User’ s Guide

PRO/Wireless 2200BG Network Connection

Model

WM3B2200BG

Intel(R) PRO/Wireless 2200BG User's Guide

Your Intel(R) PRO/Wireless 2200BG Network Connection adapter works with either 802.11b or 802.11g wireless standard. Operating at 2.4 GHz frequency at speeds of up to 54 Mbps you can now connect your computer to high-capacity existing 802.11b networks using multiple access points within large or small environments, and also to high-speed 802.11g networks. Your wireless adapter maintains automatic data rate control according to access point location to achieve the fastest possible connection. All your wireless client connections can be easily managed by the Intel(R) PROSet for Wireless utility. Using the PROSet Profile Wizard, you can create profiles automatically to suite your specific connection requirements. Enhanced security measures using 802.1x, WPA encryption and authentication, and 128-bit WEP encryption is standard for both 802.11b and 802.11g.

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September 2003

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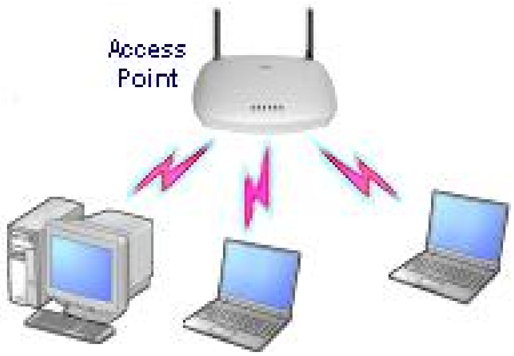
Wireless LAN Overview: Intel(R) PRO/Wireless 2200BG User's Guide

About Wireless LAN Technology

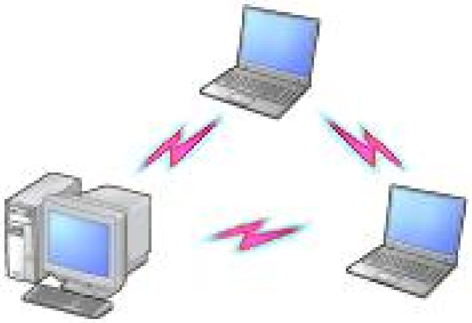
A wireless network connects computers without using network cables. Computers use radio communications to send data between each other. You can communicate directly with other wireless computers, or connect to an existing network through a wireless access point. When you set up your wireless adapter, you select the operating mode for the kind of wireless network you want. You can use your wireless adapter to connect to other similar wireless devices that comply with the 802.11 standard for wireless networking.

Choosing a Wireless LAN

Wireless LANs can operate with or without access points, depending on the number of users in the network. Infrastructure mode uses access points to allow wireless computers to send and receive information. Wireless computers transmit to the access point, the access point receives the information and rebroadcasts it to other computers. The access point can also connect to a wired network or to the Internet. Multiple access points can work together to provide coverage over a wide area.



Peer-to-Peer mode, also called Ad Hoc mode, works without access points and allows wireless computers to send information directly to other wireless computers. Ad Hoc Mode is only supported in 802.11b and 802.11g networks. You can use Peer-to-Peer mode to network computers in a home or small office or to set up a temporary wireless network for a meeting.



Configuring a Wireless LAN

There are three basic components that must be configured for an 802.11 wireless LAN to operate properly:

- **Network Name:** Each wireless network uses a unique Network Name to identify the network. This name is called the Service Set Identifier (SSID). When you set up your wireless adapter, you specify the SSID. If you want to connect to an existing network, you must use the name for that network. If you are setting up your own network you can make up your own name and use it on each computer. The name can be up to 32 characters long and contain letters and numbers.
- **Profiles:** When you set up your computer to access a wireless network, the wireless client manager creates a profile for the wireless settings that you specify. If you want to connect to another network, you can scan for existing networks and make a temporary connection, or create a new profile for that network. After you create profiles, your computer will automatically connect when you change

locations.

- **Security:** The 802.11 wireless networks use encryption to help protect your data. Wired equivalent privacy (WEP) uses a 64-bit or 128-bit shared encryption key to scramble data. Before a computer transmits data, it scrambles the data using the secret encryption key. The receiving computer uses this same key to unscramble the data. If you are connecting to an existing network, use the encryption key provided by the administrator of the wireless network. If you are setting up your own network you can make up your own key and use it on each computer.
    - **Wi-Fi Protected Access (WPA)** is a security enhancement that strongly increases the level of data protection and access control to a WLAN. WPA mode enforces 802.1x authentication and key-exchange to strengthen data encryption. WPA utilizes its Temporal Key Integrity Protocol (TKIP). TKIP provides important data encryption enhancements that include a per-packet key mixing function, a message integrity check (MIC) named "Michael", an extended initialization vector (IV) with sequencing rules, and a also re-keying mechanism. Using these improvement enhancements, TKIP protects against WEP's known weaknesses.
    - **Cisco Client Extention (CCX)** is a server and client 802.1x authentication via a user-supplied logon password. When a wireless access point communicates with a Cisco LEAP-enabled RADIUS (Cisco Secure Access Control Server (ACS) server), Cisco LEAP provides access control through mutual authentication between client wireless adapters and the wireless network and provides dynamic, individual user encryption keys to help protect the privacy of transmitted data.

Identifying a Wireless Network

Depending on the size and components of a wireless LAN, there are many ways to identify a wireless LAN:

- **The Network Name or Service Set Identifier (SSID):** Identifies a wireless network. All wireless devices on the network must use the same SSID.
- **Extended Service Set Identifier (ESSID):** A special case of SSID used to identify a wireless network that includes access points.
- **Independent Basic Service Set Identifier (IBSSID):** A special case of SSID used to identify a network of wireless computers configured to communicate directly with one another without using an access point.
- **Basic Service Set Identifier (BSSID):** A unique identifier for each wireless device. The BSSID is the Ethernet MAC address of the device.
- **Broadcast SSID:** An access point can respond to computers sending probe

packets with the broadcast SSID. If this feature is enabled on the access point, any wireless user can associate with the access point by using a blank (null) SSID.

Surveying the Site of Your Wireless LAN

Conducting a site survey for your wireless LAN is the most crucial step in the process of setting up a wireless network. It greatly reduces the amount of troubleshooting you will have to do once you have the wireless LAN set up and ready for connection testing. To conduct a site survey, you will need the following tools:

- An access point (or laptop computer) that is set up to be the transmitter. It should be mounted near and at the same height as the designated location of your wireless LAN.
- A laptop that will act as the mobile receiver. It must contain your site survey software.
- An area or building map, which will be used to plot the strength of your signals.

Once you have the tools you need, you are ready to survey the inside of the building. Launch the site survey software on the mobile receiver laptop and carry it around in the intended wireless LAN area to test the signal strength. Be sure to also check the signal strength of each intended access point location. If you encounter problems while surveying the site, make sure your transmitter laptop is not located on a wall containing metal, such as an air-conditioning duct, which will interfere with the range of your signal. Simply move the transmitter and test the signal strength again. For users to have seamless coverage when moving from access point to access point, the signal levels at each point must overlap. There is software available that will seamlessly hand off changing signal levels from one access point to another.

Your building's infrastructure can sometimes interfere with the microwave signal, but finding the location and cause of the interference will allow you to figure out the best place to mount your access points for optimal area coverage. Microwave signals travel in all directions, which means there is one access point for a multi-floor building. However, the range is highly dependent on the material used to construct the flooring, especially metal materials. Once your signal strength is strong inside the building, you are ready to check the strength outside the building. To do so, simply carry the mobile receiver laptop as far down the street or around the building as you can go without losing significant signal strength. If possible, you should be aware of the types of networks being used by the companies on the floors above and below you, so that you can work together in harmony. With wireless networks, security is very important and if you communicate with those around you, you are better prepared to select the right channels, as well as the best location for access points.

Factors Affecting Range

Although access points can transmit signals up to 60 feet away in an area with many walled barriers or as much as 500 feet away in a large open area, the range is affected by the following factors:

- Building materials, such as steel and drywall, can shorten the range of the radio signals.
- Physical layout of the area can interfere with the signals and cause them to be dropped.
- Electronic noise from cell phones, microwave ovens, or other devices on the same frequency can interfere with the transmission of the signals.
- Range is inversely proportional to data rate, so the faster that the signals are sent, the less distance they will travel.

Taking these factors into consideration when you survey the site for your WLAN is key to providing all of your users with undisturbed mobile connectivity. Using multiple access points will, of course, reduce the impact of these factors if your area has dividing walls throughout.

What is a Site Survey?

A site survey is an in-depth examination and analysis of a proposed wireless LAN site. The purpose of a site survey is to determine the number of access points needed, the types of antennas needed, and the best placement for those access points and antennas. Although the goal of a site survey is simple, the means of arriving at that goal are not. Some of the steps involve taking measurements, but most involve experience, trial and error, and a little guesswork rather than numbers and figures. When to Perform a Site Survey Intel® recommends that you perform a site survey prior to installing a wireless LAN. Site surveys are especially important when:

- **You are installing a new site:** Evaluate the placement of the access points and antennas throughout the proposed site.
- **You are changing an existing site:** When modifying or extending an existing network structure, re-evaluate the placement of the access points and antennas. If

you need a different level of coverage in some areas, you may need to move, replace, or supplement access points and antennas.

- **You are physically changing the site:** Remodeling may introduce new sources of interference, such as motors and metal structures within the coverage area of the access point, even if it does not directly effect the sites where the access points are located.

Elements of an Effective Site Survey

An effective site survey requires four elements. Failure to commit the appropriate time, money, and energy to accomplish a proper site survey in advance may result in greater expenditures of money and time later, when problems arise that require repeated adjustments to the wireless configuration. The three elements of an effective site survey are:

1. **Examine the network usage problems solved by the wireless LAN.**
   How many clients need a wireless LAN connection? What areas of the site require wireless LAN connectivity? How many hours each day is wireless LAN connectivity required? Which locations are likely to generate the largest amount of data traffic? Where is future network expansion most likely?
2. **Study blueprints of the proposed wireless LAN site.**
   A site blueprint provides a map of the site as well as the location of objects, such as walls, partitions, and anything else that could affect the performance of a wireless LAN. Examining the site blueprint prior to conducting the physical walk-through helps you identify areas in which wireless equipment is likely to perform well and areas where it is not. Many obstructions are not readily visible and, in some cases, a room originally built for a specific purpose, such as a radiology lab, might have been converted into something completely different, such as a conference room. The blueprint may also show areas proposed for future building expansion. To prepare for the next step of the site survey, mark possible wireless device locations on the blueprint and refer to the marked blueprint during the physical walk-through and inventory.
3. **Conduct a physical walk-through and inventory.**
   The primary purpose of the physical walk-through is to document any items or materials near a proposed device location that may interfere with reception or transmission and affect network performance. Document stock and inventory levels, current environmental conditions and any materials that may interfere with the wireless LAN.

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Software Installation: Intel(R) PRO/Wireless 2200BG User's Guide

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Software Installation

Installing Drivers and Intel(R) PROSet Software

See the instructions for your operating system:

- Windows 2000
- Windows XP

Installation under Windows* 2000

Preliminary Notes

The installation instructions in this section are based on the following assumptions:

- The wireless adapter hardware has already been installed in the computer in accordance with the computer manufacturer's instructions.
- The computer has not been powered on since the hardware installation was completed.
- No other wireless LAN card is installed in this computer.

To install the driver before installing hardware, use **Start > Run** and browse to the file **SetupWLD.exe** in the path **PROW2200\WIN2K** on the Intel CD. After running SetupWLD.exe, shut down the computer and install the hardware. When the computer restarts, the driver will be automatically installed.

After loading the Windows 2000 operating system, be sure to log in with administrative rights. If you log in to Windows 2000 without administrative rights, you may run into problems during the installation.

During initial adapter installation and configuration, it may take up to two minutes for adapter settings to be confirmed.

Driver Installation

To install driver software in Windows* 2000, follow these steps:

1. Power up the computer in which the wireless adapter hardware has just been installed.
2. Log in with administrative rights when prompted by Windows 2000.
3. Wait for Windows to detect the newly installed hardware and display the **Found New Hardware Wizard** dialog. If Windows does not detect the new hardware, see Troubleshooting.
4. Insert the Intel CD-ROM into your CD-ROM drive. If the **Intel(R) PRO Network Connections** menu screen appears, leave it open and click the **Found New Hardware Wizard** dialog to make that the active window.
5. On the **Install Hardware Device Drivers** screen verify that **Search for a suitable driver for my device (recommended)** is selected, then click **Next**.
6. When the **Locate Driver Files** dialog appears, verify that the item **CD-ROM drives** is checked and click **Next**.
7. When the **Driver Files Search Results** dialog appears, indicating that a driver was found, click **Next**.
8. On the **Network Name** screen, click **Next** to accept the default Network Name (SSID), or enter a specific SSID for your network, then click **Next**.
9. On the **Data Encryption** screen, click **Next** to accept the default encryption setting **None**, or enter specific encryption settings for your network, then click **Next**.
10. On the **Found New Hardware Wizard** screen, click **Finish**. Proceed to install Intel(R) PROSet.

Intel(R) PROSet Installation (Required)

Continue with the following steps to install the Intel(R) PROSet wireless configuration utility (required):

Some versions of this product do not support the **Intel(R) PRO Network Connections** menu screen for installation of utility software. If the Intel(R) PRO Network Connections menu screen does not appear, or if it does not have a menu item for Wireless LAN Adapters, you can start the Intel(R) PROSet installer manually using **Start > Run** and browsing to the file **iSetup.exe** in the path **APPS/PROSET/WINXPT32** on the Intel CD supplied with the product. Skip Steps 11 and 12 below and continue with **Step 13**.

11. On the **Intel(R) PRO Network Connections** screen, click **Wireless LAN Adapters**.

    This screen may have been launched in step 4 above. If the screen is not visible when you close the **Found New Hardware Wizard** dialog, display it by removing and re-inserting the Intel CD, or by running autorun.exe from the CD.

12. On the **Intel PRO/Wireless LAN Adapters** menu screen, click **Install Software**.
13. On the **Welcome to the InstallShield Wizard for Intel(R) PROSet** screen, click **Next**.
14. On the **License Agreement** screen, after reading the license agreement, select **I accept the terms in the license agreement** and click **Next**.
15. On the **Setup Type** screen, verify that **Typical** is selected, then click **Next**. This is the recommended setting for a first-time installation.
16. On the **Ready to Install the Program** screen click **Install**.
17. After the software is installed on your computer, click **Finish**. Click Exit to close the **Intel(R) PRO Network Connections** screen.
18. To launch Intel(R) PROSet, double-click the Intel(R) PROSet icon in the system tray or follow the path **Start > Programs > Intel Network Adapters > Intel(R) PROSet**. For additional information on the program, press **F1** or click **Help** while the program is running.

During initial adapter installation and configuration, it may take up to two minutes for adapter settings to be confirmed.

Uninstalling Intel(R) PROSet

After uninstalling Intel(R) PROSet using the "add/remove" feature in Windows, re-boot the computer. Any current connection remains active (the profile is active) until the computer re-boots.

Installation under Window* XP

Preliminary Notes

The installation instructions in this section are based on the following assumptions:

- The wireless adapter hardware has already been installed in the computer in accordance with the computer manufacturer's instructions.
- The computer has not been powered on since the hardware installation was completed.
- No other wireless LAN card is installed in this computer.

To install the driver before installing hardware, use **Start > Run** and browse to the file **SetupWLD.exe** in the path **PROW2200\WINXP** on the Intel CD. After running SetupWLD.exe, shut down the computer and install the hardware. When the computer restarts, the driver will be automatically installed.

Before proceeding, make sure that you are operating Windows XP with administrative rights. If you log in to Windows XP without administrative rights, you may run into problems during the installation.

The Intel(R) PROSet utility or the Windows XP wireless configuration feature can be used to configure wireless network settings. The instructions below include steps for installing the Intel(R) PROSet utility and for turning off the Windows XP configuration feature. If you do not turn off the Windows XP feature, you will not be able to use Intel(R) PROSet to configure wireless network settings. For information on how to use the Windows XP feature, see your Windows XP documentation.

Driver Installation

To install drivers under Windows* XP, follow these steps:

1. Power up the computer in which the wireless adapter hardware has just been installed.

2. Log in with administrative rights if prompted by Windows XP.
3. Wait for Windows to detect the newly installed hardware and display the **Found New Hardware Wizard** dialog. Verify that **Install the software automatically (Recommended)** is selected. If Windows does not detect the new hardware, see Troubleshooting.
4. Insert the Intel CD into your CD drive. The **New Hardware Found Wizard** searches for the correct driver files and copies them to your hard drive.
5. On the **Network Name** screen, click **Next** to accept the default Network Name (SSID), or enter a specific SSID for your network, then click **Next**.
6. On the **Data Encryption** screen, click **Next** to accept the default encryption setting **None**, or enter specific encryption settings for your network, then click **Next**.
7. On the **Found New Hardware Wizard** screen, click **Finish**. Proceed to disable the Windows XP wireless configuration feature.

Disable Windows XP Wireless Configuration (Required)

To disable the Windows XP wireless configuration feature so that you can use Intel(R) PROSet for wireless configuration, continue as follows:

Instructions are written for use with the Windows XP Start Menu and Control Panel Category View, not with "Classic" Start Menu or Control Panel views.

8. Click **Start** and **Control Panel**.
9. On the **Pick a category** screen, click **Network and Internet Connections**, then under the heading **or pick a Control Panel icon** click **Network Connections**.
10. In the **Network Connections** window, right-click your **Wireless Network Connection** and select **Properties**.
11. Select the **Wireless Networks** tab.
12. Click to clear ("deselect") the check box **Use Windows to configure my wireless network settings**, then click **OK** on the **Wireless Network** tab. Do not click any other tabs. Continue with the installation of Intel(R) PROSet.

Intel(R) PROSet Installation (Required)

Continue with the following steps to install the Intel(R) PROSet wireless configuration utility (required):

Some versions of this product do not support the **Intel(R) PRO Network**

Connections menu screen for installation of utility software. If the Intel(R) PRO Network Connections menu screen does not appear, or if it does not have a menu item for Wireless LAN Adapters, you can start the Intel(R) PROSet installer manually using **Start > Run** and browsing to the file **iSetup.exe** in the path **APPS/PROSET/WINXP32** on the Intel CD supplied with the product. Skip Steps 13 and 14 below and continue with **Step 15**.

13. Display the **Intel(R) PRO Network Connections** screen by removing and re-inserting the Intel CD, or by running autorun.exe from the CD. Click **Wireless LAN Adapters**.
14. On the **Intel PRO/Wireless LAN Adapters** menu screen, click **Install Software**.
15. On the **Welcome to the InstallShield Wizard for Intel(R) PROSet** screen, click **Next**.
16. On the **License Agreement** screen, after reading the license agreement, select **I accept the terms in the license agreement** and click **Next**.
17. On the **Setup Type** screen, select **Typical** and then click **Next**. This is the recommended setting for a first-time installation.
18. On the **Ready to Install the Program** screen click **Install**.
19. After the software is installed on your computer, click **Finish**. Click **Exit** to close the **Intel(R) PRO Network Connections** screen.
20. To launch Intel(R) PROSet, double-click the Intel(R) PROSet icon in the system tray or follow the path **Start > Programs > Intel Network Adapters > Intel(R) PROSet**. For additional information on the program, press **F1** or click **Help** while the program is running.

Uninstalling Intel(R) PROSet

✎ After uninstalling Intel(R) PROSet using the "add/remove" feature in Windows, re-boot the computer. Any current connection remains active (the profile is active) until the computer re-boots.

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Troubleshooting: Intel(R) PRO/Wireless 2200BG User's Guide

Troubleshooting

LAN Utility Conflict Message

Message dialog "Another wireless LAN utility is communicating with the Intel(R) PRO/Wireless LAN adapter. To avoid conflicts, Intel(R) PROSet has temporarily disabled its Profile Management features" is displayed. Refer to Enabling Intel(R) PROSet to manage Your Wireless Connections for information.

Using a Profile with an incorrect WEP Encryption Key

When connected to an access point using a profile with an incorrect WEP key encryption, the task tray icon and the General page will both indicate good signal strength and that you are associated with the AP. However, when you attempt to send data to the AP using this profile, because of the incorrect WEP key encryption, authentication cannot be established to acquire an IP address from the AP to allow data transfer.

Refer to the following WEP encryption and authentication settings.

Open Authentication with an incorrect WEP 64 or 128-bit encryption key:

- A profile with an incorrect WEP encryption key will allow the wireless adapter to associate with the access point.
- No data transfer

Open Authentication with no WEP encryption:

- Allows association to an access point
- Data transfer is allowed

Shared Authentication:

- Associated to an AP always allows data transfer.

Problems with installation

Windows does not detect the wireless adapter:

1. Remove and re-install the adapter.
2. Uninstall and reinstall the adapter's drivers.

Before calling Customer Support

Make a note of the following answers before calling customer support:

- From the **General** tab, view the adapter's connection details. Check that it is associated with an access point, and the quality and strength of the signal.
- From the **General** page, click the **Details** button and check what revision of software and hardware or other LAN software are you running?
- How many remote units do you have talking to each access point?
- What channels are you using, and how are they dispersed?
- How much coverage overlap is there between access points?
- How high above the floor are the access points mounted?
- What other electronic equipment is operating in the same band?

- What construction materials are used in wall and floors?

Users are dropped from the wireless network

Suggested causes and solutions:

- Find out if a person or workgroup moved or if the building has been rearranged.
- If two or more users are seated too close to each other, performance can suffer. Instruct your users to space themselves a small distance apart to keep receivers from being overloaded.
- Delivery trucks with very large metal sides can affect performance by reflecting destructive signals back into a building. If you have an installation that includes a shipping dock, check to see if the problem coincides with the arrival of large trucks.
- Personal “systems” can also interfere with your network. Wireless speakers, cordless earphones, some Bluetooth devices, and similar systems can be the source of an infrequent but hard to find the problem. Some systems do not conform to wireless regulations. Shut off suspect devices or remove them from the area.
- If possible, remove and reinstall your new software. Conflicts with other resident software packages are always a possibility, and they are not always the fault of the newest addition. Sometimes just starting over fixes the problem.
- Swap units around. Does your problem follow the changed units, or is it unique to a specific location? If it follows the product, the swapped unit could be damaged, or improperly configured. If the problem stays with the location, try to find out what is different about that particular room or area.

Range decreases as data rate increases

This is a normal condition. Range is inversely proportional to data rate: the faster the data, the shorter the range. This has to do with the modulation technology used. Very fast data rates require extremely complex signal waveforms, where even minor distortions can result in data errors. Slower data rates are much more tolerant, and consequently will get through even in the presence of some amount of noise, interference, distortion and echo.

Signal doesn't pass through a short or thin wall

Range is highly dependent on the physical environment. In a line-of-sight location, with elevated and calibrated antennas, range predictions are quite accurate. This is not true in a “typical” office building, where the walls may be simple drywall (which is almost transparent to microwaves), or could be plaster with metal underneath. Most sites are somewhere between these two extremes, and consist of a mixture of surfaces. You can’t tell what is inside a wall by just looking at it, and we can’t tell you exactly what distance you will achieve. Consider published range information to be typical, average, common or usual. Do not expect it to be exact.

Signal strength drops when a cell phone is used in the area

Range also depends on the electronic environment. If other equipment that could cause interference is nearby, the range of your transceiver could vary widely, and could change suddenly when the other equipment activates. This is particularly true for 802.11b installations, which share their frequencies with microwave ovens, cordless phones, wireless hi-fi speakers, electronics toys and similar devices. Try to keep your system away from other transmitters, and from other sources of electrical noise, such as large motors, spot welders, and similar “electronically noisy” devices.

Range is shorter than it should be

Repeat some tests late in the evening, or on a weekend, when there may be less interference. However, some users leave their networks turned all the time so this test is not foolproof. By all means, try more than one channel. Your range problem may just be a nearby user whose system uses your present test channel.

Interference from fluorescent lights

If you mount an access point close to fluorescent light fixtures, the lamp glow appears constant, but inside the lamp tube, ionization appears and disappears 120 times a second. This can modulate or “chop” an incoming signal and interfere with reception.

When too much range is undesirable

Too much range is not necessarily a good thing. At first it would appear that you would want as much range as possible, but with the increase in range comes an increase in interference potential, as your unit hears not only your other units but also manages to hear the systems of other companies up and down the street. If you have a large installation, you will also wind up with more than one access point using the same channel. If a remote unit hears two or more access points, this will slow the network.

Help Prevent access to wireless networks from outside the building

Excess *transmit* range presents a special reverse problem. For example, putting an access point adjacent to a second floor bay window invites anyone with the right software on the street below to pick up and enjoy all network transmissions. We discuss some possible solutions to this problem further on.

Problems with Network Connectivity

If you cannot connect to the wireless network, try the following:

Check Network Settings

1. From the **General** page, check that the Network Name (SSID) and operating mode are correct. If the laptop is configured for ad hoc networking, make sure that the channel is correct.
2. To correct these settings, click the **Networks** tab.
3. Select the profile being used.
4. Click the **Edit** button and make the changes.

Access Point Connection Problems

Check the preamble length setting in the Windows Device Manager “Advanced” tab.

If it is determined that a short preamble length is required to connect to an access point, try changing the "Auto” (default) setting to "Long Only," this option always uses a long preamble. Refer to "Changing the Preamble Length Setting" for details.

Check Security Settings

1. From the **General** page, check that the security settings are correct.
2. To correct the security settings, click the **Networks** tab.
3. Select the profile being used.
4. Click the **Edit** button.
5. Click the **Security** tab. Make sure that the settings for WEP encryption are correct.

Checking Adapter Statistics

Adapter Statistics

If the adapter is communicating with an access point (infrastructure mode) or other computers in peer-to-peer mode, click the **Statistics** button in the Troubleshooting tab to display the current information about how well the adapter is transmitting and receiving information.

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Connecting to a Network: Intel(R) PRO/Wireless 2200BG User's Guide

Connecting to a Network using Intel(R) PROSet

Enabling Intel(R) PROSet to manage Your Wireless Connections

If you are using Windows XP as your wireless manager the following described how to enable Intel(R) PROSet as your wireless manager.

1. From the Desktop, Click the **Start button > Control Panel.** If you are looking at the Category View of Control panel, click **switch to classic view**. If you are looking at the classic view of control panel, go to the next step.
2. Right-click **Network Connections**, then click **Open**.
3. In Wireless Network Connection Properties, Click the **Wireless Network** tab, verify that the *Use Windows to configure my wireless network settings* checkbox is clear

(unchecked).
4. Double-click the **Intel(R) PROSet** icon in the desktop task tray.
5. If you have previously setup your profiles, click the **Networks** tab. The profile list should display available networks to connect to. If no profiles have been established, refer to Creating a New Profile for more information.

System Wide Advanced Settings

Profile Management Options

The following Profile Management options can be found in **Advanced Settings**.

Display available networks when not associated: When cleared, disables the Intel(R) PROSet wireless manager dialog listing the available networks. When checked, the Intel Configuration Service running in the background automatically displays available networks not listed in the Profile List. This method provides automatic connection to available networks in the range of your wireless adapter. The Configuration Service constantly monitors your wireless adapter's connection status. If no matching profiles are found in the Profile List for a network, a dialog automatically displays the available network access points and computers (ad hoc mode) within range of the wireless adapter. The Configuration Service can also be used if there is more than one wireless adapter installed using 802.11b bands. When the Intel Configuration Service dialog is displayed, listing the available networks, checking "Don’t show this again" option, will prevent the dialog from displaying again if the adapter becomes unassociated. The Configuration Service will continue to function and attempt to connect, using a profile from the Profile List, or to an available network depending on the selection mode. This means that if Connect Using Preferred Profiles Only is selected and no matching profile is found, then the adapter will remain unassociated. You can still use the Connect button from the Networks tab to connect to an available network.

Notify when disabling profile management features: When cleared, Windows XP Zero Configuration wireless manager is enabled. When checked, a message dialog "Another wireless LAN utility is communicating with the Intel(R) PRO/Wireless LAN adapter. To avoid conflicts, Intel(R) PROSet has temporarily disabled its Profile Management features" is displayed. For instance, if Windows XP Zero Configuration is enabled, the Connect button on the Profile page cannot be used to connect to any available networks. The Scan button can be used to scan for available networks.

However, the Connect button is non-functioning when used to connect to an available network.

- Ad hoc mode is disabled. The Connect button in the ad hoc connect dialog is non-functioning.
- Task tray icon menu: Launching an ad hoc profile and applying a profile from the task tray menu is not available.

Notify when Windows XP Zero Configuration is enabled: If the box is cleared (default setting is checked), it indicates that Windows XP Zero Configuration wireless manager is enabled. The XP notification dialog is displayed indicating that Windows XP is currently configured to manage the wireless adapter. Do you wish to disable Windows XP management and let Intel(R) PROSet manage your wireless network?

- Select yes, Intel(R) PROSet will manage the wireless adapter.
- Select No, Windows XP will manage the wireless adapter.

Enable Profile Management Features: If the box is checked, it indicates that Intel(R) PROSet is the default wireless network manager. If cleared, Windows XP is the wireless network manager.

NOTE: *If Windows XP Zero Configuration is enabled while using Intel(R) PROSet, a notification dialog displays, if you choose "No" on this dialog, the Intel(R) PROSet profile management features are disabled. Refer to the Advanced Settings for more information.*

Mixed mode protection: Use **RTS/CTS enabled** to avoid collisions in mixed mode environments where the 802.11g and 802.11b clients cannot hear each other. **CTS-to-self enabled** improves performance in mixed mode environments where 802.11g and 802.11b clients are in close proximity and can hear each other.

Intel(R) PROSet Configuration Service

The Configuration Service feature operates in background to automatically display available networks not listed in the Profile List. This method provides automatic connection in a 2.4 environment to available networks in the range of your wireless adapter. The Configuration Service constantly monitors your wireless adapter's connection status. If no matching profiles are found in the Profile List for a network, a dialog automatically displays the available network access points and computers (ad hoc mode) within range of the wireless adapter. The Configuration Service can also be used if there is more than one wireless adapter installed using 802.11b band.

The Configuration Service features:

- The Configuration Service is launched when you log on to your computer.
- No *active* profile switching will be performed. Once the adapter is associated with the access point, if a higher priority profile becomes available, no switching will occur.
- The Configuration Service is only available if Intel(R) PROSet is installed.
- If a connection to an access point cannot be made using any of the profiles in the Profile List, a dialog will display the available networks.
- If there are multiple profiles listed for an available network, a dialog box will list the profiles for you to choose from.
- If an available network is detected with WEP encryption and authentication, a dialog for setting up WEP encryption displays before the connection is made.

The Configuration Service can be used in two ways:

1. Connect to available network using profiles only: In this mode the Configuration Service attempts to connect to a network access point using profiles from the Profile List only. If no matching profile is found, a dialog appears that lists the available networks. You can also close this dialog without connecting by clicking the Cancel button. The adapter will remain unassociated, and the list of available networks will NOT be displayed again unless another available network is detected. This mode is set in the Advanced Setting options.
2. Connect to any available network if no matching profile found: In this mode the Configuration Service attempts to connect to a network access point first using profiles from the Profile List. If no matching profile is found, the Configuration Service automatically connects to any available network. This mode is set in the Advanced Setting options.

Enabling Automatic Connection

The Configuration Service also monitors for the "resume status" after a laptop computer suspend event. When this occurs, the Configuration Service will re-enable the automatic connection service.

These features can be enabled again after rebooting your computer or after a suspend and resume cycle.

Features affected when another profile management application is detected

For AAA Client:

Select OK, and the AAA Client application will manage the adapter. The current connection will continue with the affected Intel(R) PROSet features show below. To avoid conflicts, the Intel(R) PROSet profile management features have been temporarily disabled. To re-enable these features, first disable the other LAN utility and then either:

1. Re-enable from Intel(R) PROSet's Advanced Settings.
2. Resume after a computer suspend.
3. Reboot the computer.

NOTE: ***AAA Client Wireless Manager*** *- If PROSet detects another wireless AAA client manager, a notification dialog displays, if you choose "OK" on this dialog, the Intel(R) PROSet profile management features are automatically disabled. The Advanced Setting "****Notify when disabling profile management features****" check box must be checked in order to display the notification dialog if Windows XP Zero Configuration in not enabled. The default setting is enabled (checked).*

For Windows XP Zero Configuration:

- Select Yes, to disable Windows XP Zero Configuration. Intel(R) PROSet will continue to manage the adapter.
- Select No, Windows XP will manage the adapter. The current connection will continue with the affected Intel(R) PROSet features show below. You can also prevent the dialog from being displayed again, in which case Windows XP Zero Configuration will automatically manage the wireless adapter. The notification dialog can be re-enabled from the Advanced Settings options.

Affected Intel(R) PROSet features:

- The Connect button on the Profile page is non-functioning.
- The Scan button can be used to scan for available networks, however, the Connect button is non-functioning when used to connect to an available network.

- Ad hoc mode is disabled. The Connect button in the ad hoc connect dialog is non-functioning.
- Task tray icon menu: Launching an ad hoc profile and applying a profile from the task tray menu is not available.

NOTE: *If the buttons described above are used, the following message displays: "Another wireless LAN utility is communicating with the Intel(R) PRO/Wireless LAN adapter. To avoid conflicts, Intel(R) PROSet has temporarily disabled its Profile Management features."*

Scanning for Available Networks

A fast way to connect to a network is to use the **Scan** button to search for a network access point in range of your wireless adapter. When a network is found, you can instantly connect without a profile or create a new profile.

NOTE: *Profiles with the Enable Auto-Import feature enabled will also be displayed in the profile list of available networks. Refer to Automatic Profile Distribution for more information.*

To scan for available networks:

1. From the General page, select the wireless adapter on the left side pane.
2. Select the **Networks** tab.
3. Click the **Scan** button.
4. The Available Networks dialog displays the names of the available networks. Click the **Refresh** button to refresh the list of available networks.
5. Select the network from the list, and click the **Connect** button.
6. Select the network profile name with **<no profile>** shown, and click the **Connect** button.
7. Click the **No, connect me directly without creating a profile** option. Note, you can click **Yes, create a profile for this network now** to create a profile to be used later.

NOTE: *If the selected network has 802.11x authentication, you must first create a profile using the Profile Wizard. However, if the network has no WEP security (Open), WEP 64 or 128-bit encryption, or WPA-PSK, you can enter the required security settings in the dialog that displays after clicking the Connect button. Then a one time connection without a profile can be made.*

- **The selected network has WPA-PSK security settings:** If the selected network has 802.1x authentication security settings, after clicking the Connect button, the Profile Wizard Advanced Security page will display. From this dialog you can enter the 802.1x settings and connect to the network.
- **The selected network has no (Open) WEP security settings:** If the selected network has no security (Open). Click the Connect button to connect to the network.
- **The selected network has WEP security settings:** If the selected network has WEP encryption security settings, after clicking the Connect button, the Profile Wizard Advanced Security page will display. From this dialog you can enter the WEP security settings and connect to the network.

8. Click **OK** to connect to a network.

Connecting to a Network Using an Access Point

An infrastructure network consists of one or more access points and one or more computers with wireless adapters installed. Each access point must have a wired connection to the Local Area Network (LAN).

You can connect to a network by first creating a new profile using the Profile Wizard, then selecting that profile to connect to the network access point using the Connect button. You can also connect to a network, by using the Scan button. Refer to Creating a New Profile for more information.

Connecting to a Peer-to-Peer (Ad Hoc) Network

In peer-to-peer (ad hoc) mode, you can send and receive information to other computers in an ad hoc network. All wireless clients in the ad hoc network must use the same network name (SSID) and channel number. For a list of allowed 802.11b ad hoc channels, refer to the Adapter Settings for more information.

NOTE: *While scanning with an ad hoc profile set to a specific transmit channel, if an ad hoc network is found on another channel, you will be connected using the new channel. The new channel number is displayed in the Adapter Settings.*

Connect to an Ad Hoc Network

NOTE: *For information about connecting to an ad hoc using a profile, refer to Create an Ad Hoc Profile using the Profile Wizard.*

- Connect using an ad hoc profile. Refer to Creating a New Profile for details. Select an ad hoc profile from the Profile List and click the **Connect** button. This method uses a pre-defined ad hoc profile created by the Profile Wizard. The ad hoc profile is displayed in the Profile List. When joining an ad hoc network, the transmit channel established by the first computer is used. This channel may be different than the one selected when the ad hoc profile was created by the Profile Wizard.

Ending an Ad Hoc Session

To end an ad hoc session, click the **Close** button. After the session is ended, an attempt is made to re-connect to the last profile used from the Profile List.

Creating an Ad Hoc Profile Using the Profile Wizard

The following describes how to create a new ad hoc profile using the Profile Wizard and connect to an ad hoc network

General Settings

1. From the **General** page, click the **Networks** tab.
2. Click the **Add** button. The General Settings dialog displays.
3. Enter a profile name in the **Profile Name** field.
4. Enter the network SSID, in the **Network Name (SSID)** field.

5. Click **Ad hoc** operating mode.
6. Click **Password protect this profile** to set a profile password.
7. Click **Next**.

Security Settings

8. Select either **None, WEP** for the data encryption.
9. If WEP is selected, select either **64** or **128**-bit for the Encryption Level.
10. Select the key index **1, 2, 3** or **4**.
11. Enter the required **pass phrase** or **hex key**.
12. If the Password Protection checkbox was checked on the General settings page, then
    click **Next** to display the Password page.

Password Protection Settings

13. Click the **Password protect this profile** checkbox.
14. Enter a password in the Password field.
15. Reenter the same password in the Confirm New Password field.
16. Click the **Back** button to change or verify the settings or click **Finish** when you have completed the profile settings and return to the Networks page.

Connect to the Network

17. **Changing the default transmit channel from the Adapter tab:** Unless the other computers in the ad hoc network use a different channel from the default channel, there is no need to change the default channel. If you want to change the default channel, click the **Adapter** tab, and click **Configure** under Ad Hoc Channel Selection. Choose the operating band select a channel. Click **OK** to save the setting.
18. Select the **Networks** tab
19. After creating the new profile, click the profile in the Profile List. Profiles using ad hoc mode are indicated by a computer icon next to the profile name.
20. Click the **Connect** button to connect to the ad hoc network.

Switching the Radio Off/On

When your computer is switched on, if the radio is enabled it is constantly transmitting signals. In certain situations, such as landing or takeoff of an airplane, the radio signals may need to be turned off, if not these signals may cause interference. The following describes how to use your keyboard (if this option is available) and Intel(R) PROSet to switch the radio on or off.

The radio can be enabled or disabled from your computer keyboard, the task tray wireless menu option and from Intel(R) PROSet. The current status of the radio is displayed in the task tray wireless icon and on the General page.

Using the optional hardware radio on/off switch

The radio can enabled or disabled from your keyboard, or from an external hardware switch if these options are available. Refer to your computer manufacturer for more information. Intel(R) PROSet displays the current state of the radio on the General page if one of these option is installed.

Using Intel(R) PROSet to switch the radio on/off

The radio can be switched on or off from General page in Intel(R) PROSet. The current state of the radio is displayed in the wireless adapter task tray menu option. The General page also displays the current state of the radio if the hardware option is installed.

Switching the radio On/Off

Note: When your laptop is switched on, the radio is constantly transmitting signals. In certain situations, such as in a plane, signals from the radio may cause interference.

To switch the radio OFF: From the **General** page; click the **Off** button next to Switch Radio On/Off.

- The wireless adapter is not associated with the network when the radio is off.
- Intel(R) PROSet can be used to edit or add profile contents when the radio is off.

To switch the radio ON: From the **General** page; click the **On** button next to Switch Radio On/Off.

When the radio is on, an attempt will be made to associate with the network access point using the last profile. If the adapter cannot connect to the access point, the Configuration Service will attempt to find an available network. Refer to Configuration Service for more information.

Switching the radio on or off from the Task Tray menu option

Right-click the wireless icon in the task tray and select the wireless adapter being used. Depending on the previous state of the radio, select **Switch Radio Off** (radio is already ON, select to turn OFF) or **Switch Radio On** (radio is already OFF, select to turn ON).

Disable the Radio from Windows

The radio can be disabled (made non-functional) via the Windows operating system using Device Manager.

Windows XP/2000

1. From your desktop, right-click **My Computer** and click **Properties**.
2. Click the **Hardware** tab.
3. Click the **Device Manager** button.
4. Double-click **Network adapters.**
5. Right-click the installed wireless adapter in use.
6. Choose **Disable** from the pop-up menu.
7. Click **OK**.

Viewing Adapter Advanced Settings in Windows

The following advanced options are available in the Windows Device Manager Advanced tab if Intel(R) PROset is *not* installed. If PROSet is installed the Advanced tab displays the Open button. Selected this button to open PROSet. Some of the options are also available in Intel(R) PROSet.

Advanced tab option under Windows XP and 2000:

- **Ad Hoc Transmit Power** - Set 802.11b ad hoc output power level of the wireless adapter.
- **Power Management** - Set a balance between the computer's power source and

the battery.

- **Wireless Mode** - Select the wireless mode (modulation type) for date rate. Default setting: "Connect to 802.11g and 802.11b." This option uses both 11 Mbps and 54 Mbps date rate. Other options are, "Connect to 802.11g only" and "Connect to 802.11b only."
- **Preamble** - The preamble property allows you to select the length of the preamble used to make a connection. Only available in the Windows Advanced dialog. See "Changing the Preamble Length Setting" for details.

To access the Advanced options:

1. From your desktop, right-click **My Computer** and click **Properties**.
2. Click the **Hardware** tab.
3. Click the **Device Manager** button.
4. Double-click **Network adapters.**
5. Right-click the name of the installed wireless adapter in use.
6. Select the Advanced tab.

Changing the Preamble Length Setting

The preamble property allows you to select the length of the preamble used to make a connection. If you have a problem connecting to an access point, please contact your system administrator or check the preamble length setting. If it is determined that a long preamble length is required to connect to the access point, try changing the preamble to "Long Only," this option always uses a long preamble to connect to the access point. The "Auto" (Default) setting option allows automatic detection of the preamble setting received from the access point to enable the appropriate preamble option. Short preamble is used if this option is supported, if not, long preamble is used.

To enable "Long Only" preamble length under Windows XP and 2000:

1. Start Windows and log on with administrative privileges.
2. Right-click on **My computer** on your Desktop and select **Properties**.
3. Click the **Hardware** Tab and click **Device Manager**.
4. Click **Network Adapter**, locate your installed wireless adapter, right-click on the device and select **Property**.
5. Click on **Advanced** Tab.
6. Select **Preamble**.
7. Click **Use default value**, to uncheck the box.

8. Select **Long Only** from the drop-down box.
9. Click **OK** to save and exit the dialog.

Advanced Tab Preamble Description

Property	**Value**
Preamble	**Auto (Default):** This option allows automatic detection of the preamble setting received from the access point to enable the appropriate preamble option. Short preamble is used if this option is supported, if not, long preamble is used.
	Long Only: Always use a long preamble length to connect to an access point.

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Using PROSet Profiles: Intel(R) PRO/Wireless 2200BG User's Guide

Using Intel(R) PROSet Wireless Profiles

Setting up Windows Network Profiles

A profile is a saved group of network settings. Profiles are displayed in the Profile List in the wireless client manager General page. Profiles can be arranged in order of network connection priority. You can connect to one network using the first profile in the Profile List, then automatically connect to another network using the next profile. This allows you to stay connected while roaming freely from one wireless network to another. Although you can assign multiple profiles to a single network, you can only use one profile per connection. To add a new profile, use the Profile Wizard sequence of dialogs to configure the profile contents. The following example uses all of the Profile Wizard dialogs. Some settings may not be required for all profiles.

Refer to the following to setup profile connection preferences:

Profile Connection Preferences

To access the profile connection preference option:

1. From the General page, click the **Networks** tab.
2. Click the **Advanced** button.
3. Under the **Auto-connection** heading, click the one of the following options:

- ***Connect to available networks using profiles only*** *(Default setting)*: Use the profiles in the Profile List to connect to any available network.
- ***Connect to any available network if no matching profile is found*****:** Connect to any available network without using a profile from the Profile List.
- ***Connect to any network based on profiles only (Cisco Mode):*** Connect to any available network access point using profiles enabled for Cisco CCX (version 1) mode. This mode allows connection to access points that support multiple and blank network names (SSIDs).

4. Click **OK** to save the setting and return to the previous dialog.

Creating a New Profile

To add a new profile, use the Profile Wizard sequence of dialogs to configure the profile contents. The following example uses all of the Profile Wizard dialogs, although some of the settings may not be required.

To create a new profile and connect to a network:

1. From the General page, click the Networks tab.
2. Click the **Add** button. The General Settings dialog displays.

NOTE: *If this is the first time you have created a profile, click the profile named* ***Default*** *in the Profile List, click the* ***Edit*** *button and rename the default profile in the Profile Name field on the General page.*

General Settings

3. Enter a profile name in the **Profile Name** field.

4. Enter the network SSID, in the **Network Name (SSID)** field.
5. Click **Infrastructure** or **Ad hoc** for the operating mode.
6. Click **Password protect this profile** to set a password for the profile.
7. The Mandatory AP option is only used if Infrastructure mode is selected. Use this option to connect to a specific access point. Click the **Mandatory AP** button, enter the Ethernet address for the access point. Click **OK** to save the setting and return to the General Settings page.
8. Click the **Enable Cisco Client eXtentions** option to enable CKIP data encryption.
9. Check **Enable Auto-Import** to allow this profile to be imported. Refer to Automatic Profile Distribution for more information.
10. Click **Next**.

Security Settings

11. Select **Open** or **Shared** in the Network Authentication options. Open, does not use any authentication method. Shared uses the WEP key as the authentication method.
12. Select either **None, WEP or CKIP** (if **Enable Cisco Client eXtentions** is enabled on the General Settings page) for the data encryption.
13. If WEP is selected, select either **64** or **128**-bit for the Encryption Level.
14. Select the key index **1, 2, 3** or **4**.
15. Enter the required **pass phrase** or **hex key**.
16. Click the **802.1x Enabled** checkbox to enable the 802.1x security option.
17. Select **MD5** as the 802.1x Authentication Type.
18. Click the **Configure** button to open the MD5 Setting dialog. Enter the user name and password of the user you have created on the authentication server. The user name and password do not have to be the same as name and password of your current Windows user login.
19. Click **Close** to save the settings.
20. If the Password Protection checkbox was checked on the General settings page, then
    click **Next** to display the Password page.

Password Protection Settings

21. Click the **Password protect this profile** checkbox.
22. Enter a password in the Password field.
23. Reenter the same password in the Confirm New Password field.
24. Click the **Back** button to change or verify the settings or click **Finish** when you

have completed the profile settings and return to the Networks page.

Connect to the Network

25. Click the new profile name shown in the Profile List. Use the up and down arrows to position the priority of the new profile in the priority list.
26. Click the **Advanced** button to set the network connection preferences.
27. Click the **Connect** button to connect to the network.
28. Click **OK** to close the Intel(R) PROSet dialog.

Importing and Exporting Profiles

NOTE: *A password protected profile can be imported and exported, however, before editing the profile, the password must be entered. Refer to Setting a Profile Password for more information.*

To import profiles:

1. From the **General** page, click the **Networks** tab.
2. Click the **Advanced** button.
3. Click the **Import/Export** button.
4. Click the **Import** button.
5. Locate the profile to import on your hard disk or enter the profile name in the File name field. The profile extension is .profile.
6. Click the **Import** to import the profile into the Profile List.
7. Click **OK** three times to return to the Networks page.

To export profiles:

1. From the **General** page, click the **Networks** tab.
2. Click the **Advanced** button.
3. Click the profiles to export from the export profile list.
4. Click the **Browse** button and select a directory to save the profiles in. Click **OK** to return to the previous dialog.
5. Click the **Export** button to start exporting the profiles.
6. Click **OK** three times to return to the Networks page.

Setting a Profile Password

To set a password for an existing profile:

1. Select the profile from the Profile List in the Networks page, and click the **Edit** button.
2. Click the **Password** tab.
3. Click the check box next to "Password protect this profile" to enable profile password.
4. Enter a ten character password in the Password field.
5. Enter the new password again in the Confirm New Password field.
6. Click **OK** to exit and return to the Networks page.

To password protect a new profile:

1. From the Networks page, and click the **Add** button.
2. Enter the required Profile name and network SSID information.
3. Click the **Password protect this profile** check box on the General Settings dialog.
4. Click **Next** and enter the security settings.
5. Click **Next**.
6. Click the Password protect this profile check box.
7. Enter the password and confirm password information.
8. Click **Finish** to save the profile settings and return to the Networks page.

Automatic Profile Distribution

The Enable Auto-Import feature allows a network administrator to distribute a profile automatically to computers connected to a network. The Enable Auto-Import box is located on the Profile Wizard dialogs. When the checkbox is checked the profile must be copied to a specific directory on the host computer, from there it can be distributed to multiple computers. Once the profile is received by the remote computer it will automatically be available for use from the Scan profile list. If an attempt is made to edit a distributed profile that is password protected, a password prompt will appear.

Automatically importing WLAN profiles is accomplished by monitoring the *import* folder on your hard disk for new profile files. Only profiles that have the **Enable Auto-Import** box checked on the Profile Wizard dialogs can be automatically imported. If a profile of the same name already exists in the Profile List, a dialog is displayed from which you can either reject the import, or accept in which case the existing profile will be replaced. All imported profiles will be placed at the bottom of the Profile List, and the profile file will be immediately deleted after the import whether the import was successful or not.

To import a profile into the profile list:

1. Select a profile to be edited from the Profile List in the Networks page, and click the **Edit** button or click the **Add** button to create a new profile using the Profile Wizard.
2. Check the **Enable Auto-Import** checkbox on the General page.
3. Click **OK** (Edit a profile) or **Finish** (Add a profile) to save the settings.
4. Export the profile from the profile list. Refer to Importing and Exporting Profiles for details.
5. Copy the exported profile from its directory to the **Programs Files\Intel\PROSet\Import** directory. The profile is now ready to distribute to other computers.

Editing an Existing Profile

To edit an existing profile:

1. From the **General** page, click the **Networks** tab.
2. Click the **Edit** button. The General page displays.
3. Click on the **General**, **Security**, and **Password** tabs to make the necessary changes for the network profile settings:
4. Click **OK** on any of the pages to save all the settings and return to the Networks page.

5. Click the new profile name shown in the Profile List. Use the up and down arrows to position the priority of new profile in the priority list.
6. Click the **Advanced** button to set the network connection preferences.
7. Click the **Connect** button to connect to the network.

Deleting a Profile

To delete a profile:

1. From the **General** page, click the **Networks** tab.
2. Click the profile to be deleted from the Profile List.
3. Click the **Delete** button.
4. Click **Yes** to permanently delete the profile.

NOTE: *You cannot delete all profiles from the profile list. There must always be one profile displayed in the list.*

Connecting to a Network without a Profile

To connect to an available network without a profile:

1. From the **General** page, click the **Networks** tab.
2. Click the **Scan** button.
3. Select the network profile name with **<no profile>** shown, and click the **Connect** button.
4. Click the **No, connect me directly without creating a profile** option. Note, you can click **Yes, create a profile for this network now** to create a profile to be used later.
5. Click **OK** to connect.

Connecting to a Network if a Blank SSID displays

If the wireless adapter receives a blank network name (SSID) from a stealth access point, both the blank SSID and <no profile> display in the available networks list. To associate with a stealth access point, a new profile must first be created before connection. After connection both the blank SSID and the associated SSID can be viewed in the available networks list.

To connect to an access point that transmits a blank network name (SSID) in the Available Networks list:

1. From the **General** page, click the **Networks** tab.
2. Click the **Scan** button.
3. Select the network name with a blank SSID and <no profile> shown in the Available Networks list.
4. Click the **Connect** button.
5. Click the **Yes, create a profile for this network now** option.
6. The Profile Wizard dialog displays. Enter a profile name and Network Name (SSID) and security settings if required. Click **Finish** to save the profile settings and return to the Networks page.
7. Select the new profile from the profile list and click **Connect**.

Loading a Profile from the Task Tray

To load a profile from the Task Tray:

1. Right-click **Intel(R) PROSet** icon in the task tray.
2. Select the Intel PRO/Wireless 2200BG adapter.
3. Click **Select Profile** and select the profile to be launched.

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Security Overview: Intel(R) PRO/Wireless 2200BG User's Guide

WEP Encryption and Authentication

Wired Equivalent Privacy (WEP) encryption and shared authentication provides protect for your data on the network. WEP uses an encryption key to encrypt data before transmitting it. Only computers using the same encryption key can access the network or decrypt the encrypted data transmitted by other computers. Authentication provides an additional validation process from the adapter to the access point.

Supported a uthentication schemes are Open and Shared-Key authentication:

- Shared-Key authentication is supported using 64-bit and 128-bit WEP encryption keys.
- Open mode does not use an encryption authentication method to associate to a specific access point.

Network Keys

When Data Encryption (WEP, CKIP or TKIP) is enabled, a network key is used for encryption. A network key can be provided for you automatically (for example, it might be provided on your wireless network adapter, or enter it yourself and specify the key length (64-bits or 128-bit), key format (ASCII characters or hexadecimal digits), and key index (the location where a specific key is stored). The longer the key length, the more secure the key. Every time the length of a key is increased by one bit, the number of possible keys double. Under 802.11, a wireless station can be configured with up to four keys (the key index values are 1, 2, 3, and 4). When an access point or a wireless station transmits an encrypted message using a key that is stored in a specific key index, the transmitted message indicates the key index that was used to encrypt the message body. The receiving access point or wireless station can then retrieve the key that is stored at the key index and use it to decode the encrypted message body.

Encryption Static and Dynamic Key Types

802.1x uses two types of encryption keys, static and dynamic. Static encryption keys are changed manually and are more vulnerable. MD5 authentication only uses static encryption keys. Dynamic encryption keys are renewed automatically on a periodic basis. This makes the encryption key(s) more secure. To enable dynamic encryption keys, you must use 802.1x certificate-based authentication methods, such as TLS or TTLS or PEAP.

Encryption Overview

Security in the WLAN can be supplemented by enabling data encryption using WEP (Wireless Encryption Protocol). You can choose a 64 or 128 bit level encryption. Also, the data can then be encrypted with a key. Another parameter called the key index is provides the option to create multiple keys for that profile. However, only one key can be used at a time. You can also choose to password protect the profile to ensure privacy. The pass phrase is used to generate a WEP key automatically. You have the option of either using a pass phrase or entering a WEP key manually. Using 64-bit encryption, the pass phrase is 5 characters long and you can choose to enter any arbitrary and easy to remember phrase like Acme1 or enter 10 Hexadecimal numbers for the WEP key corresponding to the network the user wants to connect to. For 128-bit encryption, the pass phrase is 13 characters long or you can enter a 26 hexadecimal numbers for the WEP key to get connected to the appropriate network.

Note: You must use the same encryption type, key index number, and WEP key as other devices on your wireless network. Also, if 802.1x authentication is being used, WEP encryption must be disabled.

Protecting Your Network

- Authentication Types
- 802.1x Authentication
- What is a RADIUS
- Wi-Fi Protected Access (WPA)
- PEAP
- Cisco LEAP

Authentication Types

The IEEE 802.1x standard provides a general authentication framework for 802 LANs and specifies an extensible authentication protocol (EAP) to enable LAN transport for many different types of authentication protocols. A WAN client initiates an authorization request to the access point, which authenticates the client to an Extensible Authentication Protocol (EAP) compliant RADIUS server. This RADIUS server may authenticate either the user (via passwords) or the machine (by MAC address). 802.1x authentication is independent of the 802.11 authentication process. The 802.1x standard provides an authentication framework. There are different 802.1x authentication types, each providing a different approach to authentication employing the same protocol and framework for communication between a client and an access point. In most protocols, upon the completion of the 802.1x authentication process, the supplicant receives a key that it uses for data encryption.

Refer to Setting up the Client for WEP and MD5 authentication for details about setting up an 802.1x profile.

802.1x Authentication

802.1x features

- 802.1x supplicant protocol support
- Support for the Extensible Authentication Protocol (EAP) - RFC 2284
- Supported Authentication Methods:
  - MD5 - RFC 2284
  - EAP TLS Authentication Protocol - RFC 2716 and RFC 2246
  - EAP Tunneled TLS (TTLS)
  - Cisco LEAP
  - PEAP
- Supports Windows XP, 2000

802.1x Authentication Notes

- 802.1x authentication methods, include passwords, certificates, and smart cards (plastic cards that hold data)
- 802.1x authentication option can only be used with Infrastructure operation mode
- Network Authentication modes are: EAP-TLS, EAP-TTLS, MD5 Challenge, LEAP (for Cisco-Client eXtentions mode only), and PEAP (for WPA modes only)

Overview

802.1x authentication is independent of the 802.11 authentication process. The 802.1x standard provides a framework for various authentication and key-management protocols. There are different 802.1x authentication types, each providing a different approach to authentication but all employing the same 802.1x protocol and framework for communication between a client and an access point. In most protocols, upon the completion of the 802.1x authentication process, the supplicant receives a key that it uses for data encryption. Refer to 802.1x and Data encryption for more information.

With 802.1x authentication, an authentication method is used between the client and a

Remote Authentication Dial-In User Service (RADIUS) server connected to the access point. The authentication process uses credentials, such as a user's password that are not transmitted over the wireless network. Most 802.1x types support dynamic per-user, per-session keys to strengthen the static key security. 802.1x benefits from the use of an existing authentication protocol known as the Extensible Authentication Protocol (EAP). 802.1x authentication for wireless LANs has three main components: The authenticator (the access point), the supplicant (the client software), and the authentication server (a Remote Authentication Dial-In User Service server (RADIUS). 802.1x authentication security initiates an authorization request from the WLAN client to the access point, which authenticates the client to an Extensible Authentication Protocol (EAP) compliant RADIUS server. This RADIUS server may authenticate either the user (via passwords or certificates) or the system (by MAC address). In theory, the wireless client is not allowed to join the networks until the transaction is complete. There are several authentication algorithms used for 802.1x; MD5-Challenge, EAP-TLS, EAP-TTLS, Protected EAP (PEAP), and EAP Cisco Wireless Light Extensible Authentication Protocol (LEAP). These are all methods for the WLAN client to identify itself to the RADIUS server. With RADIUS authentication, users identities are checked against databases. RADIUS constitutes a set of standards addressing Authentication, Authorization and Accounting (AAA). Radius includes a proxy process to validate clients in a multi-server environment. The IEEE 802.1x standard is for controlling and authenticating access to port-based 802.11 wireless and wired Ethernet networks. Port-based network access control is similar to a switched local area network (LAN) infrastructure that authenticates devices that are attached to a LAN port and prevent access to that port if the authentication process fails.

How 802.1x authentication works

A simplified description of the 802.1x authentication is:

1. A client sends a "request to access" message to an access point. The access point requests the identity of the client.
2. The client replies with its identity packet which is passed along to the authentication server.
3. The authentication server sends an "accept" packet to the access point.
4. The access point places the client port in the authorized state and data traffic is allowed to proceed.

What is a RADIUS?

RADIUS is the Remote Access Dial-In User Service, an Authorization, Authentication, and Accounting (AAA) client-server protocol for when a AAA dial-up client logs in or out of a Network Access Server. Typically, a RADIUS server is used by Internet Service Providers (ISP) to performs AAA tasks. AAA phases are described as follows:

- **Authentication phase:** Verifies a user name and password against a local database. After the credentials are verified, the authorization process begins.
- **Authorization phase:** Determines whether a request will be allowed access to a resource. An IP address is assigned for the Dial-Up client.
- **Accounting phase:** Collects information on resource usage for the purpose of trend analysis, auditing, session time billing, or cost allocation.

Wi-Fi Protected Access* (WPA)

Wi-Fi Protected Access (WPA) is a security enhancement that strongly increases the level of data protection and access control to a WLAN. WPA mode enforces 802.1x authentication and key-exchange and only works with dynamic encryption keys. To strengthen data encryption, WPA utilizes its Temporal Key Integrity Protocol (TKIP). TKIP provides important data encryption enhancements that include a per-packet key mixing function, a message integrity check (MIC) named *Michael* an extended initialization vector (IV) with sequencing rules, and a also re-keying mechanism. Using these improvement enhancements, TKIP protects against WEP's known weaknesses.

PEAP

PEAP is a new Extensible Authentication Protocol (EAP) IEEE 802.1x authentication type designed to take advantage of server-side EAP-Transport Layer Security (EAP-TLS) and to support various authentication methods, including user's passwords and one-time passwords, and Generic Token Cards.

Cisco LEAP

Cisco LEAP (EAP Cisco Wireless) is a server and client 802.1x authentication via a user-supplied logon password. When a wireless access point communicates with a Cisco LEAP-enabled RADIUS (Cisco Secure Access Control Server (ACS) server), Cisco LEAP provides access control through mutual authentication between client wireless adapters and the wireless network and provides dynamic, individual user encryption keys to help protect the privacy of transmitted data.

Cisco Rogue AP security feature

The Cisco Rogue AP feature provides security protection from an introduction of a rogue access point that could mimic a legitimate access point on a network in order to extract information about user credentials and authentication protocols which could compromise security. This feature only works with Cisco's LEAP authentication. Standard 802.11 technology does not protect a network from the introduction of a rogue access point.

CKIP

Cisco Key Integrity Protocol (CKIP) is Cisco proprietary security protocol for encryption in 802.11 media. CKIP uses the following features to improve 802.11 security in infrastructure
mode:

- Key Permutation
- Message Integrity Check
- Message Sequence Number

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Security and Encryption: Intel(R) PRO/Wireless 2200BG User's Guide

Security and Encryption

Setting up Data Encryption and Authentication

Wired Equivalent Privacy (WEP) encryption and shared authentication helps provide protection for your data on the network. WEP uses an encryption key to encrypt data before transmitting it. Only computers using the same encryption key can access the network or decrypt the encrypted data transmitted by other computers. Authentication provides an additional validation process from the adapter to the access point. The WEP encryption algorithm is vulnerable to passive and active network attacks. TKIP and CKIP algorithms include enhancements to the WEP protocol that mitigate existing network attacks and address its shortcomings

Open and Shared Key authentication

802.11 support two types of network authentication methods; Open System and Shared Key. Supported authentication schemes are Open and Shared-Key authentication:

- Using **Open** authentication, any wireless station can request authentication. The station that needs to authenticate with another wireless station sends an authentication management frame that contains the identity of the sending station. The receiving station or AP will grant any request for authentication. Open authentication allows any device network access. If no encryption is enabled on the network, any device that knows the SSID of the access point can gain access to the network.
- Using **Shared Key** authentication, each wireless station is assumed to have received a secret shared key over a secure channel that is independent from the 802.11 wireless network communications channel. Shared key authentication requires that the client configure a static WEP key. The client access will be granted only if it passed a challenge based authentication.

Network Keys

When Data Encryption (WEP, CKIP or TKIP) is enabled, a network key is used for encryption. A network key can be provided for you automatically (for example, it might be provided on your wireless network adapter, or you can enter it yourself and specify the key the key length (64-bits or 128-bit), key format (ASCII characters or hexadecimal digits), and key index (the location where a specific key is stored). The longer the key length, the more secure the key. Every time the length of a key is increased by one bit, the number of possible keys double.

Under 802.11, a wireless station can be configured with up to four keys (the key index values are 1, 2, 3, and 4). When an access point or a wireless station transmits an encrypted message using a key that is stored in a specific key index, the transmitted message indicates the key index that was used to encrypt the message body. The receiving access point or wireless station can then retrieve the key that is stored at the key index and use it to decode the encrypted message body.

Encryption Static and Dynamic Key Types

802.1x uses two types of encryption keys, static and dynamic. Static encryption keys are changed manually and are more vulnerable. MD5 authentication only uses static encryption keys. Dynamic encryption keys are renewed automatically on a periodic basis. This makes the encryption key(s) more secure. To enable dynamic encryption keys, you must use 802.1x authentication methods, such as TLS, TTLS, PEAP or LEAP.

Encryption Overview

Security in the WLAN can be supplemented by enabling data encryption using WEP (Wireless Encryption Protocol). You can choose a 64 or 128 bit level encryption. Also, the data can then be encrypted with a key. Another parameter called the key index is provides the option to create multiple keys for that profile. However, only one key can be used at a time. You can also choose to password protect the profile to ensure privacy.

The pass phrase is used to generate a WEP key automatically. You have the option of either using a pass phrase or entering a WEP key manually. Using 64-bit encryption, the pass phrase is 5 characters long and you can choose to enter any arbitrary and easy to remember phrase like Acme1 or enter 10 Hexadecimal numbers for the WEP key corresponding to the network the user wants to connect to. For 128-bit encryption, the pass phrase is 13 characters long or you can enter a 26 hexadecimal numbers for the WEP key to get connected to the appropriate network.

Note: You must use the same encryption type, key index number, and WEP key as other devices on your wireless network. Also, if 802.1x authentication is being used, WEP encryption must be disabled.

How to Enable WEP Encryption

The following example describes how to edit an existing profile and apply WEP encryption.

To enable WEP encryption:

1. From the **General** page, click the **Networks** tab.
2. Select the profile from the Profile List and click the **Edit** button.
3. Click the **Security** tab.
4. Select any Network Authentication mode (**Open** is recommended).
5. Select **WEP** for Data Encryption.
6. Select **64-bit** or **128-bit** for the Encryption Level.
7. Select a key index number **1, 2, 3, or 4**.
8. Select either of the following:

    - **Use pass phrase**: Click **Use Pass Phrase** to enable. Enter a text

phrase, up to five (using 64-bit) or 13 (using 128-bit) alphanumeric characters ((0-9, a-z or A-Z), in the pass phrase field.
- **Use hex Key**: Click **Use hex Key** to enable. Enter up to ten (using 64-bit) alphanumeric characters, 0-9, A-F, or twenty-six (using 128-bit) alphanumeric characters, 0-9, A-F in the hex key field.

9. Click **OK** to save the profiles settings.

NOTE: *You must use the same encryption type, index number, and WEP key as other devices on your wireless network.*

System Administrator Tasks

NOTE: *The following information is intended for system administrators.*

How to Obtain a Client Certificate

If you do not have any certificates for EAP-TLS, or EAP-TTLS you must get a client certificate to allow authentication. Typically you need to consult with your system network administrator for instructions on how to obtain a certificate on your network. Certificates can be managed from "Internet Settings", accessed from either Internet Explorer or the Windows Control Panel applet. Use the "Content" page of "Internet Settings".

Windows XP and 2000: When obtaining a client certificate, do not enable strong private key protection. If you enable strong private key protection for a certificate, you will need to enter an access password for the certificate each time this certificate is used. You must disable strong private key protection for the certificate if you are configuring the service for TLS/TTLS authentication. Otherwise the 802.1x service will fail authentication because there is no logged in user to whom it can display the prompt dialog.

Notes about Smart Cards

After installing a Smart Card, the certificate is automatically installed on your computer and can be select from the person certificate store and root certificate store.

Setting up the Client for TLS authentication

Step 1: Getting a certificate

To allow TLS authentication, you need a valid client (user) certificate in the local repository for the logged-in user's account. You also need a trusted CA certificate in the root store.

The following information provides two methods for getting a certificate;

- from a corporate certification authority implemented on a Windows 2000 Server
- using Internet Explorer's certificate import wizard to import a certificate from a file

Getting a certificate from a Windows 2000 CA:

1. Start Internet Explorer and browse to the Certificate Authority HTTP Service (use a URL such as http://myCA.myDomain.com).
2. Logon to the CA with the name and password of the user account you created (above) on the authentication server. The name and password do not have to be the same as the Windows logon name and password of your current user.
3. On the Welcome page of the CA select Request a certificate task and submit the form.
4. On the Choose Request Type page, select Advanced request, then click **Next**.
5. On the Advanced Certificate Requests page, select Submit a certificate request to this CA using a form, then click **Submit**.
6. On the Advanced Certificate Request page choose the User certificate template. Select "Mark keys as exportable", and click **Next**. Use the provided defaults shown.
7. On the Certificate Issued page select Install this certificate.

   Note: If this is the first certificate you have obtained, the CA will first ask you if it should install a trusted CA certificate in the root store. The dialog will not say this is a trusted CA certificate, but the name on the certificate shown will be that of the host of the CA. Click **yes**, you need this certificate for both TLS and TTLS.

8. If your certificate was successfully installed, you will see the message, "Your new certificate has been successfully installed."
9. To verify the installation, click **Internet Explorer > Tools > Internet Options > Content > Certificates**. The new certificate should be installed in "Personal" folder.

Importing a certificate from a file

1. Open Internet Properties (right-click on the Internet Explorer icon on the desktop and select Properties.
2. Click the **Certificates** button on the Content page. This will open the list of installed certificates.
3. Click the **Import** button under the list of certificates. This will start the Certificate Import Wizard. (Note: Steps 1 through 3 may also be accomplished by double-clicking the icon for the certificate.
4. Select the file and proceed to the Password page.
5. On the Password page specify your access password for the file. Clear the Enable strong private key protection option.
6. On the Certificate store page select "Automatically select certificate store based on the type of certificate" (the certificate must be in the User accounts Personal store to be accessible in the Configure dialog of the Client; this will happen if ‘automatic’ is selected).
7. Proceed to "Completing the Certificate Import" and click the **Finish** button.

The following example describes how to use WPA with TKIP encryption using TTLS or PEAP authentication.

Setting up the Client for TLS authentication

Step 2: Specifying the certificate used by Intel(R) PROSet

1. Obtain and install a client certificate, refer to **Step 1** or consult your system administrator.
2. From the **General** page, click the **Networks** tab.
3. Click the **Add** button.
4. Enter the profile and network (SSID) name.
5. Select **Infrastructure** for the operating mode.
6. Click **Next**.
7. Select **Open** for the Network Authentication. You can also select any other available authentication mode.
8. Select **WEP** as the Data Encryption. You can also select any other available encryption type.
9. Click the **802.1x Enabled** checkbox.
10. Set the authentication type to **TLS** to be used with this connection.
11. Click the **Configure** button to open the settings dialog.

12. Enter your user name in the User Name field.
13. Select the "**Certificate Issuer**" from the list. Select Any Trusted CA as the default.
    - Click the "**allow intermediate certificates**" checkbox to allow a number of unspecified certificates to be in the server certificate chain between the server certificate and the specified CA. If unchecked, then the specified CA must have directly issued the server certificate.
14. Enter the Server name.
    - If you know the server name enter this name.
    - Select the appropriate option to match the server name exactly or specify the domain name.
15. Under the "Client certificate" option click the **Select** button to open a list of installed certificates.
    - Note about Certificates: The specified identity should match the field "Issued to" in the certificate and should be registered on the authentication server (i.e., RADIUS server) that is used by the authenticator. Your certificate must be "valid" with respect to the authentication server. This requirement depends on the authentication server and generally means that the authentication server must know the issuer of your certificate as a Certificate Authority. You should be logged in using the same username you used when the certificate was installed.
16. Select the certificate from the list and click **OK**. The client certificate information displays under "Client Certificate".
17. Click **Close**.
18. Click the **Finish** button to save the security settings for the profile.

Setting up the Client for WEP and MD5 authentication

To add WEP and MD5 authentication to a new profile:

Note: Before starting, obtain a username and password on the RADIUS server from your system administrator.

1. From the **General** page, click the **Networks** tab.
2. Click the **Add** button from the Profile List.
3. Enter the profile and network (SSID) name.
4. Select **Infrastructure** for the operating mode.
5. Click **Next**.

6. Select **Open** (recommended) for the Network Authentication.
7. Select **WEP** as the Data Encryption.
8. Select either **64** or **128**-bit for the Encryption Level.
9. Select the key index **1, 2, 3** or **4**.
10. Enter the required **pass phrase** or **hex key**.
11. Click the **802.1x Enabled** checkbox.
12. Select **MD5** as the 802.1x Authentication Type.
13. Click **Configure** to open the MD5 Setting dialog. Enter the user name and password. Note: The user name and password do not have to be the same as name and password of your current Windows user login.
14. Click **Close** to save the settings.
15. If the Password Protection checkbox was checked on the General settings page, then
    click **Next** display the Password page and enter a profile password.
16. Click the **Finish** button to save the profile settings.

Setting up the Client for WPA-PSK using WEP or TKIP authentication

Use Wi-Fi Protected Access - Pre Shared Key (WPA-PSK) mode if there is no authentication server being used. This mode does not use any 802.1x authentication protocol, It can be used with the data encryption types: **WEP** or **TKIP**. WPA-PSK requires configuration of a pre-shared key (PSK). You must enter a pass phrase or 64 hex characters for a Pre-Shared Key of length 256-bits. The data encryption key is derived from the PSK.

To configure a profile using WPA-PSK:

1. From the **General** page, click the **Networks** tab.
2. Click the **Add** button.
3. Enter the profile and network (SSID) name.
4. Select **Infrastructure** for the operating mode.
5. Click **Next**.
6. Select **WPA-PSK** for the Network Authentication. You can also select authentication mode.
7. Select **WEP** as the Data Encryption.
8. Select either of the following:
    - **Use pass phrase:** Click **Use Pass Phrase** to enable. Enter a text phrase

using 8-63 alphanumeric characters ((0-9, a-z or A-Z), in the pass phrase field.
   - **Use hex Key:** Click **Use hex Key** to enable. Enter up to 64 alphanumeric characters, 0-9, A-F in the hex key field.

9. Click the **802.1x Enabled** checkbox.
10. Set the authentication type to **TLS** to be used with this connection.
11. Click the **Finish** button to save the security settings for the profile.

Setting up the Client for WPA using TKIP encryption and TLS authentication

Wi-Fi Protected Access (WPA) mode can be used with TLS, TTLS, or PEAP. This 802.1x authentication protocol using data encryption options; WEP or TKIP. Wi-Fi Protected Access (WPA) mode binds with 802.1x authentication. The data encryption key is received from the 802.1x key exchange. To improve data encryption, Wi-Fi Protected Access utilizes its Temporal Key Integrity Protocol (TKIP). TKIP provides important data encryption enhancements including a re-keying method.

1. Obtain and install a client certificate, refer to Setting up the Client for TLS authentication or consult your system administrator.
2. From the **General** page, click the **Networks** tab.
3. Click the **Add** button.
4. Enter the profile and network (SSID) name.
5. Select **Infrastructure** for the operating mode.
6. Click **Next**.
7. Select **WPA** for the Network Authentication.
8. Select **TKIP** as the Data Encryption.
9. Set the authentication type to **TLS** to be used with this connection.
10. Click the **Configure** button to open the settings dialog.
11. Enter your user name in the User Name field.
12. Select the "**Certificate Issuer**" from the list. Select Any Trusted CA as the default.
    - Click the "**allow intermediate certificates**" checkbox to allow a number of unspecified certificates to be in the server certificate chain between the server certificate and the specified CA. If unchecked, then the specified CA must have directly issued the server certificate.
13. Enter the Server name.

- If you know the server name enter this name.
- Select the appropriate option to match the server name exactly or specify the domain name.

14. Use Client Certificate: This option selects a client certificate from the Personal certificate store of the Windows logged-in user. This certificate will be used for client authentication. Click the Select button to open a list of installed certificates.
    - Note about Certificates: The specified identity should match the field "Issued to" in the certificate and should be registered on the authentication server (i.e., RADIUS server) that is used by the authenticator. Your certificate must be "valid" with respect to the authentication server. This requirement depends on the authentication server and generally means that the authentication server must know the issuer of your certificate as a Certificate Authority. You should be logged in using the same username you used when the certificate was installed.
15. Select the certificate from the list and click **OK**. The client certificate information displays under "Client Certificate".
16. Click **Close**.
17. Click the **Finish** button to save the security settings for the profile.

Setting up the Client for WPA using TKIP encryption and TTLS or PEAP authentication

Using TTLS authentication: These settings define the protocol and the credentials used to authenticate a user. In TTLS, the client uses EAP-TLS to validate the server and create a TLS-encrypted channel between the client and server. The client can use another authentication protocol, typically password-based protocols, such as MD5 Challenge over this encrypted channel to enable server validation. The challenge and response packets are sent over a non-exposed TLS encrypted channel.

Using PEAP authentication: PEAP settings are required for the authentication of the client to the authentication server. In PEAP, the client uses EAP-TLS to validate the server and create a TLS-encrypted channel between client and server. The client can use another EAP mechanism, such as Microsoft Challenge Authentication Protocol (MSCHAP) Version 2, over this encrypted channel to enable server validation. The challenge and response packets are sent over a non-exposed TLS encrypted channel.

The following example describes how to use WPA with TKIP encryption using TTLS or PEAP authentication.

1. Obtain and install a client certificate, refer to Setting up the Client for TLS authentication or consult your system administrator.
2. From the **General** page, click the **Networks** tab.
3. Click the **Add** button.
4. Enter the profile and network (SSID) name.
5. Select **Infrastructure** for the operating mode.
6. Click **Next**.
7. Select **WPA** for the Network Authentication.
8. Select **TKIP** as the Data Encryption.
9. Set the authentication type to **TTLS** or **PEAP** to be used with this connection.
10. Click the **Configure** button to open the settings dialog.
11. Enter the **roaming identity** name in the Roaming Identity field. This optional feature is the 802.1X identity supplied to the authenticator. It is recommended that this field not contain a true identity, but instead the desired realm (e.g. anonymous@myrealm).
12. Select the "**Certificate Issuer**" from the list. Select Any Trusted CA as the default.
    - Click the "**allow intermediate certificates**" checkbox to allow a number of unspecified certificates to be in the server certificate chain between the server certificate and the specified CA. If unchecked, then the specified CA must have directly issued the server certificate.
13. **Enter the Server name.**
    - If you know the server name enter this name.
    - Select the appropriate option to match the server name exactly or specify the domain name.
14. **Authentication Protocol:**
    - **PEAP:** Select **MS-CHAP-V2**. This parameter specifies the authentication protocol operating over the PEAP tunnel. The protocols are: MS-CHAP-V2 (Default), GTC, and TLS.
    - **TTLS:** Select **PAP**. This parameter specifies the authentication protocol operating over the TTLS tunnel. The protocols are: PAP (Default), CHAP, MD5, MS-CHAP and MS-CHAP-V2.
15. **Enter the user name.** This username must match the user name that is set in the authentication server by the IT administrator prior to client's authentication. The user name is case-sensitive. This name specifies the identity supplied to the authenticator by the authentication protocol operating over the TLS tunnel. This user’s identity is securely transmitted to the server only after an encrypted channel

has been verified and established.

16. **Enter the user password.** Specifies the user password. This password must match the password that is set in the authentication server.
17. Re-enter the user password. If confirmed, displays the same password characters entered in the Password field.
18. Use Client Certificate: This option selects a client certificate from the Personal certificate store of the Windows logged-in user. This certificate will be used for client authentication. Click the **Select** button to open a list of installed certificates.
    - Note about Certificates: The specified identity should match the field "Issued to" in the certificate and should be registered on the authentication server (i.e., RADIUS server) that is used by the authenticator. Your certificate must be "valid" with respect to the authentication server. This requirement depends on the authentication server and generally means that the authentication server must know the issuer of your certificate as a Certificate Authority. You should be logged in using the same username you used when the certificate was installed.
19. Select the certificate from the list and click **OK**. The client certificate information displays under "Client Certificate".
20. Click **Close**.
21. Click the **Finish** button to save the security settings for the profile.

Setting up the Client for CCX using CKIP encryption and LEAP authentication

Configuring LEAP using Intel(R) PROSet

An Intel(R) PROSet CCX (v1.0) profile must be configured to connect to a specific ESS or Wireless LAN network. The profiles settings include LEAP, CKIP and Rogue AP detection settings.

To configure a profile for CCX security settings:

1. From the **General** page, click the **Networks** tab.
2. Click the **Add** button.
3. Enter the profile and network (SSID) name.
4. Select **Infrastructure** for the operating mode.
5. Click the **Cisco Client eXtentions** check box to enable CCX security. **Note:** The

Network authentication and the *Data Encryption* now include the CCX security options: **Open**, **Shared** for 802.11 Authentication and **none, WEP, CKIP** for Data encryption.

6. Click **Next**.
7. Select **Open** in the Network Authentication options.
8. Select **CKIP** as the Data encryption.
9. Click the **802.1x Enabled** checkbox to enable the 802.1x security option.
10. Select **LEAP** as the 802.1x Authentication Type.
11. Click the **Configure** button to open the LEAP Setting dialog. Enter the user name and password of the user account created on the authentication server. The user name and password do not have to be the same as name and password of your current Windows user login.
12. Click on the "Enable Rogue AP Detection" if the network is setup to account for rogue APs. This setting should also be made if **only** the "Network-EAP" checkbox is selected in the AP configuration settings (applies to all Cisco APs).
13. Click **Close** to save the settings.
14. Select the Networks page and click the **Connect** button to connect to the appropriate CCX enabled AP using the CCX Profile.

CCX Access Point and Client Configurations

The access point provides settings to select different authentication types depending on the WLAN environment. The client sends an Authentication algorithm field during the 802.11 authentication handshake that takes place between the client and the AP during connection establishment. The Authentication algorithm values recognized by a CCX enabled AP is different for the different authentication types. For instance "Network-EAP" which denotes LEAP has a value of 0x80 while "Open" which is the 802.11 specified Open authentication and "Required EAP" which requires an EAP handshake exchange have values of 0x0.

Network-EAP only

AP: For CCX enabled networks using LEAP authentication only the authentication type is set with "Network-EAP" checkbox selected, and "Open" and "Required EAP" boxes unchecked. The AP is then configured to allow LEAP clients ONLY to authenticate and connect. In this case, the AP expects the 802.11 authentication algorithm to be set to 0x80 (LEAP), and rejects clients that attempt authentication with an Authentication algorithm value 0x0.

Client: In this case the client needs to send out an authentication algorithm value of 0x80 else the 802.11 authentication handshake would fail. During boot, when the Wireless LAN driver is already loaded, but the Intel(R) PROSet supplicant is still unloaded, the client sends 802.11 authentication with an Authentication algorithm value of 0x0. Once the Intel(R) PROSet supplicant loads, and engages the LEAP profile, it sends 802.11 authentication with an Authentication algorithm value of 0x80. ***However, the supplicant sends out 0x80 only if the Rogue AP box is checked.***

Network-EAP, Open and Required EAP

AP: If Network-EAP, Open and Required EAP boxes are checked then it would accept both types of 802.11 authentication algorithm values 0x0 and 0x80. However, once the client is associated and authenticated the AP expects an EAP handshake to take place. For any reason if the EAP handshake does not take place quickly, the AP would not respond to the client for about 60 seconds.

Client: Here the client could send out an authentication algorithm value of 0x80 or 0x0. Both values are acceptable and the 802.11 authentication handshake would succeed. During boot, when the Wireless LAN driver is already loaded and the client sends 802.11 authentication with an Authentication algorithm value of 0x0. This is sufficient to get authenticated but the corresponding EAP or LEAP credentials need to be communicated to the AP to establish a connection.

Open and Required EAP only

AP: In the case where the AP is configured with Network-EAP unchecked, but Open and Required EAP checked, the AP will reject any client attempting to 802.11 authenticate using an authentication algorithm value of 0x80. The AP would accept any client using an authentication algorithm value of 0x0, and expects EAP handshake to commence soon after. In this case, the client uses MD5, TLS, LEAP or any other appropriate EAP method suitable for the specific network configuration.

Client: The client in this case is required to send out an authentication algorithm value of 0x0. As mentioned before the sequence involves a repeat of the initial 802.11 authentication handshake. First, the Wireless LAN driver initiates authentication with a value of 0x0 and later the supplicant would repeat the process. However, the authentication algorithm value used by the supplicant depends status of the Rogue AP checkbox. ***When the Rogue AP box is unchecked***, the client sends an 802.11 authentication with ***Authentication algorithm value of 0x0*** even after the supplicant loads and engages the LEAP profile.

Some non-Intel clients, for example, when set to LEAP, cannot authenticate in this case. However, the Intel Wireless LAN client can authenticate, if the Rogue AP is unchecked.

Rogue AP Checkbox configuration

When the checkbox is checked it ensures that the client implements the Rogue AP feature as required by CCX. The client makes note of APs that it failed to authenticate with and sends this information to the AP that allows it to authenticate and connect. Also, the supplicant sets the Authentication algorithm type to 0x80 when the Rogue AP box is checked. There may be some network configurations implementing and Open and Required EAP only as described above. For this setup to work, the client must use an Authentication Algorithm value of 0x0, as opposed to the need to use 0x80 for Network-EAP only described above. Therefore, the Rogue AP checkbox also enables the client to support Network-EAP only and Open and Required EAP only.

Cisco CCX Feature Support

The Cisco mandatory Client Compliance Specifications Version1.0:

- Compliance to all mandatory items of 802.11
- De-fragmentation of MSDUs and MMPDUs
- Generate CTS in response to an RTS
- Open and Shared key authentication support
- Support Active scanning
- Wi-Fi compliance required
- On Windows platforms, Microsoft 802.11 NIC compliance
- 802.1X-2001 Compliance
- EAP-TLS (Transport Level Security, RFC 2716) support on Windows XP
- EAP-MD4 (RFC 1320) support on Windows XP
- EAP packets to be sent unencrypted
- Broadcast key rotation support
- CKIP support

- WEP/RC4 support
- Support of 4 keys for WEP
- Both WEP40 and WEP128 keys are supported
- LEAP support is required
- Rogue AP reporting support
- Cisco Extension: Aironet IE support – CWmin and CWmax fields
- Encapsulation Transformation Rule IE support
- Cisco Extension: AP IP address IE
- Cisco Extension: Symbol IE
- Mixed (WEP and non-WEP) cells
- AP may respond to more than one SSID – VLAN awareness
- Stealth mode support - Clients should ignore missing SSIDs in beacons
- Multiple SSID support – Client should be able to roam up to 3 SSIDs
- Client to use configured SSID in probe request

Note: Please refer to Cisco Client extensions version 1.0 document available at www.cisco.com for more details.

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Specifications: Intel(R) PRO/Wireless 2200BG User's Guide

Specifications

Form Factor	Mini PCI Type 3B
Dimensions	Width 2.34 in x Length 1.75 in x Height 0.20 in (59.45 mm x 44.45 mm x 5 mm)
Weight	0.7 oz. (12.90 g.)
Antenna Interface Connector	Hirose U.FL-R-SMT mates with cable connector U.FL-LP-066
Dual Diversity Antenna	On-board dual diversity switching
Connector Interface	124-pin SO-DIMM edge connector
Operating Temperature	0 to +70 degrees Celsius
Humidity	50 to 85% non-condensing

Type

Frequency band	2.412 - 2.462 GHz (US) 2.412 - 2.484 GHz (Japan) 2.412 - 2.472 GHz (Europe ETSI) 2.457 - 2.462 GHz (Spain) 2.457 - 2.472 GHz (France)

Frequency Modulation

Modulation	OFDM with BPSK, QPSK, 16QAM, 64QAM, DBPSK, DQPSK, CCK
Channels	Full 14 channel support

Data Rates	1, 2, 5.5, 6, 9, 11, 12, 24, 36, 48 and 54 Mbps
Indoor Range	100 ft (30 m) @ 11 Mbps / 300 ft (90 m) @ 1 Mbps
Outdoor Range	400 ft (120 m) @ 11 Mbps / 1500 ft (460 m) @ 1 Mbps

Power

Transmit Output Power	16 dBm (typical)
Adapter Power Consumption	
Transmit	1.45 W
Receive	0.85 W
Idle	60 mw
Disable	50 mw
Voltage	3.3 V

General

Operating Systems	Windows* XP, 2000
Wi-Fi Alliance certification	Wi-Fi certification for 802.11b and 802.11g
WLAN Standard	IEEE 802.11b
Architecture	Infrastructure or ad hoc (peer-to-peer)
Security	WPA, Cisco CCX v1.0, LEAP, PEAP, TKIP, EAP-TLS, EAP-TTLS, WEP 128-bit and 64-bit.
Product Safety	UL, C-UL, CB (IEC 60590)

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Glossary of Terms: Intel(R) PRO/Wireless 2200BG User's Guide

Numerical A B D E F I K M O P R S T U W

Numerical

802.11a: The 802.11a standard specifies a maximum data transfer rate of 54Mbps and an operating frequency of 5GHz. The 802.11a standard uses the Orthogonal Frequency Division Multiplexing (OFDM) transmission method. Additionally, the 802.11a standard supports 802.11 features such as WEP encryption for security.

802.11b: The 802.11b standard specifies a maximum data transfer rate of 11Mbps, an operating frequency of 2.4GHz, and WEP encryption for security. 802.11b networks are also referred to as Wi-Fi networks.

802.11g: The 802.11g standard specifies a maximum data transfer rate of 54Mbps, an operating frequency of 2.4GHz, and WEP encryption for security. 802.11g networks are also referred to as Wi-Fi networks.

802.11x: A series of IEEE specifications for LANs: currently 802.11b, 802.11a, and 802.11g. Using any one of these extensions to the 802.11 standard permits wireless communication between a client and an access point or between two clients. 802.1x is based on the Extensible Authentication Protocol (EAP), the 802.1x standard is one of the IEEE standards for network authentication and key management. It establishes a framework that supports multiple authentication methods. This standard can be incorporated into any type of network to enhance its security.

A

Access Point: A device that serves as a communications hub for wireless clients and provides a connection to a wired LAN.

Advanced Encryption Standard (AES): A federal information-processing standard, supporting 128-, 192-, and 256-bit keys.

B

Basic Service Set Identifier (BSSID): A unique identifier for each wireless client on a wireless network. The BSSID is the Ethernet MAC address of each adapter on the network.

Bit Rate: The total number of bits (ones and zeros) per second that a network connection can support. Note that this bit rate will vary, under software control, with different signal path conditions.

Bluetooth: An incompatible, very short-range lower speed communications system (PAN), developed first in Europe as a "cable replacement" for printers and similar peripheral connections. Its usage has expanded to include cordless earphones and similar devices. It uses the 2.4 GHz ISM band, and "co-exists" with 802.11b. Here the term, "co-exist" means that not all researchers agree on the amount of mutual interference generated when both systems operate in the same location.

Broadcast SSID: Used to allow an access point to respond to clients on a wireless network by sending probes.

D

Data Rate (Information Rate): Not all bits carry user information. Each group (packet) of bits contains headers, trailers, echo control, destination information, and other data required by the transmission protocol. It is important to understand the difference between bit rate and data rate, since the overhead information may consume more than 40% of the total transmission. This difference is common to many such data systems, including Ethernet.

Direct-Sequence Spread Spectrum (DSSS) and Frequency-Hop Spread Spectrum (FHSS): Two incompatible technologies used in radio transmission.

Dynamic IP Address: An IP address that is automatically assigned to a client station in a TCP/IP network, typically by a DHCP server. Network devices that serve multiple users, such as servers and printers, are usually assigned static IP addresses.

E

Extensible Authentication Protocol (EAP): An IETF standard that establishes an authentication protocol for network access. Many authentication methods, including passwords, certificates, and smart cards, work within this framework.

EAP-TLS: A type of authentication method using the Extensible Authentication Protocol (EAP) and a security protocol called the Transport Layer Security (TLS). EAP-TLS uses certificates which use passwords. EAP-TLS authentication supports dynamic WEP key management.

EAP-TTLS: A type of authentication method using the Extensible Authentication Protocol (EAP) and Tunneled Transport Layer Security (TTLS). EAP-TTLS uses a combination of certificates and another method, such as passwords. It is more secure than MD5 authentication, which uses passwords, and less secure than EAP-TLS authentication, which exclusively uses certificates. EAP-TTLS authentication supports dynamic WEP key management.

Encryption: Scrambling data so that only the authorized recipient can read it. Usually a key is needed to decrypt the data.

Extended Service Set IDentifier (ESSID): A type of unique identifier applied to both the AP and the wireless PC Card that is attached to each packet. This allows the AP to recognize each wireless client and its traffic.

F

Firewall:A firewall is a set of related programs, located at a network gateway server, that protects the resources of a network from users from other networks.

Frequencies: Strike a piano key and you generate a tone. Pick up the tone with a microphone and your tone turns in to a "vibrating" or "cycling" electronic signal. The rate of vibration depends on the key struck. In electronics we refer to this rate of vibration as the number of "cycles per second." The formal term for this value is Hertz. As we move up in rate, such as in the Broadcast Band, we can use Kilohertz (KHz) to represent 1,000 Hz, or Megahertz (MHz) to represent 1,000,000 Hz. Continuing much further upward, we finally reach 1,000,000,000 Hz, which we can fortunately shorten to a Gigahertz (GHz). These frequencies are the home of both 802.11a (5 GHz) and 802.11b (2.4 GHz).

I

Independent Basic Service Set Identifier (IBSSID): Used to identify a wireless network configured to allow each wireless client to communicate directly with each other without an access point.

Independent Network: A network that provides (usually temporarily) peer-to-peer connectivity without relying on a complete network infrastructure.

Infrastructure Network: A wireless network centered around 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.

Institute of Electrical and Electronics Engineers (IEEE): An organization involved in setting computing and communications standards.

ISM Bands: A series of frequency bands, set aside by the FCC for Industrial, Scientific and Medical applications. Users of these bands operate equipment on a shared basis, meaning that they must expect, and accept interference from other legal users. Products manufactured for ISM Band use must be approved by the FCC, but the user does not have to be licensed. In addition to WLAN, ISM bands support cordless phones, microwave ovens, baby monitors, toys, ham radio transceivers, and other wireless services.

K

Kerberos: An authentication system enabling protected communication over an open network using a unique key called a ticket.

M

Media Access Control (MAC) Address: A hardwired address applied at the factory. It uniquely identifies network hardware, such as a wireless PC Card, on a LAN or WAN.

Microcell: A bounded physical space in which a number of wireless devices can communicate. Because it is possible to have overlapping cells as well as isolated cells, the boundaries of the cell are established by some rule or convention.

Microwave: Technically, the term describes any frequency above 1.0 GHz. Unfortunately the advertising industry has contorted this meaning considerably. In our discussion we will stick to the technical definition.

Multipath: The signal variation caused when radio signals take multiple paths from transmitter to receiver.

O

Orthogonal Frequency Division Multiplexing (OFDM): A modulation technique for transmitting large amounts of digital data over radio waves. 802.11a uses OFDM, as will 802.11g.

P

Peer-to-Peer Mode: A wireless network structure that allows wireless clients to communicate with each other without using an access point.

Personal Area Network (PAN): A personal area network, or PAN, is a networking scheme that enables computing devices such as PCs, laptop computers, handheld personal computers, printers and personal digital assistants (PDAs) to communicate with each other over short distances either with or without wires.

Preamble: A preliminary signal transmitted over a WLAN to control signal detection and clock synchronization.

R

Radio Frequency (RF) Terms (GHz, MHz, Hz): The international unit for measuring frequency is Hertz (Hz), which is equivalent to the older unit of cycles per second. One Mega-Hertz (MHz) is one million Hertz. One Giga-Hertz (GHz) is one billion Hertz. For reference: 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 microwave ovens typically operate at 2.45 GHz.

Range: The distance over which a given system can communicate.

RC4: An encryption algorithm designed at RSA Laboratories; specifically, a stream cipher of pseudo-random bytes that is used in WEP encryption.

Remote Authentication Dial-In User Service (RADIUS): An authentication and accounting system that verifies users' credentials and grants access to requested resources.

Roaming: Movement of a wireless node between two microcells. Roaming usually occurs in infrastructure networks built around multiple access points.

S

Service Set Identifier (SSID): Used to identify clients on a wireless network.

Shared key: An encryption key known only to the receiver and sender of data.

Site Survey: A process where you set up one transceiver in a fixed location, and then use another unit to plot the field strength of the first unit's transmitted signal. By moving the transmitter around, and repeating the plots, you can develop a plan as to the best locations for access points. You will also identify dead zones and other areas in need of special attention. This can be a long, slow process, but it beats ripping up an unsatisfactory installation and starting over. These tests require special software commands. Refer to your manual for specific instructions. If you have a very large, or unusually complex installation situation, you might want to consider calling in professionals to do your survey. We are not permitted to suggest installer names, but you can check your yellow pages or similar sources for likely candidates.

Static IP Address: A permanent IP address that is assigned to a node in a TCP/IP network.

T

Transmission Control Protocol (TCP): A method (protocol) used with the IP (Internet Protocol) to send data in the form of message units between network devices over a LAN or WAN. The IP carries the delivery of the data (routing), and TCP keeps track of the individual units of data (called packets) that a message is divided into for delivery over the network.

Transmission Control Protocol/Internet Protocol (TCP/IP): The basic communication language or set of protocols for communications over a network (developed specifically for the Internet). TCP/IP defines a suite or group of protocols and not only TCP and IP.

Transceiver: A commonly used term that describes a combination transmitter and receiver. Both 802.11a and 802.11b devices would be properly described as data transceivers.

U

UNII Bands: Unlicensed National Information Infrastructure. In contrast to the ISM bands, these are a group of frequency bands set aside by the FCC for WLAN type communications only. Users must accept interference from other legal WLAN users, but the other sources of interference problems are, or legally should be, missing.

W

WEP64 and WEP128: Wired Equivalent Privacy, 64 bit and 128 bit (64 bit is sometimes referred to as 40 bit). This is a low-level encryption technique designed to give the user about the same amount of privacy that he would expect from a LAN. It is extremely important to understand that WEP is not some CIA-proof supercode! It performs as intended, giving the user a simple level of data security and protection from casual electronic eavesdropping. Use of the 128 bit option at all possible times is recommended. Remember that 802.11 devices transmit (broadcast) in all directions, and that it is possible, with very complex software, to copy and decode WEP transmissions. The task is not trivial, but it is possible. If your data is extremely sensitive, you should consider some form of secondary protection, such as strong passwords and an additional level of encryption. Suitable software packages are available from reputable suppliers. Although not intended by the original architects, WEP also helps prevents unauthorized access to your system by an outsider. Hackers have been known to access systems from outside a building, and to then to access the Web for a leisurely session, all at the system owner’s expense.

Wide Area Network (WAN): A wide area network (WAN) is a voice, data, or video network that provides connections from one or more computers or networks within a business to one or more computers or networks that are external to such business.

Wireless: A microwave transceiver system.

Wireless LAN (WLAN): Wireless LAN is a type of local-area network that uses high-frequency radio waves rather than wires to communicate between nodes. WLAN is a flexible data communication system used as an alternative to, or an extension of a wired LAN.

Wireless Node: A user computer with a wireless network interface card (adapter).

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Customer Support: Intel(R) PRO/Wireless 2200BG User's Guide

Customer Support

welcome to support

for Intel consumer products

get technical help

Select your product type at the left to find solutions, specifications, compatibility information and documentation.

download software, drivers and utilities

search the support site

Intel support is available online or by telephone. Available services include the most up-to-date product information, installation instructions about specific products, and troubleshooting tips.

Online Support

Technical Support: http://support.intel.com

Network Product Support: http://www.intel.com/network

Corporate Web Site: http://www.intel.com

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Regulatory Information: Intel(R) PRO/Wireless 2200BG User's Guide

Information for the user

Intel(R) PRO/Wireless 2200BG Network Connection adapter (model WM3B2200BG)

Safety Notices

The FCC with its action in ET Docket 96-8 has adopted a safety standard for human exposure to radio frequency (RF) electromagnetic energy emitted by FCC certified equipment. The Intel(R) PRO/Wireless 2200BG adapter meets the Human Exposure limits found in OET Bulletin 65, 2001, and ANSI/IEEE C95.1, 1992. Proper operation of this radio according to the instructions found in this manual will result in exposure substantially below the FCC’s recommended limits.

The following safety precautions should be observed:

- Do not touch or move antenna while the unit is transmitting or receiving.
- Do not hold any component containing the radio such that the antenna is very close or touching any exposed parts of the body, especially the face or eyes, while transmitting.
- Do not operate the radio or attempt to transmit data unless the antenna is connected; if not, the radio may be damaged.
- Use in specific environments:
    - The use of wireless devices in hazardous locations is limited by the constraints posed by the safety directors of such environments.

    - The use of wireless devices on airplanes is governed by the Federal Aviation Administration (FAA).
    - The use of wireless devices in hospitals is restricted to the limits set forth by each hospital.
- Antenna use:
    - In order to comply with FCC RF exposure limits, low gain integrated antennas should be located at a minimum distance of 20 cm (8 inches) or more from the body of all persons.
    - High-gain, wall-mount, or mast-mount antennas are designed to be professionally installed and should be located at a minimum distance of 30 cm (12 inches) or more from the body of all persons. Please contact your professional installer, VAR, or antenna manufacturer for proper installation requirements.
- Explosive Device Proximity Warning (see below)
- Antenna Warning (see below)
- Use on Aircraft Caution (see below)
- Other Wireless Devices (see below)
- Power Supply (Access Point) (see below)

Explosive Device Proximity Warning

⚠ **Warning:** Do not operate a portable transmitter (such as a wireless network device) near unshielded blasting caps or in an explosive environment unless the device has been modified to be qualified for such use.

Antenna Warnings

⚠ **Warning:** It is recommended that the user limit exposure time if the antenna is positioned closer than 20 cm (8 inches).

⚠ **Warning:** The Intel(R) PRO/Wireless 2200BG product is not designed for use with high-gain directional antennas. Use of such antennas with these products is illegal.

Use On Aircraft Caution

⚠ **Caution:** Regulations of the FCC and FAA prohibit airborne operation of radio-frequency wireless devices because their signals could interfere with critical aircraft instruments.

Other Wireless Devices

Safety Notices for Other Devices in the Wireless Network: Refer to the documentation supplied with wireless Ethernet adapters or other devices in the wireless network.

Local Restrictions on Radio Usage

⚠ **Caution:** Due to the fact that the frequencies used by Intel(R) PRO/Wireless 2200BG product device may not yet be harmonized in all countries. The Intel(R) PRO/Wireless 2200BG product is designed for use only in specific countries, and is not allowed to be operated in countries other than those of designated use. As a user of this product, you are responsible for ensuring that the product is used only in the countries for which it was intended and for verifying that it is configured with the correct selection of frequency and channel for the country of use. Any deviation from the permissible settings for the country of use is an infringement of national law and may be punished as such.

For country-specific information, see the additional compliance information supplied with the product.

Wireless interoperability

The Intel(R) PRO/Wireless 2200BG adapter is designed to be interoperable with any wireless LAN product that is based on direct sequence spread spectrum (DSSS) radio technology and to comply with the following standards:

- IEEE Std. 802.1b-1999. Standard on Wireless LAN.
- Wireless Fidelity (WiFi) certification, as defined by the WECA (Wireless Ethernet Compatibility Alliance).

The Intel(R) PRO/Wireless LAN 2200BG adapter and your health

The Intel(R) PRO/Wireless 2200BG adapter, like other radio devices, emits radio frequency electromagnetic energy. The level of energy emitted by this device, however, is less than the electromagnetic energy emitted by other wireless devices such as mobile phones. The Intel(R) PRO/Wireless 2200BG adapter wireless device operates within the guidelines found in radio frequency safety standards and recommendations. These standards and recommendations reflect the consensus of the scientific community and result from deliberations of panels and committees of scientists who continually review and interpret the extensive research literature. In some situations or environments, the use of the Intel(R) PRO/Wireless 2200BG adapter wireless device may be restricted by the proprietor of the building or responsible representatives of the applicable organization. Examples of such situations include the following:

- Using the Intel(R) PRO/Wireless 2200BG adapter equipment on board airplanes, or
- Using the Intel(R) PRO/Wireless 2200BG adapter equipment in any other environment where the risk of interference with other devices or services is perceived or identified as being harmful.

If you are uncertain of the policy that applies to the use of wireless devices in a specific organization or environment (an airport, for example), you are encouraged to ask for authorization to use the Intel(R) PRO/Wireless 2200BG adapter wireless device before you turn it on.

Regulatory information

USA—Federal Communications Commission (FCC)

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

- This device may not cause harmful interference.
- This device must accept any interference that may cause undesired operation.

NOTE—The radiated output power of the Intel(R) PRO/Wireless 2200BG adapter wireless network device is far below the FCC radio frequency exposure limits. Nevertheless, the Intel(R) PRO/Wireless 2200BG wireless network device should be used in such a manner that the potential for human contact during normal operation is minimized.

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 in a residential installation. This equipment generates, uses, and can radiate radio frequency energy. If the equipment is not installed and used in accordance with the instructions, the equipment may cause harmful interference to radio communications. There is no guarantee, however, that such 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 taking one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the distance between the equipment and the receiver.
- Connect the equipment to 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.

NOTE—The Intel(R) PRO/Wireless 2200BG adapter wireless network device must be installed and used in strict accordance with the manufacturer's instructions as described in the user documentation that comes with the product. Any other installation or use will violate FCC Part 15 regulations.

U.S. Frequency Bands

2.400 - 2.4835 GHz

Canada—Industry Canada (IC)

This Class B digital apparatus complies with Canadian ICES-003, Issue 2, and RSS-210, Issue 4 (Dec. 2000).

Cet appariel numérique de la classe B est conforme à la norme NMB-003, No. 2, et CNR-210, No 4 (Dec 2000).

"To prevent radio interference to the licensed service, this device is intended to be operated indoors and away from windows to provide maximum shielding. Equipment (or its trasmit antenna) that is installed outdoors is subject to licensing."

« Pour empêcher que cet appareil cause du brouillage au service faisant l'objet d'une licence, il doit être utilisé a l'intérieur et devrait être placé loin des fenêtres afinde fournir un écran de blindage maximal. Si le matériel (ou son antenne d'émission) est installé à l'extérieur, il doit faire l'objet d'une licence. »