

Installation Guide for the NETGEAR 54 Mbps Wireless PCI Adapter WAG311



NETGEAR

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Technical Support

Please refer to the support information card that shipped with your product. By registering your product at www.netgear.com/register, we can provide you with faster expert technical support and timely notices of product and software upgrades.

NETGEAR, INC. Support Information

Phone: 1-888-NETGEAR, for US & Canada only. For other countries, see your Support information card.

E-mail: support@netgear.com

Web site: www.netgear.com

This manual is written for the WAG311 Wireless PCI Adapter according to these specifications.:

Table 0-1. Manual Specifications

Product Version	NETGEAR 54 Mbps Wireless PCI Adapter WAG311
Firmware Version Number	?
Manual Part Number	M-10148-01
Manual Publication Date	June 2003, Full Manual



Note: Product updates are available on the NETGEAR, Inc. web site at <http://www.netgear.com/support/main.asp>. Documentation updates are available on the NETGEAR, Inc. web site at <http://www.netgear.com/docs>.

Statement of Conditions

In the interest of improving internal design, operational function, and/or reliability, NETGEAR reserves the right to make changes to the products described in this document without notice.

NETGEAR does not assume any liability that may occur due to the use or application of the product(s) or circuit layout(s) described herein.

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other countries. Other brand and product names are trademarks or registered trademarks of their respective holders. Information is subject to change without notice. All rights reserved.

Certificate of the Manufacturer/Importer

It is hereby certified that the Model WG311 Wireless PCI Adapter has been suppressed in accordance with the conditions set out in the BMPT- AmtsblVfg 243/1991 and Vfg 46/1992. The operation of some equipment (for example, test transmitters) in accordance with the regulations may, however, be subject to certain restrictions. Please refer to the notes in the operating instructions.

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.

VCCI Statement

This equipment is in the Class B 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.

FCC Information to User

This product does not contain any user serviceable components and is to be used with approved antennas only. Any product changes or modifications will invalidate all applicable regulatory certifications and approvals

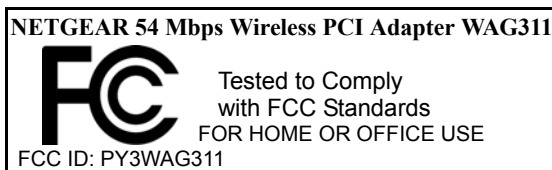
FCC Guidelines for Human Exposure

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between radiator & your body.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

If this device is going to be operated in 5.15 ~ 5.25GHz frequency range, then it is restricted in indoor environments only.

FCC Radio Frequency Interference Statement



This equipment has been tested and found to comply with the limits for a class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. 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.

Operation of this equipment in a residential area may cause harmful interference, in which case the user will be required to correct the interference at his own expense.

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

Export Restrictions

This product or software contains encryption code which may not be exported or transferred from the US or Canada without an approved US Department of Commerce export license.

Europe - EU Declaration of Conformity

This device complies with the essential requirements and other relevant provisions of the European R&TTE Directive 1999/5/EC. Compliance to essential test suites is met per standards:

R&TTE Harmonized Standard	Description
LVD specification EN 60950	EN 60950,ed. (1992), incl A1(1993), A2(1993), A3(1995) and A4(1997) Safety of information technology equipment, including electrical business equipment. Meets R&TTE directive art. 3.1.a of essential requirements on protection of the health and safety of the user.

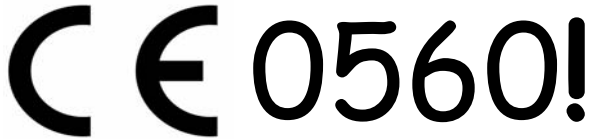
FCC Electronic Emission Notices

This device complies with part 15 of the FCC Rules. ☐

Operation is subject to the following two conditions: ☐

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

ETSI EMC specification ETSI EN 301 489-1 V1.2.1 (2000-08) ETSI EN 301 489-17 V1.1.1 (2000-09)	Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; <i>Part 1: Common technical requirements</i> <i>Part 17: Specific conditions for Wideband data and HIPERLAN equipment</i> Meets R&TTE directive art. 3.1.b of essential requirements on protection with respect to <u>Electro Magnetic Compatibility</u>.
ETSI RF specification ETSI EN 300 328 Part 1 V1.2.2 (2000-07) ETSI EN 300 328 Part 2 V1.1.1 (2000-07)	Electromagnetic compatibility and Radio spectrum Matters (ERM); Wideband Transmission systems; data transmission equipment operating in the 2,4 GHz ISM band and using spread spectrum modulation techniques; <i>Part 1: Technical characteristics and test conditions</i> <i>Part 2: Harmonized EN covering essential requirements under article 3.2 of the R&TTE Directive</i> Meets R&TTE directive art. 3.2.a on effective use of spectrum so as to avoid harmful interference.

	This device is a 2.4 GHz low power RF device intended for home and office use in EU and EFTA member states. In some EU / EFTA member states some restrictions may apply. Please contact local spectrum management authorities for further details before putting this device into operation.
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Canadian Department of Communications Radio Interference Regulations

This digital apparatus (Model WAG311 Wireless PCI Adapter) does not exceed the Class B limits for radio-noise emissions from digital apparatus as set out in the Radio Interference Regulations of the Canadian Department of Communications.

Canada ID: 4054A-WAG311

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Chapter 1

Introduction

This chapter introduces the features, package contents, and appearance of the NETGEAR® 54 Mbps WAG311 Wireless PCI Adapter.

About the NETGEAR 54 Mbps Wireless PCI Adapter WAG311

The NETGEAR 54 Mbps Wireless PCI Adapter WAG311 gives you flexibility to install the PC in the most convenient location available. The WAG311 frees you from traditional Ethernet wiring that is limited by cabling requirements.

Its auto-sensing capability allows high packet transfer up to 54 Mbps (up to 108 Mbps in 802.11a Turbo Mode) for maximum throughput or dynamic range shifting to lower speeds due to distance or operating limitations in an environment with a lot of electromagnetic interference.

The WAG311 Wireless PCI Adapter provides reliable, standards-based 802.11a/g/bb Wireless Local Area Network (WLAN) connectivity that is protected with industry-standard security. In addition, it offers the faster speeds of the soon-to-be ratified 802.11g standard. The WAG311 works with Windows 98, Me, 2000, and XP operating systems.

802.11a and 802.11b/g Wireless Networking

The WAG311 Wireless PCI Adapter provides continuous, high-speed up to 54 Mbps access between your wireless devices.

- 802.11a Standards-based wireless networking at up to 54 Mbps.
- 802.11g wireless networking at up to 54 Mbps, which will conform to the 802.11g standard when ratified.
- 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.

Key Features and Related NETGEAR Products

The WAG311 Wireless PCI Adapter provides the following features:

- Reliable IEEE 802.11b standards-based wireless technology.
- Supports roaming between access points when configured in Infrastructure mode.
- 54 Mbps high speed data transfer. Wireless nodes negotiate to operate in the optimal data transfer rate. In a noisy environment or when the distance between the wireless nodes is far, the wireless nodes automatically fall back to operate at lower transfer rates.
- High level of data encryption using 128-bit Shared Key WEP data encryption method. Lower level of data encryption or no data encryption is available to simplify your network setup or to improve the data transfer rate.

The following NETGEAR products can be configured to communicate with the WAG311 Wireless PCI Adapter:

- WG602 54 Mbps Wireless Access Point
- WGR614 54 Mbps Cable/DSL Wireless Router
- WGR511 54 Mbps Wireless PC Card
- MA111 802.11b Wireless USB Adapter
- ME103 802.11b ProSafe Wireless Access Point
- MA311 802.11b Wireless PCI Adapter
- MR814 802.11b Wireless Cable/DSL Routers
- MA521 802.11b Wireless Compact Flash Card

What's in the Box?

The product package should contain the following items:

- NETGEAR 54 Mbps Wireless PCI Adapter WAG311
- Installation Guide for the NETGEAR 54 Mbps Wireless PCI Adapter WAG311
- *NETGEAR 54 Mbps Wireless PCI Adapter WAG311 Resource CD (SW-10012-01)*, including:
 - Configuration Utility Software
 - Installation Guide for the NETGEAR 54 Mbps Wireless PCI Adapter WAG311
- Warranty card
- Support information card

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.

A Road Map for ‘How to Get There From Here’

The introduction and adoption of any new technology can be a difficult process. Wireless technology has removed one of the barriers to networking—running wires. It allows more people to try networking, while at the same time exposes them to the inherent complexity of networking. General networking concepts, set up, and maintenance can be difficult to understand. In addition, wireless technology adds issues such as range, interference, signal quality, and security to the picture.

To help overcome potential barriers to successfully using wireless networks, the table below identifies how to accomplish such things as connecting to a wireless network, assuring appropriate security measures are taken, browsing the Internet through your wireless connection, exchanging files with other computers and using printers in the combined wireless and wired network.

Table 1-1. A Road Map for How to Get There From Here

If I Want To ... ?	What Do I Do?	What's Needed?	How Do I?
Connect to a wireless network	1. Identify the wireless network name (SSID) and, if used, the wireless security settings. 2. Set up the NETGEAR 54 Mbps Wireless PCI Adapter WAG311 with the settings from step 1.	1. A wireless network 2. A desktop PC within the operating range of the wireless network. For guidelines about the range of 802.11b/g wireless networks, please see “Observe Location and Range Guidelines” on page 2-2.	To set up the WAG311, see Chapter 2, “Basic Setup” and follow the instructions provided. To learn about wireless networking technology, see Appendix B, “Wireless Networking Basics” for a general introduction.

Table 1-1. A Road Map for How to Get There From Here

If I Want To ... ?	What Do I Do?	What's Needed?	How Do I?
Protect my wireless connection from snooping, hacking, or information theft.	1. Assure that the wireless network has security features enabled. 2. Configure my WAG311 with the security settings of the wireless network. 3. Use Windows security features.	1. A wireless network with authentication and WEP encryption enabled. 2. Wireless networking equipment that supports WEP encryption, such as the WAG311 and all NETGEAR wireless networking products.	To learn about wireless networking security, see "Authentication and WEP Data Encryption" on page B-2. To use WEP security features, please see "Enabling Wireless Security Features" on page 3-8 and configure your WAG311 accordingly.
Note: Secure Internet sites such as banks and online merchants use encryption security built into browsers like Internet Explorer and Netscape. Any wireless networking security features you might implement are in addition to those already in place on secure Internet sites.			
Connect to the Internet over my wireless network.	1. Activate my wireless link and verify my network connection. 2. Open an Internet browser such as Internet Explorer or Netscape Navigator.	1. An active Internet connection like those from cable or DSL service providers. 2. A wireless network connected to the cable or DSL Internet service through a cable/DSL router as illustrated in "Connect to an Access Point in Infrastructure Mode" on page 3-3. 3. TCP/IP Internet networking software installed and configured on my PC according to the requirements of the Internet service provider 4. A browser like Internet Explorer or Netscape Navigator.	To configure your WAG311 in Infrastructure Mode, see "Basic Installation Instructions" on page 2-4, and locate the section for your version of Windows. For assistance with configuring the TCP/IP Internet software on a PC, see "Preparing Your Computers for TCP/IP Networking" on page C-1 or refer to the PC Networking Tutorial on the <i>NETGEAR 54 Mbps Wireless PCI Adapter WAG311 Resource CD (SW-10012-01)</i> and the Help information provided in the Windows system you are using.

Table 1-1. A Road Map for How to Get There From Here

If I Want To ... ?	What Do I Do?	What's Needed?	How Do I?
Exchange files between a wirelessly connected notebook computer and other computers in a my combined wireless and wired network.	1. Use the Windows Network Neighborhood feature to browse for computers in the combined wireless and wired network. 2. Browse the hard drive of the target computer in the network in order to locate the directory or files you want to work with. 3. Use the Windows Explorer copy and paste functions to exchange files between the computers.	1. The desktop computer I am using to connect to the wireless network needs to be configured with the Windows Client and File and Print Sharing. 2. The desktop computer I am using to connect to the wireless network needs to be configured with the same Windows Workgroup or Domain settings as the other Windows computers in the combined wireless and wired network. 3. Any Windows networking security access rights such as login user name/ password that have been assigned in the Windows network or for sharing particular files must be provided when Windows prompts for such information. 4. If so-called Windows 'peer' Workgroup networking is being used, the drive, file system directory, or file need to be enabled for sharing.	For assistance with Windows networking software, see Appendix C, "Preparing Your PCs for Network Access" for configuration scenarios or refer to the Help system included with your version of Windows. Windows Domain settings are usually managed by corporate computer support groups. Windows Workgroup settings are commonly managed by individuals who want to set up small networks in their homes, or small offices. For assistance with setting up Windows networking, refer to the PC Networking Tutorial on the <i>NETGEAR 54 Mbps Wireless PCI Adapter WAG311 Resource CD (SW-10012-01)</i> and the Help information provided in the Windows system you are using.

Table 1-1. A Road Map for How to Get There From Here

If I Want To ... ?	What Do I Do?	What's Needed?	How Do I?
Use printers in a combined wireless and wired network.	1. Use the Windows Printers and Fax features to locate available printers in the combined wireless and wired network. 2. Use the Windows Add a Printer wizard to add access to a network printer from the PC you are using to wirelessly connect to the network. 3. From the File menu of an application such as Microsoft Word, use the Print Setup feature to direct your print output to the printer in the network.	1. The desktop computer I am using to connect to the wireless network needs to be configured with the Windows Client and File and Print Sharing. 2. The desktop computer I am using to connect to the wireless network needs to be configured with the same Windows Workgroup or Domain settings as the other Windows computers in the combined wireless and wired network. 3. Any Windows networking security access rights such as login user name/ password that have been assigned in the Windows network must be provided when Windows prompts for such information. 4. If so-called Windows 'peer' networking is being used, the printer needs to be enabled for sharing.	Windows Domain settings are usually managed by corporate computer support groups. Windows Workgroup settings are commonly managed by individuals who want to set up small networks in their homes, or small offices. For assistance with setting up Windows networking, refer to the PC Networking Tutorial on the <i>NETGEAR 54 Mbps Wireless PCI Adapter WAG311 Resource CD (SW-10012-01)</i> and the Help information provided in the Windows system you are using. For assistance with setting up printers in Windows, refer to the Help and Support information that comes with the version of the Windows operating systems you are using.

Chapter 2

Basic Setup

This section describes how to install your NETGEAR 54 Mbps Wireless PCI Adapter WAG311 and set up basic wireless connectivity on your Wireless Local Area Network (WLAN). Advanced wireless network configuration is covered in [Chapter 3, “Configuration”](#) in this manual.



Note: Indoors, computers can easily connect to 802.11 wireless networks at distances of several hundred feet. Because walls do not always block wireless signals, others from outside your immediate area could access your network. It is important to take appropriate steps to secure your network from unauthorized access. The NETGEAR 54 Mbps Wireless PCI Adapter WAG311 provides highly effective security features which are covered in [“Enabling Wireless Security Features” on page 3-8](#). Deploy the security features appropriate to your needs.

What You Will Need Before You Begin

You need to verify that your computer meets the minimum system requirements and identify the wireless network configuration settings of the WLAN where you will connect before you can configure your wireless PCI adapter and connect.

Verify System Requirements

Before installing the NETGEAR 54 Mbps Wireless PCI Adapter WAG311, please make sure that these minimum requirements have been met:

- Pentium® III class computer with an available PCI slot
- CD-ROM drive
- 20 Mbytes of free hard disk space
- Some versions of Windows may ask for the original Windows operating system installation files to complete the installation of the WAG311 driver software

Observe Location and Range Guidelines

Computers can connect over 802.11g wireless networks indoors at a range which varies significantly based on the physical location of the computer with the NETGEAR 54 Mbps Wireless PCI Adapter WAG311. For best results, avoid potential sources of interference, such as:

- Large metal surfaces
- Microwaves
- 2.4 GHz Cordless phones

In general, 802.11g wireless devices can communicate through walls. However, if the walls are constructed with concrete, or have metal, or metal mesh, the 802.11g effective range will decrease if such materials are between the devices.

Note: The 802.11a standard operates at a higher frequency and should be less susceptible to interference with cordless phones. This higher 802.11a frequency may not offer as much range of coverage as the lower frequency 802.11b/g in a indoor environment with lots of obstructions.

Two Basic Operating Modes

The WAG311 Wireless PCI Adapter, like all 802.11a/b/g adapters, can operate in the following two basic modes:

- **Infrastructure Mode:** An 802.11 networking framework in which devices and computers communicate with each other by first going through an access point (AP). For example, this mode is used when computers in a house connect to an AP that is attached to a router which lets multiple computers share a single Cable or DSL broadband Internet connection.
- **Ad-Hoc Mode:** An 802.11 networking framework in which devices or computers communicate directly with each other, without the use of an access point. For example, Ad-Hoc Mode is used when two Windows computers are configured with file and print sharing enabled and you want to exchange files directly between them.

Both of these configuration options are available with the WAG311 Wireless PCI Adapter. Infrastructure configuration procedures for basic network connectivity are covered below. Advanced infrastructure configuration procedures and ad-hoc configuration are covered in [Chapter 3, “Configuration”](#) of this manual.

WAG311 Default Wireless Configuration Settings

If this is a new wireless network installation, use the factory default settings to set up the network and verify wireless connectivity. If this is an addition to an existing wireless network, you will need to identify the wireless configuration and security parameters already defined.

Your NETGEAR 54 Mbps Wireless PCI Adapter WAG311 factory default basic settings are:

- Network Name Service Set Identification (SSID): **ANY** — a special name which indicates the first available network will be used
Note: In order for the WAG311 Wireless PCI Adapter to communicate with a wireless access point or wireless adapter, all devices must be configured with the same wireless network name (SSID).
- Network Mode (Infrastructure or Ad-Hoc): **Infrastructure**
- Data security WEP encryption: **Disabled**

The section below provides instructions for setting up the NETGEAR 54 Mbps Wireless PCI Adapter WAG311 for basic wireless connectivity to an access point. The procedures provide step-by-step installation instructions for Windows PCs. Use the procedure that corresponds to the version of Windows you are using.

Basic Installation Instructions

Use the procedure below that corresponds to the version of Windows you are using.

For Windows XP Users Installing a WAG311

1

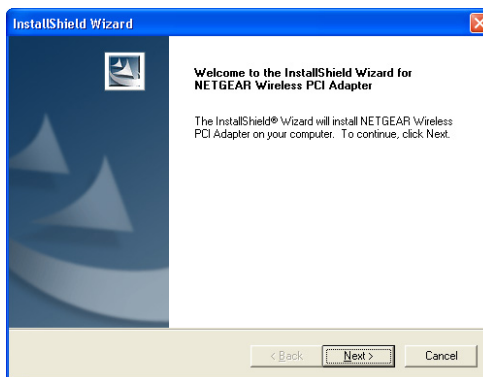
Install the WAG311 software.

- a. Power on your computer, let the operating system boot up completely, and log in as needed.
- b. Insert the *NETGEAR 54 Mbps Wireless PCI Adapter WAG311 Resource CD (SW-10012-01)* into your CD-ROM drive. The CD main page shown at the right will load.
- c. Click the “Install Driver & Utility” link.
- d. Follow the InstallShield Wizard steps, and click Finish when done to restart your computer.



WAG311 Resource CD

Note: If this page does not automatically appear, browse the root of the CD and double-click on `autorun.exe` to display this page.



Found New Hardware Wizard

Note: If a Windows XP Certification warning appears, click **Continue Anyway** to proceed.

2

Install the NETGEAR 54 Mbps Wireless PCI Adapter WAG311.

- a. Shut down the PC and remove the power cord. Hold the PCI Adapter with the NETGEAR logo facing up and insert it into an available PCI slot.

Connect the antenna to the adapter and position the antenna to the up position. Reconnect the power cord and reboot the computer.

- b. The Found New Hardware Wizard displays. Click **Next** and follow the prompts to proceed.

Click **Continue Anyway** if you are prompted with a Windows XP Logo testing message.

- c. After the installation completes, click **Finish** to close the wizard.

You should see the WAG311 system tray icon on the lower right portion of the Windows task bar.

Windows XP will display a Wireless Network Connection message.



Add New Hardware Wizard



WAG311 System Tray Icon



Windows XP Network Connection Alert

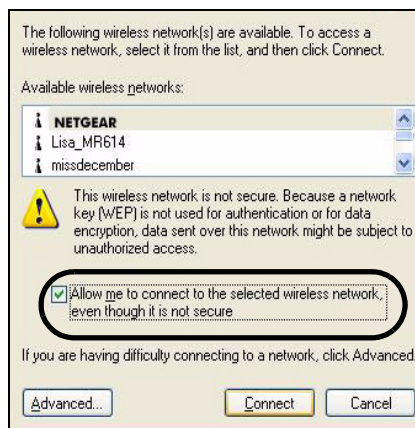
3

Configure your WAG311.

- a. Right-click on the network icon in the Windows XP system tray to open the network options menu.
- b. Click on the View Available Wireless Networks menu item.
- c. If there is more than one wireless network in your vicinity, select the one to which you will connect.
- d. Click on the “Allow me to connect to the selected wireless network even though this is not secure” check box.
- e. Click Connect.



Right-click here to display this menu.



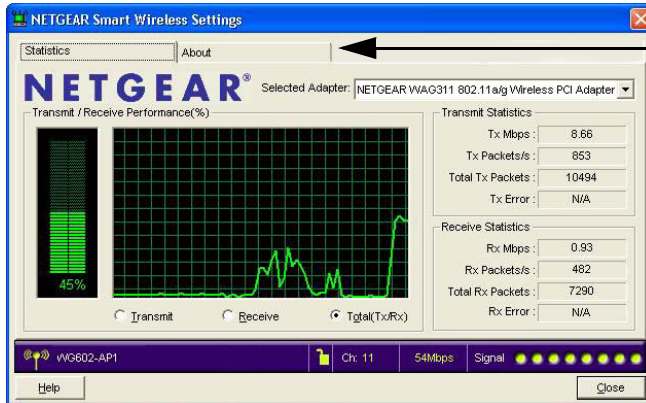
Windows XP Network Connection Alert

Note: This procedure assumes your wireless network is not using WEP security. If your wireless network uses WEP, set up your WAG311 accordingly. To view WEP settings help, click the Advanced button and click the “Learn about...” link on the Windows XP Local Area Connection Wireless Networks Properties tab page.

4

Verify wireless connectivity to your network.

- Open the WAG311 utility by clicking on the icon  in the Windows system tray.



Note: When the Windows XP wireless configuration utility is enabled (the default), only these two tab pages appear.

To use the full NETGEAR utility, see [“Understanding the Configuration Options”](#) on page 3-1.

- Verify that your connection information matches your wireless network.
- Verify connectivity to the Internet or network resources.

Note: If you are unable to connect, see [“Basic Troubleshooting Tips”](#) on page 2-13.

For Windows 2000 & 98/Me Users Installing a WAG311

1

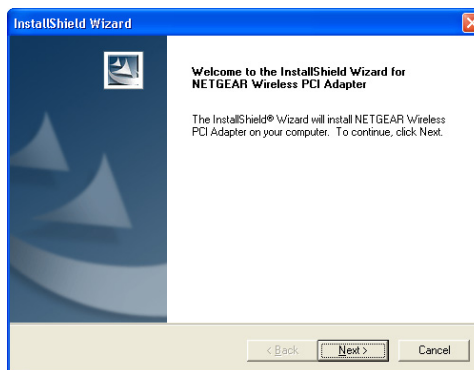
Install the WAG311 software.

Note: Windows 2000 may require you to be logged on with administrator rights.

- a. Power on your computer, let the operating system boot up completely, and log in as needed.
- b. Insert the Resource CD for the WAG311 into your CD-ROM drive. The CD main page shown at the right will load.
- c. Click the “Install Driver & Utility” link.
- d. Follow the InstallShield Wizard steps, and click Finish when done to restart your computer.



WAG311 Resource CD



InstallShield Wizard

2

Install the NETGEAR 54 Mbps Wireless PCI Adapter WAG311.

- a. Shut down the PC and remove the power cord. Insert the WAG311 Wireless PCI Adapter with the NETGEAR logo facing up into an available PCI slot.
- b. Reconnect the power cord and reboot the computer. After a short delay, the Found New Hardware Wizard displays.
- c. Click **Next** and follow the prompts to proceed. After the installation completes, click **Finish** to close the wizard.

You should see the WAG311 system tray icon on the lower right portion of the Windows task bar.



Add New Hardware Wizard

Note: If Windows displays a Digital Signature Not Found warning, click **Yes** to continue.



WAG311 System Tray Icon

3

Configure your WAG311 and save the Profile.

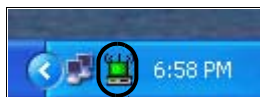
- a. Open the WAG311 Smart Wireless Settings Utility by clicking on the icon in the Windows system tray. The utility opens to the Settings page.

- b. Change the Network Name SSID to match your network.

Tip: As an alternative to typing in the SSID, you can use the Network tab to view the available wireless networks. Double-click on the desired network.

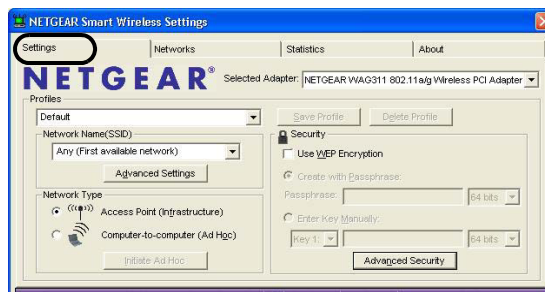
- c. Click the Apply button to activate the connection.
- d. Enter a name for your profile and click the Save Profile button to store the current settings.

Note: This procedure assumes you are connecting to a wireless network which is not using WEP security. If your network includes WEP settings, enter the security information in the Security section. For help with these steps, see [“Enabling Wireless Security Features”](#) on page 3-8.



Click here to open the configuration utility.

WAG311 system tray icon



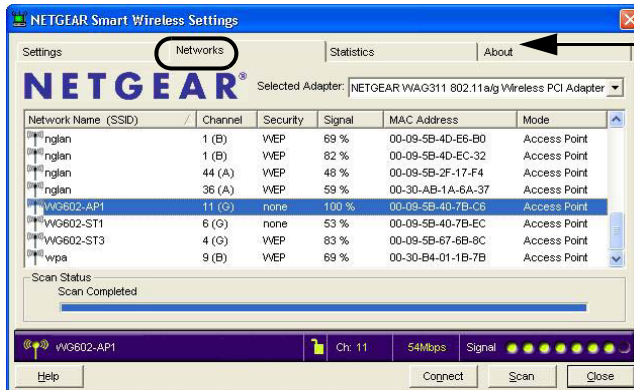
WAG311 Configuration Utility

Note: The NETGEAR default settings are **Infrastructure mode**, with **ANY** for the wireless network name SSID, and WEP disabled.

4

Verify wireless connectivity to your network.

- a. Verify that your connection information matches your wireless network.



Note: You can use the Networks tab to verify the availability of wireless networks and their SSIDs.

For more information, see [“Understanding the Configuration Options”](#) on page 3-1.

- b. Verify connectivity to the Internet or network resources.

Note: If you are unable to connect, see [“Basic Troubleshooting Tips”](#) on page 2-13.

WAG311 Wireless Connection Indicators

The NETGEAR 54 Mbps Wireless PCI Adapter WAG311 SysTray icon, which is on the System Tray portion of the taskbar in the Microsoft Windows desktop, is an indicator that gives you feedback on the status of your wireless connection. The color of the SysTray icon indicates the status of the connection.

Interpreting System Tray Icon Colors

The System Tray (SysTray) resides on one end of the taskbar in the Microsoft Windows desktop.

Color	Condition	Description
Red 	The wireless PCI Adapter has no connection to any other wireless node.	The wireless PCI Adapter is not able to link to any other wireless node or the link is lost. Check your configuration or try moving to a location where the wireless signal quality is better.
Yellow 	The wireless PCI Adapter has a connection with another wireless node.	The wireless link is weak. You may need to move to a better spot, such as closer to the wireless access point. Also, look for possible interference such as a 2.4 GHz cordless phone or large metal surface.
Green 	The wireless PCI Adapter has a connection with another wireless node.	The wireless PCI Adapter has established good communication with an access point and the signal quality is strong.

Basic Troubleshooting Tips

If you have problems connecting to your wireless network, try the tips below.

Symptom	Cause	Solution
I can connect to an access point, but I cannot connect to other computers on the network or the Internet.	This could be a physical layer problem or a network configuration problem.	Check to make sure that the access point is physically connected to the Ethernet network. Make sure that the IP addresses and the Windows networking parameters are all configured correctly. Restart the cable or DSL modem, router, access point, and notebook PC.

Also, for problems with accessing network resources, the Windows software might not be installed and configured properly on your computers. Please refer to [Appendix C, “Preparing Your PCs for Network Access”](#) of the Reference Manual on the *NETGEAR 54 Mbps Wireless PCI Adapter WAG311 Resource CD (SW-10012-01)*.

About Page

The About page displays important information about the NETGEAR 54 Mbps Wireless PCI Adapter WAG311.

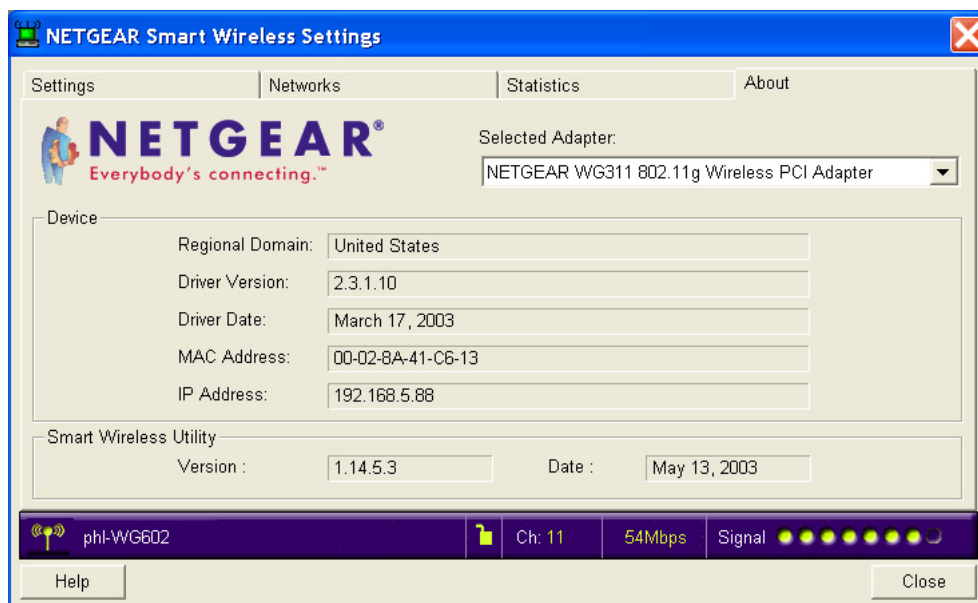


Figure 2-1: About page

The About page shows the following information:

- **Regional Domain:** This is the region setting for the wireless adapter. The approved channels for this region are automatically scanned. Governments regulate the channels used for wireless transmission. Operating the wireless adapter in a different region may violate local laws.
- **Driver Version:** The wireless adapter driver version.
- **Driver Date:** The wireless adapter driver release date.

- **MAC Address:** The MAC address of this adapter. The Media Access Control address is a unique 48-bit hardware address assigned to every network interface card. Some wireless networks will restrict access based on a list of known MAC addresses. If you are communicating with such a network, you would have to provide the address shown here to the network administrator before you would be allowed to connect. Restricting access by MAC address adds an obstacle against unwanted access to your network. However, unless you use data encryption security, the data broadcast over the wireless link is fully exposed.
- **IP Address:** The IP address assigned to this adapter.
- **Configuration Utility Software:** The version and release date of this utility.

Chapter 3

Configuration

This section describes how to configure your NETGEAR 54 Mbps Wireless PCI Adapter WAG311 for wireless connectivity on your Wireless Local Area Network (WLAN) and use the data security encryption features.



Note: The instructions in this section refer to the NETGEAR WAG311 configuration utility. Windows XP users must first disable the Windows XP configuration utility. Open the network connections from the system tray icon, click the Properties button, click the Wireless Networks tab and then clear the “Use Windows to configure my wireless network settings” check box.

Understanding the Configuration Options

The WAG311 configuration utility provides a complete and easy to use set of tools to:

- Configure wireless settings.
- Monitor wireless network connections.
- Save your settings in configuration profiles.

The section below introduces these capabilities of the configuration utility.

Using Configuration Profiles

The WAG311 configuration utility uses profiles to store all the configuration settings for a particular wireless network. You can store multiple profiles and recall the one which matches the network you want to join.

For example, if you use your PC to connect to a wireless network in an office and a wireless network in your home, you can create a profile for each wireless network. Then, you can easily load the profile that has all the configuration settings you need to join the network you are using at the time.

There are two types of wireless network connections you can configure:

- **Infrastructure Mode** — uses the 802.11 infrastructure mode.
- **Ad-Hoc Mode** — uses the 802.11 ad-hoc mode

For more information on 802.11 wireless network modes, see [“Wireless Networking Overview” on page B-1](#) of this manual.

Networks Page

The Networks page shows the available networks at your location.

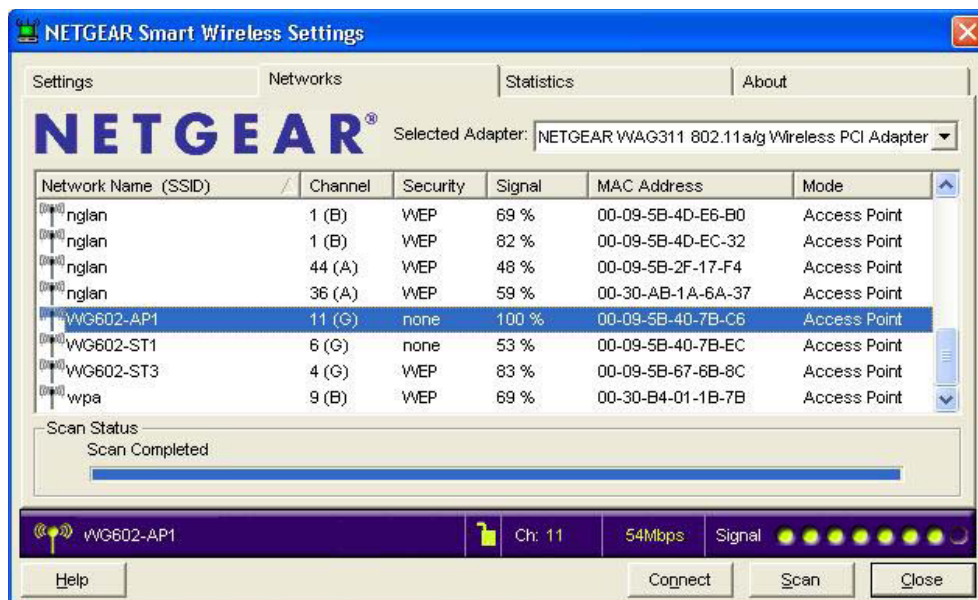


Figure 3-1: Networks tab page

The Networks page displays the following fields:

- **Wireless Network Name (SSID):** Wireless Network Name (SSID) is the name assigned to a wireless network. This is the same as the SSID or ESSID configuration parameter. Note that, as a security measure, some wireless access points do not broadcast their SSID. In such cases, the SSID field will be blank even though the rest of the information will still be displayed.
- **Channel:** The channel determines which operating frequency will be used.
- **Security:** Identifies if the wireless network requires WEP security settings.
- **Signal:** Identifies the signal strength of the communications.
- **MAC Address:** Identifies the hardware address (MAC Address) of the wireless device broadcasting this information.
- **Mode:** Identifies the type of wireless network — Access Point (Infrastructure) or Computer-to-computer (Ad-Hoc).

To connect to a network:

1. Click Scan to view the available networks.
2. Click on the column header to sort for better viewing if you have many networks.
3. Double-click to connect to the SSID.
4. The highlighted SSID is the one currently connected.

Connect to an Access Point in Infrastructure Mode

This section provides instructions for configuring the NETGEAR 54 Mbps Wireless PCI Adapter WAG311 to connect to a wireless access point.

How to Configure an Infrastructure Mode Profile

Follow the instructions below to configure an infrastructure mode profile for connecting to an access point.

1. Run the WAG311 Configuration Utility.

- a. Open the configuration utility by clicking on the WAG311 icon  in the Windows system tray.

- b. Click on the Settings tab to display the view shown below.



Figure 3-2: Settings tab page

2. Configure the wireless Network settings.

- a. In the Network Type section, be sure that Infrastructure is selected.
- b. Enter the SSID. This is also called the Wireless Network Name.

Note: You will not get a wireless network connection unless the network SSID matches exactly what is configured in the access point.

Tip: You can click the Networks tab to view a list of the available wireless networks and their SSIDs at your location.

3. Save your settings in a Profile.

- a. Type a descriptive name for the Profile in the “Profiles” name field.
- b. Click Save Profile. All the configuration settings are saved in this profile.
- c. Click Apply.
- d. Click Close to exit the configuration utility or Cancel to return to the previous settings.

4. Verify wireless connectivity to your network.

Verify connectivity by using a browser such as Netscape or Internet Explorer to connect to the Internet, or check for file and printer access on your network.

You can check the status bar in the configuration utility for the current connection status.

Note: If you cannot connect, see the [“Basic Troubleshooting Tips” on page 2-13](#). Also, if you have problems accessing network resources, the Windows Client and File and Print Sharing software might not be installed and configured properly on your computers. Please refer to [“Preparing Your Computers for TCP/IP Networking” on page C-1](#).

Connecting to Another PC in Ad-Hoc Mode

The computer-to-computer setting of the WAG311 uses Ad-Hoc mode. Ad-Hoc mode is an 802.11 networking framework in which devices or computers communicate directly with each other, without the use of an access point. For example, this mode is used when two Windows computers are configured with file and print sharing enabled and you want to exchange files directly between them.

How to Configure an Ad-Hoc Mode Profile

Note: Ad-Hoc mode will not work using DHCP settings. Ad-Hoc mode requires either static IP addresses (such as 192.168.0.1) or other appropriate Windows networking configuration parameters such as adding IPX protocol support. For instructions on setting up static IP addresses or IPX protocol settings on a Windows PC, refer to the PC Networking Tutorial included on the *NETGEAR 54 Mbps Wireless PCI Adapter WAG311 Resource CD (SW-10012-01)*.

Follow the instructions below to configure an Ad-Hoc mode profile.

1. Run the WAG311 Configuration Utility.

- a. Open the configuration utility by clicking on the WAG311 icon  in the Windows system tray.



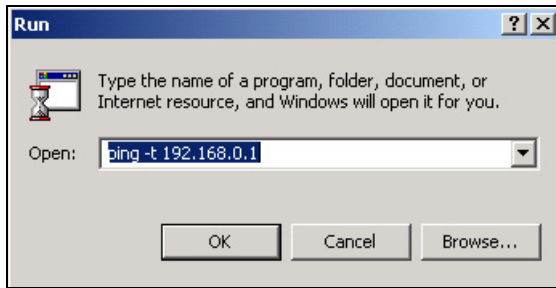
Figure 3-3: Settings tab page

- b. Click the Settings tab to display the view shown above.
 - c. Select Ad-Hoc in the Network Type section.
 - d. Enter the SSID for the Ad-Hoc network.
 - e. Click Apply.
2. **Save your settings in a Profile.**
 - a. Type a descriptive name for the Profile Name.
 - b. Click Save Profile. All the configuration settings are saved in this profile.
 - c. Click Apply.
 - d. Click Close to exit the configuration utility.
3. **Configure the PC network settings.**
 - a. Configure each PC with either a static IP address or with the IPX protocol.

Note: For instructions on configuring static IP addresses or the IPX protocol, refer to the networking tutorial on your *NETGEAR 54 Mbps Wireless PCI Adapter WAG311 Resource CD (SW-10012-01)*.
 - b. Restart the PCs.
4. **Verify wireless connectivity between your peer devices.**

Verify connectivity by using the Ping program:

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



- b. Assuming the target PC is configured with 192.168.0.1 as its IP address, type `ping -t 192.168.0.1` and then click OK.
- c. This will cause a continuous ping to be sent to the device with the 192.168.0.1 static IP address. The ping response should change to “reply.”

```
Request timed out.  
Request timed out.  
Reply from 192.168.0.1: bytes=32 time=40ms TTL=127  
Reply from 192.168.0.1: bytes=32 time=41ms TTL=127  
Reply from 192.168.0.1: bytes=32 time=30ms TTL=127
```

At this point the connection is established.

You may need to reboot in certain Windows operating systems such as Windows 98.

Note: If you cannot connect, see [“Basic Troubleshooting Tips” on page 2-13](#). Also, if you have problems accessing network resources, the Windows Client and File and Print Sharing software might not be installed and configured properly on your computers. Please refer to [“Preparing Your Computers for TCP/IP Networking” on page C-1](#).

How to Start a Computer-to-Computer (Ad-Hoc) Network

Note: Ad-Hoc wireless networks require static IP address configurations. For more information on configuring TCP/IP settings, please see the PC Networking Tutorial included on the *NETGEAR 54 Mbps Wireless PCI Adapter WAG311 Resource CD (SW-10012-01)*.

1. Fill in the Network Name (SSID).
2. Select the Computer-to-Computer (Ad-Hoc) network type.
3. Click Initiate Ad-Hoc. The Ad-Hoc Setting dialog box will appear, as shown below.

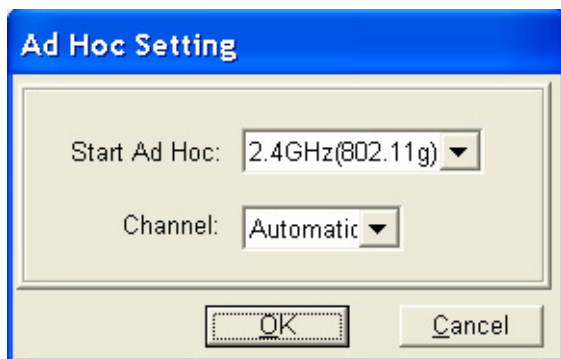


Figure 3-4: Ad-Hoc Setting page

4. In the Start Ad-Hoc field, choose the wireless standard (802.11b or 802.11g) for your Ad-Hoc computer-to-computer network.
5. In the Channel field, Automatic should work. If you notice interference problems with another nearby wireless device, select a channel that is not being used by any other wireless networks near your wireless adapter. Use the Networks tab page to identify the channels in use in your area.
6. Click OK.

Note: The channel number differs depending on the country. The connection speed automatically defaults to the highest speed.

Enabling Wireless Security Features

You can strengthen the security of your wireless connection by enabling Wired Equivalent Privacy (WEP) encryption of the wireless data communications. For more information on 802.11 wireless security, see [“Authentication and WEP Data Encryption” on page B-2](#).

In addition to the WAG311 wireless security features, you should also configure appropriate LAN network security features such as requiring a user name and password to access the shared resources in your network.

The procedures below identify how to configure the WEP encryption settings of your NETGEAR 54 Mbps Wireless PCI Adapter WAG311.

Before You Change the SSID and WEP Settings

Take the following steps. For a new wireless network, print or copy this form and fill in the configuration parameters. For an existing wireless network, the person who set up or is responsible for the network will be able to provide this information. .

- **Network Name (SSID):** The Network Name identifies the wireless local area network. **ANY** is the default for the WAG311. You may customize it by using up to 32 alphanumeric characters. Write your customized SSID on the line below.

Note: The SSID in the wireless PCI adapter is what you the wireless network uses. All wireless nodes in the same network must be configured with the same SSID.

802.11a SSID: _____

802.11b/g SSID: _____

- **Authentication**

The two bands can use different authentication settings. “Shared Key” is more security.

802.11a SSID, circle one: Open System or Shared Key

802.11b/g SSID, circle one: Open System or Shared Key

Note: If you select shared key, the other devices in the network will not connect unless they are set to Shared Key as well.

- **WEP Encryption**

802.11a and 802.11b/g differ in their use of WEP encryption keys. See “[Security Configuration](#)” on page 2-21 for a description of these differences.

802.11a WEP Encryption Keys

Key 1: _____ Circle Key Size: 64 or 128 or 152 bits

Key 2: _____ Circle Key Size: 64 or 128 or 152 bits

Key 3: _____ Circle Key Size: 64 or 128 or 152 bits

Key 4: _____ Circle Key Size: 64 or 128 or 152 bits

802.11b/g WEP Encryption Keys

For all four 802.11bg keys, choose the Key Size. Circle one: 64 or 128 bits

Key 1: _____

Key 2: _____

Key 3: _____

Key 4: _____

How to Configure WEP Encryption Security

Following the steps below to configure WEP Encryption Security.

1. Run the WAG311 Configuration Utility.

- a. Open the configuration utility by clicking on the WAG311 icon  in the Windows system tray.



Figure 3-5: Settings tab page

- b. Click on the Settings tab to display the view shown above.
- ### 2. Configure the Security settings.
- a. Select the Use WEP Encryption check box.
 - b. Enter the SSID. This is also called the Wireless Network Name.

Note: You will not get a wireless network connection unless the network SSID matches exactly what is configured in the access point.

Tip: You can click the Networks tab to view a list of the available wireless networks and their SSIDs at your location.

3. Save your settings in a Profile.

- a. Type a descriptive name for the Profile name.
- b. Click Save Profile. All the configuration settings are saved in this profile.
- c. Click Apply.
- d. Click Close to exit the configuration utility.

4. Select the WEP encryption strength you will use.

The choices are:

- 64-bit WEP data encryption
- 128-bit WEP data encryption

Note: Larger encryption keys require more processing and may slow the communications response times.

5. Select Create with Passphrase and enter the passphrase. The configuration utility will automatically generate the WEP keys.

Note: The characters are case sensitive. Be sure to use the same passphrase for all the wireless devices in the network.

If the passphrase method is not available in the other devices, you must manually enter the keys to match exactly what is in the access point and other 802.11b/g wireless devices.

6. The Default Key setting must match what is set in the access point and the other 802.11 wireless devices.
7. Click Apply for the changes to take effect.

Statistics Page

The Statistics page provides real time and historical trend information on the data traffic and performance of your wireless adapter.

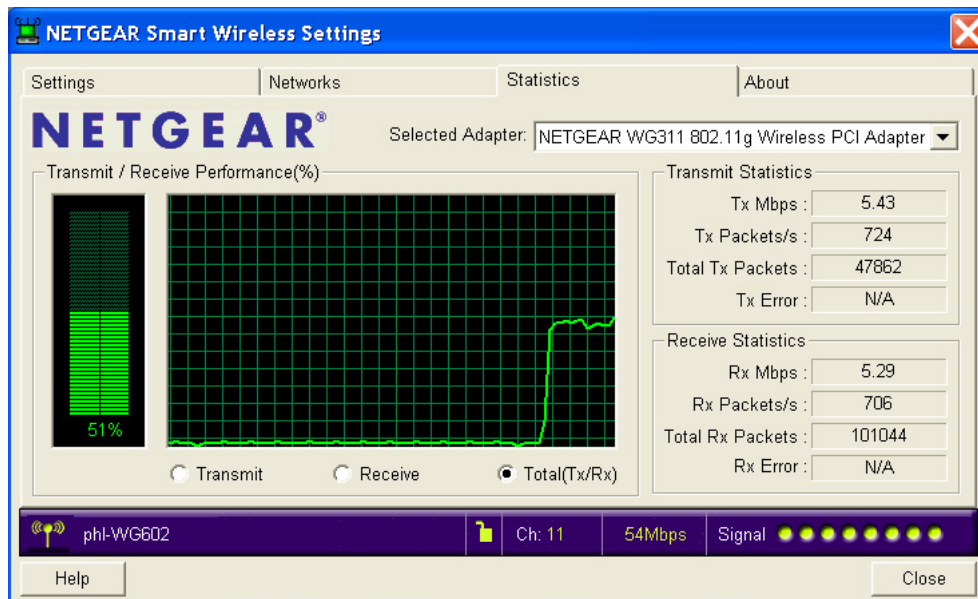


Figure 3-6: Statistics tab page

- **Transmit/Receive Performance (%):** A real time graph identifying the Total, Receive, and Transmit utilization as a percentage the total possible.
- **Total/Receive/Transmit Graph:** Identifies the trend of transmit/receive data communications over time.
- **Transmit Statistics:** Identifies Transmit megabits per second (Mbps), transmit packets per second (Tx Packets/s), total transmitted packets, and transmit errors.
- **Receive Statistics:** Identifies Receive megabits per second (Mbps), receive packets per second (Rx Packets/s), total received packets, and received errors.

Advanced Settings Page

Generally, Advanced settings should not require adjustment. Except for the power saving setting, changing any of the settings incorrectly on this page could cause your wireless connection to fail.

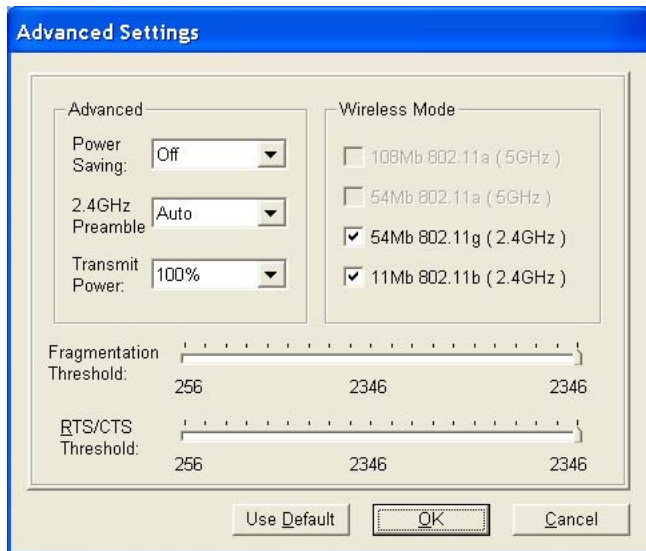


Figure 3-7: Advanced Settings page

- **Power Saving:** Select On if you are using a notebook computer running on battery power.
- **Preamble:** A long transmit preamble may provide a more reliable connection or slightly longer range. A short transmit preamble might give slightly better performance.
- **Transmit Power:** Lowering the output power level lets you reduce the chance of interference with other nearby access points but reduces the range of your adapter.
- **Wireless Mode:** Select the wireless protocols you will use. Depending on your wireless adapter, you can choose some or all of the available 802.11 wireless protocols. Note that, if the wireless network you are communicating with uses the 802.11a Turbo mode, you must include that in your selection.
- **Fragmentation Threshold:** This is the maximum packet size used for fragmentation. Packets larger than the size programmed in this field will be fragmented. The Fragment Threshold value must be larger than the RTS Threshold value.

- **RTS/CTS Threshold:** The packet size that is used to determine whether it should use the CSMA/CD (Carrier Sense Multiple Access with Collision Detection) mechanism or the CSMA/CA (Carrier Sense Multiple Access with Collision Avoidance) mechanism for packet transmission. CSMA/CD is slightly more efficient.

Appendix A

Technical Specifications

This appendix provides technical specifications for the NETGEAR 54 Mbps Wireless PCI Adapter WAG311.

Antennae	2 Integrated internal diversity antennae
Radio Data Rate	1, 2, 5.5, 6, 9, 12, 18, 24, 36, 48, and 54 Mbps (Auto Rate Sensing)
Frequency	2.4GHz to 2.5GHz CCK and OFDM Modulation)
Emissions	FCC, CE, TELEC
Bus interface	PCI
Provided drivers	Microsoft Windows 98, 2000, Me, XP
Weight	40 g
LED	Power, Activity
Operating Environment	Operating temperature: 0 to 55 degrees C, 32 to 131 degrees F
Encryption	40-bit (also called 64-bit) and 128-bit WEP data encryption

Appendix B

Wireless Networking Basics

This chapter provides an overview of Wireless networking.

Wireless Networking Overview

The WAG311 Wireless PCI Adapter conforms to the Institute of Electrical and Electronics Engineers (IEEE) 802.11b standard for wireless LANs (WLANs) and a product update will bring the WAG311 into conformance to the 802.11g standard when it is ratified. On an 802.11b or g 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 802.11b 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 802.11g auto rate sensing rates are 1, 2, 5.5, 6, 9, 12, 18, 24, 36, 48, and 54 Mbps. Likewise, the 802.11a wireless link offers a maximum data rate of 54 Mbps, but will automatically back down to rates 48, 36, 24, 18, 12, 9, and 6 Mbps.

The 802.11 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 802.11 devices. The 802.11 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.

The ESSID is usually broadcast in the air from an access point. The wireless station sometimes can be configured with the ESSID **ANY**. This means the wireless station will try to associate with whichever access point has the stronger radio frequency (RF) signal, providing that both the access point and wireless station use Open System authentication.

Authentication and WEP Data Encryption

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 these two types of authentication methods:

- **Open System.** With Open System authentication, a wireless PC can join any network and receive any messages that are not encrypted.

- **Shared Key.** 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.

802.11 Authentication

The 802.11 standard defines several services that govern how two 802.11 devices communicate. The following events must occur before an 802.11 Station can communicate with an Ethernet network through an access point such as the one built in to the WAG311:

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 802.11 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.

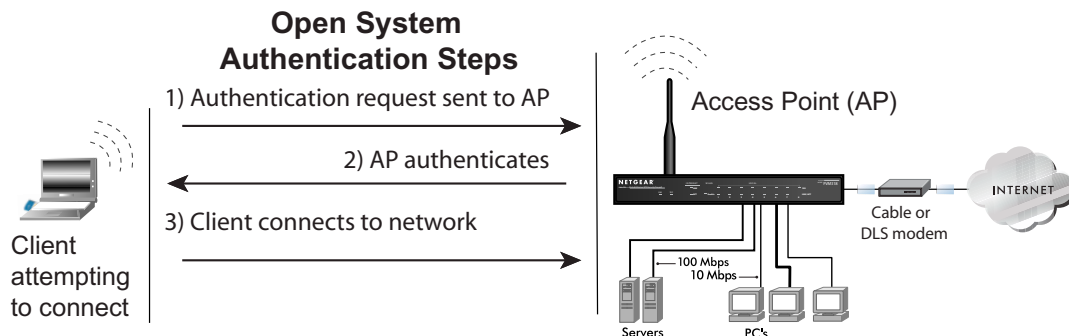


Figure B-1: Open system authentication

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 802.11 network or Ethernet network.

This process is illustrated in below.

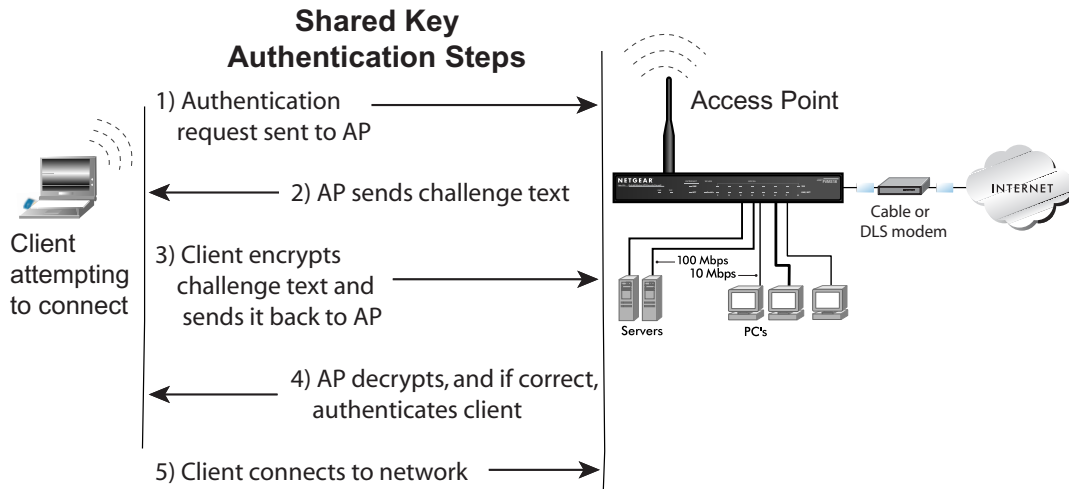


Figure B-2: Shared key authentication

Overview of WEP Parameters

Before enabling WEP on an 802.11 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 802.11 products:

1. **Do Not Use WEP:** The 802.11 network does not encrypt data. For authentication purposes, the network uses Open System Authentication.
2. **Use WEP for Encryption:** A transmitting 802.11 device encrypts the data portion of every packet it sends using a configured WEP Key. The receiving device decrypts the data using the same WEP Key. For authentication purposes, the network uses Open System Authentication.
3. **Use WEP for Authentication and Encryption:** A transmitting 802.11 device encrypts the data portion of every packet it sends using a configured WEP Key. The receiving device decrypts the data using the same WEP Key. For authentication purposes, the wireless network uses Shared Key Authentication.

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

Key Size

The IEEE 802.11 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.

In NETGEAR's 802.11a solutions, there are three shared key methods implemented: the standards based 40-bit and 128-bit WEP data encryption; and an extended 152-bit WEP data encryption.

When configured for 40-bit encryption, 802.11 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, 802.11 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.

Table B-1: Encryption Key Sizes

Encryption Key Size	# of Hexadecimal Digits	Example of Hexadecimal Key Content
64-bit (24+40)	10	4C72F08AE1
128-bit (24+104)	26	4C72F08AE19D57A3FF6B260037
152-bit (24+128)	32	4C72F08AE19D57A3FF6B26003715DAC2

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

WEP Configuration Options

The WEP settings must match on all 802.11 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 802.11 access points and all of the 802.11 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

The wireless frequencies used by 802.11a and 802.11b/g networks are different. These channel frequency options are discussed below.

802.11b/g Wireless Channels

IEEE 802.11b/g 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 in 802.11b/g networks are listed in [Table D-2](#):

Table B-2: 802.11b/g 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. For example, Channels 1 to 11 are supported in the U.S. and Canada, and Channels 1 to 13 are supported in Europe and Australia.

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.

802.11a Legal Power Output and Wireless Channels

IEEE 802.11a utilizes 300 MHz of bandwidth in the 5 GHz Unlicensed National Information Infrastructure (U-NII) band. Though the lower 200 MHz is physically contiguous, the FCC has divided the total 300 MHz into three distinct domains, each with a different legal maximum power output. Below is a table of summary for different regulatory domains.

Table B-3: 802.11a Radio Frequency Channels

U-NII Band	Low	Middle	High
Frequency (GHz)	5.15 – 5.25	5.25 – 5.35	5.725 – 5.825
Max. Power Output	50 mW for US 200 mW for Canada, Europe, and Australia	250 mW for US 200 mW for Europe and Australia 1 W for Canada	1 W for US and Australia 4 W for Canada 25 mW for Europe

Note: Please check your local Authority for updated information on the available frequency and maximum power output.

IEEE 802.11a uses Orthogonal Frequency Division Multiplexing (OFDM), a new encoding scheme that offers certain benefits over a spread spectrum in channel availability and data rate. The 802.11a uses OFDM to define a total of 8 non-overlapping 20 MHz channels across the 2 lower bands; each of these is divided into 52 sub carriers and each carrier is approximately 300 KHz wide.

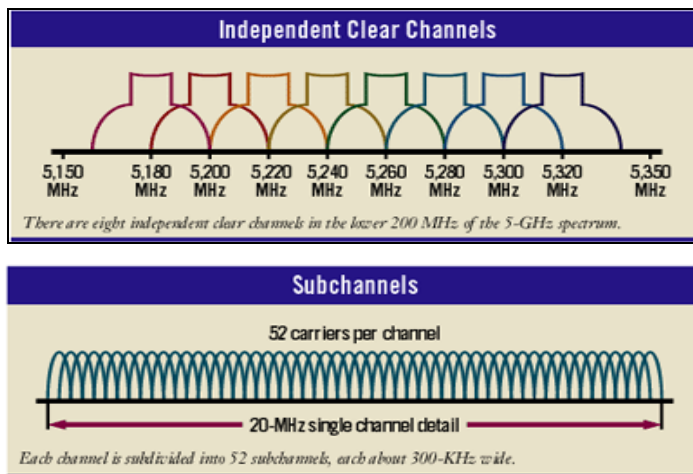


Figure B-3: IEEE 802.11a Channel Allocations

The WAG311 user can use thirteen channels in **non-turbo** mode.

Table B-4: 802.11a Turbo Mode Off Radio Frequency Channels

Turbo Mode OFF

Channel	Frequency
36	
40	
44	
48	
52	
56	
60	
64	
149	5.745 GHz
153	5.765 GHz
157	5.785 GHz
161	5.805 GHz
165	5.825 GHz

The WAG311 user can use five channels in turbo mode.

Turbo Mode ON	
Channel	Frequency
42	5.21 GHz
50	5.25 GHz
58	5.29 GHz
152	5.76 GHz
160	5.8 GHz

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

Appendix C

Preparing Your PCs for Network Access

This appendix describes how to prepare your PCs to connect to the Internet through the NETGEAR 54 Mbps Wireless PCI Adapter WAG311.

For adding file and print sharing to your network, please consult the Windows help information included with the version of Windows installed on each computer on your network.

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.

In your TCP/IP network, each PC and the wireless access point must be assigned a unique IP addresses. Each PC must also have certain other TCP/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 startup.

Configuring Windows 98 and Me for TCP/IP Networking

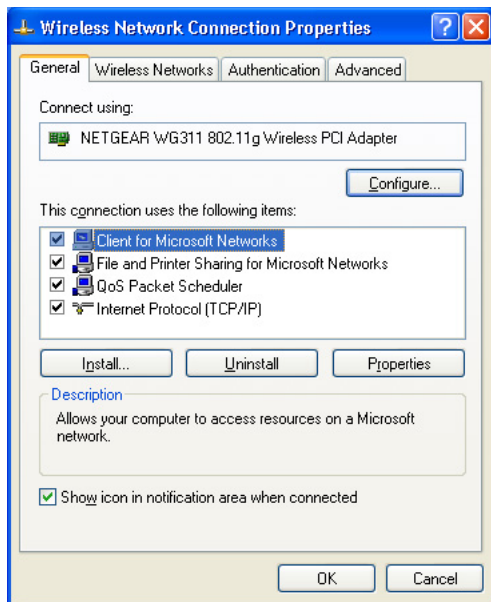
As part of the PC preparation process, you may need to install and configure TCP/IP on your PC. Before starting, locate your Windows CD; you may need to insert it during the TCP/IP installation process.

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 or an WAG311, the TCP/IP protocol, and the 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 add 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 to add the 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.

If you need to add File and Print Sharing for Microsoft Networks:

- a. Click the Add button.
 - b. Select Client, and then click Add.
 - c. Select Microsoft.
 - d. Select File and Print Sharing for Microsoft Networks, and then click OK.
3. Restart your PC for the changes to take effect.

Enabling DHCP to Automatically Configure TCP/IP Settings

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.

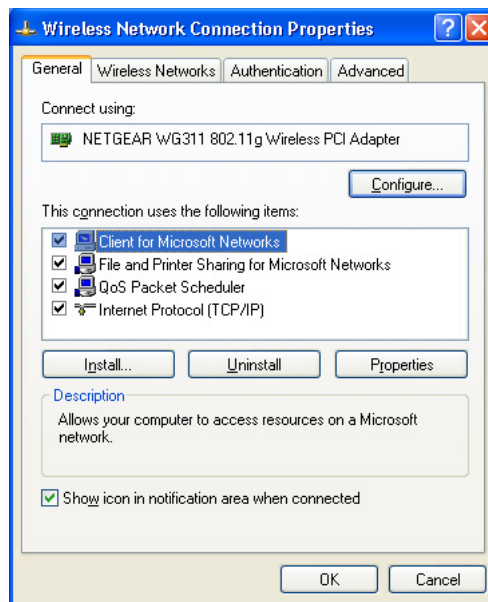
- If the Network Neighborhood icon is on the Windows desktop, position your mouse pointer over it and right-click your mouse button.
- If the icon is not on the desktop,
 - Click **Start** on the task bar located at the bottom left of the window.
 - Choose **Settings**, and then **Control Panel**.
 -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

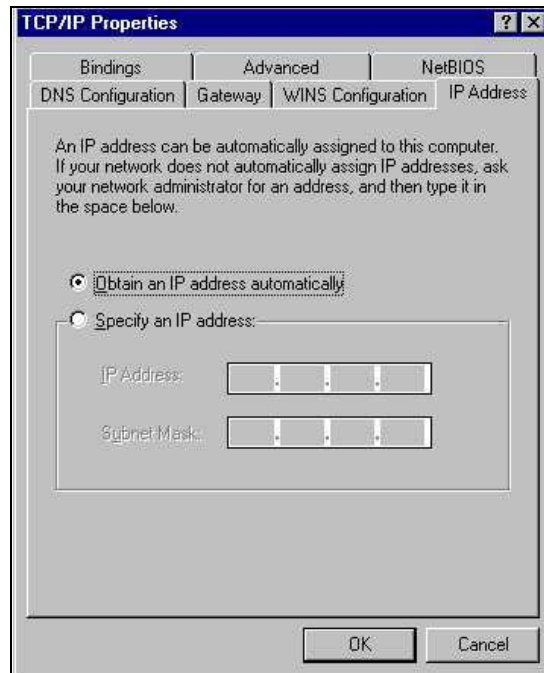
- Verify the following:

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 the 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 2000 or XP for TCP/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 Dial-up 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 Dial-up Connections windows.
8. Then, restart your PC.

DHCP Configuration of TCP/IP in Windows XP or 2000

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.

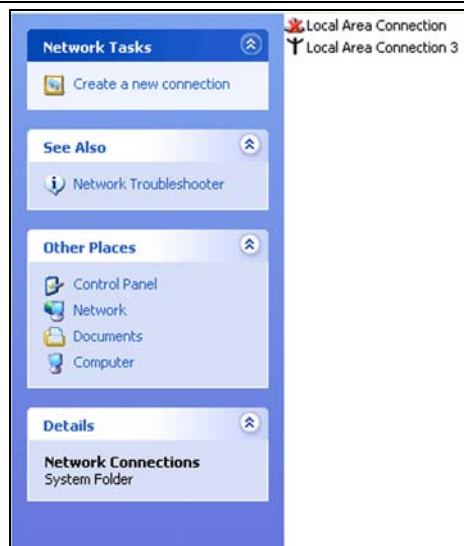
- Select **Control Panel** from the Windows XP Start Menu.
- Select the **Network Connections** icon on the Control Panel. This will take you to the next step.

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**.

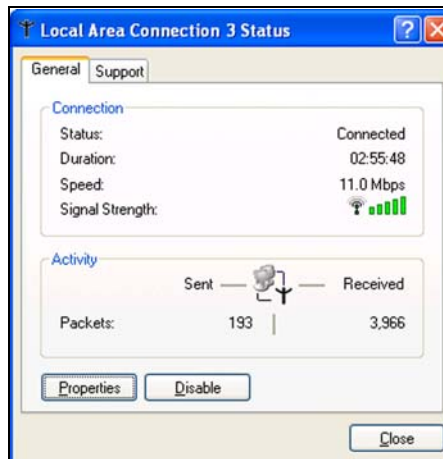


3

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.

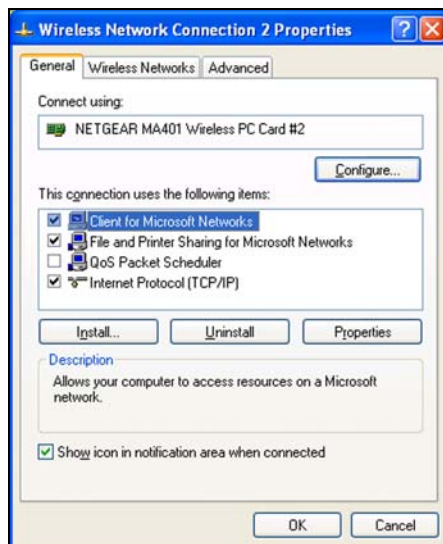
- Click the **Properties** button to view details about the connection.



4

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

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



Verify that **Obtain an IP address**

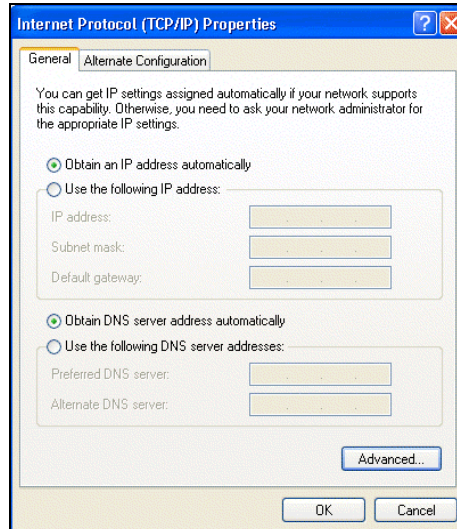
5

automatically radio button is selected and that the **Obtain DNS server address automatically** radio button is selected.

- Click the **OK** button.

This completes the DHCP configuration 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

After you install a network card, TCP/IP for Windows 2000 is configured and set to DHCP without your having to configure it. However, if there are problems, following the steps below 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.

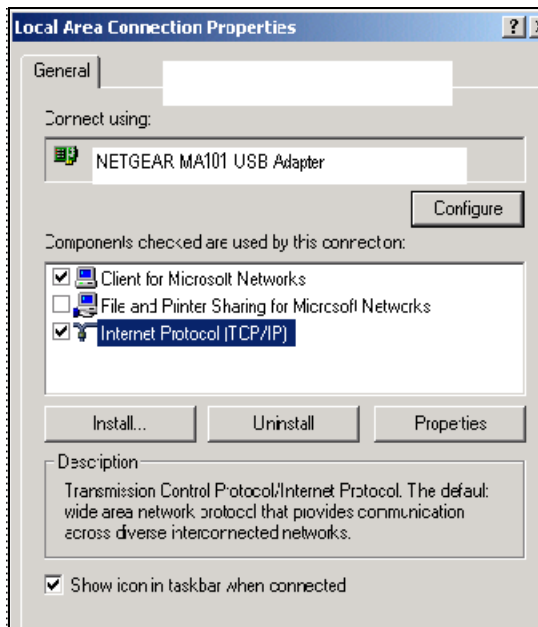
- Right click on **Local Area Connection** and select **Properties**.

2

The **Local Area Connection Properties** dialog box appears. Verify that you have the correct Ethernet card selected in the **Connect using:** box and that 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**.



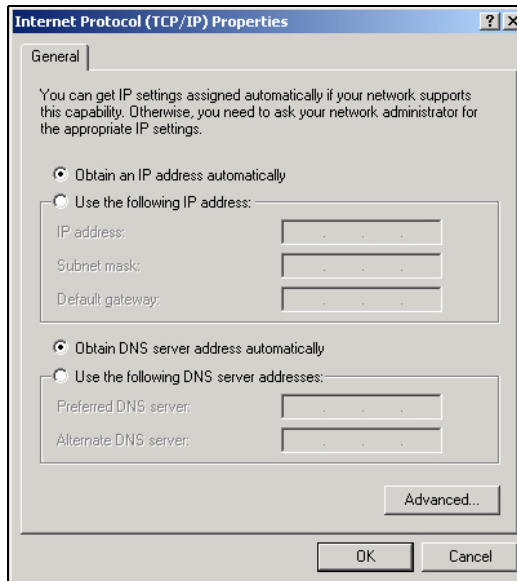
3

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. Click **OK** again to complete the configuration process.

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



Verifying TCP/IP Properties for Windows XP or 2000

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**

Glossary

List of Glossary Terms

Use the list below to find definitions for technical terms used in this manual.

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.

802.11a

IEEE specification for wireless networking at 54 Mbps operating in unlicensed radio bands over 5GHz.

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 2.4GHz.

802.11g

A soon to be ratified IEEE specification for wireless networking at 54 Mbps using direct-sequence spread-spectrum (DSSS) technology and operating in the unlicensed radio spectrum at 2.4GHz. 802.11g is backwards compatible with 802.11b.

ADSL

Short for asymmetric digital subscriber line, a technology that allows data to be sent over existing copper telephone lines at data rates of from 1.5 to 9 Mbps when receiving data (known as the downstream rate) and from 16 to 640 Kbps when sending data (known as the upstream rate).

ADSL requires a special ADSL modem. ADSL is growing in popularity as more areas around the world gain access.

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.

DNS

Short for Domain Name System (or Service), an Internet service that translates domain names into IP addresses.

Because domain names are alphabetic, they're easier to remember. The Internet however, is really based on IP addresses. Every time you use a domain name, therefore, a DNS service must translate the name into the corresponding IP address. For example, the domain name `www.example.com` might translate to `198.105.232.4`. The DNS system is, in fact, its own network. If one DNS server doesn't know how to translate a particular domain name, it asks another one, and so on, until the correct IP address is returned.

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.

DSL

Short for digital subscriber line, but is commonly used in reference to the asymmetric version of this technology (ADSL) that allows data to be sent over existing copper telephone lines at data rates of from 1.5 to 9 Mbps when receiving data (known as the downstream rate) and from 16 to 640 Kbps when sending data (known as the upstream rate).

ADSL requires a special ADSL modem. ADSL is growing in popularity as more areas around the world gain access.

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.

ESSID

The Extended Service Set Identification (ESSID) is a thirty-two character (maximum) alphanumeric key identifying the wireless local area network.

Gateway

A local device, usually a router, that connects hosts on a local network to other networks.

IETF

Internet Engineering Task Force. 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.

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.

IP

Internet Protocol is 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-byte number uniquely defining each host on the Internet, usually written in dotted-decimal notation with periods separating the bytes (for example, `134.177.244.57`).

Ranges of addresses are assigned by Internic, an organization formed for this purpose.

IPX

Short for Internetwork Packet Exchange, a networking protocol used by the Novell NetWare operating systems.

Like UDP/IP, IPX is a datagram protocol used for connectionless communications. Higher-level protocols, such as SPX and NCP, are used for additional error recovery services.

ISP

Internet service provider.

Internet Protocol

The main internetworking protocol used in the Internet. Used in conjunction with the Transfer Control Protocol (TCP) to form TCP/IP.

LAN

A communications network serving users within a limited area, such as one floor of a building.

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

The Media Access Control address is a unique 48-bit hardware address assigned to every network interface card. Usually written in the form 01:23:45:67:89:ab.

Mbps

Megabits per second.

NetBIOS

The Network Basic Input Output System is an application programming interface (API) for sharing services and information on local-area networks (LANs).

Provides for communication between stations of a network where each station is given a name. These names are alphanumeric names, up to 16 characters in length.

Network Address Translation

NAT. A technique by which several hosts share a single IP address for access to the Internet.

NIC

Network Interface Card. An adapter in a computer which provides connectivity to a network.

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.

router

A device that forwards data between networks. An IP router forwards data based on IP source and destination addresses.

Routing Information Protocol

RIP. A protocol in which routers periodically exchange information with one another so that they can determine minimum distance paths between sources and destinations.

SSID

A Service Set Identification is a thirty-two character (maximum) alphanumeric key identifying a wireless local area network. For the wireless devices in a network to communicate with each other, all devices must be configured with the same SSID.

This is typically the configuration parameter for a wireless PC card. It corresponds to the ESSID in the wireless Access Point and to the wireless network name. *See also* Wireless Network Name and ESSID.

Subnet Mask

A mask used to determine what subnet an IP address belongs to. Subnetting enables a network administrator to further divide an IP address into two or more subnets.

TCP/IP

The main internetworking protocols used in the Internet. The Internet Protocol (IP) used in conjunction with the Transfer Control Protocol (TCP) form TCP/IP.

WAN

A long distance link used to extend or connect remotely located local area networks. The Internet is a large WAN.

WEB Proxy Server

A Web proxy server is a specialized HTTP server that allows clients access to the Internet from behind a firewall.

The proxy server listens for requests from clients within the firewall and forwards these requests to remote Internet servers outside the firewall. The proxy server reads responses from the external servers and then sends them to internal client clients.

WEP

Wired Equivalent Privacy 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.

Wi-Fi

A trade name for the 802.11b wireless networking standard, given by the Wireless Ethernet Compatibility Alliance (WECA, see <http://www.wi-fi.net>), an industry standards group promoting interoperability among 802.11b devices.

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 the Windows Network Neighborhood feature.

WINS

WINS. Windows Internet Naming Service is a server process for resolving Windows-based computer names to IP addresses.

Wireless Network Name (SSID)

Wireless Network Name (SSID) is the name assigned to a wireless network. This is the same as the SSID or ESSID configuration parameter.

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