Aironet™

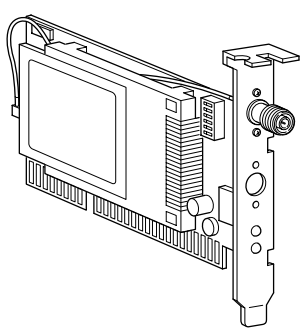# *User's Guide and Technical Reference Manual*
Aironet Wireless LAN Adapter
Products supported:
ISA4500, ISA4800, PCI4800, and PCI4500

ISA   **PCI**

Aironet Wireless Communications, Inc.

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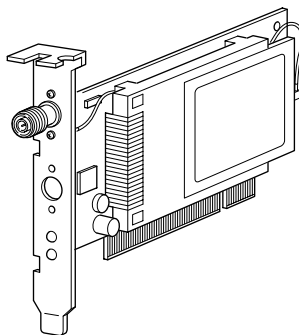
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About the User's Guide and Technical Reference Manual

This guide covers the installation, configuration, control, and maintenance of your Aironet 4000 Series Wireless LAN Adapter.

Please read Sections 2 and 3 before attempting to install or use the hardware and software described in this guide.

This Guide is arranged as follows:

Section 1 – *Welcome to the Aironet 4000 Series Wireless LAN Adapter* – provides you with a general introduction to the 4000 Series Card, direct sequence radio technology, and the various configurations you can use when operating the 4000 Series Card in your infrastructure.

Section 2 – *Installing the Hardware* – describes the physical installation of the Wireless LAN Adapter and antenna.

Section 3 – *Installing the Software* – describes installation and configuration of the various network drivers.

Section 4 – *Utilities* – provides detailed procedures for using the utilities to perform link tests and site surveys as well as loading new firmware versions.

Section 5 – *Error Messages and Troubleshooting* – provides detailed descriptions of the LED messages and error codes, as well as general procedures for correcting common problems.

Appendix A – *Wireless LAN Adapter Specifications* – provides radio and physical specifications.

Appendix B – *Using the WinDGS Utility* – provides detailed descriptions on using the WinDGS utility.

Appendix C – *Channels* – provides channel identifiers and channel center frequencies for various area regulatory agencies.

Appendix D – *Declaration of Conformity* – provides conformity information about the Wireless LAN Adapter.

Appendix E – *Technical Support* – provides contact information for Aironet.

Typographical Conventions

When reading the User's Guide and Technical Reference Manual, it is important to understand the symbol and formatting conventions used in the documentation. The following symbols are used in the guide.

Convention	Type of Information
	Indicates a note which contains important information.
	A caution message that appears before procedures which, if not observed, could result in loss of data or damage to the equipment.
Bold type	An action you must perform such as type or select.

Section 1

Welcome to the Aironet 4000 Series Wireless LAN Adapter

The Aironet 4000 Series Wireless LAN Adapter provides transparent wireless data communications between fixed, portable, or mobile devices and other wireless devices or a wired network infrastructure (Ethernet or Token Ring). Host devices can be any device equipped with a PC/AT, PC/XT, ISA (Industry Standard Architecture), or 32 bit PCI (Peripheral Component Interconnect) slot.

The Wireless LAN Adapter is fully compatible when used in a device supporting Plug-and-Play technology.

Safety Information

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 Aironet products meet the uncontrolled environmental limits found in OET-65 and ANSI C95.1, 1991. Proper operation of this radio according to the instructions found in this manual will result in the user exposure to be substantially below the FCC recommended limits.
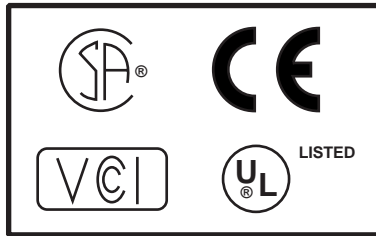
- Do not touch or move antenna(s) while the unit is transmitting or receiving.

- 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 a portable transmitter near unshielded blasting caps or in an explosive environment unless it is a type especially qualified for such use.

- Do not operate radio or attempt to transmit data unless the antenna is connected, if not, the radio may be damaged.

Dipole Antenna

Always orient antenna such that it is at least 15 cm (6 inches) away from your body.

High Gain Antennas

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 your body. Please contact your professional installer, VAR, or antenna manufacturer for proper installation requirements.

Other Devices in the Wireless Network

Refer to the User's Guide or Technical Reference Manual for the Access Point, Universal Client, or Bridge for additional information.

Radio Characteristics

The Wireless LAN Adapter operates in the 2.4 GHz license-free Industrial Scientific and Medical (ISM) band. Data is transmitted over a half-duplex radio channel operating up to 2 Mbps (4500 Series) or 11 Mbps (4800 Series).

Direct Sequence Radio Technology

The Aironet 4000 Series Wireless LAN Adapter uses Direct Sequence Spread Spectrum (DSSS) transmission previously developed for military "anti-jamming" and "low probability of intercept" radio systems. The signal is transmitted over a wide frequency range, using multiple frequencies. This protects the data transmission from interference.

Data Transparency and Protocols

The Aironet 4000 Series Wireless LAN Adapter transports data packets transparently as they move through the wireless infrastructure. The Wireless LAN Adapter operates similarly to a standard network product except the wire is replaced with a radio connection. No special wireless networking functions are required. All existing applications, which operate over a network, will operate using the Aironet 4000 Series Wireless LAN Adapter.

Protocols Supported

The Aironet 4000 Series Wireless LAN Adapter can be used in a variety of infrastructure configurations. Aironet Access Points (AP4500 or AP4800) provide connections to Ethernet or Token Ring Networks. When using the Aironet standard device drivers, the Wireless LAN Adapter is fully compliant with the following protocols and wired networks:

Drivers	Operating System
ODI	DOS based driver for Novell NetWare
NDIS2	MS DOS, Windows 3.xx
NDIS3	Windows 95, Windows 98, Windows NT
Packet	MS DOS, Windows 3.xx

Radio Ranges

This section provides general guidelines on factors that influence network performance (see **Section 4** - *Site Survey and Link Test*).

Site Survey

Because of differences in component configuration, placement and physical environment, every network application is a unique installation. Before installing the system, users should perform a site survey in order to determine the optimum utilization of networking components and to maximize range, coverage and network performance.

Here are some operating and environmental conditions that need to be considered:

- **Data Rates.** Sensitivity and range are inversely proportional to data bit rates. The maximum radio range is achieved at the lowest workable data rate. There will be a decrease in receiver threshold sensitivity as the radio data rate increases.

- **Antenna Type and Placement**. Proper antenna configuration is a critical factor in maximizing radio range. As a general guide, range increases in proportion to antenna height.

  For a detailed explanation of antenna types and configurations along with guidelines on selecting antennas for specific environments, see the Aironet Antenna Guide, document number 710-003725.

- **Physical Environments.** Clear or open areas provide better radio range than closed or filled areas. Also, the less cluttered the work environment, the greater the range.

- **Obstructions.** A physical obstruction such as metal shelving or a steel pillar can hinder the performance of the Wireless LAN Adapter. Avoid locating the computing device and antenna in a location where there is a metal barrier between the sending and receiving antennas.

- **Building Materials.** Radio penetration is greatly influenced by the building material used in construction. For example, drywall construction allows greater range than concrete blocks. Metal or steel construction is a barrier to radio signals.

Link Test

> The link test tool is used to determine RF coverage. The test results help the installer eliminate low RF signal level area that can result in loss of connection.

Security Features

The Aironet 4000 Series Wireless LAN Adapter employs Direct Sequence Spread Spectrum Technology, previously developed for military "anti-jamming" and "low probability of intercept" radio systems.

The Aironet Access Point must be set to the same Service Set Identifier (SSID) as all other Aironet devices on the wireless infrastructure. Units with a different SSID will not be able to directly communicate with each other.

Terminology

When configuring your system, and when reading this manual, keep in mind the following terminology:

Association – Each root unit or repeater in the infrastructure contains an association table that controls the routing of packets between the Access Point and the wireless infrastructure. The association table maintains entries for all the nodes situated below the Access Point on the infrastructure including repeaters and client nodes.

End Node – A client node that is located at the end of the Network Tree.

Infrastructure – The wireless infrastructure is the communications system that combines Access Points, mobile nodes and fixed nodes. Access Points within the infrastructure can be either root units, which are physically wired to the LAN backbone, or can act as wireless repeaters. Other RF enabled devices serve as fixed nodes or mobile client nodes.

Parent/Child Node – Refers to the relationships between nodes in the wireless infrastructure. The complete set of relationships is sometimes described as a Network Tree. For example, the Access Point (at the top of the tree) would be the parent of the end nodes. Conversely, the end nodes would be the children of the Access Point.

Power Saving Protocol (PSP) and Non-Power Saving Protocol – The Power Saving Protocol allows computers (usually portable computers) to power up only part of the time to conserve energy. If a client node is using the Power Saving Protocol to communicate with the network, the Aironet Access Point must be aware of this mode and implement additional features such as message store and forward. If the client node is powered from an AC line, PSP should not be used.

Repeater – A repeater is an Access Point that extends the radio range of the infrastructure. A repeater is not physically attached to the wired LAN, but communicates via radio to another Access Point, which is either a root unit or another repeater.

Root Unit – The root unit is an Access Point that is located at the top, or starting point, of a wireless infrastructure. A root unit provides the physical connection to the wired LAN (such as Ethernet or Token Ring) and contains configuration information in its association table that covers all nodes that access the wired network (backbone). All Access Points directly attached to the wired LAN backbone are root units.

System Configurations

The Aironet 4000 Series Wireless LAN Adapter can be used in a variety of network system configurations. Aironet Access Points (AP4500 or AP4800) provide connections to your Ethernet or Token Ring networks or act as repeaters increasing wireless communication range. The maximum communication range is based on how you configure your wireless infrastructure.

Examples of some common system configurations are shown on the pages that follow, along with a description of each.

Figure 1.1 - Ad Hoc Wireless LAN
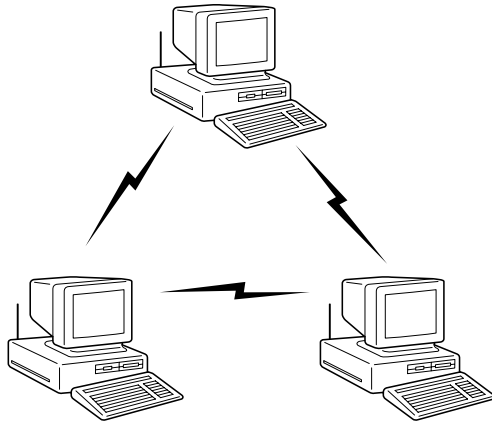
An ad hoc wireless LAN is the simplest wireless LAN configuration. In a wireless LAN, using an ad hoc network operating system (such as Windows for Workgroups, Windows 95, or Windows 98), all devices equipped with the Wireless LAN Adapter can be linked together and communicate directly with each other.

Figure 1.2 - Wireless Infrastructure
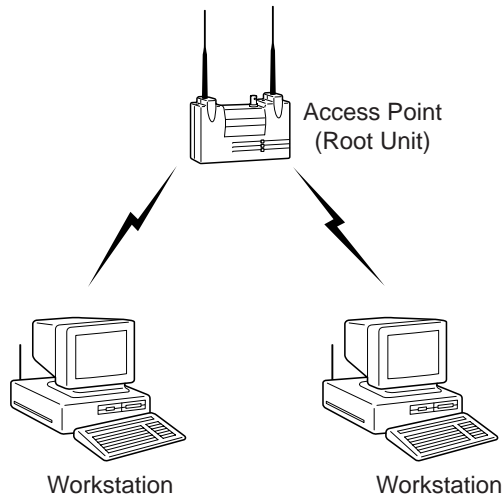
In a wireless infrastructure, an Aironet Access Point is used as a stand-alone root unit. The root unit is not attached to any wired LAN (such as an Ethernet or Token Ring LAN), but functions as a hub linking all stations together. This configuration is similar to the ad hoc network, except the Aironet Access Point serves as the focal point for communications. This increases the effective communication range over the ad hoc LAN since both stations are not required to be in direct communication range of each other.

Figure 1.3 - Wireless Infrastructure with Workstations Accessing a Wired LAN
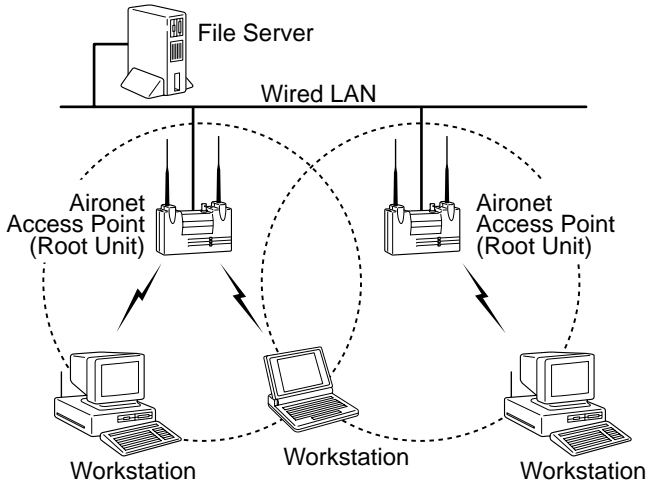
A Micro-Cellular Network can be created by placing two or more Aironet Access Points on a LAN.

The Aironet roaming protocols allow remote workstations to move from one microcell domain to another. The process is seamless and transparent. The connection to the file server or host is maintained without disruption. This configuration is useful with portable or mobile stations allowing them to be directly connected to the wired network, even while moving about (roaming). When an infrastructure is configured using multiple Aironet Access Points and/or repeaters, a mobile station is automatically associated and re-associated to the Aironet Access Point which provides the best performance. This is referred to as seamless roaming.

Figure 1.4 - Extended Infrastructure Using Repeaters
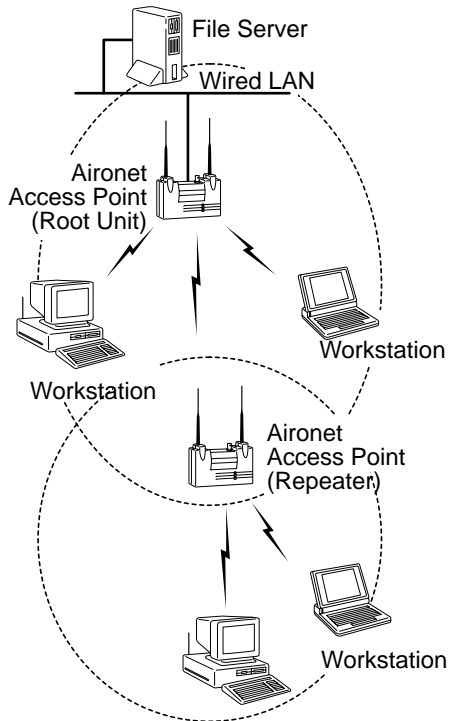
An Aironet Access Point can be configured as a stand-alone repeater to extend the range of your infrastructure, or to overcome an RF blocking obstacle. The repeater forwards traffic between the Aironet 4000 Series Wireless LAN Adapter equipped workstations and devices and the wired LAN by sending packets to either another repeater or to another Aironet Access Point attached to the wired LAN. The data is sent through whichever route provides the greatest performance for the client. Multiple repeater hops can be supported in the path to the wired LAN.

Coverage Options

The system architecture options of the wireless station and Access Points provide for a variety of coverage alternatives and flexibility. The system can be designed to provide a wide coverage area with minimal overlap (Figure 1.5) or coverage with heavy overlap (Figure 1.6). The latter improves system performance and protection against down-time in the event of a component failure.

Figure 1.5 - Minimal Overlap Coverage Option
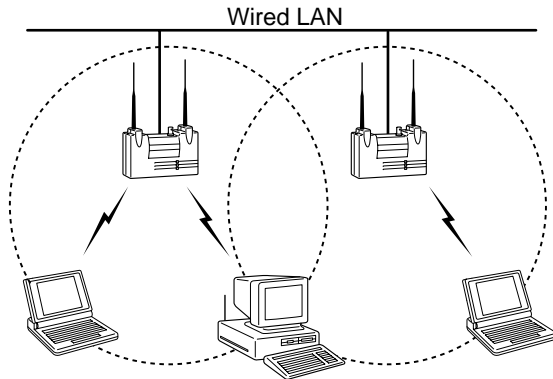
By arranging the Access Points so the overlap in coverage area is minimized, a large area can be covered with minimal system cost. The total bandwidth available to each mobile station will depend on the amount of data each mobile station desires to transfer and the number of stations located in each cell. Seamless roaming is supported as a mobile station moves in and out of range of each Access Point, thereby maintaining a constant connection to the wired LAN. Each Access Point (and Wireless LAN Adapter) must be configured with the same Service Set Identifier (SSID) in order to provide the roaming capability.

Figure 1.6 - Heavy Overlap Coverage Option
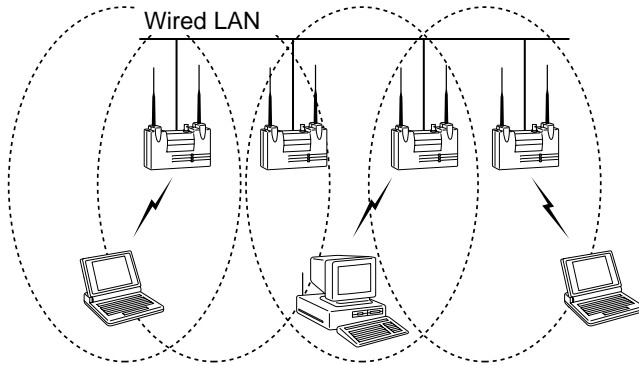
By arranging the Access Points so the overlap in coverage area is nearly maximized, a large number of mobile stations can be supported in the same wireless infrastructure. However, units in overlapping coverage areas on the same frequency will detect adjacent cell traffic and delay transmissions that cause collisions. This reduces the aggregate radio system throughput. Heavy cell overlap is not recommended for maximum system throughput. Due to the redundancy in coverage overlap, system access is not lost in the event of an Access Point failure. Upon failure of the Access Point, the station will automatically roam to an operational Access Point. With this architecture, all Access Points and PC Card units must be configured with the same Service Set Identifier (SSID).

Figure 1.7 - Multiple Overlapping Systems Coverage Option
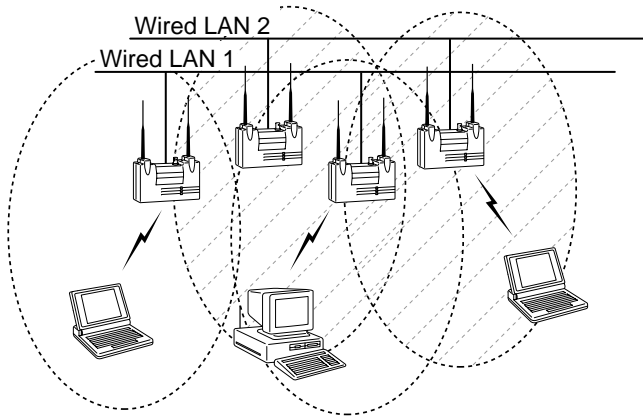
Multiple systems can operate in the same vicinity. The architecture provides multiple channels, which can exist in the same area with virtually no interference to each other. In this mode, each system must be configured with different Service Set Identifiers (SSID) and different channels, which prevent clients from roaming to Access Points of a different wireless system.

Section 2

Installing the Hardware

This section describes the procedures for installing the Wireless LAN Adapter.

Here's what you'll find in this section:

- Before You Start
- Installing the Wireless LAN Adapter
- Configuring the DIP Switches (ISA Only)
- Attaching the Antenna
- Viewing the Indicator Displays

Before You Start

For the Wireless LAN Adapter to be used with a computing device, the device must be equipped with a PC/AT, ISA, or PCI slot. Please follow the manufacturers guidelines for installing the software as well as installing the Wireless LAN Adapter.

After unpacking the Wireless LAN Adapter, make sure the following items are present and in good condition:

- Wireless LAN Adapter (ISA or PCI)
- Standard 2 dBi dipole antenna
- Software Driver Diskette

If any item is damaged or missing, contact your Aironet supplier. Save all shipping and packing material in order to repack the unit should service be required.

> **NOTE:** Any remote antenna and its associated wiring are ordered and packed separately.

Figure 2.1 - Overview of the Wireless LAN Adapter

**PnP/Non-PnP, IRQ Level and
Base Address DIP Switches**

**Antenna
Connector**

**Status and
Activity LEDs**

**ISA Card Edge
Connector**

ISA3500

**Antenna
Connector**

**Status and
Activity LEDs**

**PCI Card Edge
Connector**

PCI3500

2-3
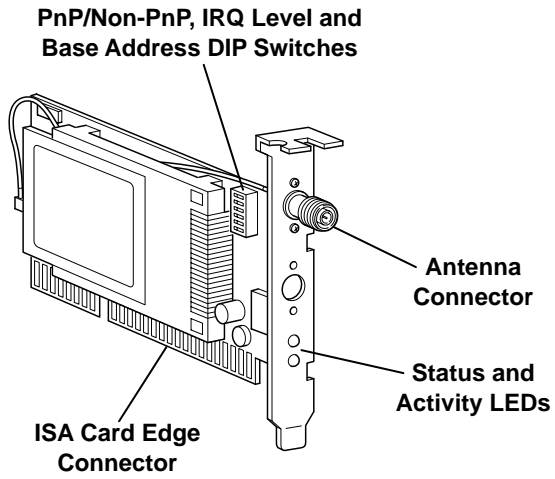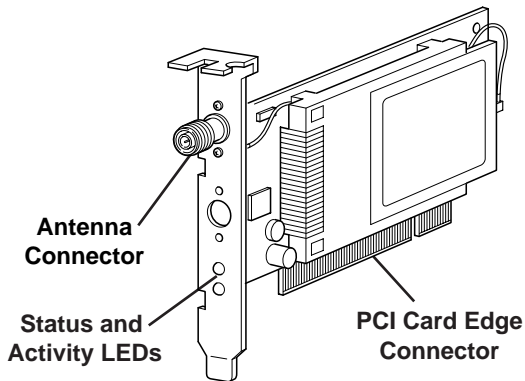
Installing the Wireless LAN Adapter

NOTE: The following procedures and physical connections apply generally to normal and conventional slots. In the cases of custom or non-conventional equipment, be alert to possible differences in slot configurations.

Installation

1. Power off all computer system components.

2. Remove the CPU cover.

3. Remove the screw from the top of the CPU back panel. This screw is used to hold the metal bracket on the back panel.

CAUTION: Static electricity can be destructive. Discharge by touching a metal part of a grounded unit before removing the Wireless LAN Adapter from the anti-static packaging.

4. Tilt the Wireless LAN Adapter to allow the antenna connector and LED lights to slip through the opening in the CPU back panel.

5. Press the Wireless LAN Adapter into an empty slot until its connector is firmly seated.

⚠ **CAUTION:** Do not force the Wireless LAN Adapter into the slot. Forcing it will damage both the Wireless LAN Adapter and the slot. If the Wireless LAN Adapter does not go in easily, remove the card and re-insert.

ISA
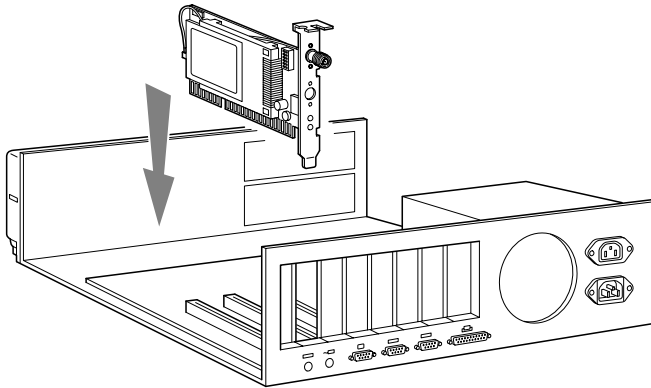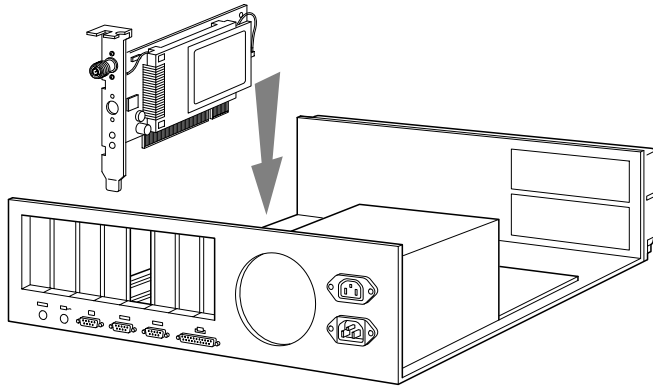
PCI

6. Reinstall the screw to the top of the CPU back panel.

Configuring the DIP Switches (ISA Only)

The ISA Wireless LAN Adapter contains DIP switches for setting the Plug and Play Mode (PnP), Base Address, and Interrupt Levels (IRQ). The switches have been factory set for PnP before shipment (this is the recommended setting).

Expansion cards cannot share the same Base Address or IRQ. Check the switch settings on the ISA Wirelss LAN Adapter to ensure they do not conflict with other expansion cards in the computer.
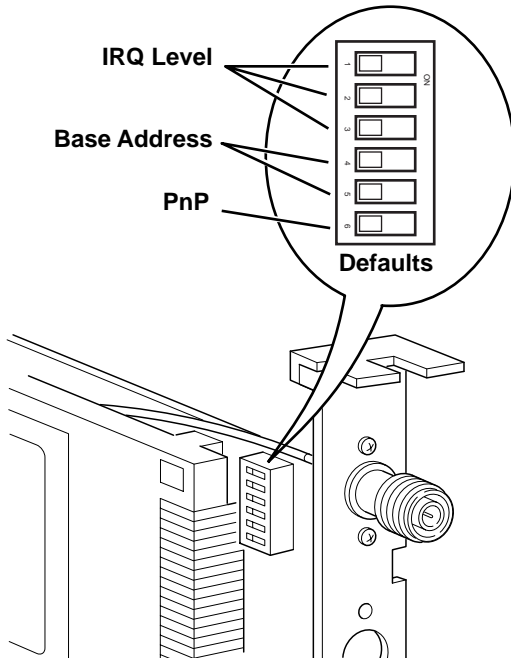
Base Address

The Wireless LAN Adapter uses 64 bytes of shared memory space with a base address that can be set to any boundary between 0xC000 and 0xDE00. The default factory setting is 0xD000. The Base Address is controlled through DIP switches 4 and 5.

DIP Switch	
6	
On (Non-PnP)	Off (PnP)

NOTE: When PnP is selected, the information in the table below will read "Don't Care".

DIP Switch		Base Address
5	4	
On	On	140
On	Off	180
Off	On	300
Off	Off	340

IRQ Level

The IRQ level is selected through DIP switches 1-3. The table below shows the switch position settings required for different IRQ levels.

NOTE: When PnP is selected, the information in the table below will read "Don't Care".

DIP Switch			IRQ Level
3	2	1	
On	On	On	5
On	On	Off	7
On	Off	On	9
On	Off	Off	10
Off	On	On	11
Off	On	Off	12
Off	Off	On	14
Off	Off	Off	15

Attaching the Antenna

The Wireless LAN Adapter comes with one 2 dBi dipole antenna.

With the unit powered off, attach the antenna to the antenna connector on the Wireless LAN Adapter.

NOTE: Do not over-tighten; finger tight is sufficient. Position the antenna vertically for best omni-directional signal reception.

NOTE: Due to FCC and DOC Regulations, the antenna connector on the Wireless LAN Adapter is of reverse polarity to the standard TNC connectors.
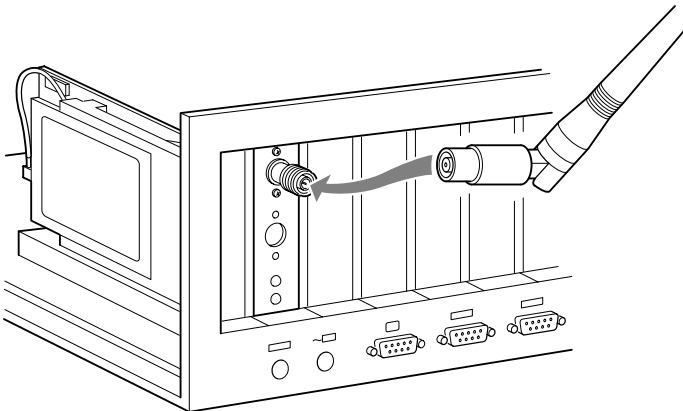
Viewing the Indicator Displays

The indicators are a set of displays located on the
Wireless LAN Adapter.

- **Status Indicator** – Shows solid green when the Aironet
  Access Point has accepted a radio association.

- **Radio Indicator** – Used to indicate radio traffic activity.
  The light is normally off, but will blink amber whenever a
  packet is received or transmitted over the radio.

When the Wireless LAN Adapter is initially powered up, the
displays will blink amber and then green, in sequence. If a
power-on test fails, the status indicator will go solid and the
unit will stop functioning. See **Table 2.1** for a detailed expla-
nation of the indicators.

ISA   **PCI**
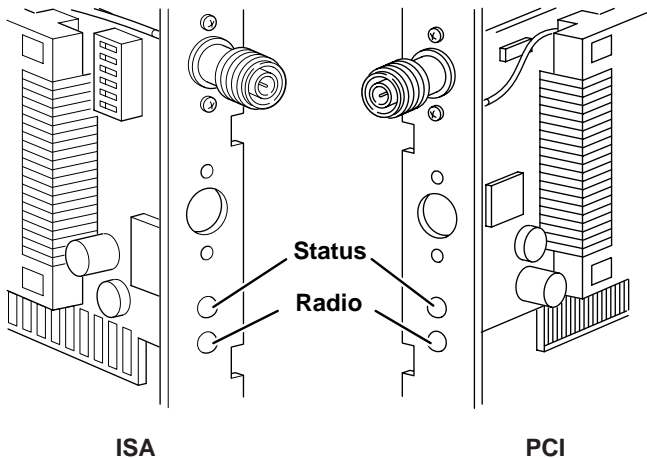
Table 2.1 – Indicator Description

Type	Indicator Display		Description
	Status (Green)	**Radio (Amber)**	
Nonassoci-ated Node	Blinking Fast	Blinking Fast	No nodes associated
Associated/ Operational	Blinking Slow	Blinking when transmitting and/or receiving	One or more nodes associated
Firmware Upgrade	Solid	Solid	Firmware upgrading
Bad Firmware		3 blinks, pause	Need new firmware to load
Bad Configuration		1 blink, pause, 2 blinks, pause	Host sent bad parameters

Section 3

Installing the Software

The Wireless LAN Adapter is supplied with PACKET, NDIS2, NDIS3 and ODI drivers allowing operation under DOS, Windows 3.x, Windows for Workgroups, Windows 95, Windows 98, Windows NT, and Novell Netware. The Wireless LAN Adapter is fully IEEE 802.11 compliant.

Driver Overview

The Wireless LAN Adapter is shipped with two diskettes:

• WinDGS diagnostics diskette

• Aironet driver diskette

This section covers the drivers. The utilities are discussed in **Section 4** – *Utilities*.

The DOS, Windows 3.x and Windows for Workgroups based drivers must have a configuration file created (or edited) with an ASCII text editor. Installation of each driver is discussed in the following tables.

The driver disk shipped with the Wireless LAN Adapter is organized as follows:

Table 3.1 - Driver Disk Structure

README.TXT	Contains latest information about the disk contents
DIAG	Directory containing utilities
FLSH3545.COM	Flash firmware
NDIS2	Directory containing NDIS2 driver files
AWC2N45C.DOS	NDIS2 driver
OEMSETUP.INF	NDIS2 compatible install file for MicroSoft Windows for Workgroups
PROTOCOL.INI	The required configuration file for the NDIS2 driver. The PROTOCOL.INI file on the diskette provides sample entries for operation in Infrastructure Mode.
PROTOCOL.AHC	Sample PROTOCOL.INI file with entries for Ad Hoc Mode
PKT	Directory containing DOS packet driver files
AWCP45C.COM	DOS based packet driver
AWCPKT.INI	The required configuration file for the Packet driver. The AWCPKT.INI file on the diskette has sample entries for operation in Infrastructure Mode.
AWCPKT.AHC	Sample AWCPKT.INI file with entries for Ad Hoc Mode.

NDIS3 (4500 Series)	Directory containing NDIS3 driver files
PC4500.INF	WIN95/98 install file
PC4500.SYS	NDIS3 driver
PC4500.DLL	NDIS3 library
VXD4500.VXD	Virtual device driver for Aironet WinDGS utility
OEMSETUP.INF	WIN NT install file
ODI	Directory containing ODI driver files
AWCO45C.COM	DOS based ODI driver
NET.CFG	The required configuration file for ODI. The NET.CFG file on the drive diskette contains sample entries for operation in Infrastructure Mode.
NDIS3 (4800 Series)	Directory containing NDIS3 driver files
PC4800.INF	WIN95/98 install file
PC4800.SYS	NDIS3 driver
PC4800.DLL	NDIS3 library
VXD4800.VXD	Virtual device driver for Aironet WinDGS utility
OEMSETUP.INF	WIN NT install file
ODI	Directory containing ODI driver files
AWCO45C.COM	DOS based ODI driver
NET.CFG	The required configuration file for ODI. The NET.CFG file on the drive diskette contains sample entries for operation in Infrastructure Mode.

Windows 95 or Windows 98 NDIS3 Installation

To complete the installation of the Wireless LAN Adapter using Windows 95 or Windows 98:

> **ⓘ** **NOTE:** Expansion cards cannot share the same Base Address or IRQ. Check the switch settings on the ISA4500 or ISA4800 to ensure they do not conflict with other expansion cards in the computer.

> **ⓘ** **NOTE:** PnP must be enabled. See "Configuring the DIP Switches (ISA Only)" in Section 2.

1. Power on your computer and boot Windows.
2. Windows will display the **New Hardware Found** dialog box.
3. When prompted for the manufacturer's disk, insert the disk provided with the adapter into the appropriate drive.
4. Type **A:\NDIS3** at the prompt and press **Enter**.
5. Select the appropriate Infrastructure Mode and enter the SSID of the wireless network.
6. Select the Bitrate parameters.
7. Press **Enter**.
8. Windows will prompt for the system disks. Enter the correct network path.
9. Restart Windows after the files are copied. The system will reboot and the installation will be complete.

Choosing the adapter from the Network Icon and selecting Properties will allow the setting of additional parameters. See *Driver Keywords and Settings* for information.

Windows NT NDIS3 Installation

To complete the installation of the Wireless LAN Adapter using Windows NT:

> **ⓘ** **NOTE:** Expansion cards cannot share the same Base Address or IRQ. Check the switch settings on the ISA4500 or ISA4800 to ensure they do not conflict with other expansion cards in the computer.

1. Shutdown the Windows NT workstation.

2. Insert the Wireless LAN Adapter into one of the slots.

> **ⓘ** **NOTE:** PnP must be enabled. See "Configuring the DIP Switches (ISA Only)" in Section 2.

3. Power up the Windows NT workstation.

4. From the control panel, select the Network icon.

For Windows NT 4.xxx	For Windows NT 3.51
5. Select **Adapters**.	Select **Add Adapters**.
6. Select **Add**.	Select **<Other> Require disk from manufacturer** from the list of adapters.
7. Select **Have Disk**.	Select **Continue**.

8. Insert the driver disk provided with the adapter into the appropriate drive.

9. Type **A:\NDIS3** at the prompt and press **Enter**.

10. Select **OK** when the dialog box shows the appropriate Wireless LAN Adapter.

11. Select the appropriate parameters, such as Infrastructure Mode, SSID, and Bitrate.

12. Verify that the Interrupt and IO Base Address do not conflict with other devices' resources.

13. Select **OK**.

14. Select **Close**.

15. Add all other related network information if applicable (IP address, DHCP, DNS, GATEWAY).

16. Select **Yes** to restart the workstation.

Windows for Workgroups NDIS2 Installation

1. Power on your computer and start Windows for Workgroups.

2. Go to the Network program group and click on **Network Set-Up**.

3. Under Network Setup, choose **Networks....**.

4. Under Networks choose **Install Microsoft Windows Network**. Select **OK**.

5. Under Network Setup, choose **Drivers...**.

6. Under Network Drivers, choose **Add Adapters**.

7. If the drivers were already copied to the hard disk, they will be displayed in the list.

8. Under Add Adapter, choose the appropriate Wireless LAN Adapter. If it is not on the menu list, choose **Unlisted** or **Updated Network Driver**. The Install Driver pop up window will ask you for the Aironet driver disk.

9. Place the driver disk in drive A:.

10. Type **A:\NDIS2** at the prompt and press **Enter**.

11. Choose the correct Aironet Adapter and click **OK**.

12. If the chosen adapter is displayed in the **Network Drivers**, click on **Setup**.

13. Select the appropriate parameters, such as Infrastructure Mode, SSID, and Bitrate.

14. Exit Windows for Workgroups.

15. To modify the system parameters, edit the PROTOCOL.INI file in the Windows directory.

16. Reboot your computer.

DOS NDIS2 Installation

The Aironet Wireless LAN Adapter can be installed in a NetBIOS compliant DOS environment such as MicroSoft LAN Manager or PC LAN.

The installation of this driver includes creating or editing a configuration file (PROTOCOL.INI).

It is required that this file contains the following lines:

Table 3.2 - Minimum PROTOCOL.INI Driver Settings

Infrastructure Mode	Ad Hoc Mode
[AW2N45C]	[AW2N45C]
DRIVERNAME=AWC2N45C$	DRIVERNAME=AWC2N45C$
If INFRASTRUCTURE is omitted the default will be "ON"	INFRASTRUCTURE = "NO"
SSID = "your_SSID_here"	SSID = "your_SSID_here"
	CHANNEL =<channel>

Additional variables defined in the following section may also be used.

1. Power on your computer.

2. Copy the \NDIS2\AWC2N45C.DOS from the Aironet Device Driver diskette to the directory containing the network files.

3. Copy the PROTOCOL.INI file to the network directory or merge statements from the Aironet supplied file into your existing PROTOCOL.INI file.

4. Modify the CONFIG.SYS file. After the line containing: Device=PROTMAN.DOS, add Device=[drive:] [path] AWC2N45C.DOS.

5. To modify the system parameters, edit the PROTO-COL.INI file in the network directory. For a list of parameters which can be modified, see **Table 3.2**.

6. Reboot your computer.

DOS Packet Driver Installation

The installation of this driver includes creating or editing a configuration file (AWCPKT.INI). It is required that this file contain the following lines:

Table 3.3 - Minimum AWCPKT.INI Driver Settings

Infrastructure Mode	Ad Hoc Mode
[AWCPKT]	[AWCPKT]
If INFRASTRUCTURE is omit-ted the default will be "ON"	INFRASTRUCTURE = "NO"
SSID = "your_SSID_here"	SSID = "your_SSID_here"
	CHANNEL =<channel>

Additional variables defined in the following section may also be used.

The Wireless LAN Adapter can be installed in a DOS environment using DOS IP stack products such as FTP software.

1. Power on your computer.
2. Copy the \PKT\AWCP45C.COM file from the Aironet Device Driver diskette to the directory containing the network files.
3. Copy the AWCPKT.INI file from the Aironet Device Driver diskette to the directory containing the Packet driver.

4. If you would like to modify the system parameters, edit the AWCPKT.INI file. For a list of parameters which can be modified, see **Table 3.3**.

5. Load the driver by typing **AWCP45C [-cinuw] <int_number>** at the DOS prompt (i.e. AWCP45C 0x65) and press **Enter**.

> **i** **NOTE:** To unload the driver, type **AWCP45C –u <int_number>** (i.e. AWCP45C –u 0x65).

6. Load the DOS IP stack.

ODI Driver Installation

The Wireless LAN Adapter can be installed in an ODI compliant DOS environment such as Novell NetWare.

Table 3.4 - Minimum NET.CFG Driver Settings

Infrastructure Mode
Link Driver AWCO45C
If INFRASTRUCTURE is omitted the default will be "ON"
SSID = "your_SSID_here"
CHANNEL = <channel> (only required in ad hoc mode)

1. Power on your computer.
2. Copy the \ODI\AWCO45C.COM driver from the Aironet Driver diskette to the directory containing the network files.
3. Copy the \ODI\NET.CFG file from the Aironet Driver diskette or merge the Aironet supplied NET.CFG file into your existing NET.CFG file in the network directory.
4. Modify the Wireless LAN Adapter system parameters by editing the NET.CFG file. For a list of parameters which can be modified, see **Table 3.4**.
5. Run the batch files created by the NetWare installation disks or manually load the driver from AUTOEXEC.BAT or the command line. This can be done by running LSL, followed by AWCO45C, IPXODI, and NETX or VLM.

General Information

- AWCPKT.INI file must have a section header of [AWCPKT].

- PROTOCOL.INI file can have any section header, but the section must contain the keyword and parameter DRIVERNAME="AWC2N45C$".

- NET.CFG file must have a section header of [Link Driver AWCO45C].

---

i **NOTE:** These lines may appear anywhere within a section. Only the sections that contain these lines will be parsed.

- Multiple sections are supported.

- Blank lines are supported.

- Comments begin with semi-colon and may appear anywhere on a line.

- Keywords can be upper or lower case and may be surrounded by white space if desired.

- Any parameter that begins with "0x" will be assumed to be hexadecimal. Any parameter that begins with a digit (excluding the "0x" case) will be assumed to be decimal. Any parameter that begins with quotes will be assumed to be a quoted string parameter. Any other parameter will be assumed to be an unquoted string parameter.

- For PROTOCOL.INI string parameters, double quotes are required around the string if the string contains any special characters.

NOTE: PROTOCOL.INI does not support some of the white space characters in a quoted string. If a string begins with an alphabetic character and contains no special characters, the quotes may be omitted.

• For Packet string parameters, the string can be enclosed with double quotes or single quotes. If a string is quoted, any character except a "null" and the quote delimiter itself can occur between the quotes.

NOTE: If double quotes are used for a delimiter, a single quote may appear in the string, and vise versa. If the string begins with an alphabetic character and contains no special characters, the quotes may be omitted.

• For numeric parameters, the value can be hexadecimal or decimal. Hexadecimal numbers must be preceded with the characters "0x" but all characters can be upper or lower case.

• Mac address parameters are parsed as string parameters, therefore, the addresses must be enclosed in single or double quotes.

NOTE: The MAC address cannot be a multicast address.

Driver Keywords and Settings

The default Wireless LAN Adapter configuration is set to:

• Constant Awake Mode

• Infrastructure Mode – This allows association with any Aironet Access Point matching the SSID supplied by the user

• Receive directed packets to this address as well as multicasts and broadcasts

• Retry data packets up to 16 times before discarding the frame

• Retry RTS sequence up to 16 times before discarding the frame

• RTS exchange on all frames greater than 300 bytes

• Fragment frames longer than 700 bytes

• Kill fragmented transmit packets if not delivered in 5 seconds

• Kill fragmented receive frames if not complete after 10 seconds

• Active scanning with 3 Kμsec energy detect time and 20 Kμsec probe response wait timeout

• Re-scan if eight beacons are consecutively missed

• Send an Access Point keep-alive message every 10 seconds

The following tables contain keywords and parameter settings common to both the NDIS2 PROTOCOL.INI, ODI NET.CFG, and the PKT AWCPKT.INI configuration files.

Basic system operation can be adjusted with the following parameters.

Table 3.5 - General Network Keywords

Keywords	Value	Description
AUTHENTICATION	OFF, PRIVACY (WEP), SHARED KEY	Optional – determines the level of security of the wireless network.
BITRATES	1, 1&2_1, 1&2_2, 2	Allowed data bit rate and basic bit rate. The allowed bit rate and basic bit rate depend on the regulatory body that controls the radio spectrum in the location in which the unit is used.
DATA RETRY	8-32	Optional – specifies the number of times a packet will be retried before the packet is dropped and a transmit error is reported to the driver (default is 16).
DIVERSITY	ON, OFF	Optional – specifies the transmit diversity method to be used by the Wireless LAN Adapter (default is OFF).
INFRASTRUCTURE	ON, YES OFF, NO	Optional – specifies whether system operation uses an infrastructure or peer-to-peer/ad hoc network (default is ON, YES).
MAXIMUM MULTICAST	2-16	
NETWORK ADDRESS	Any IEEE MAC address except broadcast and multicast	Optional – this setting allows for locally administered MAC addresses by overriding the unique MAC ID on the PC Card.

NODEID	1 to 16 character string	Optional – specifies a readable name for the station.
POWER SAVING MODE (PSP)	CAM, FASTPSP, PSP, PSP-CAM	Optional – specifies a particular operational mode (default is CAM). CAM = Constant Awake Mode PSP = Power Save Mode FASTPSP = Fast Power Save Mode Note: In Ad Hoc Mode, ATIMDURATION must also be set.
RTS RETRY LIMIT	8-32	
SPECIFIED AP-1	Any IEEE MAC address except broadcast and multicast	Optional – forces association to one of the specified Access Points.
SPECIFIED AP-2	Any IEEE MAC address except broadcast and multicast	Optional – forces association to one of the specified Access Points.
SPECIFIED AP-3	Any IEEE MAC address except broadcast and multicast	Optional – forces association to one of the specified Access Points.
SPECIFIED AP-4	Any IEEE MAC address except broadcast and multicast	Optional – forces association to one of the specified Access Points.
SSID-1	1 to 32 character string	This parameter must match the SSID of the system for proper infra-structure operation.
SSID-2	1 to 32 character string	This parameter must match the SSID of the system for proper infra-structure operation.
SSID-3	1 to 32 character string	This parameter must match the SSID of the system for proper infra-structure operation.
TRANSMIT POWER	1, 100, 20, 200, 5, 50	
USE SAVED CONFIGURATION	NO, YES	

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Network performance can be optimized with the following variables.

Table 3.6 - Advanced Network Keywords

Keywords	Value	Description
RTSTHRESHOLD	0 – 2312	Optional – specifies the minimum frame size, in bytes, for which RTS/CTS delivery will be used. Packets longer than this value will be delivered using RTS/CTS handshaking (default is 300).
TXMSDULIFETIME	0 – 0xFFFF	Optional – specifies the maximum time to attempt packet delivery (default is 5,000 Kμsec [5 seconds]).
RXMSDULIFETIME	0 – 0xFFFF	Optional – specifies the maximum time for receiving a fragmented packet (default is 10,000 Kμsec [10 seconds]).
TXPOWERLEVEL	0 – 250	Optional – selects the next highest programmed power level for transmit in mW.

Additional system performance adjustments can be made with the following group of variables.

Table 3.7 - Fragmentation Keywords

Keywords	Value	Description
FRAGTHRESHOLD	256 – 2312 (must be even)	Optional – specifies the fragmentation size in bytes. Frames longer than this value will be transmitted using multiple packets (default is 700).

The Wireless LAN Adapter power management can be adjusted with the following group of variables.

Table 3.8 - Power Management Keywords

Keywords	Value	Description
ATIMDURATION	Between 0 and less than the beacon interval.	Optional – ad hoc/IBSS only – specifies the length of time in Kμsec for ATIMs following a beacon (this value must be non-zero for PSP ad hoc operation. 0 is Constant Awake Mode (default is 5). This value is only used when starting a new network. When joining a network, the value currently in use will be adopted.
SLEEPFORDTIM	ON, OFF	Optional – infrastructure with PSP or Fast PSP Modes only – if ON, the node is allowed to sleep through DTIMs for extra power saving. Broadcast and multicast traffic may be missed (default is OFF).
LISTENTIME	0 – 0xFFFF	Optional – infrastructure with PSP or Fast PSP Modes only – determines how often to awaken for beacons. Note that the PC Card will always awaken to receive DTIMs when in PSP Mode, unless sleep for DTIMs is set (default is 200 Kμsec [200 ms]).

Table 3.8 - Power Management Keywords (Continued)

Keywords	Value	Description
FASTLISTENTIME	0 – 0xFFFF	Determines how often to awaken for beacons. Note that the PC Card will always awaken to receive DTIMs when in Fastpsp Mode (default is 100 Kµsec).
LISTENDECAY	0 – 0xFFFF	Optional – infrastructure with PSP or Fast PSP Modes only – rate at which the listen interval grows. The number of times to use the current listen interval before doubling it. Listen interval will begin at FASTLINSTENTIME and eventually decay to LISTENTIME (default is 2).
FASTLISTENDELAY	0 – 0xFFFF	Optional – infrastructure with PSP or Fast PSP Modes only – time to delay immediately after a transmission before beginning at FASTLISTENTIME (default is 200 Kµsec).

Additional system performance adjustments can be made with the following group of variables.

Table 3.9 - Scanning Keywords

Keywords	Value	Description
SCANMODE	ACTIVE, PASSIVE, ADVANCED	Optional – parameter to determine the current scanning mode to be used by the PC Card (default is ACTIVE).
BEACONLISTENTO	0 – 0xFFFF	Optional – for passive scanning mode, determines the amount of time (Kμsec) to listen for a beacon on each channel (default is 40 Kμsec).
PROBEENERGYTO	0 – 0xFFFF	Optional – for active scanning mode, determines the amount of time to listen for RF energy following a probe (default is 3 Kμsec).
PROBERESPONSETO	0 – 0xFFFF	Optional – for active scanning mode, determines the amount of time to wait for a probe response after energy is detected on a channel (default is 20 Kμsec).
STATIONARY	ON, OFF, YES, NO	Optional – indicates whether or not the station is mobile (default is OFF).
PROBEDELAY	0 – 0xFFFF	Optional – indicates how long to wait on a frequency before sending a probe request (default is 3 Kμsec).
OFFSCANINTERVAL	0 – 0xFFFF	Optional – how often to attempt to use the "off line" scanning method to search for new Access Points (default is 0 which disables off line scanning).
OFFSCANDURATION	0 – 0xFFFF	Optional – how long to use the "off line" scanning method during each attempt (default is 0 which disables off line scanning).

Additional system performance adjustments can be made with the following parameters.

Table 3.10 - Infrastructure Keywords

Keywords	Value	Description
BEACONLOSTTIME	0 – 0xFFFF	Optional – determines the interval of consecutively missed beacons which will cause a re-scan (default is 500 Kμsec).
REFRESHINTERVAL	0 – 0xFFFF	Optional – determines the amount of time in seconds between refresh packets to the Access Point. Use 0xFFFF to disable (default is 10,000 Kμsec [10 sec]).
SPECIFIEDAPTO	0 – 0xFFFF	Optional – time in Kμsec to attempt to associate to a specified Access Point before searching for any available Access Points (with matching SSID) (default is 10,000 Kμsec [10 sec]).
AUTHTIMEOUT	0 – 0xFFFF	Optional – time to attempt to authenticate to an Access Point (default is 2,000 Kμsec [2 sec]).
AUTHTYPE	OFF, OPEN, HAREDKEY, ENCRYP-TONLY	Optional – determines the level of security of the wireless network (default is OPEN).
ASSOCIATIONTO	0 – 0xFFFF	Optional – indicates the maximum amount of time the client will wait for a response to an association request from the Access Point (default is 2,000 Kμsec [2 sec]).

Ad hoc system operation is accomplished with the following group of variables.

Table 3.11 - Ad Hoc Keywords

Keywords	Value	Description
JOINNETTO	0 – 0xFFFF	Optional – determines the amount of time that an ad hoc station will scan before starting its own network (default is 10,000 Kμsec [10 sec]).
BEACONPERIOD	0 – 0xFFFF	Optional – specifies the beaconing interval in Kμsec. (default is 100 Kμsec).
DSCHANNEL	0-14	Optional – this parameter is valid only for a node that starts a network. This is the channel identifier specifying the frequency to communicate on. For all other nodes, the radio will scan for the proper frequency. Default is 0, which will cause the radio to pick a default channel appropriate for its programmed carrier set. Any other value (1-14) will be validated against the programmed carrier set and rejected if invalid.
ATIMDURATION	Between 0 and less than the beacon interval	Ad hoc only – specifies the length of time for ATIMs following a beacon (this value must be non-zero for PSP ad hoc operation) (default is 5). This value is only used when starting a new network. When joining a network, the value currently in use will be adopted.

Table 3.12 - Wireless LAN Adapter Keywords

Keywords	Value	Description
PORTBASE	0 – 0xFFFF	Optional – specifies the starting address for a block of 64 consecutive 16-bit I/O ports. Make sure the block of I/O addresses does not overlap the address of another device in the machine. This can be used to override a card service assignment. If card services are not used, this will default to 0x140.
PORT		Only valid in NET.CFG file (same as PORTBASE).
INT	2-15	Optional – specifies the hardware interrupt the PC Card will use. The Interrupt must be unique (i.e. not used by another device in the machine). This can be used to override a card service assignment. If card services are not used, this will default to 11.
IRQ		Same as INT.
SOCKET	0-7	Optional – If card services are used, this keyword is ignored. If card services are not used, this is the PC Card socket the PC Card is inserted into (default is 0).
MEMORY	0xC000 – 0xDF00	Optional – If card services are used, this keyword is ignored. If card services are not used, this is a block of memory the driver will use to view the PC Card CIS (default is 0xD000). In the NET.CFG file the parameter is D0000, not 0xD000.
MEM		Same as MEMORY.

Section 4

Utilities

This section describes procedures for using utilities and updating firmware depending on the operating system used.

See Appendix B for detailed configuration procedures for WinDGS using Windows 95 or Windows 98.

Here's what you will find in this section:

- Using the utilities
- Loading new firmware versions

Site Survey and Link Test

In order to perform a meaningful site survey, it is necessary to conduct a test that will accurately model the intended use of the system. It is important to perform a site survey using equipment which is similar to that implemented. Items to be surveyed are:

- Transmit power
- Antenna(s) type(s)
- Antenna(s) location(s)
- Packet (fragment) size
- Interference

The site survey should be conducted with all variables set to the operational values. It should also be performed during the time the RF link will generally be functioning with all other systems and noise sources operational. For efficiency, the site survey application should be executed entirely from the mobile station.

The link test tool helps determine the RF network coverage. The results of the link test will help eliminate low RF signal level areas that can result in loss of connection between the Wireless LAN Adapter and the Aironet Access Point.

It is important to remember the information being displayed is from the Aironet Access Point viewpoint. Therefore, packets sent are from the Aironet Access Point to the Wireless LAN Adapter client. Packets received are from the Wireless LAN Adapter to the Aironet Access Point. Signal quality is an estimate of the signal strength recorded at the time of packet reception by the radio.

Using Windows 3.11 or DOS to Perform a Link Test Using Telnet

Link test using telnet is a useful tool for determining:

- Coverage range of an Access Point
- Communication range of stations/mobile stations

To perform the link test using a telnet session:

1. Install the drivers.
2. Configure the drivers for network operation.
3. Ensure unique IP assignments of the Wireless LAN Adapter and Aironet Access Point.
4. Set up an Aironet Access Point for the intended operation (set fragmentation thresholds, RTS thresholds, etc.)
5. Start the operating system on the station.
6. Configure the adapter.
7. Make sure the station is associated to the Aironet Access Point.

8. Start a telnet session on the station to the Aironet Access Point. Depending on the system in use, the telnet application may have logging and note taking capability. If so, enable these modes.

9. Navigate through the Aironet Access Point menu to the link test option. See the appropriate Access Point Technical Reference Manual for more information.

10. Set up the test options to accurately model the system.

11. Set the test for continuous operation with a 1 second delay.

12. Begin traversing the area around the Aironet Access Point to determine its coverage. If logging and notes are not possible with the telnet application, maintain a manual log.

The telnet session packets are interspersed with test packets which may have the effect of increasing the round trip time for some frames. The link test will show progress changes as the test is being conducted.

The first time delivery success rate for the packet may not be important for transaction based systems and can result in a slightly larger range. Using longer packets can provide some degree of safety margin in the range estimate.

NOTE: Roundtrip time will be effected by the telnet session maintenance.

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Using Windows 95 or Windows 98 to Perform a Link Test

You may use either:

- Telnet
- The link test or site survey commands in WinDGS
- Linkscope

Link Test Command in WinDGS

WinDGS may be used to assess the performance of RF links. TCP/IP protocol must be installed to run this link test. See the Help section of Windows 95/98/NT for more information on installing and setting up TCP/IP. An IP address must also be configured for the Access Point.

1. From the link test command menu, enter the following parameters:

    - **IP address of Aironet Access Point:**
      This parameter specifies the IP address of the Access Point with which you want to test the RF link. Set this value before running the link test.

    - **Number of Packets:**
      This parameter specifies the number of packets the link test will attempt to send. The display will show the number of packets of the specified size that are successfully transmitted and received. This parameter is ignored if Continuous Link Test is selected.

    - **Packet Size:**
      This parameter specifies the size of the data packet to be sent to the Aironet Access Point. Be aware that the TCP/IP stack that comes with Windows 95 will fragment packets greater than 512 bytes. Therefore, the number of packets transmitted will not match the number of packets received (even if none are lost) if the packet size is greater than 512 bytes.

    - **Continuous Link Test:**
      Selecting this item causes the link test to run continuously until Stop, OK, or Cancel is selected. The Number of Packets parameter is ignored if Continuous Link Test is selected.

2. Once the parameters have been entered, click on the Start button at the bottom of the dialog box to start the link test. When the link test is running, necessary statistics will be displayed and updated periodically.

3. To stop the link test, click on Stop, OK, or Cancel at the bottom of the dialog box. Once the link test has sent the number of packets specified, the Stop button will toggle back to a Start button.

Linkscope

Linkscope provides a graphical display of:

• Signal Quality

• Signal Strength

Linkscope determines the performance of the RF link between a Wireless LAN Adapter and an Aironet Access Point. Any Windows 95, Windows 98, or Windows NT unit associated to an Aironet Access Point can run the linkscope test.

Signal strength is displayed along the vertical axis of the graphical display. Signal quality is displayed along the horizontal axis. The combined result is represented by a diagonal line. The Aironet Access Point associating with the Wireless LAN Adapter is indicated along the bottom of the display as well as its MAC address. For more information on the Aironet Access Point testing procedures, see the appropriate Access Point Technical Reference Manual.

Loading New Firmware Versions

The firmware is contained in the card's flash memory. Flash memory allows for easy updating of the firmware as necessary.

Upgrading Firmware for Windows 95, Windows 98, or Windows NT

The WinDGS program is used to load new firmware.

To load new firmware:

1. Make sure the Wireless LAN Adapter is up and running.
2. Select **Commands**.
3. Select **Load New Firmware**.
4. Select **Look In....**Use the drop down button to select the appropriate path and image file.
5. Select **Open**. This will flash the card with the selected image.

Loading Firmware for Windows 3.11 and DOS

The FLSH3545.COM program is used to load new firmware to systems operating under DOS and Windows 3.11.

To load new firmware:

1. Before upgrading the firmware, uninstall the driver or reboot the computer and do not load the driver during the boot process.
2. Type **FLSH3545** at the DOS prompt.
3. Enter the option (see Table below).
4. Type the filename of the new firmware.
5. Press **Enter**.

Utility	Description
-p	Specifies the starting address for a block of 64 consecutive 16-bit I/O ports. Make sure the block of I/O addresses does not overlap the address of another device in the machine. This can be used to override a card service assignment. If card services are not used, this will default to 0x140.
-s	Optional – If card services are used, this parameter is ignored. If card services are not used, this is the PC Card socket the PC Card is inserted into (default is 0).
-m	If card services are used, this parameter is ignored. If card services are not used, this is a block of memory the driver will use to view the PC Card CIS (default is 0xD000).
-q	Quiet Mode, no messages will appear while flash upgrade is in progress.

Section 5

Error Messages and Trouble Shooting

The Wireless LAN Adapter provides LED messages and error codes. This section provides the general procedures for correcting common problems encountered when installing the Wireless LAN Adapter
system.

Indicator LEDs

The Wireless LAN Adapter has two indicator LEDs (green and amber) located on the back of the card.

The green indicator is the Link Integrity/Power LED. It lights when the card is receiving power and flashes slowly when the Wireless LAN Adapter is linked with the network.

The amber indicator is the Link Activity LED. It flashes when the Wireless LAN Adapter is receiving or transmitting data or in a pattern to indicate an error condition.

See Tables 5.1 and 5.2 for an explanation of the LED Messages.

Table 5.1 – Green LED Operating Messages

Green LED	Condition
Off	No power or error
Blinking Quickly	Power on, self-test OK, scanning for network
Blinking Slowly	Associated with an infrastructure network

Table 5.2 – Amber LED Operating Messages

Amber LED	Green LED	Condition
Blinking	Continuously on or flashing slowly	Wireless LAN Adapter is transmitting or receiving data while associated with an Access Point
Blinking in a Pattern	Continuously on	Indicates an error condition

If Your Radio Fails to Establish Contact

- Change your location or the location of the antenna by a few feet and try again.

- Make sure the antenna is securely attached.

- Make sure the Wireless LAN Adapter is securely inserted in the slot.

- Make sure the receiving equipment is turned on and operating.

- Make sure the receiving equipment is properly connected to the host computer.

- Check that all parameters are set properly for both the Wireless LAN Adapter and the Aironet Access Point.

If the radio fails to establish contact, contact Aironet Technical Support for additional assistance:

Phone   - (330) 664-7903
Fax   - (330) 664-7990
e-mail   - techsupp@aironet.com
              http://www. aironet.com

Appendix A

Wireless LAN Adapter Specifications

LAN Drivers Supported

Table A.1 – Supported Drivers

Protocol	Operating System
ODI	DOS based driver for Novell Netware
NDIS 2	MS DOS, Windows 3.xx
NDIS 3	Windows 95, Windows 98, Windows NT
Packet	MS DOS, Windows 3.xx

Radio Specifications

Table A.2 – Radio Specifications

Item	Specification	Description
Radio Type	Direct Sequence	2.4 GHz ISM Band
Operating Frequency	2400-2497	North American, ETSI, and Japan channel coverage, factory configurable
FCC ID	(ISA4500)	FCC approval
	(PCI4500)	
	(ISA4800)	
	(PCI4800)	
Channeling	1 MHz increments	Programmable for IEEE 802.11
Type of Modulation	BPSK 1 Mb (4500) QPSK 2 Mb	IEEE 802.11 FHSS
	BPSK 1 Mb(4800) QPSK 2 Mb CCK 5.5 and 11 Mb/s	
Power Output (North American Configuration)	100 mW	Meets FCC Part 15.247 requirements
Antenna Type	1 External	2 dBi Dipole
Mating Antenna Connector		R-TNC

Power Requirements

Table A.3 – Power Requirements

Specification	Value
Operational Voltage	5.0V ±0.25 Volts
Receive Mode Current	500 mA (4500)
	150 mA (4800)
High Power Transmit Mode Current	800 mA (4500)
	150 mA (4800)

Physical Specifications

Table A.4 – Physical Characteristics

Item	Description	
	ISA	PCI
Size	16.1 cm x 8.1 cm x 1.3 cm (6.3 in. x 3.2 in. x .5 in)	14.7 cm x 8.1 cm x 1.3 cm (5.8 in. x 3.2 in. x .5 in)
Weight	.13 Kg (4.6 oz.)	
Operating Temperature	0° C to 70° C minimum (32° F to 158° F)	
Storage Temperature	-40° C to +85° C (-40° F to 185° F)	
Humidity, Non-Condensing	95%	
ESD	15kV (human body model)	
Connectors	ISA or PCI card edge	
Status Indicators	Green and Amber LEDs – link association/activity	

Appendix B

Using the WinDGS Utility

WinDGS is used to perform user level diagnostics on your Aironet Wireless LAN Adapter Card in the Windows 95, Windows 98, or Windows NT operating system environment.

Commands Menu

The Commands Menu includes:

- Select Card
- Loading New Firmware
- Edit Properties
- Statistics
- Status
- Link test
- Site Survey
- Radio Off/On
- Exit

Select Card

This allows another installed Aironet Wireless LAN Adapter to be chosen. The property screens will change to reflect the parameters specific to each card type.

Load New Firmware

See **Section 4** – *Utilities* for more information on loading and upgrading firmware versions.

Edit Properties

WinDGS allows you to change the configuration parameters of your currently installed Wireless LAN Adapter. Depending on the preferences you have set, WinDGS can save the current properties to the registry. See *Save Properties Options* for more information.

Statistics

The Statistics screen shows the current statistics from the Wireless LAN Adapter. Statistics are updated at the rate specified by the Screen Update Timer. Clear the current statistics by clicking on **Reset**. Exit the Statistics screen by clicking on **OK**, or by clicking on the **X** in the upper right hand corner of the dialog box.

Status

The Status screen shows the current status from the Wireless LAN Adapter. Status is updated at the rate specified by the Screen Update Timer. Exit the Status screen by clicking on **OK**, or by clicking on the **X** in the upper right hand corner of the dialog box.

Link Test

See **Section 4** – *Utilities* for information on using link test.

Site Survey

See **Section 4** – *Utilities* for information on using site survey.

Radio Off/On

Radio Off/On allows you to selectively turn off or on the power to the radio. Turning the radio off prevents all RF energy from being transmitted by the Wireless LAN Adapter.

Exit

Closes all windows and exits WinDGS.

Options Menu

The Options Menu includes:

- Preferences
- Screen Update Timer
- Save Properties Options

Preferences

The WinDGS Preferences allow you to customize various parameters that control the operation of WinDGS. For example, you can set the rate at which the values are updated in the status and statistics screens via the Screen Update Timer. You can also set the Save Properties Options, which controls what is done with changes to the current settings.

Screen Update Timer

The Screen Update Timer controls how often the statistics and status screens are updated. The screen can be updated in one second increments, from once a second to once every 60 seconds. The default is once every five seconds. You can use either the edit box or the slider to change this value.

Save Properties Options

Use Save Properties Options to select the default operations for saving the current adapter configuration. Choose either:

- **Save Properties to the Registry**: This option allows you to save the configuration to the Windows Registry. The configuration will be restored the next time you reboot.
- **Save Properties to the Adapter**: This option saves the current configuration to non-volatile memory in the adapter.
- **Always Prompt the User**: This option will prompt the user to save the current settings to the Registry. If the box is not checked, the operation will default to "Save Properties to the Registry".

Edit Parameters

The Wireless LAN Adapter Parameters include:

- System Parameters
- Network Parameters
- RF Network Parameters
- Advanced (Infrastructure or Ad Hoc)

System Parameters

System parameters include:

• Name

• SSID

• Network Type (Infrastructure or Ad Hoc)

• Constant Awake Mode (CAM)

• Power Save Mode

• Fast Power Save Mode

Name

The station name is displayed in the table of connected devices on the Access Point. It provides a logical name to determine which machines are connected without having to memorize every MAC address. The name can be up to 16 characters.

SSID

The Service Set Identifier (SSID) controls access to a given wireless network. This value MUST match the SSID of any/all Access Points that you want to communicate with. If the value does not match, access to the system is not granted. The SSID can be up to 32 characters (case sensitive).

Network type (Infrastructure Mode)

This mode is used to set up a connection to a wired network, such as Ethernet or Token Ring. This mode requires an Access Point to gain access to the wired network.

Network type (Ad Hoc Mode)

This mode is used to set up a small, temporary network between two or more computers. For example, you might set up an ad hoc network between computers in a conference room so users can share information in a meeting.

Constant Awake Mode (CAM)

Constant Awake Mode is the normal mode for desktop machines or other machines where power consumption is not an issue. It keeps the radio powered up continuously so there is little latency for responding to messages. This mode is recommended for devices where high availability is desired.

Power Save Mode

Power Save Mode is recommended for devices where power consumption is a major concern, such as small battery powered devices. Power Save Mode causes the Access Point to buffer incoming messages. The Wireless LAN Adapter must wake up periodically and poll the Access Point to see if there are any buffered messages waiting. The Wireless LAN Adapter can request each message and then go back to sleep.

Fast Power Save Mode

Fast Power Save Mode (Fast PSP Mode) switches between PSP and CAM based on network traffic. When retrieving a high number of packets, Fast PSP Mode will switch to CAM to retrieve the packets. Once the packets are retrieved, it switches back to PSP.

Network Parameters

User modifiable parameters are limited to the choice of
MAC Address:

- **Factory MAC Address**: This is the default MAC
  address which is guaranteed to be unique. Unless you
  have a very good reason to define your own MAC
  address, it is STRONGLY RECOMMENDED that you
  use the factory MAC address.

- **User Defined MAC Address**: If you must define your
  own MAC address, you can enter it here. If you do not
  use a unique value, you may not be able to communi-
  cate to your wired network or you may disrupt other net-
  work devices. For this reason, it is STRONGLY
  RECOMMENDED that you use the factory MAC
  address. The MAC address is 12 hexadecimal digits.
  You do not need to use delimiters, but you can use
  spaces or the colon character.

RF Network Parameters

RF Network Parameters include:

- **Fragment Threshold**: This parameter defines a thresh-
  old above which the RF packet will be split up or frag-
  mented. If a packet is fragmented or transmission of
  part of it is interfered with, only the portion that was
  unsuccessful would need to be re-sent. The throughput
  will generally be lower for fragmented packets since the
  fixed packet overhead consumes a higher portion of the
  RF bandwidth.

- **Data Retries**: This parameter defines the number of times a packet will be re-sent if the initial transmission is unsuccessful. If the network protocol automatically retries itself, set this to a small value. A "bad" packet status will be sent up the protocol stack more quickly so the application can re-transmit the packet.

- **Basic Data Rate**: This parameter determines the data rate used to transfer all management frames by the client device when associated within a given Basic Service Set (BSS). When operating in Infrastructure Mode, this parameter should be set to correspond to the Access Point setting. When operating in Ad Hoc Mode, all stations should have the same setting.

Model	Allowable Selections
4500	1 Mbps or 2 Mbps
4800	1 Mbps, 2 Mbps, 5.5 Mbps, or 11 Mbps

- **Supported Data Rates**: This parameter specifies the data rates that will be supported by a given radio device in the BSS.

Model	Allowable Selections
4500	1 Mbps, 1_2 Mbps, or 2 Mbps
4800	1 Mbps, 1_2 Mbps, 1_5.5 Mbps, 1_11 Mbps 2 Mbps, 2_5.5 Mbps, 2_11 Mbps, 5.5 Mbps, 5.5_11 Mbps, or 11 Mbps

Advanced (Infrastructure)

The following parameters are contained in both the Infrastructure and Ad Hoc Modes:

- Specified Access Point
- RTS Threshold
- RTS Retry Limit

Specified Access Point

This parameter is the MAC address of the preferred Access Point you want to associate with. It is important to note that if you specify the Access Point, you MAY associate to another Access Point if the Specified Access Point is not found. If you roam out of range, you will probably associate with another Access Point. Setting a Specified Access Point will slow down the roaming process. Thus, for normal operation for the majority of users, leave this field blank.

RTS Threshold

This parameter controls what size data packet the low level RF protocol issues to an RTS packet. There are several trade-offs to consider when setting this parameter. Setting this parameter to a small value causes RTS packets to be sent more often, consuming more of the available bandwidth, therefore reducing the apparent throughput of other network packets. However, the more often RTS packets are sent, the quicker the system can recover from interference or collisions. Refer to the IEEE 802.11 Standard for more information on the RTS/CTS mechanism.

RTS Retry Limit

This parameter controls the number of times the Wireless LAN Adapter will re-send the RTS packet if it does not receive a CTS from the previously sent RTS packet. Setting this to a large value will decrease the available bandwidth whenever interference is encountered, but will make the system more immune to interference and collisions. Refer to the IEEE 802.11 Standard for more information on the RTS/CTS mechanism.

Advanced (Ad Hoc/IBSS)

In Ad Hoc Mode, you can also modify the following parameters:

- Channel
- Beacon Period
- Wake Duration

Channel

This parameter specifies the channel identifier the unit will use if it must start its own network. For all other situations, the radio will scan for the proper frequency. See **Appendix C** for channel identifier parameters.

Beacon Period

This parameter specifies the duration between beacon packets that are used by IEEE 802.11 systems to synchronize the "hops" (change to another frequency). The beacon packet contains timing information and hop pattern information that is broadcast over the airwaves. Any station that can hear the beacon packet can then synchronize their internal timer so that it can hop at the correct time. The default beacon period is one-half of the dwell period so two beacons are transmitted per hop dwell period (default is 100 Kμsec). Refer to the IEEE 802.11 Standard for more information on the timing and scanning.

Wake Duration

This parameter specifies the amount of time per Hop Dwell Period that the adapter stays awake listening for data packets. This is only used in Power Save Mode.
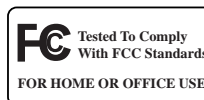
Appendix C

Manufacturers Federal Communication Commission Declaration of Conformity Statement

Models: ISA4500, ISA4800, PCI4500, PCI4800

Manufacturer:

Aironet Wireless Communications, Inc.
3875 Embassy Parkway
Akron, OH 44333-8357
330-664-7900

FC **Tested To Comply With FCC Standards**

FOR HOME OR OFFICE USE

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

1) this device may not cause harmful interference, and 2) this device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits of a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a residential environment. This equipment generates, uses, and radiates radio frequency energy, and if not installed and used in accordance with the instructions, may cause harmful interference. However, there is no guarantee that interference will not occur. If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to correct the interference by one of the following measures:

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

User Warning

The Part 15 radio device operates on a non-interference basis with other devices operating at this frequency. Any changes or modification to said product not expressly approved by Aironet could void the user's authority to operate this device.

Department of Communications—Canada
Canadian Compliance Statement

This Class B Digital apparatus meets all the requirements of the Canadian Interference - Causing Equipment Regulations.

Cet appareil numerique de la classe B respecte les exigences du Reglement sur le material broilleur du Canada.

This device complies with RSS-210 of Industry of Canada. Operation is subject to the following two conditions: 1) this device may not cause harmful interference, and 2) this device must accept any interference received, including interference that may cause undesired operation.

The device is certified to the requirements of RSS-139-1 for 2.4 GHz spread spectrum devices. The use of this device in a system operating either partially or completely outdoors may require the user to obtain a license for the system according to the Canadian regulations. For further information, contact your local Industry Canada office.

European Telecommunication Standards Institute Statement of Compliance Information to User

This equipment has been tested and found to comply with the European Telecommunications Standard ETS 300.328. This standard covers Wideband Data Transmission Systems referred in CEPT recommendation T/R 10.01.

This type accepted equipment is designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy, and if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications.

Declaration of Conformity

Aironet Model Number:
ISA4500, PCI4500

Radio CE Type Certificate Number: BCL/EC/98-0309/B
Radio Type Approval Examiniation Number: CPC/ARLAN/DK/9815

Application of Council Directive: 89/336/EEC
Application of Council Directive: 72/23/EEC

Standards which Conformity is Declared:

    EN 55022 (B)
    EN 55011 (B)
    EN 50082-1
    EN 60950

Manufacturer: Aironet Wireless Communication
       3875 Embassy Parkway
       Akron, OH 44333

The undersigned hereby declares the above specified equipment conforms to the above Directives and standards.

Michael Smedley
Director, Manufacturing Engineering
Aironet Wireless Communications, Inc.

Declaration of Conformity

Aironet Model Number:
ISA4800, PCI4800

Radio CE Type Certificate Number:
Radio Type Approval Examiniation Number:

Application of Council Directive: 89/336/EEC
Application of Council Directive: 72/23/EEC

Standards which Conformity is Declared:

EN 55022 (B)
EN 55011 (B)
EN 50082-1
EN 60950

Manufacturer: Aironet Wireless Communication
3875 Embassy Parkway
Akron, OH 44333

*The undersigned hereby declares the above specified equipment
conforms to the above Directives and standards.*

Michael Smedley
Director, Manufacturing Engineering
Aironet Wireless Communications, Inc.

Appendix D

Technical Support

Communications

Use the following information to contact the Aironet Technical Support group:

Telephone - (330) 664-7903
Fax -   (330) 664-7990
e-mail -   techsupp@aironet.com

Web Site

For additional product information and technical support, including the capability to download new firmware and drivers, use the Aironet web site at:

http://www.aironet.com