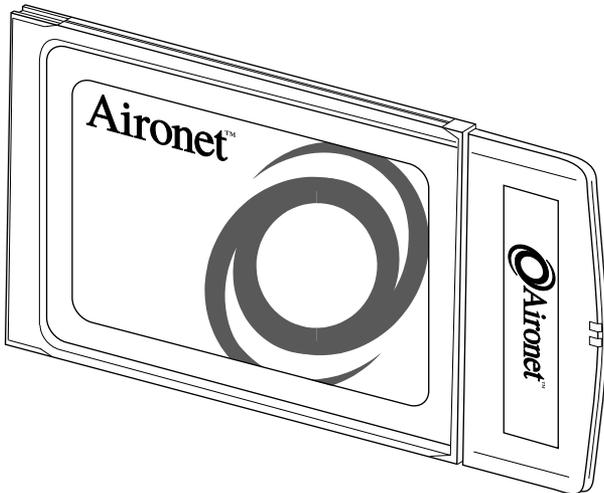




Technical User's Guide
4800 Series
Aironet Wireless LAN Adapter
PC4800

DOC-710-00520-A0



Aironet Wireless Communications, Inc.

No part of this document may be reproduced or transmitted in any means, electronic or mechanical, for any purpose, without the written permission of Aironet. Information in this document is subject to change without notice. Aironet makes no representation or warranties with respect to the contents of this manual and specifically disclaims any express or implied warranties of merchantability or fitness for any particular purpose.

© 1999 Aironet Wireless Communications, Inc.
All rights reserved.

LM4500™, AP4500™, PC4500™, LM4800™, AP4800™, PC4800™, and Aironet™ are trademarks of Aironet Wireless Communications, Inc.

Other trademarks used are properties of their respective owners.

Printed in USA

DOC-710-00520-A0

Table of Contents

| | |
|--|------|
| About the Technical User's Guide | vii |
| Typographical Conventions | viii |
| Section 1 | |
| Installing the Wireless LAN Adapter | 9 |
| Before You Start | 10 |
| Installing the Wireless LAN Adapter | 11 |
| Section 2 | |
| Drivers for Special Installations | 25 |
| Driver Overview | 25 |
| Windows for Workgroups NDIS2 Installation | 28 |
| DOS NDIS2 Installation | 29 |
| DOS Packet Driver Installation | 31 |
| ODI Driver Installation | 33 |
| General Information | 34 |
| Driver Keywords and Settings | 36 |
| Section 3 | |
| Using the WinDGS Utilities | 49 |
| WinDGS Commands Menu | 49 |
| Select Card | 49 |
| Load New Firmware | 49 |
| Edit Properties | 51 |
| Statistics | 51 |
| Status | 51 |
| Link Test | 52 |
| Site Survey | 54 |
| Radio Off/On | 56 |
| Exit | 56 |
| Options Menu | 56 |
| Preferences | 56 |
| Core Dump | 57 |
| NDIS Driver Core Dump | 57 |
| Using Edit Properties | 57 |
| System Parameters | 58 |
| Network Parameters | 60 |
| RF Network Parameters | 60 |
| Advanced (Infrastructure) | 62 |
| Advanced (Ad Hoc/IBSS) | 64 |
| Using the Site Survey Active Mode Feature | 65 |
| Destination MAC Address | 65 |
| Continuous Link Test | 66 |
| Destination is Another Aironet Device | 66 |
| Number of Packets | 66 |
| Packet Size | 66 |

Table of Contents

| | |
|--|-----|
| Data Retries | 66 |
| Data Rates | 66 |
| Delay Between Packets | 67 |
| Packet Tx Type | 67 |
| Packet Success Threshold | 67 |
| Using the Linkscope Utility | 68 |
| Section 4 | |
| Error Messages and Troubleshooting | 69 |
| Indicator LEDs | 69 |
| If Your Radio Fails to Establish Contact | 71 |
| Appendix A | |
| Aironet Wireless LAN Adapter Overview | 73 |
| Safety Information | 74 |
| Radio Characteristics | 76 |
| Direct Sequence Radio Technology | 76 |
| Data Transparency and Protocols | 76 |
| Protocols Supported | 77 |
| Radio Ranges | 77 |
| Radio Antenna | 78 |
| Security Features | 79 |
| Terminology | 79 |
| System Configurations | 81 |
| Coverage Options | 85 |
| Appendix B | |
| PC Card Specifications | 89 |
| LAN Drivers Supported | 89 |
| Radio Specifications | 90 |
| Power Requirements | 91 |
| Physical Specifications | 91 |
| Mechanical Description | 92 |
| Appendix C | |
| Channels | 93 |
| Appendix D | |
| Declarations of Conformity | 95 |
| Appendix E | |
| Technical Support | 101 |

About the Technical User's Guide

This guide covers the installation, configuration, control, and maintenance of your Aironet 4800 Series PC Card Wireless LAN Adapter. The Guide is arranged as follows:

Section 1 – *Installation* – describes installation of the PC Card.

Section 2 – *Drivers for Special Installations* – describes installation and configuration of the various network drivers.

Section 3 – *Utilities* – provides detailed procedures for using the utilities to load new firmware versions, as well as how to perform link tests and site surveys.

Section 4 – *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 – *Aironet Wireless LAN Adapter Overview* – provides a general introduction to the 4800 Series PC Card, direct sequence radio technology, and the various configurations you can use when operating the 4800 Series PC Card in your infrastructure.

Appendix B – *Specifications* – provides radio and physical specifications.

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

Appendix D – *Declarations of Conformity* – provides conformity information about the 4800 Series 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. |
|  | Indicates 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 typing a character or making a selection with your mouse. |



Section 1

Installing the Wireless LAN Adapter

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

Before You Start

For the PC Card to be used with a computing device (desktop personal computer, notebook, laptop computer, portable or hand-held device), the device must be equipped with an internal or external PC Card Type II or Type III slot. All drivers and supporting software (card and socket services) for the PC Card slot must be loaded and configured.

After unpacking the PC Card, make sure the following items are present and in good condition:

- PC4800 Wireless LAN Adapter
- Software Driver Diskette
- Utilities Diskette

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



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

Installing the Wireless LAN Adapter

This section provides instructions for installing an Aironet client card on a computer using Windows 95 or 98, and on a computer using Windows NT. The instructions for Windows 95 and 98 show screens typical in Windows 98, and the instructions for Windows NT show screens typical in NT 4.0. If your computer uses Windows 95 or Windows NT 3.51, your screens will differ slightly.

If you are installing your client card on a computer using Windows for Workgroups, DOS, Novell Netware, or any other ODI-compliant DOS environment, see **Section 2 — Drivers for Special Installations**.

Before you begin, examine the PC Card. One end is a dual-row, 68-pin PC Card connector. This side will be inserted into the PC Card slot with the Aironet logo on the PC Card facing up. The card is keyed so it can be inserted only one way into the PC Card slot.



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

The PC Card can be connected to a PC Card Type II slot. This includes slots that support both Type II and Type III cards.

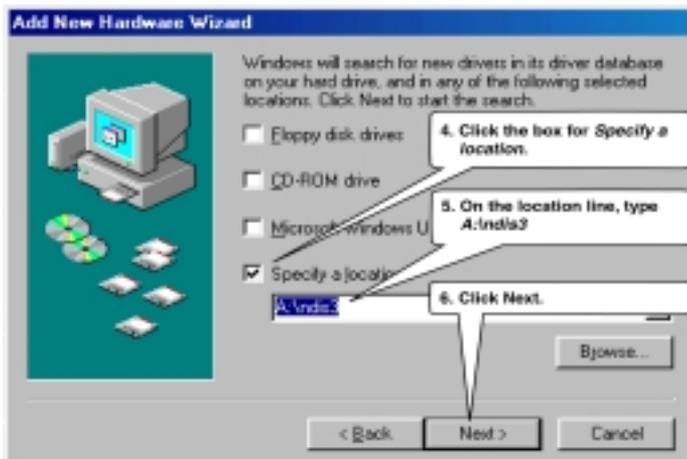
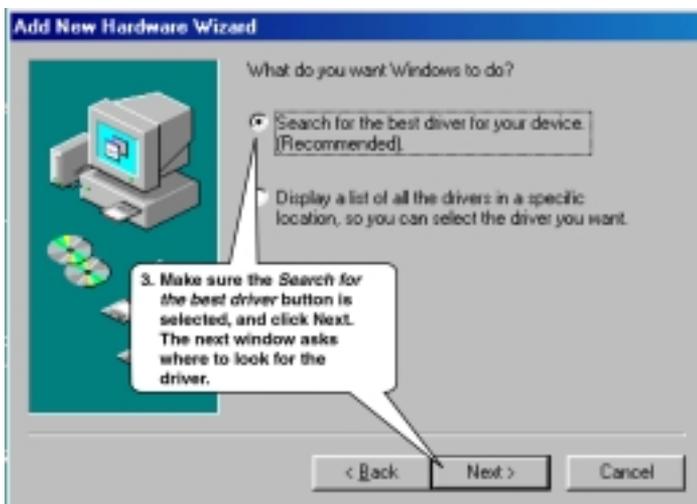


CAUTION: Do not force the PC Card into the PC Card slot. Forcing it will damage both the PC Card and the slot. If the PC Card does not go in easily, remove the card and re-insert it.

If the operating system on your computer is Windows 95 or 98, follow these steps:

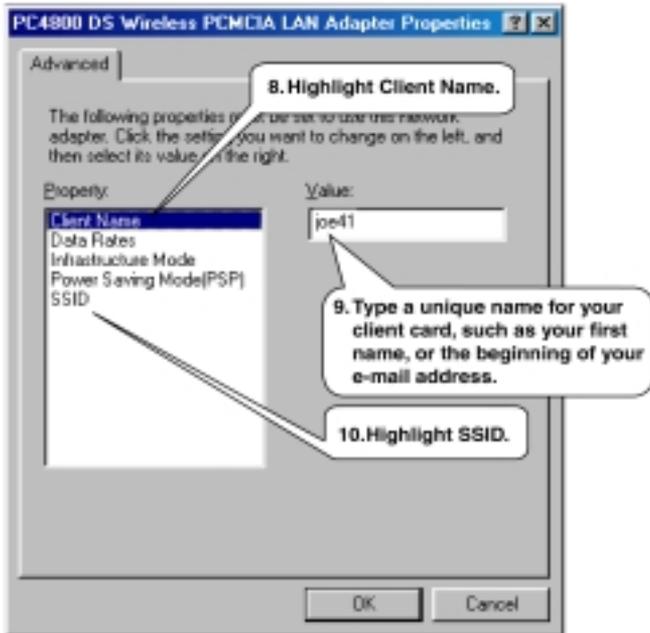
1. While your computer is up and running, hold the PC Card so the Aironet logo is facing up, and slide the PC Card into the slot until its connector is firmly seated and the slot's eject button pops out. The New Hardware Found window appears briefly, followed by the Add New Hardware window:

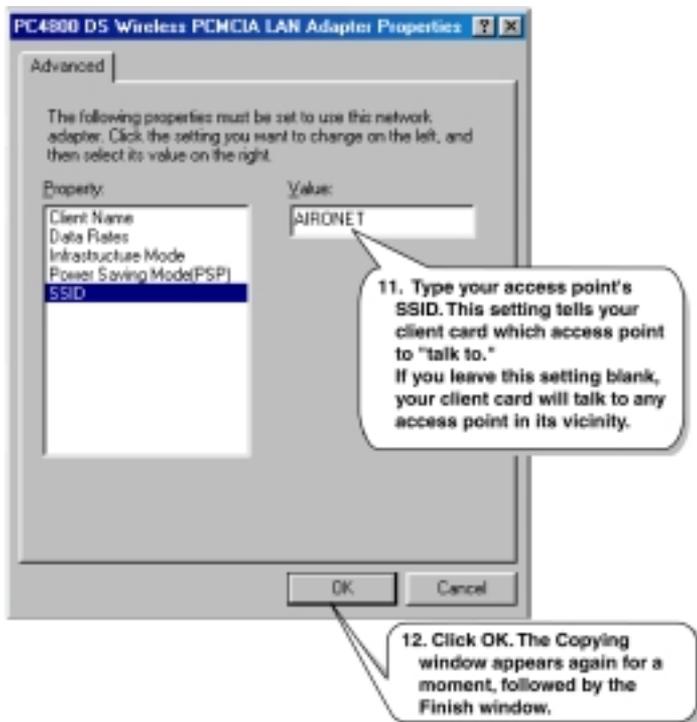


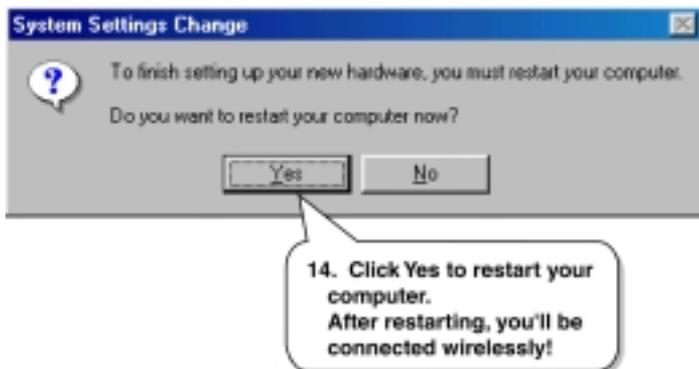




Note: Steps 8, 9, 10, and 11 allow you to name your client card and specify the name of the access point your card will “talk to.” Your client card will work fine if you skip these steps, however. For the simplest setup of your client card, click OK and skip to step 13 of these instructions.

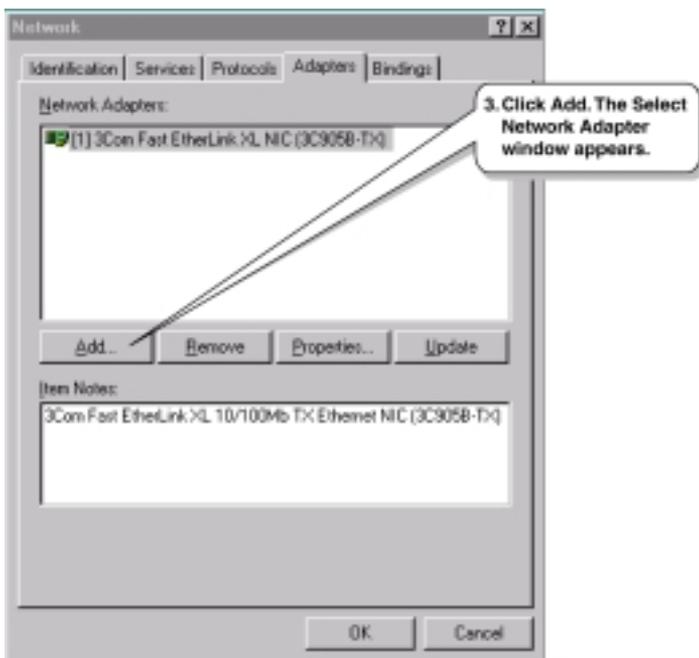




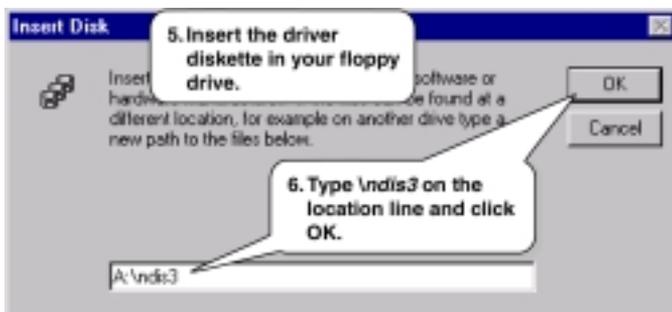
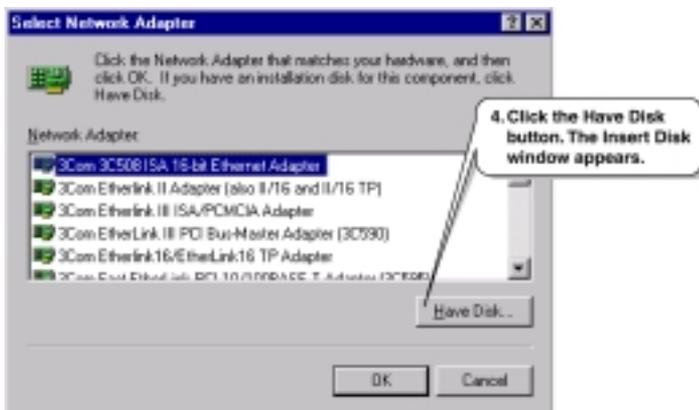


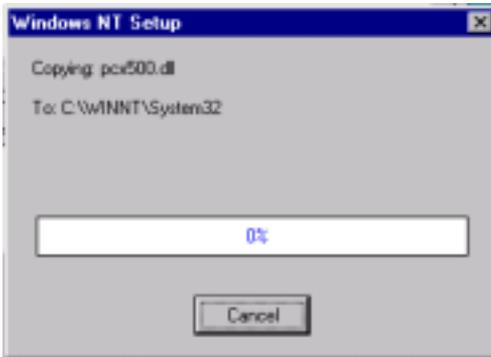
If the operating system on your computer is Windows NT, follow these steps:

1. Turn your computer off, plug the card into the PCMCIA slot, and turn the computer back on.
2. On your Windows Control Panel (click the Start button, then select Settings, then Control Panel), select the Network icon. The Network window appears.

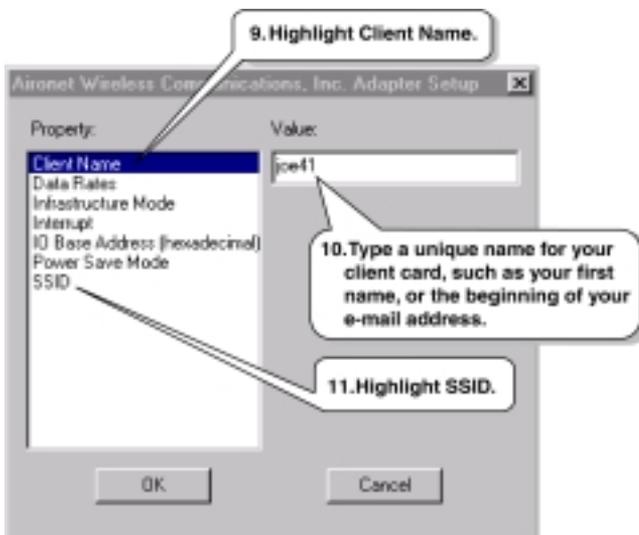


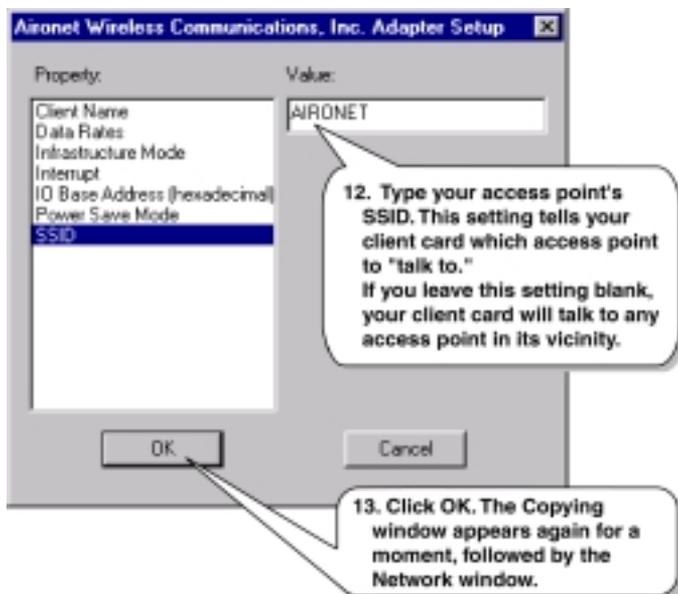
Section 1: Installing the Wireless LAN Adapter

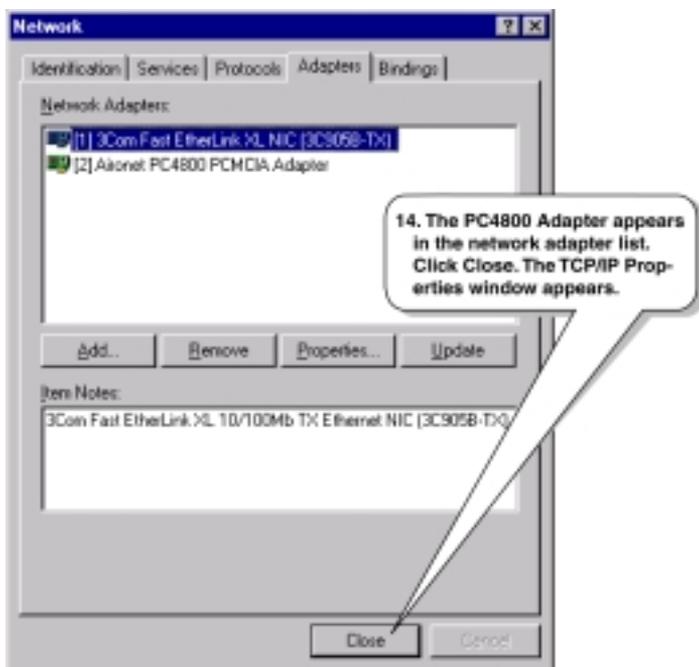


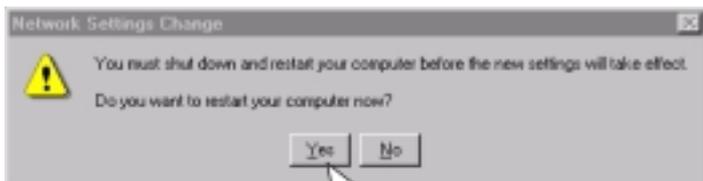
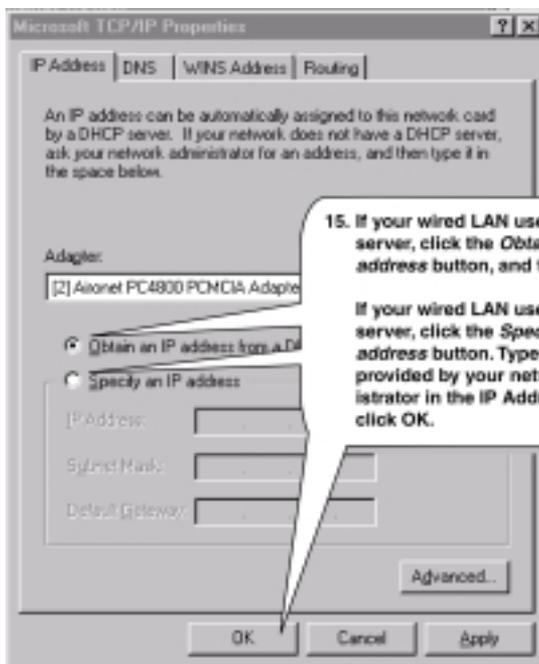


Note: Steps 9, 10, 11, and 12 allow you to name your client card and specify the name of the access point your card will “talk to.” Your client card will work fine if you skip these steps, however. For the simplest setup of your client card, click OK and skip to step 14 of these instructions.









Section 2

Drivers for Special Installations

The PC Card 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 PC Card is fully IEEE 802.11 compliant.

Driver Overview

The PC Card is shipped with two diskettes:

- WinDGS diagnostics diskette
- Aironet driver diskette

This section covers the drivers. The utilities are discussed in **Section 3 – Utilities**.

To use the DOS, Windows 3.x and Windows for Workgroups based drivers, you must create or edit a configuration file created 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 2.1 - Driver Disk Structure

| | |
|--------------|---|
| README.TXT | Contains latest information about the disk contents |
| DIAG | Directory containing utilities |
| FLSH3545.COM | PC card flash firmware |
| 45C???.BIN | Latest firmware release |
| 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. |

Drivers for Special Installations

| | |
|----------------|---|
| NDIS3 (PC4500) | 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 | PC4500 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 (PC4800) | Directory containing NDIS3 driver files |
| PC4800.INF | WIN95 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 | PC4800 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 for Workgroups NDIS2 Installation

1. Turn 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 Aironet 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, Channel, and Bitrate.
14. Exit Windows for Workgroups.
15. To modify the PC Card 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).

PROTOCOL.INI must contain the following lines:

Table 2.2 - 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 PC Card system parameters, edit the PROTOCOL.INI file in the network directory. For a list of parameters which can be modified, see Table 2.2.
6. Reboot your computer.

DOS Packet Driver Installation

The installation of this driver includes creating or editing a configuration file (AWCPKT.INI). This file must contain the following lines:

Table 2.3 - Minimum AWCPKT.INI Driver Settings

| Infrastructure Mode | Ad Hoc Mode |
|---|-------------------------|
| [AWCPKT] | [AWCPKT] |
| 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.

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 PC Card 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**.



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 PC Card can be installed in an ODI compliant DOS environment such as Novell NetWare.

Table 2.4 - 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 PC Card 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=iAWC2N45C\$.
- NET.CFG file must have a section header of [Link Driver AWCO45C].



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 vice 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 PC Card configuration is set to:

- Constant Awake Mode
- Infrastructure Mode – This allows association with any Aironet Access Point matching the SSID supplied by the user
- The factory supplied network address
- 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 2.5 - General Network Keywords

| Keywords | Value | Description |
|----------------|---|---|
| INFRASTRUCTURE | ON, YES OFF, NO | Optional – specifies whether system operation uses an infrastructure or peer-to-peer/ad hoc network (default is ON, YES). |
| SSID | 1 to 32 character string | This parameter must match the SSID of the system for proper operation. |
| NODENAME | 1 to 16 character string | Optional – specifies a readable name for the station. |
| NETADDRESS | 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. |
| NODE ADDRESS | | Same as NETADDRESS (keyword only valid in NET.CFG file). |
| RXMODE | NORMAL, UNICAST, NOMULTICAST | Optional – this setting determines what frames are delivered to the driver from the PC Card (default is NORMAL). NORMAL indicates unicast, multicast and broadcast frames are received. |
| DATARATE1 | 0-255 | Optional – specified in increasing speed to identify the network configuration to associate to (default is 1_2 [4500] or 1_11 [4800]). |
| DATARATE2 | 0-255 | Optional – specified in increasing speed to identify the network configuration to associate to. |

Network performance can be optimized with the following variables.

Table 2.6 - Advanced Network Keywords

| Keywords | Value | Description |
|-----------------|--------------------------|--|
| LONGRETRYLIMIT | 0 – 255 | Optional – specifies the number of times an unfragmented packet will be retried before the packet is dropped and a transmit error is reported to driver (default is 16). |
| SHORTRETRYLIMIT | 0 – 255 | Optional – specifies the number of times that a fragmented packet will be retried to gain access before a packet is dropped and a transmit error is reported to the driver (default is 16). |
| 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 – 100 | Optional – selects the next highest programmed power level for transmit in mW. |
| RXDIVERSITY | DEFAULT, ON, RIGHT, LEFT | Optional – specifies the receive diversity method to be used by the PC Card (default is on). |
| TXDIVERSITY | DEFAULT, ON, RIGHT, LEFT | Optional – specifies the transmit diversity method to be used by the PC Card (default is on). |

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

Table 2.7 - 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 2.8 - Power Management Keywords

| Keywords | Value | Description |
|-----------------|--|--|
| POWERSAVERMODE | CAM, PSP, FASTPSP | 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. |
| 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 2.8 - 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 FASTLISTENTIME 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 2.9 - 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). |
| PROBERESPON- SETO | 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 2.10 - Infrastructure Keywords

| Keywords | Value | Description |
|-----------------|---|--|
| SSID | 1 to 32 character string | This parameter must match the SSID of the system for proper infrastructure operation. |
| 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]). |
| SPECIFIEDAP | Any IEEE MAC address except broadcast and multicast | Optional – forces association to the specified Access Point. |
| SPECIFIEDAP2 | Any IEEE MAC address except broadcast and multicast | Optional – forces association to one of the specified Access Points. |
| SPECIFIEDAP3 | Any IEEE MAC address except broadcast and multicast | Optional – forces association to one of the specified Access Points. |
| SPECIFIEDAP4 | Any IEEE MAC address except broadcast and multicast | Optional – forces association to one of the specified Access Points. |

Table 2.10 - Infrastructure Keywords (Continued)

| Keywords | Value | Description |
|-----------------|---------------------------------|--|
| 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, HAREKEY, ENCRYPTONLY | 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 2.11 - 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. |

The following is a list of keywords that will control the host system hardware resources the Aironet 4000 Series Wireless LAN Adapter requires.



NOTE: At a minimum, the PC Card requires 64 consecutive 16-bit I/O ports, one non-sharable Interrupt and one PC Card type II slot.

If you are using card services, these resources will be assigned for you. However, you may override the card services resource assignments by including the PortBase and/or INT/IRQ keywords in the appropriate configuration file.

If you are not using card services, your host system must have an Intel 82365 or compatible PC Card controller chip. The 4000 Series driver will then configure the PC Card controller chip directly and each of the following parameters should be specified in your configuration file.

Table 2.12 - PC Card 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 3

Using the WinDGS Utilities

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

WinDGS Commands Menu

The Commands Menu includes:

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



Select Card

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

Load New Firmware

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 or Windows 98

The WinDGS program is used to load new firmware.

To load new firmware:

1. Make sure the PC Card 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.

Upgrading 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).



NOTE: If using card and socket services, no options should be required.

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. |

Edit Properties

WinDGS allows you to change the configuration parameters of your currently installed Aironet 4000 Series Wireless LAN Adapter. See “Using Edit Properties” on page 3-49 for details on this command.

Statistics

The Statistics screen shows the current statistics from the PC Card. 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 PC Card. 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

You can use WinDGS to assess the performance of RF links. TCP/IP protocol must be installed on your system to run this link test. See the Windows 95/98/NT Help section 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.

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

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 mobile/portable PC Card devices 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 mobile station.
6. Configure the adapter.
7. Make sure the mobile station is associated to the Aironet Access Point.
8. Start a telnet session on the mobile 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 increase 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.

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

Site Survey

To perform a meaningful site survey, you need 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 the equipment that will be implemented. Common survey items include:

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

You should always conduct a site survey with all variables

set to the operational values. You should also try to perform the survey during the time the RF link will generally be functioning with all other systems and noise sources operational. For efficiency, you should execute the site survey application 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 PC Card and the Aironet Access Point.

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

Note: If your Wireless LAN Adapter contains new firmware, you can use WinDGS's Active Mode Survey. See "Using the Site Survey Active Mode Feature" on page 3-57 for details.

The Overall Link Quality rating on the Site Survey window indicates the ability of the Aironet Wireless LAN Adapter to successfully communicate with an Access Point. Ratings are Excellent, Good, Fair, and Poor. The rating is derived from the Current Signal Strength (PC4500/PC4800) and Current Signal Quality.

- Excellent: Both values are greater than 75%
- Good: Both values are greater than 40%, but one or both are less than 75%
- Fair: Both values are greater than 20% but one or both are less than 40%
- Poor: One or both values are less than 20%

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 PC Card.

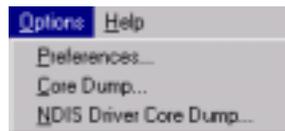
Exit

Closes all windows and exits WinDGS.

Options Menu

The Options Menu includes:

- Preferences
- Core Dump
- NDIS Driver Core Dump



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.

Status Bar Options

Use the Status Bar Options to include seconds on the clock display on the WinDGS main screen.

Core Dump

Core Dump allows you to perform a core dump of the Wireless LAN Adapter's firmware. Enter file names for core dumps 1 and 2, or accept the defaults (C:\Aironet\WinDGS4_07\Core4800.1 and Core4800.2). Click the Do Core Dump button to perform the dump.

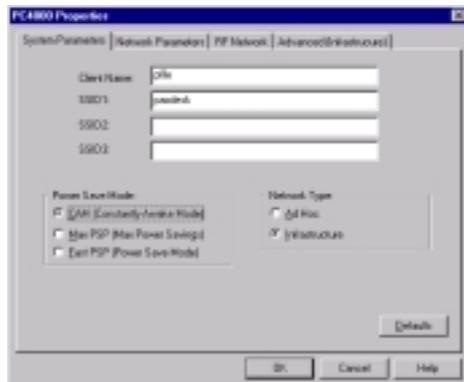
NDIS Driver Core Dump

NDIS Driver Core Dump allows you to perform a core dump of the Wireless LAN Adapter's drivers. Enter a file name for the core dump, or accept the default (C:\Aironet\WinDGS4_07\Core4800.cor). Click the Do Core Dump button to perform the dump.

Using Edit Properties

The Edit Properties screen, which you access from the Commands menu, includes four "pages," which you select by clicking the tabs at the top of the window:

- System Parameters
- Network Parameters



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

Each sub-screen is described below.

System Parameters

System parameters include:

- Name
- SSID
- Network Type (Infrastructure or Ad Hoc)
- Constant Awake Mode (CAM)
- Power Save Mode
- Fast Power Save Mode
- Maximum 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. If the client node is powered from an AC line, PSP should not be used. Power Save Mode causes the Access Point to buffer incoming messages. The Aironet 4000 Series Wireless LAN Adapter must wake up periodically and poll the Access Point to see if there are any buffered messages waiting. The PC Card 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.

Maximum Power Save Mode

Maximum Power Save Mode (Max PSP Mode) can only be used in conjunction with PS or Fast PSP Modes. This mode allows the Aironet 4000 Series Wireless LAN

Adapter to conserve the most power while still maintaining an infrastructure connection. Using Max PSP Mode conserves power but will reduce throughput.

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 communicate to your wired network or you may disrupt other network 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 threshold above which the RF packet will be split up or fragmented. 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 sta-

tus 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 |

- **Authentication type:** This parameter controls the validation of the WEP Key. Shared Key Authentication validates that the client is using the same WEP Key as the Access Point. The Access Point sends a known, un-encrypted “challenge packet” to the client. The client then encrypts the challenge packet and sends it back to the Access Point. The Access Point then attempts to decrypt the encrypted challenge packet, and sends an Authentication response packet indicating the success or failure of the decryption back to the client. Open Authentication does not check for a matching WEP Key. The Shared Key selection is not available if the client’s WEP Key is not set.
- **Modulation:** This parameter determines the type of radio modulation that the Wireless LAN Adapter uses at the 5.5 Mbps and 11 Mbps data rates. Older versions of firmware use MOK modulation, while newer firmware versions use the IEEE 802.11 Standard CCK modulation. The modulation that the PC4800 uses *must* match the modulation of the Access Point (in an Infrastructure Mode configuration) or other Wireless LAN Adapters (in an Ad Hoc Mode configuration). Otherwise, the radio will not communicate with the other devices.

- **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:

- Antenna Mode
- Specified Access Point
- RTS Threshold
- RTS Retry Limit

Antenna Mode

Three options are available for the type of antenna you have connected to the Aironet 4000 Series Wireless LAN Adapter:

- **Antenna Diversity:** This allows the PC Card to use the stronger signal from the two antenna ports. Diversity can help the radio maintain the RF connection in areas of interference. Due to the nature of how RF signals are affected by the surroundings, one antenna may be in an RF “null” where the signal is very weak, but the other antenna (even though it is only a small distance away) may have a stronger signal strength. The PC Card would automatically select the antenna that has the highest signal strength. Antenna Diversity is the recommended setting for the standard Snap-On antenna.

- **Right Antenna Only (J1):** Choose this option if the antenna you are using is connected to the right hand antenna port and you are not using the standard Snap-On antenna. The PC Card will not attempt to communicate using the left hand antenna port since no antenna is connected to it.
- **Left Antenna Only (J2):** Choose this option if the antenna you are using is connected to the left hand antenna port and you are not using the standard Snap-On antenna. This tells the PC Card not to attempt to communicate using the right hand antenna port since no antenna is connected to it.

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 PC Card 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 mechanism.

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.

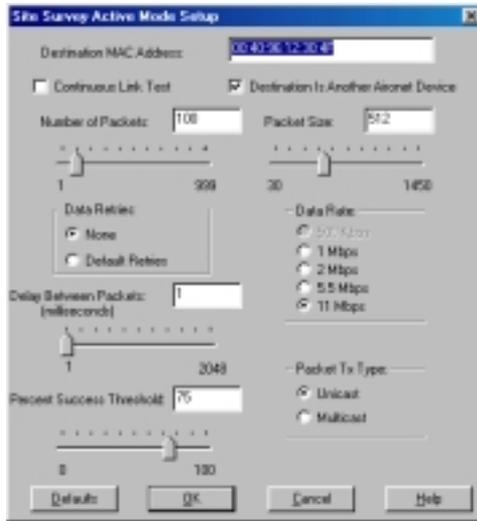
Using the Site Survey Active Mode Feature

If your PC4800 Wireless LAN Adapter contains the latest firmware, and if you have the latest drivers on your system, you can use the Site Survey Active Mode feature to set up a customized link test.

When you select Site Survey from the Commands menu and click the Setup button at the bottom of the window, the Setup window appears. Each setting is described below.

Destination MAC Address

This parameter specifies the Access Point that will be involved in the test. The default is the MAC address of the AP the Aironet Wireless LAN Adapter is currently associated with.



Continuous Link Test

If you click this check box, the Active Mode test will run repeatedly until you press the OK or Stop buttons on the Site Survey page. (The test will loop repeatedly for the number of packets you specify on the Number of Packets setting.)

Destination is Another Aironet Device

Click this check box if the Access Point you named in the Destination MAC Address field is an Aironet Access Point.

Number of Packets

This parameter sets the quantity of packets that will be sent during the test.

Packet Size

This parameter sets the size of the packets that will be sent during the test. You should use a packet size that will be typical during normal use of the system.

Data Retries

This parameter sets the number of times a transmission will be retried if an ACK is not returned by the destination device. Click None for no retries, or Default Retries for the firmware's default value for retries.

Data Rates

This parameter sets the bit rate at which packets will be transmitted. No rate shifting will occur during the test.

Delay Between Packets

This parameter sets the delay (in milliseconds) between successive transmissions.

Packet Tx Type

This parameter sets the packet type that will be used during the test. If you select Unicast, the system will expect an ACK back from the destination, and retries can occur. If you select Multicast, no packet retries will occur during the test.

Packet Success Threshold

This parameter controls the red line on the “Percent Successful” histogram. Percentages greater than or equal to this value will show up as green bars, while percentages below this value will show up as yellow bars on the Percent Successful histogram.

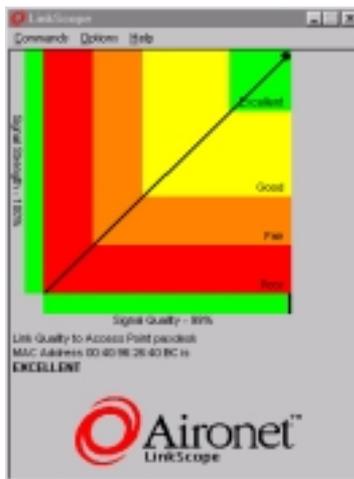
Using the Linkscope Utility

The Linkscope utility provides a graphical display of:

- Signal Quality
- Signal Strength

Linkscope determines the performance of the RF link between a PC Card 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 PC Card 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.



Section 4

Error Messages and Troubleshooting

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

Indicator LEDs

The PC Card has two indicator LEDs (green and amber) on the face 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 PC Card is linked with the network.

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

See Tables 4.1 and 4.2 for an explanation of the LED Messages.

Table 4.1 – Green LED Operating Messages

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

Table 4.2 – Amber LED Operating Messages

| Amber LED | Green LED | Condition |
|-----------------------|------------------------------------|---|
| Flashing | Continuously on or flashing slowly | PC Card is transmitting or receiving data while associated with an Access Point |
| Flashing 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 PC Card is securely inserted in the PC Card 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 PC Card 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](http://www.aironet.com)

Appendix A

Aironet Wireless LAN Adapter Overview

The Aironet 4800 Series Wireless LAN Adapter is a PC Card radio module that 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 Card Type II or Type III slot. These devices include:

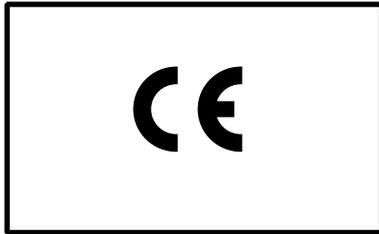
- Desktop systems
- Portable laptops
- Notebook computers
- Personal digital assistants
- Pen based computers
- Other data collection devices

The PC Card is fully compatible when used in a device supporting Plug-and-Play technology.

The PC Card can also be built into peripheral devices such as printers to provide a transparent wireless connection to a wired network.

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 exposure substantially below the FCC's recommended limits.



- Do not touch or move antenna(s) while the unit is transmitting or receiving.
- Do not hold any component containing the radio so 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 the antenna is not connected, the radio may be damaged.

Snap-On Antenna

Always orient the antenna so that it is at least 5 cm (2 inches) away from your body.

Dipole Antenna

Always orient the antenna so that it is at least 15 cm (six 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.

Warning for Laptop User

To comply with the FCC RF exposure limits, it is recommended when using a laptop with the snap-on antenna, that the antenna should not be positioned closer than 5 cm (two inches) from your body or nearby persons for extended periods of time while it is transmitting (or operating). If the antenna is positioned less than 5 cm (two inches) from the user, it is recommended that the user limit exposure time.

Other Devices in the Wireless Network

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

Radio Characteristics

The PC Card 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 Megabits per second (Mbps) for the PC4500 or up to 11 Mbps for the PC4800.

Direct Sequence Radio Technology

The Aironet 4800 Series Wireless LAN Adapter uses Direct Sequence Spread Spectrum (DSSS) transmission originally developed for military “anti-jamming” and “low probability of intercept” radio systems. The signal is transmitted over a wide frequency range, using multiple frequencies simultaneously. This protects the data transmission from interference.

If a particular frequency encounters a level of noise and/or interference, there is enough redundancy built into the signal on other frequencies that the Aironet 4800 Series Wireless LAN Adapter will usually still be successful in its transmission.

Data Transparency and Protocols

The Aironet 4800 Series Wireless LAN Adapter transports data packets transparently as they move through the wireless infrastructure. The PC Card 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 4800 Series Wireless LAN Adapter.

Protocols Supported

The Aironet 4800 Series Wireless LAN Adapter can be used in a variety of infrastructure configurations. Aironet Access Points (AP4500 and AP4800) provide connections to Ethernet or Token Ring Networks. When using the Aironet standard device drivers, the PC Card 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 to determine the optimum utilization of networking components and to maximize range, coverage and network performance.

Here are some operating and environmental conditions you should consider:

- **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 PC Card, particularly when using the small Snap-On antenna. 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.

Radio Antenna

The Snap-On Diversity antenna comes standard with the PC Card and provides omni-directional coverage.

A benefit of the diversity antenna system is improved coverage. At the edges of the RF coverage or fringe areas, there are very often multiple signals reaching the receiver, all from the same transmitter. These signals travel in different paths (multipath) and are caused by reflection and shadows of the RF signals. When the signals combine, the receiver may have trouble decoding the data. The Aironet radio's ability to switch and sample between these antennas allows it to select the optimum antenna for receiving the packet.

Optional antennas are offered for the PC Card. Consult the Aironet Antenna Guide (document number 710-003725) for more information.

Security Features

The Aironet 4800 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.

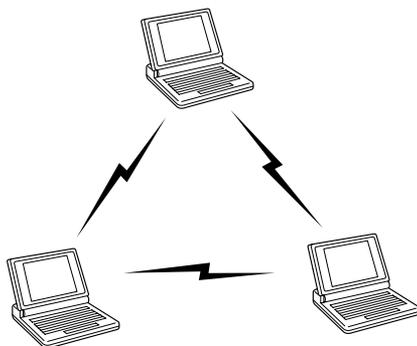
Root Unit – The root unit is an Access Point that is located at the top, or starting point, of a wireless infrastructure. A root unit provides the physical connection to the wired LAN (such as Ethernet or Token Ring) and contains configuration information in its association table that covers all nodes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

System Configurations

The Aironet 4800 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.

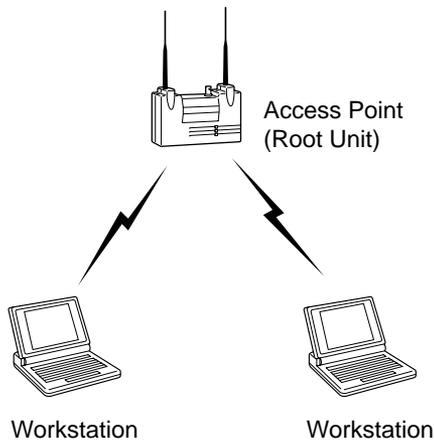
Examples of some common system configurations are shown on the pages that follow, along with a description of each.

Figure 1.1 - Ad Hoc Wireless LAN



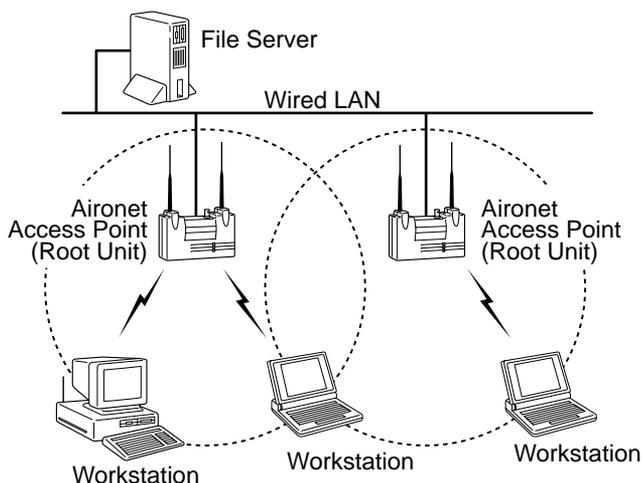
An ad hoc wireless LAN is the simplest wireless LAN configuration. In a wireless LAN, using an ad hoc network operating system (such as Windows for Workgroups or Windows 95), all devices equipped with the PC Card can be linked together and communicate directly with each other.

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.

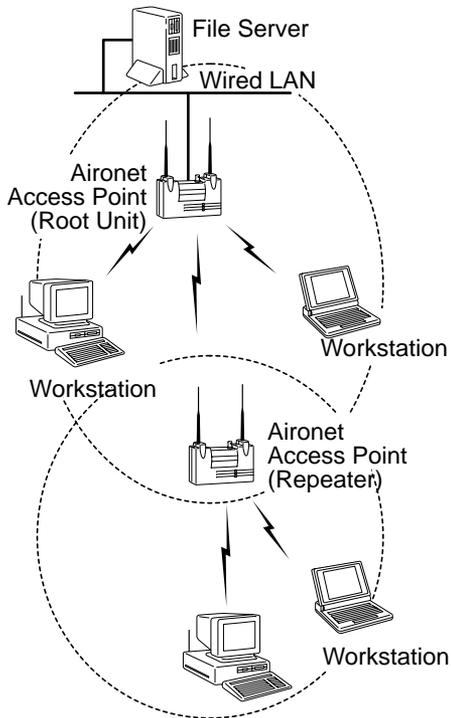
Figure 1.3 - Wireless Infrastructure with Workstations Accessing a Wired LAN



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

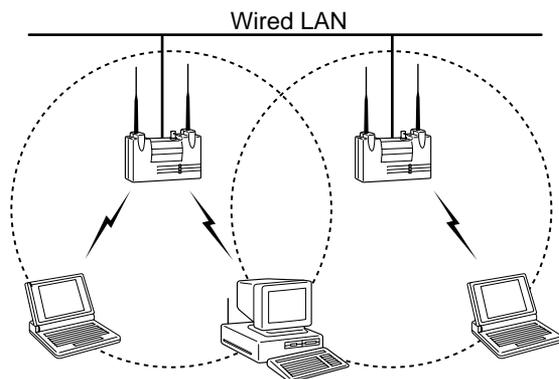


An Aironet Access Point can be configured as a stand-alone repeater to extend the range of your infrastructure, or to overcome an RF blocking obstacle. The repeater forwards traffic between the Aironet 4800 Series Wireless LAN Adapter equipped workstations and devices and the wired LAN by sending packets 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

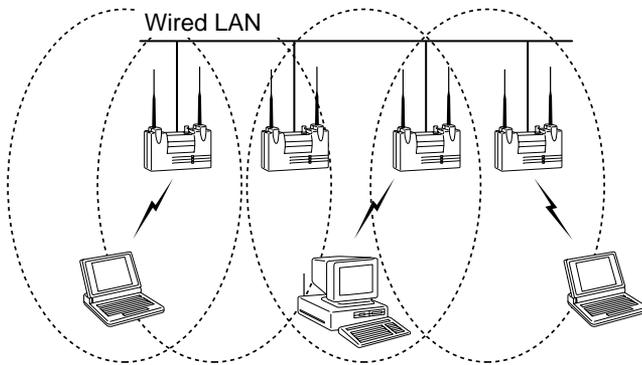
The system architecture options of the wireless station and Access Points provide for a variety of coverage alternatives and flexibility. The system can be designed to provide a wide coverage area with minimal overlap (Figure 1.5) or coverage with heavy overlap (Figure 1.6). The latter improves system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

Figure 1.5 - Minimal Overlap Coverage Option



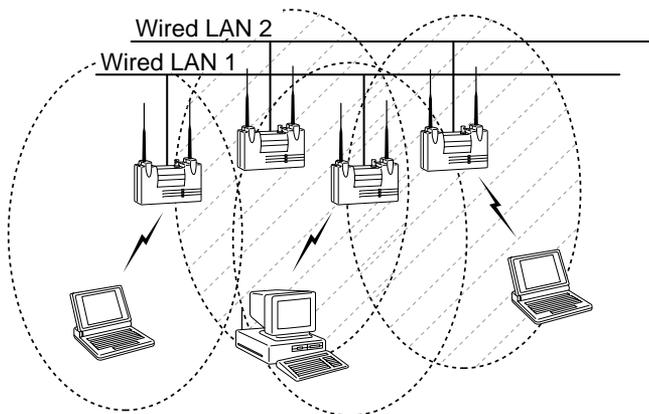
By arranging the Access Points so the overlap in coverage area is minimized, a large area can be covered with minimal system cost. The total bandwidth available to each mobile station will depend on the amount of data each mobile station desires to transfer and the number of stations located in each 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 PC Card) 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 would 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.

Appendix B

PC Card Specifications

LAN Drivers Supported

Table B.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 B.2 – Radio Specifications

| Item | Specification | Description |
|---|--|---|
| Radio Type | Direct Sequence | 2.4 GHz ISM Band |
| Operating Frequency | 2400-2497 MHz | North American, ETSI, and Japan channel coverage, factory configurable |
| FCC ID | LOZ102036 | FCC approval |
| Channeling | 1 MHz increments | Programmable for IEEE 802.11 |
| Type of Modulation | BPSK 1 Mbit/s QPSK 2 Mbit/s CCK 5.5 and 11 Mbits/s | Nominal 10 MHz BW (-6 db) |
| Power Output (North American Configuration) | 30 mW | Meets FCC Part 15.247 requirements |
| Antenna Type | Diversity | Integrated antenna |
| Antenna Connectors | 2 Amphenol MicroMate female | Unique connector per FCC Part 15.203. Snap-On with 1.5-2.5 lb retension force |
| Mating Cable Connectors | Huber & Suhner: Amphenol: | MMCX-50 Series |
| MicroMate Series | PCMCIA Connector | Card Connector Per PC Card (Nov 95) Physical Specification 4.1 |

Power Requirements

Table B.3 – Power Requirements

| Specification | Value |
|--|---------------------------|
| Operational Voltage | 5.0V \pm 0.25 Volts |
| Receive Mode Current | 260 mA (220 mA typically) |
| High Power Transmit Mode Current (30 mW) | 490 mA (350 mA typically) |
| Sleep Mode Current | 10 mA |

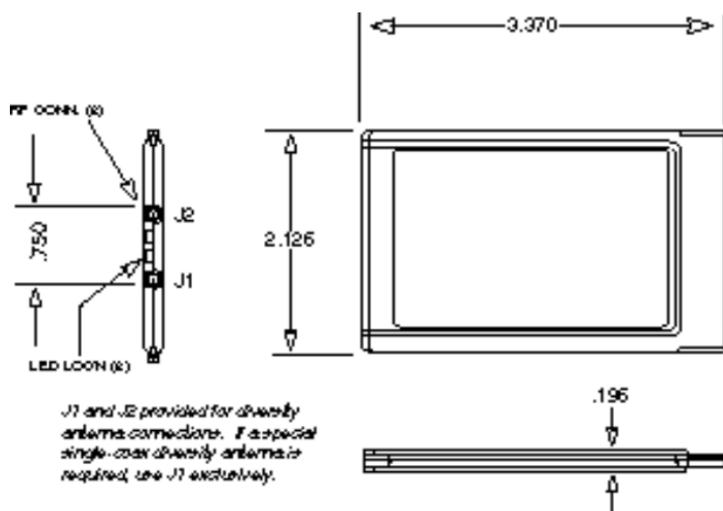
Physical Specifications

Table B.4 – Physical Characteristics

| Item | Description |
|---|--|
| Size | 3.37" L x 2.13" W x .20" H (8.56 cm L x 5.41 cm W x .51 cm H) |
| Enclosure | PC Card Type II |
| Weight | 1.3 oz. |
| Operating Temperature | 0° C to 70° C minimum (-22° F to 158° F) |
| Storage Temperature | -40° C to +85° C (-40° F to 185° F) |
| Humidity, Shock, Drop, Vibration, Thermal Shock | per PC Card version 2.01, section 13.6.2 specifications |
| ESD | 15kV (human body model) |
| Connectors | 68-pin PC Card |
| Status Indicators | Green and Amber LEDs – link association/activity |

Mechanical Description

Figure B.1 – Mechanical Outline



Appendix C

Channels

The channel identifiers and the channel center frequencies of each 22 MHz wide channel are shown in the table below, as appropriate for the various areas or regulatory agencies.

| Channel Identifier | Center Frequency | Regulatory Domains | | | | |
|--------------------|------------------|--------------------|------|-------|--------|-------|
| | | North America | ETSI | Spain | France | Japan |
| 1 | 2412 MHz | X | X | - | - | - |
| 2 | 2417 Mhz | X | X | - | - | - |
| 3 | 2422 MHz | X | X | - | - | - |
| 4 | 2427 Mhz | X | X | - | - | - |
| 5 | 2432 Mhz | X | X | - | - | - |
| 6 | 2437 Mhz | X | X | - | - | - |
| 7 | 2442 MHz | X | X | - | - | - |
| 8 | 2447 MHz | X | X | - | - | - |
| 9 | 2452 MHz | X | X | - | - | - |
| 10 | 2457 MHz | X | X | X | X | - |
| 11 | 2462 MHz | X | X | X | X | - |
| 12 | 2467 MHz | - | X | - | X | - |
| 13 | 2472 MHz | - | X | - | X | - |
| 14 | 2484 MHz | - | - | - | - | X |

Appendix D

Declarations of Conformity

Manufacturers Federal Communication Commission Declaration of Conformity Statement



Models: PC4500, PC4800

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

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.

Appendix D: Declarations of Conformity

- 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

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 numérique de la classe B respecte les exigences du Règlement sur le matériel brouilleur 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:
PC4500***

Radio CE Type Certificate Number: BCL/EC/98-0308/B

Radio Type Approval Examination 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.



A handwritten signature in black ink that reads "Michael Smedley". The signature is written over a solid horizontal line.

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

Declaration of Conformity

***Aironet Model Number:
PC4800***

Radio CE Type Certificate Number:

Radio Type Approval Examination 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.



A handwritten signature in black ink that reads "Michael Smedley". The signature is written over a solid horizontal line.

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

Appendix E

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>

