Access Point and search for a better link with another Access Point. This function will take some time.

Change SSID – Click on this to set the SSID.

Search & Connect – Click on this to connect to an available network.

4.2 Status - Connection Tab

You can view the current link statistics about the ASUS WLAN mini-PCI card. These statistics are updated once per second and are valid only if the ASUS WLAN mini-PCI card exists.



Throughput

Transmitted – The number of bytes in frames that were transmitted.
Received – The number of bytes in frames that were received.

Frame Error

Transmitted – The number of frames that were not successfully transmitted.

Received – The number of frames that were not successfully received.

Connection Quality

Link Quality – Reflects the quality level related to the Access Point the station is currently connected to. Ratings are: Excellent, Good, Fair, and Poor.

Signal Strength – Reflects the signal level related to the Access Point the station is currently connected to. Ratings are: Excellent, Good, Fair, and Poor.

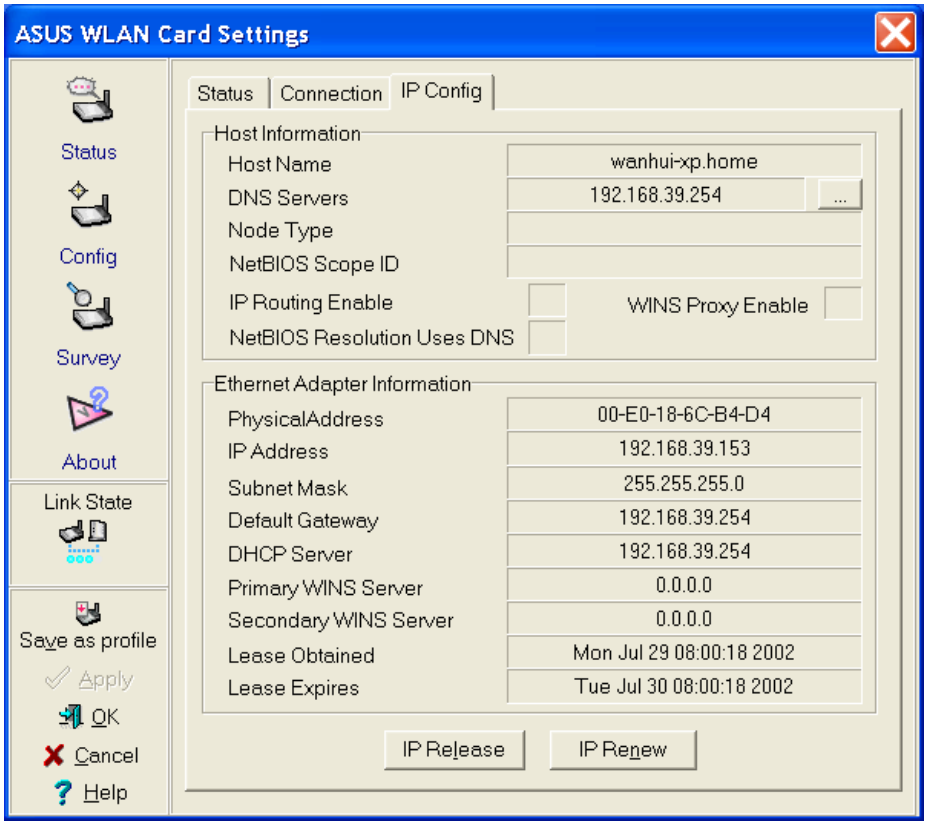
Overall Connection Quality

Derives from the current “Link Quality” and the current “Signal Strength”. A graph displays a connection quality range between 0 and 100 percent.

4.3 Status - IP Config Tab

IP Config tab shows all the current network configuration information for the ASUS WLAN mini-PCI card. Use it to verify your network settings.

IP CONFIG will display all the current TCP/IP configuration values including the IP address, subnet mask, default gateway and Windows Internet Naming Service (WINS) and DNS configuration.



Button

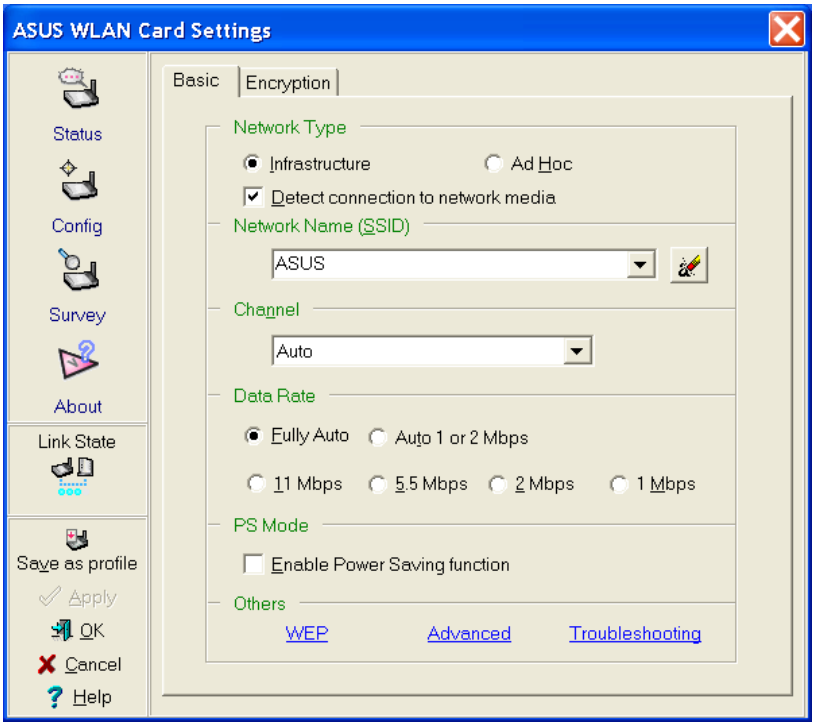
IP Release - Releases the DHCP IP address for the ASUS WLAN mini-PCI card.

IP Renew - Renews the DHCP IP address for the ASUS WLAN mini-PCI card.

NOTE : The IP Release and IP Renew buttons can only be used on the ASUS WLAN mini-PCI card that is configured with DHCP.

4.4 Config - Basic Tab

Lets you can change the ASUS WLAN mini-PCI card configurations without rebooting your computer.



Network Type

Infrastructure – Select the Infrastructure mode to establish a connection with an Access Point. Your computer is able to access wireless LAN and wired LAN (Ethernet), via an associated access point. The Channel field turns to “Auto” when “Infrastructure” is selected.

Ad Hoc – Select the “Ad Hoc” mode to communicate directly with each other without using an Access Point. An “Ad Hoc” network is typically formed quickly and easily without pre-planning. For example, share meeting notes between networked computers in a meeting room.

SSID

Use the SSID filed to configure the SSID for the ASUS WLAN mini-PCI card. You can enter a new SSID or select one from the drop-down list box. SSID stands for “Service Set Identifier”, which is a string used to identify a wireless LAN. You will only be able to connect Access Points which has the same SSID as the one you set. Use different SSIDs to segment the wireless LAN and increase security. SSIDs must all be printable characters and having a maximum of 32 case sensitive characters, such as “ Wireless LAN”.

Set the SSID to “any” if you wish to allow your station to connect to any IEEE 802.11 Infrastructure Network it can find. When you set to “any”, “Scanning...” will begin and may take a long time. Use “Survey” to view all Access Points within range and their SSIDs.

Channel

Using the Channel field to select the radio channel for ASUS WLAN mini-PCI card. In an “infrastructure” network, your PC Card will automatically select the correct frequency channel required to communicate with an Access Point, this parameter will be fixed in “Auto” and cannot be changed. In an “Ad Hoc” network, you can decide the channel number for the ASUS WLAN mini-PCI card. Any ASUS WLAN mini-PCI card can communicate in the same network if each has the same frequency channel setting. The radio channels you may use depend on the regulations in your country. For United States (FCC) and Canada (IC), channels 1 to 11 are supported. For Europe (ETSI) except Spain and France, channels 1 to 13 are supported. For Spain channel 10 and 11 are supported. For France, channels 10 to 13 are supported. For operation in Japan (MKK), channels 1 to 14 are supported.

Data Rate

Fully Auto – Automatic transmit data rate falls back to 1, 2, 5.5, or 11 megabits per second when necessary to maintain transfers with devices.

Auto 1 or 2 Mbps – The PC Card will adjust to the most suitable transmission rate. The transmit data rate is either 1 Mbps or 2 Mbps.

11 Mbps – Fix data rate to 11 megabits per second.

5.5 Mbps – Fix data rate to 5.5 megabits per second.

2 Mbps – Fix data rate to 2 megabits per second.

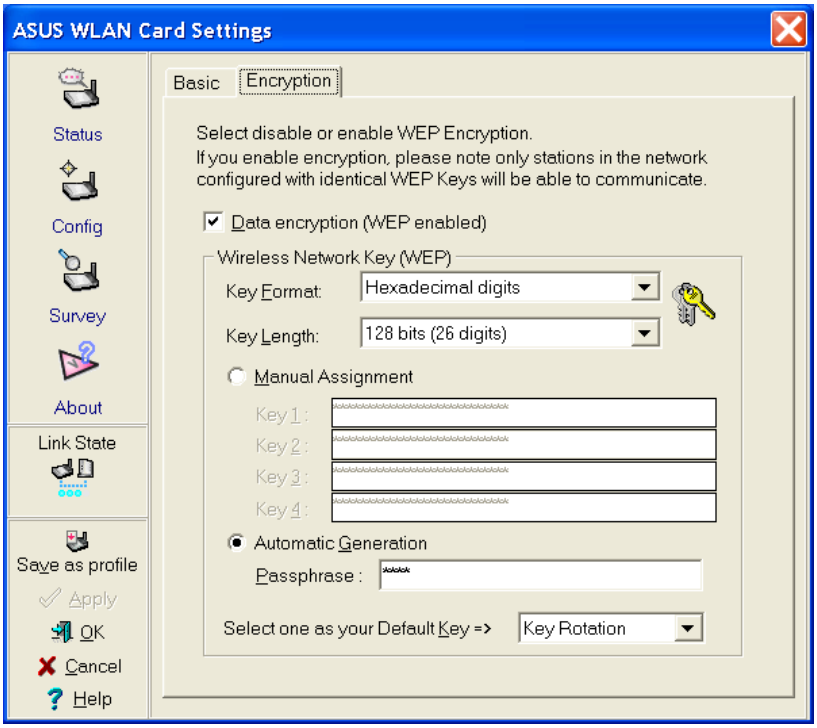
1 Mbps – Fix data rate to 1 megabits per second.

Other

WEP - Click on this to show the "Encryption" page.
Advanced - Click on this to show the "Advanced" tab. In most cases, the default values do not have to be changed.
Troubleshooting - Click on this to show the "Troubleshooting" utility.

4.5 Config - Encryption Tab

Lets you configure the ASUS WLAN mini-PCI card encryption settings. For data confidentiality in a wireless environment, IEEE 802.11 specifies a Wired Equivalent Privacy (WEP) algorithm to offer transmission privacy similar to wired network. The WEP uses keys to encrypt transmitted data packets and decrypt received data packets. The encryption process can scramble frame bits to avoid disclosure to others.



Data encryption (WEP enabled)

This option allows you to enable or disable the Wired Equivalent Privacy (WEP) function. If this check box is selected, a WEP Key is used to encrypt your data before it is transmitted over the air.

If you enable WEP encryption, you will only be able to communicate with wireless devices that use the same WEP keys.

WEP Key

This option is enable only if you enable WEP Encryption. The WEP Key is a 64 bits (5 byte) or 128 bits (13 byte) Hexadecimal digits that is used to encrypt transmit data packets and decrypt received data packets.

Key Format

You can enter the WEP Key as Hexadecimal digits (0~9, a~f, and A~F), or as ASCII characters, based on the state of the Key Format.

Key Length

For 64 bits encryption, each Key contains exactly 10 hex digits, or 5 ASCII characters. For 128 bits encryption, each Key contains exactly 26 hex digits, or 13 ASCII characters.

Two ways to assign WEP keys

Manual Assignment – When you click this button, the cursor appears in the field for Key 1. For 64-bit encryption, you are required to enter four WEP Keys. Each Key contains exactly 10 hex digits (0~9, a~f, and A~F). For 128-bit encryption, you are required to enter four WEP Keys. Each Key contains exactly 26 hex digits (0~9, a~f, and A~F).

Automatic Generation – Type a combination of up to 64 letters, numbers, or symbols in the Passphrase column, then the Wireless Settings Utility uses an algorithm to generate four WEP Keys for encryption.

NOTE: This function eases users from having to remember their passwords and is compatible to some existing WLAN utilities, but this is not very secure. "Manual Assignment" is more secure.

Default Key – The Default Key field lets you specify which of the four encryption keys you wish to use to transmit data on your wireless LAN. You can change the default key by clicking on the down arrow at the right of this field, selecting the number of the key you want to use, and then clicking the **Apply** button. As long as the Access Point or station with which you are communicating has the same key in the same position, you can use any of the keys as the default.

Click the **Apply** button to create your encryption keys. After you click the **Apply** button, the "Wireless Settings" utility uses asterisks to mask your keys.

Click Apply to save and activate the new configurations.

64/128bits versus 40/104bits

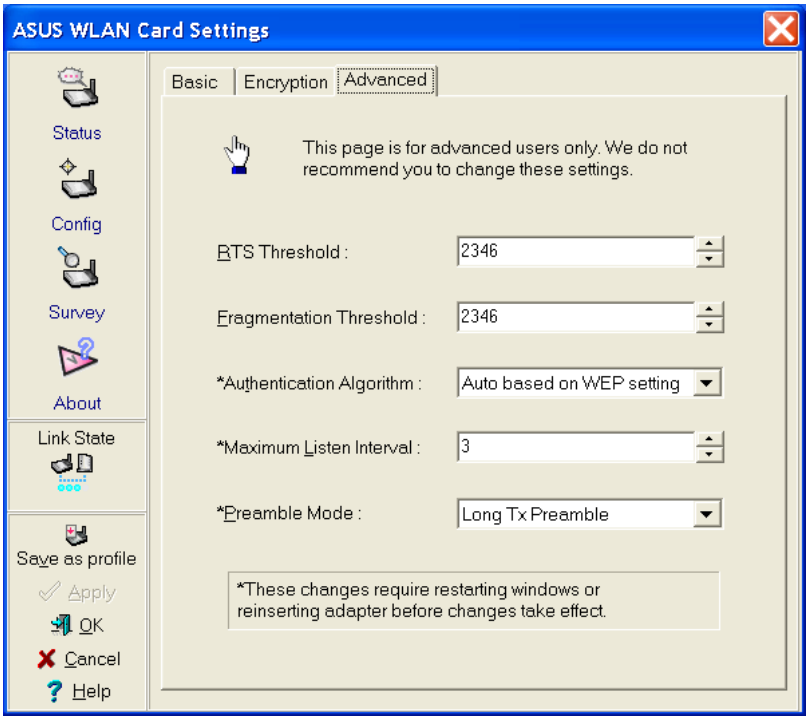
You may be confused about configuring WEP encryption, especially when using multiple wireless LAN products from different vendors. There are two levels of WEP Encryption: 64 bits and 128 bits.

First, 64 bit WEP and 40 bit WEP are the same encryption method and can interoperate in the wireless network. This lower level of WEP encryption uses a 40 bit (10 Hex character) as a “secret key” (set by user), and a 24 bit “Initialization Vector” (not under user control). This together makes 64 bits (40 + 24). Some vendors refer to this level of WEP as 40 bits and others refer to this as 64 bits. ASUS WLAN card products use the term 64 bits when referring to this *lower* level of encryption.

Second, 104 bit WEP and 128 bit WEP are the same encryption method and can interoperate in the wireless network. This higher level of WEP encryption uses a 104 bit (26 Hex character) as a “secret key” (set by user), and a 24 bit “Initialization Vector” (not under user control). This together makes 128 bits (104 + 24). Some vendors refer to this level of WEP as 104 bits and others refer to this as 128 bits. ASUS WLAN card products use the term 128 bits when referring to this *higher* level of encryption.

4.6 Config - Advanced Tab

Advanced tab provides some additional settings for the ASUS WLAN mini-PCI card. The “Advanced” tab is hidden until you click Advanced on the Config - Basic page.



NOTE: This page is for advanced users. Do not change these settings if you do not fully understand these items.

RTS Threshold

Defines the size of packets that the station uses for RTS/CTS handshake boundary. Setting the minimum size packet too small causes RTS packets to be sent more often, adding excessive overhead to the network and decreasing network utilization. However, the more often RTS packets are sent, the more transmission collisions can be avoided. RTS threshold ranges from 0 to 2346 in 64 steps.

Fragmentation Threshold

Define the number of bytes used for fragmentation boundary. If the length of the data unit exceedsthis parameter , it will be divided into smaller fragments for transmission. Each of the fragments is sent independently. If there is a significant interference present, set the fragment size smaller. Otherwise,set the fragment size lar ger. Because send multiple frames lead to overhead on the network.Fragmentation Threshold ranged from 256 to 2432 steps 128.

Authentication Algorithm

Because there is no precise bound in wireless LANs, it needs to be implemented in another mechanism to provide a higher level of security. That is where Authentication services come in. If a mutual authentication relationship has not been established between the ASUS WLAN mini-PCI card(s) and the Access Point(s), an association cannot be established.

Auto based on WEP setting – Switch the authentication mode based upon the ASUS WLAN mini-PCI card Client using WEP encryption or not.

Open System – A null authentication algorithm. A station can authenticate with any other station or Access Point and without checking any WEP Key, even if one exists.

Share Key – In a Share Key Authentication system, four-step exchange of frames is required to validate that the station is using the same WEP Key as the Access Point. Using this Authentication mechanism requires implementation of the WEP option.

Maximum Listen Interval

This value is used to indicate how often a station will wake up to listen to beacon management frames. Listen intervals range from 0 to 77 in steps of 1.

Preamble Mode

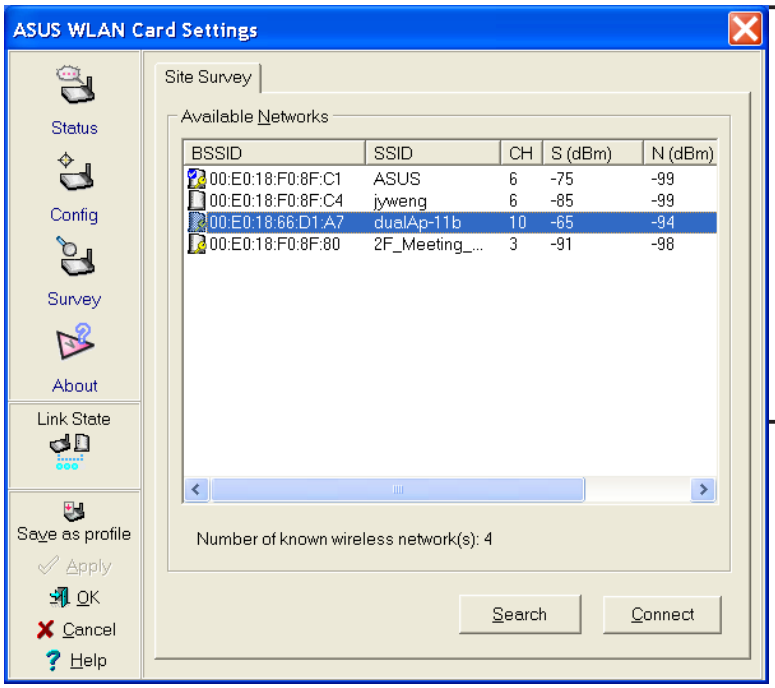
This parameter is used to control whether frames will transmit with the long or short preamble.

Click Apply to save and activate the new configurations.

4.7 Survey - Site Survey Tab

Use the Site Survey tab to view statistics on the wireless networks available to the ASUS WLAN mini-PCI card. The Site Survey tab is read-only with no user configurable data fields. Use the Site Survey tab to view the following network parameters.

- **BSSID** – View the IEEE MAC addresses of the available networks.
- **SSID** – View the SSID (service set identification) within available networks.
- **CH** – View the direct-sequence channel used by each network.
- **S (dBm)** – Signal field to view the strength of the signal transmitted by each network. This information is helpful in determining which network you should be associated to. The value is then normalized to a dBm value.
- **N (dBm)** – Noise field to view average noise level statistics and Relative Signal Strength Information (RSSI). This information is helpful in determining which network you should be associated to. The value is then normalized to a dBm value.
- **Type** – View wireless network status information, the value is either AP (infrastructure) or STA (Ad Hoc).
- **WEP** – View wireless network WEP encryption information, the value is either OFF (disable encryption) or ON (enable encryption).



Some Access Points can disable broadcasting SSID to hide themselves from "Site Survey" or "Site Monitor" for added security but still allow you to join if you know their SSID.

Buttons

Search – Scan all available wireless networks and show the scan result in the "Available Network List".

Connect – To associate a network, select it from the "Available Network List" and click this button.

4.8 About - Version Info Tab

Click about to view version information. The version under the copyright is the utility version. The version information field includes driver, hardware, and firmware versions.

4.9 Link Status

ASUS WLAN mini-PCI card connection quality icon appears on the left of the ASUS WLAN Card Settings. Use the icon to view the current signal quality of the adapter.

Excellent Link Quality (Infrastructure)

Good Link Quality (Infrastructure)

Fair Link Quality (Infrastructure)

Poor Link Quality (Infrastructure)

Not linked (Infrastructure)

Linked (Ad Hoc)

Not Linked (Ad Hoc)

To Exit Wireless Settings

To exit Wireless Settings, you can click **OK** or **Cancel**. This utility may be closed at any time and from any tab. If you did not save the configuration settings, you will be prompted to do so.

5. Mobile Manager

Mobile Manager is a convenient tool to setup and manage network location settings. Mobile Manager lets users configure multiple alternative configurations for different locations. You only need to set this once, and then easily switch configurations when you change your location.

Starting Mobile Manager

- Click the Windows **Start** button, select **Programs**, select **ASUS Utility**, select WLAN Card, and then click **Mobile Manager**.

or

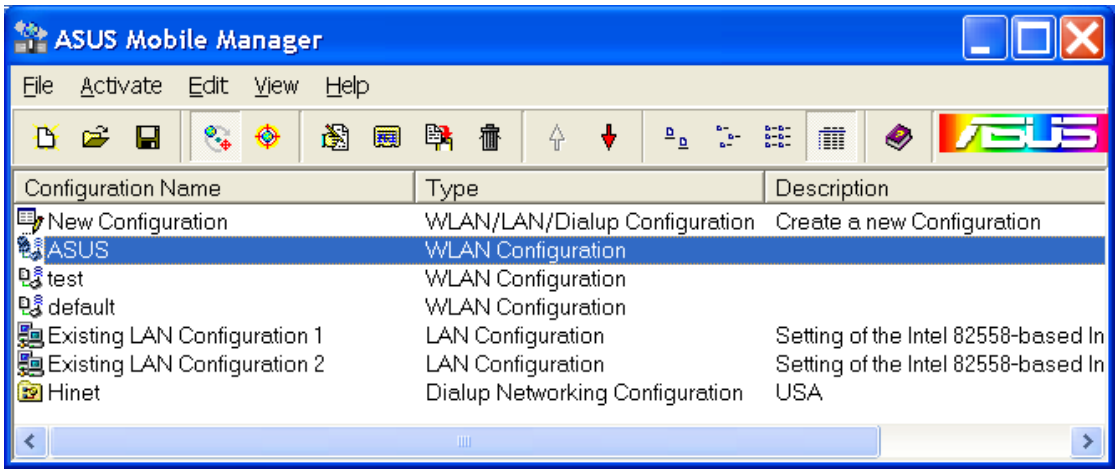
- Right-click the **Control Center** icon on the Windows taskbar and then click **Mobile Manager**.

Using Mobile Manager - Quick Guide

1. The first time you launch the Mobile Manager utility, it will automatically generate configurations that stores the current settings of all installed network devices in your system.
2. Change the name of the configuration to a descriptive name like “Work-Meeting Room” or “Home-ADSL”.
3. On the **File** menu, click **New Configuration**, the New Configuration Wizard dialog appears. Follow the on-screen instructions to create your own location configurations.
4. After you have created your configurations, you can see them in the main window.
5. Select the configuration you want to use and then click **Mobilize Configuration** from the **Mobilize** pull-down menu. Your system will then switch to the network settings configured to your chosen selection.

5.1 Main Window

You can use the Mobile Manager utility main window to create a new configuration, edit a configuration or activate a configuration. The main window includes a menu bar, tool bar, and a list view for showing existing configurations.



Using the pull-down menu and toolbar

The following topics show the commands available from the Mobile Manager pull-down menu and toolbar. If no configuration is selected, some commands will be grayed out and inaccessible. The toolbar contains buttons for many of the most commonly used commands in Mobile Manager. It allows quick access to some of the most useful features of Mobile Manager. The commands provided by the toolbar buttons are also available from the pull-down menu.

File Menu

New Configuration - Select New Configuration in the File menu to open a New Configuration Wizard dialog. Use the New Configuration Wizard dialog to create a new configuration. See Using New Configuration Wizard for details on this command.

Import Configuration - Load a configuration from an INI File.

Export Configuration - Save the selected configuration (containing Wireless Settings, TCP/IP Settings, Network Settings, ...) to an INI File. The INI file can be placed on a floppy diskette and then imported by other computers using Mobile Manager. This can also be used as a backup feature for yourself.

Exit - Close the Mobile Manager utility.

Mobilize Menu

Auto Roaming – If an association changes, it will automatically switch into a network configuration that you have made. If no associations have been made, it will automatically connect to a wireless network based on configurations that you specify.

Activate Configuration – Applies the configuration that you have selected from the list. You may be prompted to restart Windows depending on the required changes. Follow the instructions on the screen. Windows 2000 and XP usually do not require restarting your computer, but Windows 98 and ME usually will require a restart.

Edit Menu

All these commands are also available from the context menu that appears when you right-click with a configuration in the Mobile Manager window.

Edit Configuration - Select Edit Configuration in the Edit menu to open an Edit Configuration dialog to edit selected configuration items. See “Using Edit Configuration” for details on this command.

Rename - Change the name of the selected configuration.

Copy - Duplicate the selected configuration.

Delete - Discard the selected configuration.

Up - Raises the position of the selected wireless netowork configuration in the preferred network list.

Down - Lowers the position of the selected wireless netowork configuration in the preferred network list.

View Menu

Large Icons - Displays large icons for each configuration.

Small Icons - Displays small icons for each configuration.

List - Shows the configuration names in a list.

Details - The Detailed view expands this list to include information about the configurations. The information includes configuration name, type, and description.

Help Menu

Contents - Displays the WinHelp contents window (the one you are reading now) for online Help.

About Mobile Manager - Displays the version number and copyright information for Mobile Manager. Click on the logo to connect to ASUS' website.

5.2 Using New Configuration Wizard

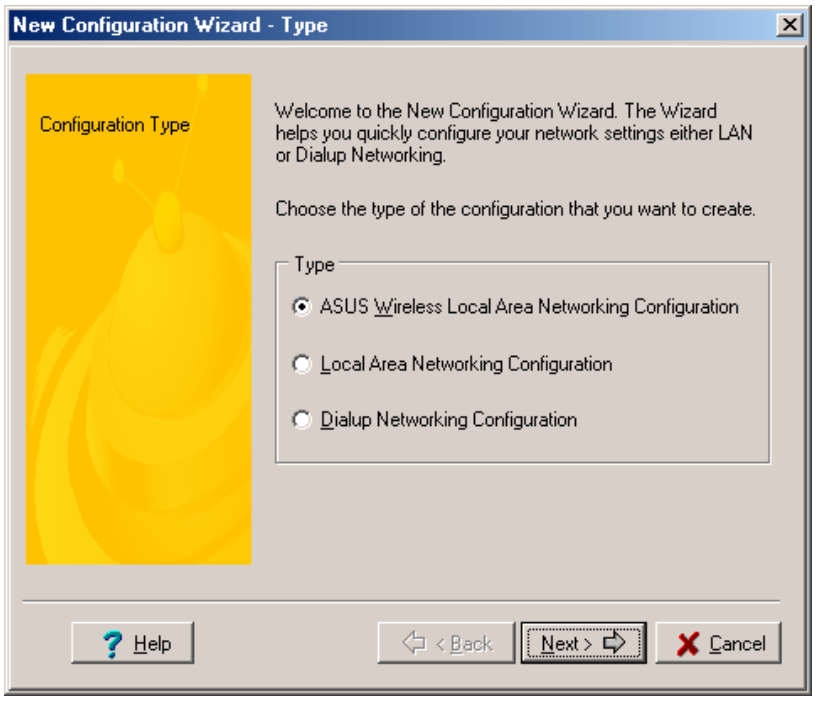
Create a new configuration

Create a new configuration if you are in a specific location that does not have an existing configuration defined. Use the New Configuration Wizard to create a configuration in a few easy steps.

1. Do one of the following:
   - On the **File menu**, click **New Configuration**.

   or
   - Double-click **New Configuration** on the Main window.

   Then the New Configuration Wizard dialog starts.
2. Choose the type of configuration that you want to create and click **Next**.
   - **Wireless Local Area Network Configuration:** You must have an ASUS WLAN mini-PCI card installed in your PC.
   - **Wired Local Area Network Configuration:** You must have a NIC (LAN card) (other than ASUS WLAN mini-PCI card) installed in your PC.
   - **Dialup Networking Configuration:** You must have a modem installed in your PC.



3. Enter the name and description you want to use for this configuration in the Name and description field. And Click **Next**.
4. Follow the on-screen instructions, it will guide you through the process of specifying the settings in your configuration. The Wizard reads the current system settings (TCP/IP, NT Domain, Proxy, File, and Printer Sharing) and displays it. Depending on the configuration that you have created, you can set the following groups of settings:
   - Wireless settings (for Wireless Configuration)
   - Network settings (for Wireless/Wired Configuration)
   - TCP/IP settings (for Wireless/Wired Configuration)
   - Dialing settings (for Dialup Configuration)
   - Dialup Networking settings (for Dialup Configuration)
   - Internet settings (for Wireless/Wired/Dialup Configuration)
   - Sharing settings (for Wireless/Wired/Dialup Configuration)

   See “Using Edit Configuration” for detailed information on each.
5. Enter the appropriate information in the wizard. After specifying the appropriate information on each page, click **Next** to continue.
6. On the final window of the New Configuration Wizard, you will see a **Finish** button.
   - If you do not want to use this new configuration now, click **Finish** to save the new configuration. It will be shown in the Mobile Manager main window.

   or
   - If you want to use this new configuration now, click **Mobilize**.

5.3 Using Edit Configuration

Edit an existing configuration

Edit a configuration if you want to view or change dialup or LAN settings.

- On the **Edit menu**, click **Edit Configuration**.

or

- Double-click one existing configuration on the Main window.

Then the Edit Configuration dialog starts.

The Edit Configuration dialog contains various settings, which you select by clicking the buttons at the left of the window. Each setting is described below.

General settings

Name – This field is mandatory, and used for indicating the location from which you are dialing or connecting to the network. For example, if this is used for a meeting room at work, you can use a name like "Work-Meeting Room". If it is used for home on your ADSL, you can name like "Home-ADSL".

Description – This field is optional, you can use it to provide more details about this configuration.

Network settings

Network settings include: "Identification" and "Microsoft Networking".

Identification

Computer name – Give your computer a unique name of up to 15 characters. Thecomputer name is the name that others on your network will see your computer as. For complete compatibility, do not use spaces or symbols. It's generally the same as the DNS hostname, for example, "JohnDoe".

Workgroup – Type an existing workgroup name or create a new workgroup by typing a new name that contains up to 15 characters. Use it to identify your computer group that you belong to.

Computer Description – This information is displayed as a comment next to the computer name when the computer is seen in "Details" view (select from the Windows pull-down menu). Use it to describe your computer, for example, your name, or location.

Microsoft Networking

Logon validation – Specify how Windows 9x clients connect to a Windows NT Server Domain at this location.Check *Log on to Windows NT domain* box if you are using a Windows NT Server in domain controller mode. And then enter the Window NT server domain name in *Window NT domain* field.

Network logon options – Specify how Windows 9x clients try to logon. Select *Quick logon* to wait until the shared network drives is actually used to attempt the login. Select *Logon and restore network connections* to logon to all shared network drives when the user logs into Windows.

Wireless settings

Network Type

Infrastructure – Select the Infrastructure mode to establish a connection with an Access Point.

Ad Hoc – Select the Ad Hoc mode to communicate directly with each other without using an Access Point.

SSID

Using the SSID filed to configure the SSID setting for the ASUS WLAN mini-PCI card. SSID stands for Service Set Identifier, which is a string used to identify a wireless LAN. You will only be able to connect with an Access Point, which has the same SSID. Use different SSIDs to segment the wireless LAN and add security.

Note that the SSID must be all printable character string (case sensitivity) and up to 32 characters long, such as " WIRELESS LAN". Set the SSID to "any" if you wish to allow your station to connect to any IEEE 802.11 Infrastructure Network it can find.

Channel

Using the Channel filed to select the radio channel for PC Card. In infrastructure network, your PC Card will automatically select the correct frequency channel required to communicate with an Access Point, this parameter will be fixed in "Auto" and can't change it. In an Ad Hoc Network, you can decide channel number for the PC Card to operate. PC Cards can communicate in the network if each has the same frequency channel setting.

Data Rate

Fully Auto – Automatic transmit data rate fallback to 1, 2, 5.5, or 11 megabits per second for communication with other devices.

Auto 1 or 2 Mbps – The ASUS WLAN mini-PCI card will use the most suitable transmission rate of either 1 Mbps or 2 Mbps.

11 Mbps – Fix transmit data rate to 11 megabits per second.

5.5 Mbps – Fix transmit data rate to 5.5 megabits per second.

2 Mbps – Fix transmit data rate to 2 megabits per second.

1 Mbps – Fix transmit data rate to 1 megabits per second.

WEP

Select disable or enable (64-bit or 128-bit) WEP encryption. The *WEP Key* is a 64-bit (5 byte) or 128-bit (13 byte) Hexadecimal digit that is used to encrypt transmit data packets and decrypt received data packets.

TCP/IP settings

TCP/IP settings include five tabs: Device, IP Address, Gateway, DNS, and WINS.

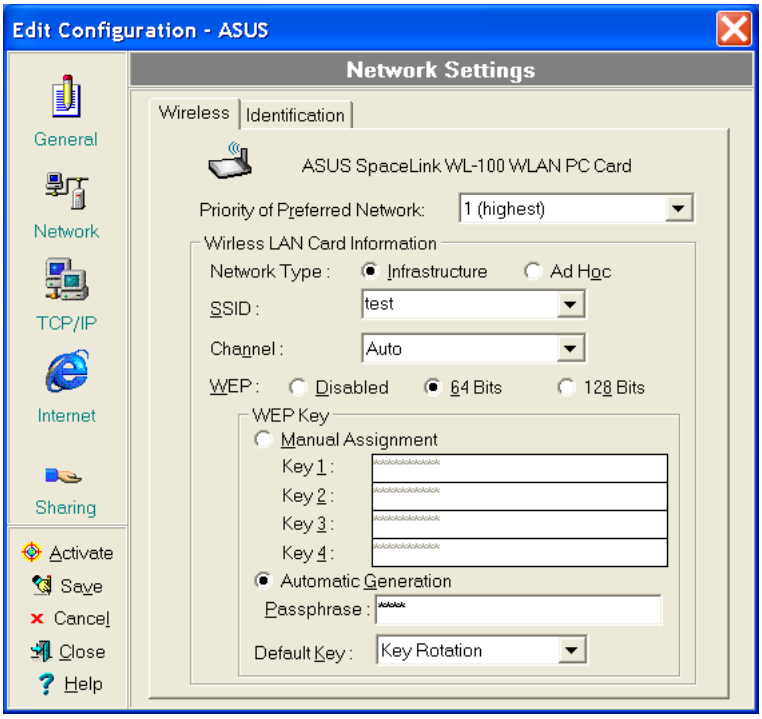
Device

Choose the network adapter that you want to use for this configuration.

IP Address

Obtain an IP address from a DHCP server – Dynamic host configuration protocol (DHCP) server assigns IP addresses automatically within a specified range to devices.

Specify an IP address – Ask your network administrator for the IP address and subnet mask that you should use. Type in the IP Address and Subnet Mask fields manually.



Gateway

Specify the gateways. There can be more than one specified.Set up the primary gateway first.

Add a gateway - Type the IP address of the gateway in the **New Gateway** field and then click **Add**. The gateway you specified appears in the **Installed Gateways** list. Repeat to specify another gateways. The value in each field must be a number between 0 and 255. You can have up to eight IP addresses for gateways.

Remove a gateway - Select the gateway from the **Installed Gateways** list and click **Remove**.

DNS

Select Enable or Disable DNS. If you enable DNS, fill the following parameters.

Host – Enter the name of your computer. That is used to identifier the computer on the Internet. The hostname is generally the same as the Microsoft networking computer name, for example, “S82000W”.

Domain – Enter the TCP/IP domain name for your network.The full domain name consists of one or more names that are separated by dots, for example, “asus.com”.

DNS Server Search Order – Specify the DNS Servers in the desired order to search for DNS information.

Domain Suffix Search Order – Add any domain suffixes that may be valid attached to the end of Internet domain name.

WINS

Specify the WINS server. There can be more than one specified.Set up the primary WINS server first.

Disable WINS Resolution – Do not use WINS resolution.

Enable WINS Resolution – Use WINS resolution. Specify the IP addresses of the WINS servers in the desired search order. *Scope ID* is used when NetBIOS over TCP/IP is enabling on the workstations. If this protocol has been enabled, then every workstation group must have the same Scope ID for those computers to communicate within the group. The Scope ID is usually left blank.

Use DHCP for WINS Resolution – If a DHCP server is available that is configured to provide information on available WINS servers.

Dialing settings

Specify how the call will be dialed. This is useful if you want to change the call to a calling card, use your computer from different locations, or add a dial prefix, country code, or area code automatically.

Dialup Networking settings

Dialup Networking settings include four tabs: Device, Phone Number, Server Type, and TCP/IP.

Device

Choose the modem you want to use by Dial-Up Networking to connect to another computer for this connection.

Phone Number

Specify area code, telephone number, and country code for this connection. Clear the **Use area code and Dialing Properties** checkbox, if you want to ignore area code and dialing settings.

Server Type

Type of Dial-Up Server – Select the server type for this connection.

Advanced options

Select **Log on to network** checkbox to specify that Dial-Up Networking will attempt to log on to the network you are connecting to, using the user name and password you typed when you logged on to Windows.

Select **Enable software compression** checkbox to specify whether incoming or outgoing information is compressed before it is sent. This is useful to speed up the transfer of information. Compression occurs only if both computers are using compatible compression.

Select **Require encrypted password** checkbox to specify that only encrypted passwords can be sent to or accepted by your computer. This is useful if you need additional security for this connection. When type your password while dialing out, this setting will encrypt your password but the target computer must support encrypted passwords for your password to be understood.

Allowed network protocols – Specifies the network protocols that your computer can use.

Select **NetBEUI** protocol to connect to Windows NT, Windows for Workgroups, or LAN Manager servers.

Select **IPX/SPX Compatible** protocol to connect to Netware and Windows NT servers and Windows 98 computers.

Select **TCP/IP** protocol to connect to Internet and wide-area networks.

TCP/IP

Server assigned IP address – Specifies whether Dialup Networking accepts an IP address from a ppp server. If the ppp server does not offer an IP address, the IP address specified for TCP/IP Dial-Up Adapter in the Network dialog box is used.

Specify an IP address – Provides a space for you to type the preferred IP address for this connection. Dial-Up Networking tries to use this address first.

Server assigned name server addresses – Specifies whether Dial-Up Networking accepts a DNS and WINS server addresses from a ppp server. If the ppp server does not offer DNS and WINS addresses, DNS and WINS server addresses specified for TCP/IP Dial-Up Adapter in the Network dialog box are used.

Specify name server addresses – Provides a space for you to type one or two DNS and WINS server addresses for this connection only. Dial-Up Networking tries to use these addresses first.

Use IP header compression – Specifies whether Dial-Up Networking uses IP header compression for this connection. IP header compression optimizes data transfer between computers.

Use default gateway on remote network – Specifies whether IP traffic is routed to the WAN connection by default.

Internet settings

A proxy server acts as a security barrier between your internal network (Intranet) and the Internet, keeping other people on the Internet from gaining access to confidential information on your internal network or your computer.

Disable Proxy Server – Do not use proxy server.

Enable Proxy Server – Use the Proxy server to gain access to the Internet.

Use the same proxy server for all protocols – Specifies whether you want to use the same proxy server to gain access to the Internet using all protocols.

Servers – Provides spaces for you to type the address and port number of the proxy server you want to use to gain access to the Internet over HTTP, Secure, FTP, Gopher, and Socks protocol.

Exceptions

Do not use proxy server for address beginning with – Provides a space for you to type the Web addresses that do not need to be accessed through the proxy server. If you want to connect to a computer on your Intranet, make sure you type its address in this box. You can use wild cards to match domain and host names or addresses, for example, "*.company.com", "192.72.111.*".

Bypass proxy server for local addresses – Specifies whether you want to use the proxy server for all local (Intranet) addresses. You might be able to gain access to local addresses easier and faster if you do not use the proxy server.

Sharing settings

I want to be able to give others access to my files – Turn file sharing ON or OFF. File sharing enables people using other computers to read or modify files you share on your computer.

I want to be able to allow others to print to my printer(s) – Turn printer sharing ON or OFF. Printer sharing enables people using other computers to printer their files on your printers.

Click **Save** button to save all the changes you have made without closing the Edit Configuration dialog box.

Click **Cancel** button to close the Edit Configuration dialog box without saving any changes you have made.

Click **Close** button to close the Edit Configuration dialog box and save any changes that you have made.

6. Site Monitor

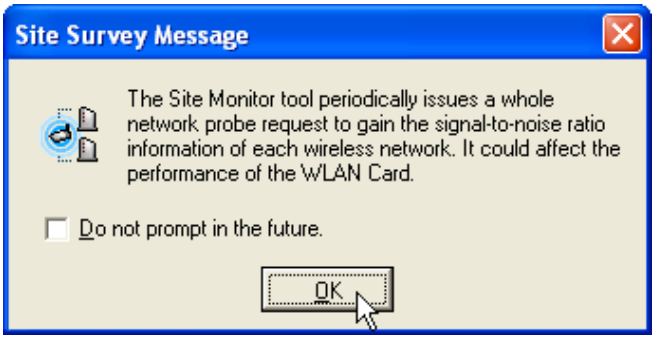
Site Monitor measures the signal-to-noise (SNR) values of all available wireless networks. This tool is used for determining the best placement of Access Points to provide the best coverage for a wireless network.

6.1 Starting Site Monitor

- Click the Windows **Start** button, select **Programs**, select **ASUS Utility**, select WLAN Card, and then click **Site Monitor**.

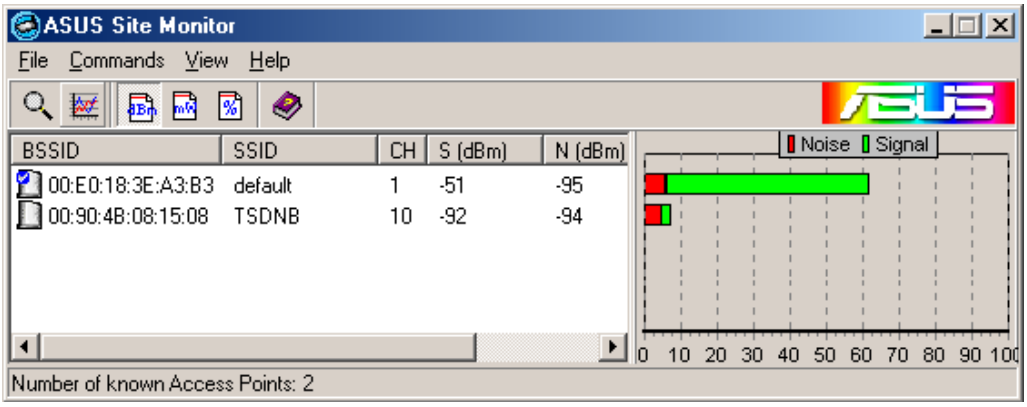
or

- Right-click the **Control Center** icon on the Windows taskbar and then click **Site Monitor**.



6.2 Main Screen

Measures the signal-to-noise (SNR) values of all available wireless networks.



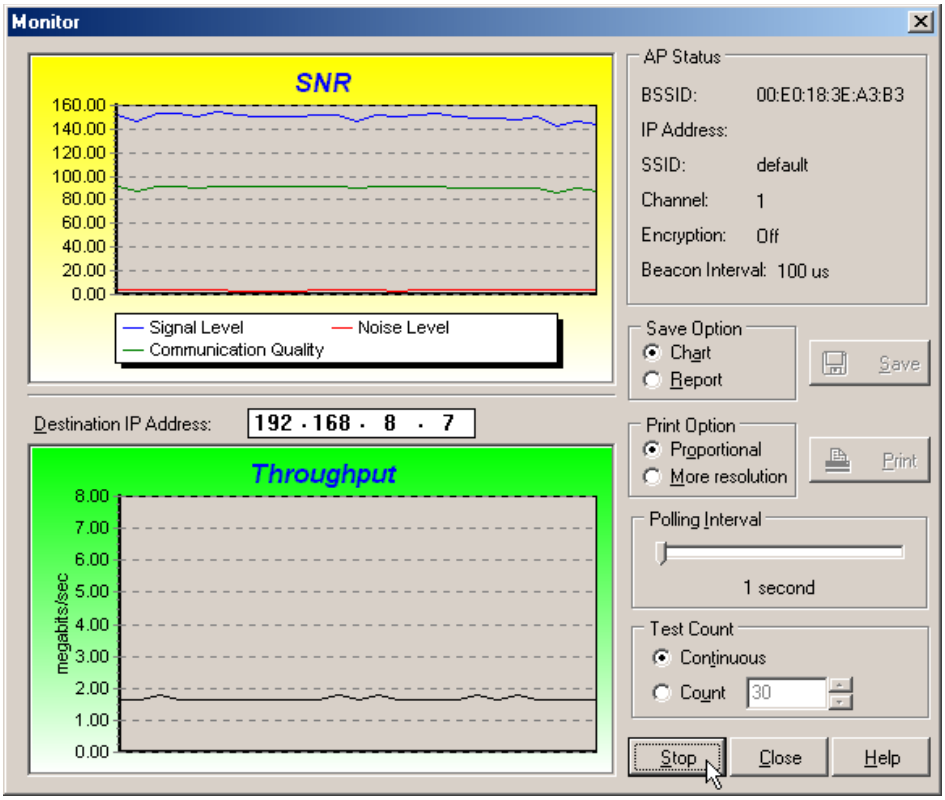
Some Access Points can disable broadcasting SSID to hide themselves from "Site Survey" or "Site Monitor" for added security but still allow you to join if you know their SSID.

6.3 Monitor

Directed link state test with one wireless network, including:

- SNR: This indicates the quality of communications within the current network. The communication quality is based on signal level and noise level measurements. In principle, the higher the SNR, the better your communications quality.
- Communication Quality: Specifies the Communication Quality of the Basic Service Set to which the station is currently connected to.
- Signal Level: Specifies the Average Signal Level of the Basic Service Set to which the station is currently connected to.
- Noise Level: Specifies the Average Noise Level of the Frequency Channel currently used for communications.
- Throughput: This sends a specified number of data packets to the remote host and calculates the average megabytes per second.

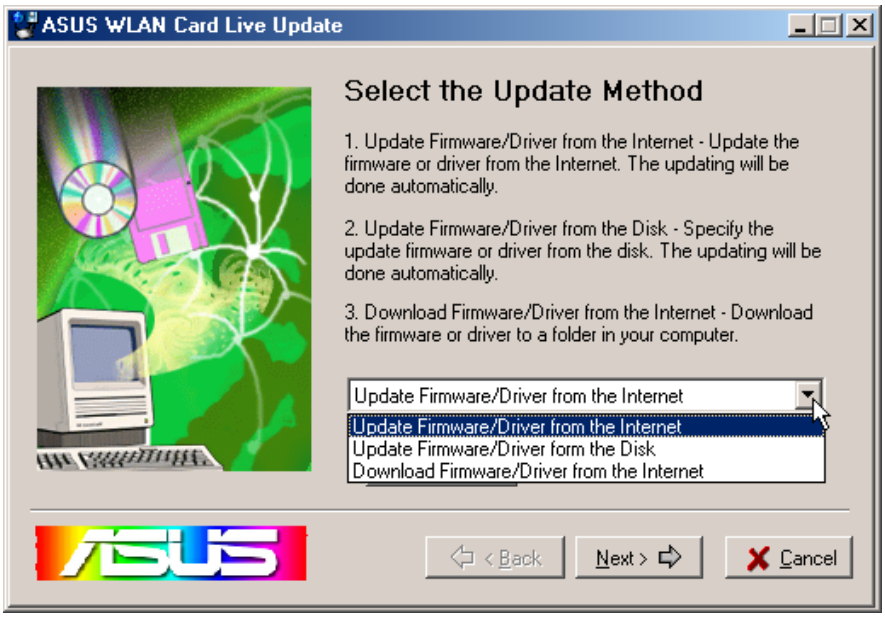
During the test, the Start button toggles to Stop. You can click **Start** button to begin the link test and click **Stop** button at any time to terminate the test.



7. Live Update

Live Update is a utility that allows you to update your ASUS WLAN mini-PCI card's firmware and drivers. The use of this utility assumes that you are properly connected to Internet through an Internet Service Provide (ISP).

1. Insert the ASUS WLAN mini-PCI card Support CD into your CD-ROM drive to bring up the autorun menu. If the autorun menu does not show, double-click the CD drive icon in My Computer or run Setup.exe in the root directory of your CD-ROM drive. When the Main menu appears, click **Run Live Update**.
2. Select an update method from the pull-down menu.

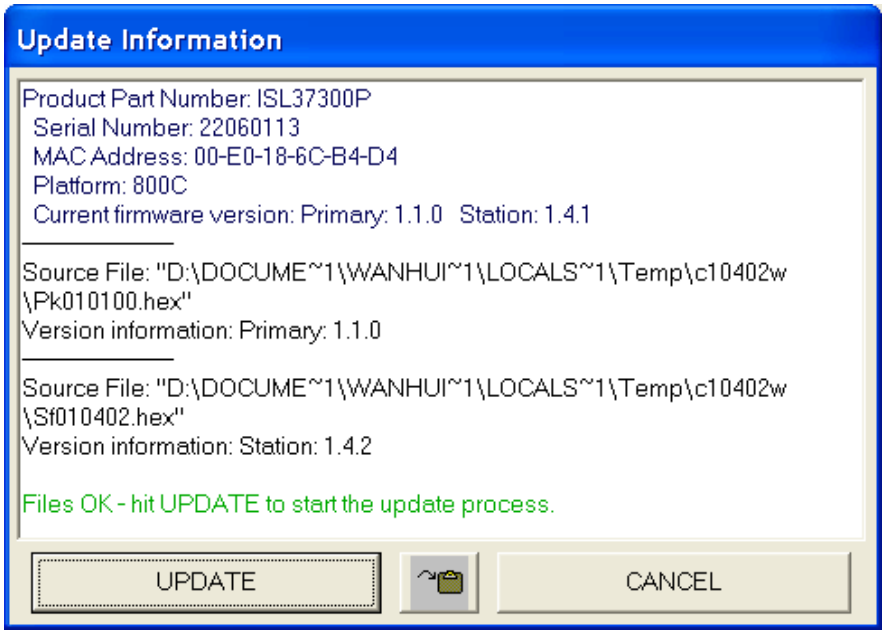


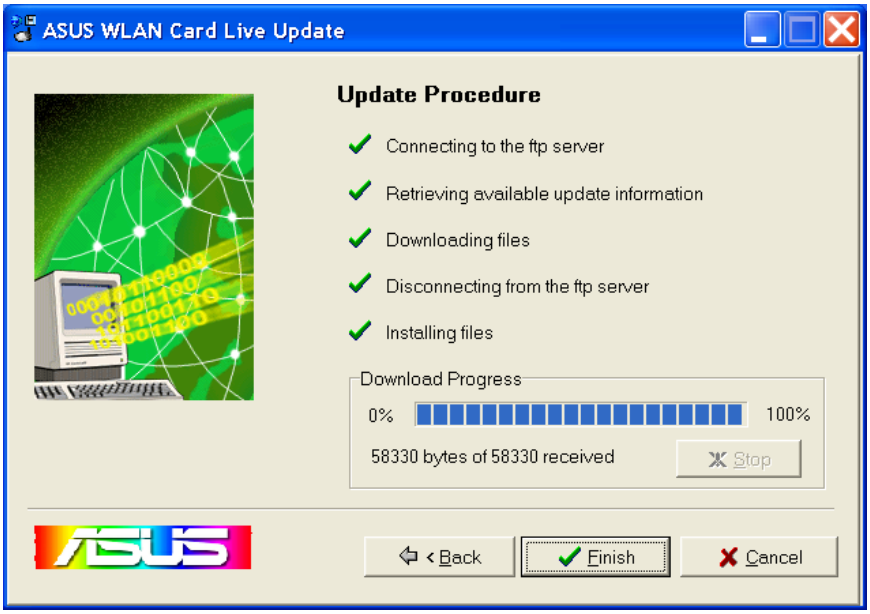
Update Firmware/Driver from the Internet: Lets you update the ASUS WLAN mini-PCI card's firmware or driver from the Internet. The updating (running the flash utility or the installation program) will be done automatically.

Update Firmware/Driver from the Disk: Lets you specify the update firmware or driver file from a disk. The updating (running the flash utility or the installation program) will be done automatically.

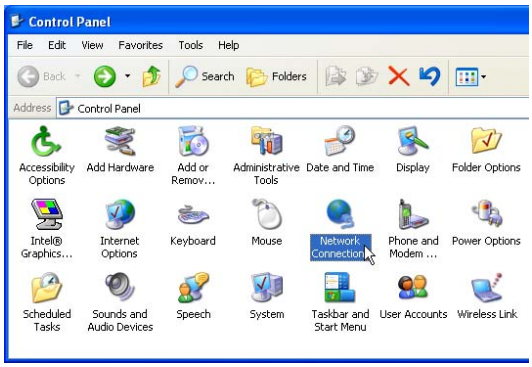
Download Firmware/Driver from the Internet: Lets you download the firmware or driver to a disk on your computer for manual updating later.

3. Follow any on-screen instructions or prompts to complete setup. If you already have the latest revision of your ASUS WLAN mini-PCI card's firmware files or driver files, Live Update reports that no update is necessary. When Live Update starts the firmware upgrade, a warning message will tell you that incorrect firmware upgrades may cause your ASUS WLAN mini-PCI card to malfunction. You can cancel the update process at this point. If you continue, a message will tell you that the update process has started. Do not turn OFF your computer until the upgrade has completed. The upgrade will take approximately 30 seconds. A subsequent message states whether the update was successful.

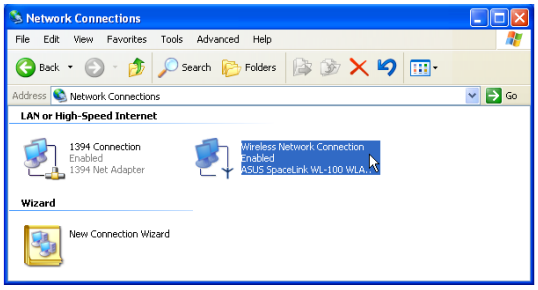




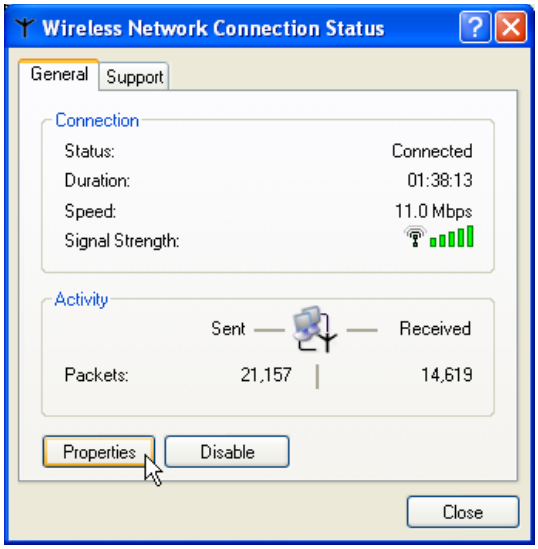
8. Windows XP Wireless Properties



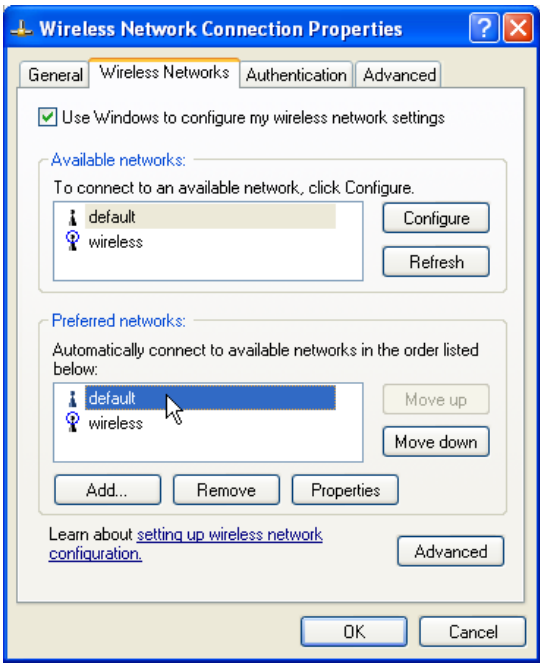
1. Double-click **System** icon in the Control Panel.



2. Double-click **ASUS 802.11b Network...**

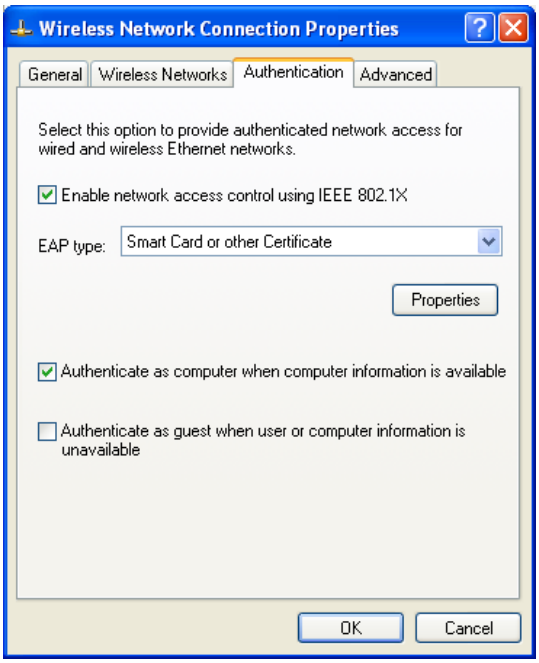


3. The “General” page will show status, duration, speed, and signal strength. Signal strength is represented by green bars with 5 bars meaning excellent signal and 1 bar meaning poor signal.

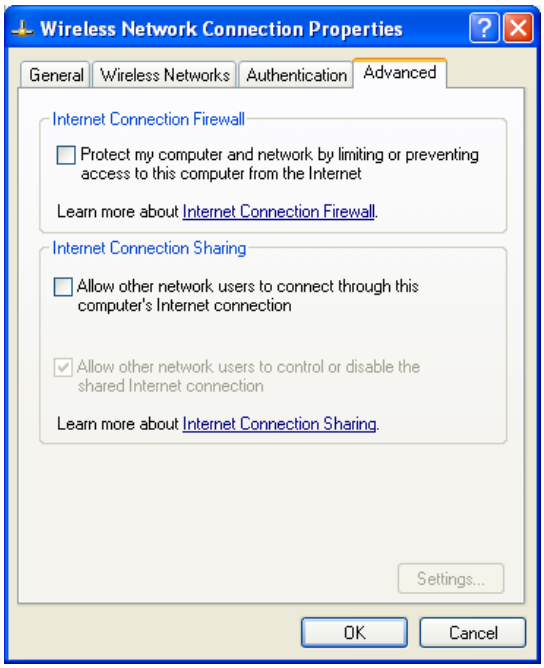


4. The “Wireless Networks” page will show Available networks and Preferred networks. Use the **Add** button to add the “SSID” of available networks and set the connection preference order with the **Move up** and **Move down** buttons. The radio tower with a signal icon identifies the currently connected access point.

8. Windows XP Wireless Properties (Cont.)



5. The “Authentication” page allows you to add security settings. Read Windows help for more information.



6. The “Advanced” page allows you to set firewall and sharing. Read Windows help for more information.

Troubleshooting

The below troubleshooting guides provide answers to some of the more common problems, which you may encounter while installing or using ASUS WLAN mini-PCI card products. If you encounter difficulties that are not mentioned in this section, please contact ASUS Wireless LAN Technical Support.

Verify if the mini-PCI Card is installed correctly.

When the ASUS WLAN mini-PCI card setup task is complete, you can verify if the driver has been setup properly. Right click **My Computer**, select **Properties**, and click the **Device Manager** tab. Then double-click the **Network adapters** icon; you should see “ASUS 802.11b Network Adapter” with an icon of expansion card. There should not be a “!” or “?” (problem) or “x” (disabled) symbol over this icon.

There is a yellow exclamation mark or a yellow question mark in Device Manager in front of ASUS 802.11b Network Adapter.

To resolve the problem, you should update/reinstall the ASUS WLAN mini-PCI card driver. In “Device Manager”, right click **ASUS 802.11b Network Adapter**, select **Properties**, and select **Driver** tab. Click on **Update Driver** button, then follow the “Update Device Driver Wizard” to complete the driver installation.

In addition, you may be able to resolve this issue by reinstalling the driver. Choose **ASUS 802.11b Network Adapter**, click **Remove** button in “Device Manager”, and then run the **Add New Hardware Wizard** from the **Control Panel**.

Cannot connect to any Access Points

Follow the procedure below to configure your ASUS WLAN mini-PCI card.

a. Verify that the “Network Type” is in “Infrastructure” mode.
b. Verify that the “SSID” of your ASUS 802.11b Network Adapter is set to “any” or set to the same “SSID” of an Access Point.
c. Verify that the “Encryption” type is the same as that of an Access Point. If you enabled “WEP” encryption, you must also set the same WEP Keys on both sides.

Cannot connect to a Station (ASUS WLAN mini-PCI card)

Follow the procedure below to configure your ASUS WLAN mini-PCI card

a. Verify that the “Network Type” is in “Ad Hoc” mode.
b. Verify that the “SSID” of your ASUS 802.11b Network Adapter is set to “any” or set to the same “SSID” of the other station (or another ASUS 802.11b Network Adapter).
c. Verify that the “channel” of the ASUS 802.11b Network Adapter is “Auto” or set to the same “channel” of the other station (or another ASUS 802.11b Network Adapter).
d. Verify that the “Encryption” type is the same as the other station (or another ASUS 802.11b Network Adapter). If “WEP” encryption is enabled, you must set the same “WEP” Keys on both stations.

Bad link quality or bad signal strength

There are two possible reasons. First is radio interference, keep the environment around the ASUS WLAN mini-PCI card away from microwave ovens and large metal objects. Second is the distance, decrease the distance between your ASUS WLAN mini-PCI card and the Access Point or station (or another ASUS WLAN mini-PCI card).

The TCP/IP protocol did not bind to the WLAN mini-PCI Card.

This will occur when the computer already has six TCP/IP bindings in Windows 98 or ten bindings in Windows Me. These limits are imposed by the Microsoft operating system.

Solution: If your computer already has the maximum number of TCP/IP bindings, remove one of the network adapters from the Network configuration before installing the ASUS WLAN mini-PCI card driver.

In Ad Hoc network mode, I have connected to a station but my ASUS WLAN mini-PCI card cannot get an IP address.

Windows Me/2K/XP contains the “Media Sensing” feature, which can detect a disconnect state on the media, it removes the bound protocols from that adapter until it has detected a link. But in Ad Hoc mode, it will erroneously detect the media as being disconnected.

Solution: (1) Run **Wireless Settings** (2) click **Config** (3) uncheck **Detect connection to network media** (4) click **Apply** (5) restart your computer

Glossary

Access Point (AP)

An networking device that seamlessly connects wired and wireless networks. Access Points combined with a distributed system support the creation of multiple radio cells that enable roaming throughout a facility.

Ad Hoc

A wireless network composed solely of stations within mutual communication range of each other (no Access Point).

Basic Service Area (BSS)

A set of stations controlled by a single coordination function.

Channel

An instance of medium use for the purpose of passing protocol data units that may be used simultaneously, in the same volume of space, with other instances of medium use (on other channels) by other instances of the same physical layer, with an acceptably low frame error ratio due to mutual interference.

Extended Service Set (ESS)

A set of one or more interconnected basic service set (BSSs) and integrated local area networks (LANs) can be configured as an Extended Service Set.

Ethernet

The most widely used LAN access method, which is defined by the IEEE 802.3 standard. Ethernet is normally a shared media LAN meaning all devices on the network segment share total bandwidth. Ethernet networks operate at 10Mbps using CSMA/CD to run over 10-BaseT cables.

Gateway

A network component that acts as an entrance to another network.

IEEE 802.11

IEEE 802.xx is a set of specifications for LANs from the Institute of Electrical and Electronic Engineers (IEEE). Most wired networks conform to 802.3, the specification for CSMA/CD based Ethernet networks or 802.5, the specification for token ring networks. 802.11 defines the standard for wireless LANs encompassing three incompatible (non-interoperable) technologies: Frequency Hopping Spread Spectrum (FHSS), Direct Sequence Spread Spectrum (DSSS), and Infrared. 802.11 specifies a carrier sense media access control and physical layer specifications for 1 and 2 Mbps wireless LANs.

IEEE 802.11b

802.11b specifies a carrier sense media access control and physical layer specifications for 5.5 and 11 Mbps wireless LANs.

Infrastructure

A wireless network centered about an access point. In this environment, the access point not only provides communication with the wired network but also mediates wireless network traffic in the immediate neighborhood.

IP (Internet Protocol)

The TCP/IP standard protocol that defines the IP datagram as the unit of information passed across an Internet and provides the basis for connectionless packet delivery service. IP includes the ICMP control and error message protocol as an integral part. It provides the functional equivalent of ISO OSI Network Services.

IP Address

An IP address is a 32-bit number that identifies each sender or receiver of information that is sent across the Internet. An IP address has two parts: the identifier of a particular network on the Internet and an identifier of the particular device (which can be a server or a workstation) within that network.

ISM Bands (Industrial, Scientific, and Medicine Bands)

Radio frequency bands that the Federal Communications Commission (FCC) authorized for wireless LANs. The ISM bands are located at 902 MHz, 2.400 GHz, and 5.7 GHz.

ISP (Internet Service Provider)

An organization that provides access to the Internet. Small ISPs provide service via modem and ISDN while the larger ones also offer private line hookups (T1, fractional T1, etc.).

LAN (Local Area Network)

A communications network that serves users within a defined geographical area. The benefits include the sharing of Internet access, files and equipment like printers and storage devices. Special network cabling (10 BaseT) is often used to connect the PCs together.

NIC (Network Interface Card)

A network adapter inserted into a computer so that the computer can be connected to a network. It is responsible for converting data from stored in the computer to the form transmitted or received.

Packet

A basic message unit for communication across a network. A packet usually includes routing information, data, and sometimes error detection information.

PCMCIA (Personal Computer Memory Card International Association)

The Personal Computer Memory Card International Association (PCMCIA), develops standards for PC cards, formerly known as PCMCIA cards. These cards are available in three types, and are have about the same length and width as credit cards. However, the different width of the cards ranges in thickness from 3.3 mm (Type I) to 5.0 mm (Type II) to 10.5 mm (Type III). These cards can be used for various functions, including memory storage, landline modems and wireless modems.

Radio Frequency (RF) Terms: GHz, MHz, Hz

The international unit for measuring frequency is Hertz (Hz), equivalent to the older unit of cycles per second. One megahertz (MHz) is one million Hertz. One gigahertz (GHz) is one billion Hertz. The standard US electrical power frequency is 60 Hz, the AM broadcast radio frequency band is 0.55-1.6 MHz, the FM broadcast radio frequency band is 88-108 MHz, and wireless 802.11 LANs operate at 2.4 GHz.

SSID (Service Set ID)

SSID is a group name shared by every member of a wireless network. Only client PCs with the same SSID are allowed to establish a connection.

Station

Any device containing IEEE 802.11 wireless medium access conformity.

TCP (Transmission Control Protocol)

The standard transport level protocol that provides the full duplex, stream service on which many application protocols depend. TCP allows a process or one machine to send a stream of data to a process on another. Software implementing TCP usually resides in the operating system and uses the IP to transmit information across the network.

Safety Statements

Federal Communications Commission Statement

This device complies with FCC Rules Part 15. Operation is subject to the following two conditions:

- This device may not cause harmful interference, and
- This device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a class B digital device, pursuant to Part 15 of the Federal Communications Commission (FCC) rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

WARNING! The use of a shielded-type power cord is required in order to meet FCC emission limits and to prevent interference to the nearby radio and television reception. It is essential that only the supplied power cord be used. Use only shielded cables to connect I/O devices to this equipment. You are cautioned that changes or modifications not expressly approved by the party responsible for compliance could void your authority to operate the equipment.

Reprinted from the Code of Federal Regulations #47, part 15.193, 1993. Washington DC: Office of the Federal Register, National Archives and Records Administration, U.S. Government Printing Office.

Canadian Department of Communications

This digital apparatus does not exceed the Class B limits for radio noise emissions from digital apparatus set out in the Radio Interference Regulations of the Canadian Department of Communications.

This Class B digital apparatus complies with Canadian ICES-003. Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.

7. Wireless LAN Safety Statements

MPE Safety Statement

Your device contains a low power transmitter. When device is transmitted it sends out Radio Frequency (RF) signal.

FCC Radio Frequency Exposure Statement

This Wireless LAN radio device has been evaluated under FCC Bulletin OET 65C and found compliant to the requirements as set forth in CFR 47 Sections 2.1091, 2.1093, and 15.247(b)(4) addressing RF Exposure from radio frequency devices. The radiation output power of this Wireless LAN device is far below the FCC radio frequency exposure limits. Nevertheless, this device shall be used in such a manner that the potential for human contact during normal operation – as a mobile or portable device but use in a body-worn way is strictly prohibited.

CAUTION: To maintain compliance with FCC's RF exposure guidelines established in the ANSI C95.1 standards, this equipment should be installed and operated with minimum distance 20cm between the radiator and your body. Use on the supplied antenna. Unauthorized antenna, modification, or attachments could damage the transmitter and may violate FCC regulations.

Installation and use of this Wireless LAN device must be in strict accordance with the instructions included in the user documentation provided with the product. Any changes or modifications (including the antennas) made to this device that are not expressly approved by the manufacturer may void the user's authority to operate the equipment. The manufacturer is not responsible for any radio or television interference caused by unauthorized modification of this device, or the substitution of the connecting cables and equipment other than manufacturer specified. It is the responsibility of the user to correct any interference caused by such unauthorized modification, substitution or attachment. Manufacturer and its authorized resellers or distributors will assume no liability for any damage or violation of government regulations arising from failing to comply with these guidelines.

Co-location Prohibition

This device must not be co-located or co-operated in conjunction with another antenna or transmitter from another device.