Technical Support

You can find the most recent software and user documentation for all WaveLAN products on our internet site.

Software and Documentation	
World Wide Web	http://www.wavelan.com
FTP Server	ftp://ftp.wavelan.com/pub

If you encounter problems when installing or using this product, or would like information about our other WaveLAN products, please contact your **local Authorized WaveLAN Reseller** or **regional Lucent Technologies Sales Office**. You can find their address and phone numbers on the WaveLAN website.

In case no local or regional support is available, you can reach us at the addresses or telephone numbers listed below.

WaveLAN Regional Support	
U.S.A / Canada	usasupport@wavelan.com
Caribbean/ Latin America	calasupport@wavelan.com
Europe/ Middle-East/ Africa	emeasupport@wavelan.com
Asia/ Pacific	apasupport@wavelan.com
WaveLAN Global Support	
U.S.A / Canada	Voice: +1 800 WAVELAN-3
Caribbean/ Latin America	

When contacting WaveLAN Support, please complete the WaveLAN Problem Report form and include it with your email or fax. The form (report.txt) is available on the WaveLAN Software CD-ROM, and on the WaveLAN Support pages of the WaveLAN website.

Information to the User

Wireless Interoperability

The IEEE 802.11 WaveLAN products are designed to be inter-operable with any wireless LAN product that is based on Direct Sequence Spread Spectrum (DSSS) radio technology, and is compliant to the IEEE 802.11 Standard on Wireless LANs (Revision B), as defined and approved by the Institute of Electrical and Electronics Engineers.

WaveLAN and your Health

WaveLAN, like other radio devices, emits radio frequency electromagnetic energy. The level of energy emitted by WaveLAN devices however is far much less than the electromagnetic energy emitted by wireless devices like for example mobile phones.

Because WaveLAN operates within the guidelines found in radio frequency safety standards and recommendations, Lucent Technologies believes WaveLAN is safe for use by consumers. These standards and recommendations reflect the consensus of the scientific community and result from deliberations of panels and committees of scientists who continually review and interpret the extensive research literature.

In some situations or environments, the use of WaveLAN may be restricted by the proprietor of the building or responsible representatives of the organization. These situations may for example include:

- Using the WaveLAN equipment on board of airplanes, or
- In any other environment where the risk of interference to other devices or services is perceived or identified as harmful.

If you are uncertain of the policy that applies on the use of wireless devices in a specific organization or environment (e.g. airports), you are encouraged to ask for authorization to use the WaveLAN device prior to turning on the equipment.

Regulatory Information

The IEEE 802.11 WaveLAN PC Card must be installed and used in strict accordance with the manufacturer's instructions. This device complies with the following radio frequency and safety standards.

Canada - Industry Canada (IC)

This device complies with RSS 210 of Industry Canada.

Europe - EU Declaration of Conformity

This device complies with the specifications listed below, following the provisions of the EMC Directive 89/336/EEC:

- ETS 300-826 General EMC requirements for Radio equipment.
- ETS 300-328 Technical requirements for Radio equipment.

USA - Federal Communications Commission (FCC)

This device complies with Part 15 of FCC Rules. Operation of the devices in a WaveLAN System is subject to the following two conditions:

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

Exposure to Radio Frequency Radiation.

Exposure to Radio Frequency Radiation. The radiated output power of the IEEE 802.11 WaveLAN PC Card is far below the FCC radio frequency exposure limits. Nevertheless, the WaveLAN PC Card shall be used in such a manner that the potential for human contact during normal operation is minimized. When using this device in combination with WaveLAN Outdoor Antenna products, a certain separation distance between antenna and nearby persons has to be kept to ensure RF exposure compliance. Refer to the Regulatory Statements as identified in the documentation that comes with those products for additional information.

Interference Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

This equipment generates, uses, and can radiate radio frequency energy. If not installed and used in accordance with the instructions, it may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try and correct the interference by one or more of the following measures:

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

Lucent Technologies is not responsible for any radio or television interference caused by unauthorized modification of the devices included with this IEEE 802.11 WaveLAN Kit, or the substitution or attachment of connecting cables and equipment other than specified by Lucent Technologies.
The correction of interference caused by such unauthorized modification, substitution or attachment will be the responsibility of the user.

For country-specific approvals, please consult the flyer “Radio Certification Information” that was inserted into this kit.

Table of Contents

Technical Support i

Information to the User ii

Regulatory Information iii

Table of Contents i

1 About WaveLAN/IEEE 1-1

Kit Contents 1-1

WaveLAN Network Scenarios 1-2

- It's Easy 1-4

WaveLAN PC Card Features 1-5

- WaveLAN PC Card Types 1-6
- Can I Upgrade WaveLAN Cards? 1-9

About the Software CD-ROM 1-10

Optionally Available 1-13

- WaveLAN IEEE Adapter Cards 1-13
- External Antennas 1-13

Connecting to a Network 1-17

- Connect to Any IEEE 802.11 LAN 1-18
- Connect to a Specific IEEE 802.11 LAN 1-19

2 Hardware Installation 2-1

Installing your WaveLAN Kit 2-1

- Preparation 2-1
- Card Removal and Re-insertion 2-2

3 Installation for Windows 3-1

Introduction 3-1

- Before You Start the Installation 3-1
- What You Need to Know 3-2

Getting Started in Windows 95/98 3-3

- Starting Installation 3-3

Getting Started in Windows NT 3-5

- Starting Installation 3-6

Installing the Miniport Driver 3-9

- Network Installation 3-12

Setting the WaveLAN Parameters 3-13

- Which Parameters Do You Need? 3-13
- Basic WaveLAN Parameters 3-14
- WaveLAN Encryption Parameters 3-18

Finishing the WaveLAN Installation 3-20

- After Restarting Your Computer 3-20

Working with WaveLAN & Windows 3-21

- View Other WaveLAN Stations 3-21
- Selecting the Networking Protocol 3-22
- Verifying the Current Protocol Setting 3-23
- Display or Modify WaveLAN Parameters 3-24

4 Advanced WaveLAN Parameters 4-1

Introduction 4-1

MAC Address 4-2

AP Density 4-3

Transmit Rate 4-4

- The Auto Transmit Rate Select Mechanism 4-4
- The User-defined Transmit Rate 4-5

Medium Reservation 4-8
Power Management 4-13
■ Enable Power Management: 4-14

5 Monitoring WaveLAN Performance 5-1
About WaveMANAGER/CLIENT 5-1
Installing WaveMANAGER/CLIENT 5-2
Running WaveMANAGER/CLIENT 5-3
■ Monitoring Options 5-3
■ What to Monitor 5-4
■ Choosing your WaveMANAGER Tool 5-6
WaveLAN Status/Function Window 5-7
WaveLAN Link Test 5-8
■ Testing Radio Communications Quality 5-9
■ Testing Data Throughput Efficiency 5-10
WaveLAN Card Diagnostics 5-13
Advanced User Options 5-14
■ Basic Mode versus Enhanced Mode 5-14
■ Logging Measurement Data 5-15

6 WaveLAN Security Options 6-1
Introduction 6-1
■ Closing the Infrastructure 6-2
■ Wireless Access Control 6-3
■ Wireless Data Encryption 6-4

A Card Specifications A-1

Physical Specifications A-1

Networking Characteristics A-2

Radio Characteristics A-3

- Supported Frequency Sub-bands A-7

WaveLAN PC Card Types A-9

- About Previously Purchased Cards A-9
- Can I Upgrade WaveLAN Cards? A-12

B Troubleshooting B-1

LED Activity B-1

Windows Operating Systems B-4

- Generic Problems B-4
- Hardware Conflict B-6

Upgrading the WaveLAN Miniport Driver B-14

- Removing the WaveLAN Miniport Driver B-20

MS-DOS Systems B-23

- Error Messages B-23
- Can Not Connect To The Network B-23

C Installing in Windows CE C-1

Introduction C-1

- Installing the WaveLAN Driver C-2
- Using WaveLAN with Windows CE C-4
- Modifying Configuration Parameters C-5

D Installation for MS-DOS D-1

Introduction D-1

- What You Need to Know D-1
- Driver Types D-1
- Installation Overview D-2

Copy the WaveLAN Software D-3

Setup the WaveCAD Program D-4

- Card & Socket Services D-4
- Intel 82365 PCIC D-5

Install the Network Client Software D-9

Setup the WaveLAN Parameters D-10

- DOS ODI Driver Configuration D-10
- Packet Driver Configuration D-19

Finishing Installation D-25

Advanced Options D-27

- Dual Card Configuration D-27
- Start-up Menu Configuration D-27

E Installing in Apple Macintosh E-1

Introduction E-1

Installing the WaveLAN Driver E-2

- Installing Networking Protocols E-2
- Enabling your WaveLAN Card E-3

Using WaveLAN with PowerBooks E-5

- Basic Parameters E-6
- Advanced Parameters E-7
- Monitoring Wireless Performance E-9
- Modifying Configuration Parameters E-9

Removing the WaveLAN Driver E-10
Index IX-1

W Warranty Repair Card Warranty-1
About Warranty and Repair Warranty-1
Limited Warranty Warranty-2
List of Figures LOF-1
List of Tables LOT-1
Index IX-1

About WaveLAN/IEEE

1

Contents

Kit Contents 1-1

WaveLAN Network Scenarios 1-2

It's Easy 1-4

WaveLAN PC Card Features 1-5

WaveLAN PC Card Types 1-6

- Silver Label Cards 1-6
- Gold Label Cards 1-7
- About Using Different Card Types 1-7
- About the Fixed Wireless PC Card 1-8

Can I Upgrade WaveLAN Cards? 1-9

About the Software CD-ROM 1-10

Optionally Available 1-13

WaveLAN IEEE Adapter Cards 1-13

External Antennas 1-13

- WaveLAN Range Extender Antenna 1-14
- WaveLAN Vehicle-Mount Antenna 1-15

Connecting to a Network 1-17

Connect to Any IEEE 802.11 LAN 1-18

Connect to a Specific IEEE 802.11 LAN 1-19

About WaveLAN/IEEE

1

Kit Contents

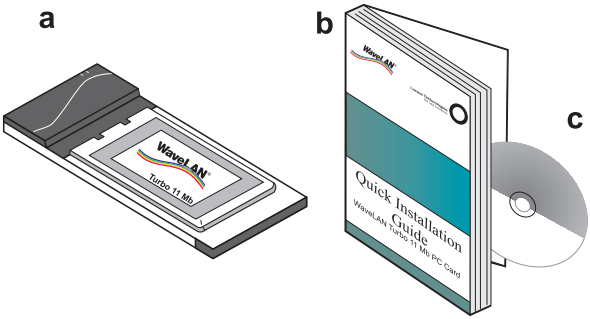
The WaveLAN/IEEE Turbo 11 Mb PC Card kit includes the following items as pictured in Figure 1-1:

a. A WaveLAN/IEEE Turbo 11 Mb PC Card.

b. The Quick Installation Guide (this document).

c. WaveLAN Software CD-ROM.

Figure 1-1 WaveLAN IEEE 802.11 Kit Contents



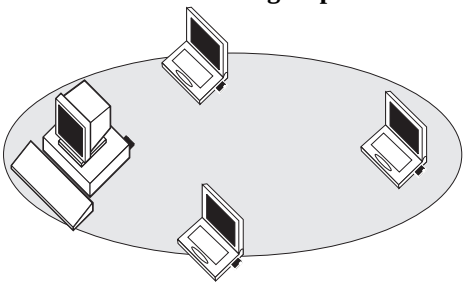
The printed Quick Installation Guide is an abstract of the electronic Installation Guide included on the WaveLAN Software CD-ROM. For detailed information you may wish to consult the electronic version that is available in Adobe's Acrobat Portable Document File (*.pdf) format.

WaveLAN Network Scenarios

This WaveLAN/IEEE Turbo 11 Mb PC Card Kit enables you to:

- Connect your computer to an ad-hoc workgroup of wireless computing devices, or
- Connect your computer to a Local Area Network (LAN) Infrastructure that includes Lucent Technologies WavePOINT-II access points, or other IEEE 802.11 compliant Local Area Network (LAN) systems
- Expand the capabilities of your WavePOINT-II access points, to support wireless devices that have been equipped with IEEE 802.11 adapter cards.

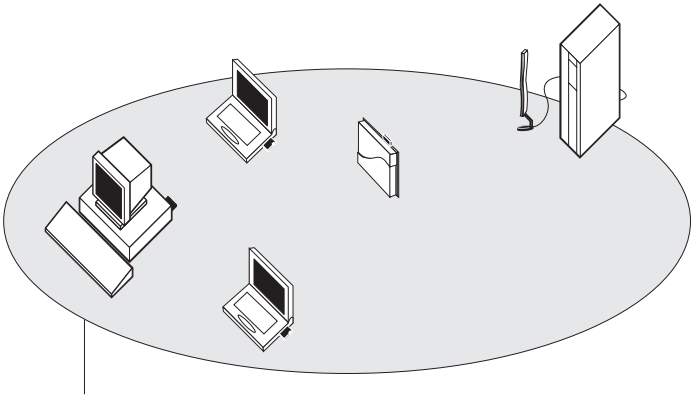
Figure 1-2 Ad-hoc Wireless Workgroup



The ad-hoc workgroup configuration enables you to quickly set up a small wireless workgroup, where the workgroup participants can exchange files using features like “Files and Printer Sharing” as supported by Microsoft Networking.

You can use this type of wireless peer-to-peer networks “on the road”, or in Small Office Home Office (SOHO) environments. As long as the station are within range of one another, this is the easiest and least expensive way to set up a wireless network.

Figure 1-3 Stand Alone Wireless LAN

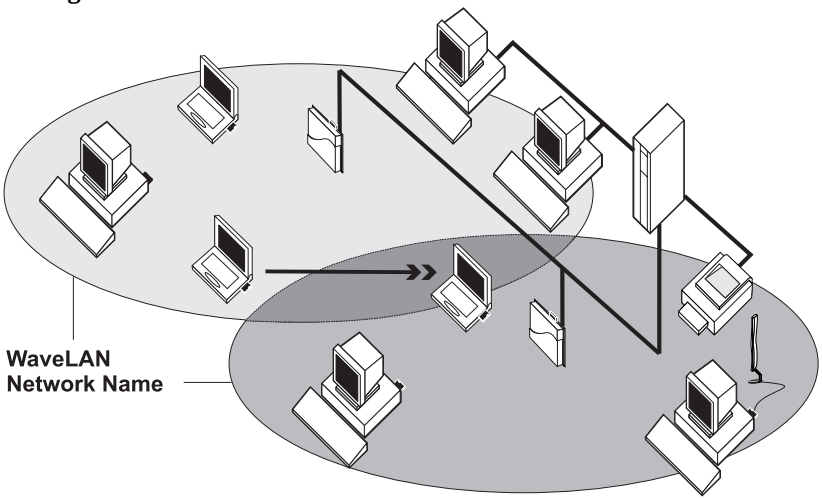


WaveLAN Network Name

Local Area Network (LAN) Infrastructures may either be:

- Stand-alone wireless LANs as pictured in Figure 1-3.
- Wireless network infrastructures connected to an existing Ethernet network as pictured in Figure 1-4 on page 1-4.
- Wireless network infrastructures that may include previously marketed WaveLAN products such as:
  - Standard WaveLAN IEEE 802.11 PC Cards
  - WaveLAN/IEEE Turbo PC Cards
  - Previous generation WaveLAN Legacy cards.

Figure 1-4 LAN Infrastructure



It's Easy

The WaveLAN PC Card functions like any standard wired Ethernet card, but WaveLAN does not need any wires!

Where an Ethernet card requires a cable connection to a hub and/ or patch panel, the cable physically ties you down to the location of the wired connection.

WaveLAN allows you to connect your computer to a Local Area Network (LAN) system from anywhere within the wireless coverage area. Expanding or re-designing your network is easy: Add or relocate WavePOINT-II access points, power-up your (new) WaveLAN computers, and you're done!

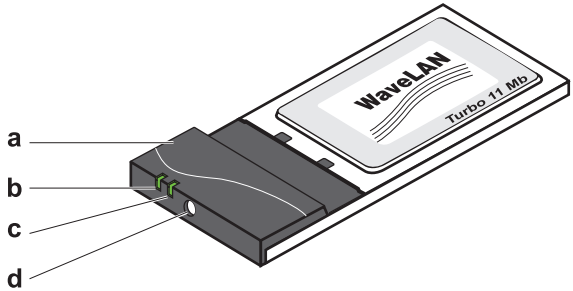
Unlike Ethernet, WaveLAN will enable you to roam throughout the network while remaining connected to the LAN.

WaveLAN PC Card Features

The WaveLAN/IEEE Turbo 11 Mb PC Card is a standard PC Card that fits into any PC Card Type II slot.

The WaveLAN/IEEE Turbo 11 Mb PC Card has two LED indicators and two integrated antennas. Optionally you can use the WaveLAN/IEEE Turbo 11 Mb PC Card in combination with an external antenna (see page 1-13).

Figure 1-5 The WaveLAN/IEEE Turbo 11 Mb PC Card



a. Integrated Antennas
b. Transmit/ Receive LED
   - Off - No wireless activity
   - Blinking - Sensing/transmitting wireless data
c. Power ON/OFF LED
   - Solid Green - standard operational mode
   - Blinking Green - Power Management mode
d. Connector for optional External Antenna (see page 1-13).

For a more detailed overview of the LED activity, please consult Table B-1 on page B-2 of Appendix B.

WaveLAN PC Card Types

The WaveLAN/IEEE Turbo 11 Mb PC Card is a wireless network adapter card that complies with the IEEE 802.11 standard on wireless LANs Rev. B. This card that supports data rates up to 11 Mbit/s is available in two variants:

- WaveLAN/IEEE Turbo 11 Mb Silver Label, and
- WaveLAN/IEEE Turbo 11 Mb Gold Label

Both types of WaveLAN/IEEE Turbo 11 Mb PC Cards are:

- Fully compatible with any other wireless LAN system based on Direct Sequence Spread Spectrum (DSSS) radio technology that complies with the “IEEE 802.11 standard on wireless LANs (Revision B)”.
- Backwards compatible with any other previously released model of the WaveLAN/IEEE product family.

Silver Label Cards

The WaveLAN/IEEE Turbo 11 Mb Silver PC Cards supports the following wireless LAN features:

- Automatic Transmit Rate Select mechanism in the range of "High, Medium, Standard and Low".
- Frequency Channel Selection (2.4 GHz).
- Roaming over multiple channels.
- Power Management.
- Wired Equivalent Privacy (WEP) data encryption, based on the 64 bit RC4 encryption algorithm as defined in the IEEE 802.11 standard on wireless LANs.

These features are described in more detail in Chapter 4 ”Advanced WaveLAN Parameters”

Gold Label Cards

The WaveLAN/IEEE Turbo 11 Mb Gold PC Cards supports the same functionality as the WaveLAN/IEEE Turbo 11 Mb Silver cards. The Gold card however provides an enhanced type of data encryption, based on the 128 bit RC4 algorithm.

NOTE:
The WaveLAN/IEEE Turbo 11 Mb Gold PC Card may not be marketed in all parts of the world, subject to national legislation or local regulations. For availability in your country, please consult your local Lucent Technologies Sales Office.

About Using Different Card Types

When using WaveLAN/IEEE Turbo 11 Mb PC Cards in networks that include different types and/or versions of WaveLAN/IEEE products carefully read the items listed below.

Different Transmit Rates

When using different types of WaveLAN/IEEE PC Cards, your WaveLAN cards will always revert to higest compatible transmit rate as supported by both cards.

For example your 11 Mb PC Card will switch to the Standard Transmit Rate (2 Mbit/s) when communicating with a wireless device that has been equipped with:

— A Standard IEEE PC Cards (identified by either a white, Bronze or Silver label).

— WaveLAN/IEEE Turbo PC Cards (identified by a Bronze or Silver label that does not include the designator "**11 Mb**).[1]

Different Types of Data Encryption

When using the encryption feature, please note that encrypted messages can only be deciphered by cards that will also have encryption enabled and are using an identical encryption key.

When using the WaveLAN/IEEE Turbo 11 Mb Gold PC Card in combination with Silver cards, your Gold card should be configured with a WEP compatible (64-bit) encryption key.

Are you upgrading to 11 Mb/s PC Cards?

Transmissions at higher data rates, may not travel as far as communications at Standard or Low Tranmit rate.

When you consider upgrading your wireless network to WaveLAN/ IEEE Turbo 11 Mb PC Cards, you may need to perform a site survey again to verify that the entire coverage area allows for data transmissions at the highest transmit rates.

You can use the WaveMANAGER/CLIENT IEEE tool described in Chapter 5 of this Quick Installation Guide to perform such a site survey.

About the Fixed Wireless PC Card

This card is a special WaveLAN PC Card for outdoor antenna installations that is marketed in Europe and Japan only. It is typically used in combination with WavePOINT-II access points and/or the WaveLAN Vehicle-Mount Antenna to connect a wireless LAN device to an outdoor antenna installation (see Chapter 1of).

---

1 The High and Medium Transmit rates, supported by these cards, are not compatible with the high-speed rates as deifned by the IEEE 802.11 standard Revision B.

The Fixed Wireless PC Card can be recognized from the distinct red color of the extended part of the PC Card. It supports the same networking capabilities as the other WaveLAN cards, but has different radio specifications, to comply with radio regulations for outdoor antenna installations as defined by the European Telecommunications Standards Institute (ETSI).

For more details about this card, please consult Appendix A ”Card Specifications” and/or the “WaveLAN Outdoor Antenna Installation Guide” that can be downloaded from the WaveLAN website.

Can I Upgrade WaveLAN Cards?

To enhance (wireless) performance of your WaveLAN/IEEE cards, *updates* are made available via the WaveLAN website at regular intervals.

Updates typically enhance existing features supported by the specific waveLAN/IEEE PC Card, or resolve minor bugs.
You can not use the updates to "*upgrade*" a WaveLAN/IEEE Silver card to a WaveLAN/IEEE Turbo 11 Mb Gold PC Card.

Updates for WaveLAN/IEEE PC Cards are managed via a dedicated tool, called the WaveLAN Station Update tool (WSU). This tool will update the embedded software of the card (also referred to as the Station Firmware).

Whenever an update becomes available, you will be able to download the latest WSU tool from the WaveLAN website. You are advised to visit the WaveLAN website at regular intervals to check if newer versions are available for your product.

About the Software CD-ROM

The WaveLAN software CD-ROM contains both software and documentation for all WaveLAN products that support roaming functionality in indoor environments.

If you wish to install WaveLAN driver software, turn to Chapter 2 ”Hardware Installation” and follow the instructions as described for installing your WaveLAN/IEEE Turbo 11 Mb PC Card.

If you would like to explore the contents of the CD-ROM, the contents map as pictured in Figure 1-6 on page 1-11, may help you find the items you are looking for:

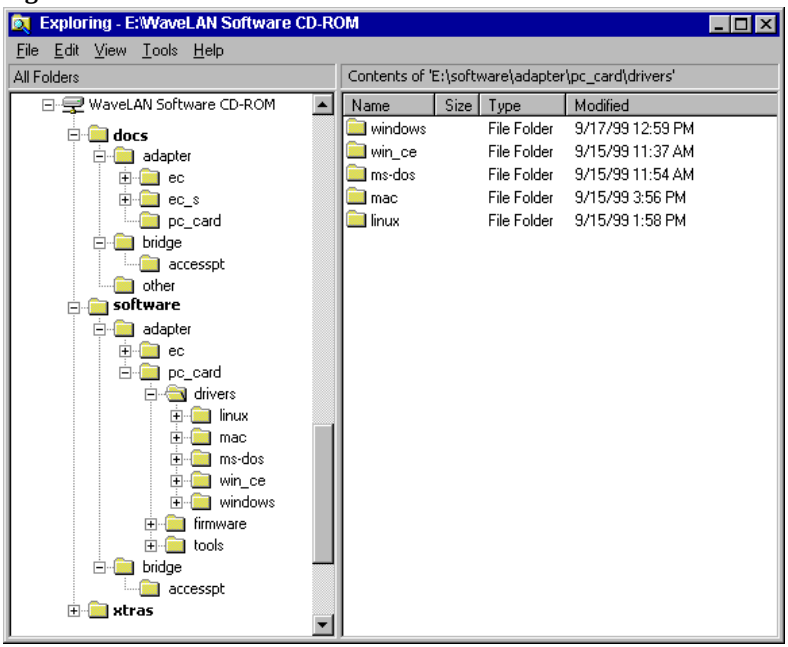
- WaveLAN User Guides and other reference documents are located in the folder “**docs**”.
- Software for WaveLAN client stations and/or infrastructure products, such as the WavePOINT-II access points, are located in the folder “**software**”.

Both the “**docs**” and “**software**” folder have been divided into dedicated subfolders, related to the type of WaveLAN device. For example:

- The folder "**software\adapter\pc_card**" contains all the software avaialble for your WaveLAN/IEEE PC Card.
- The folder “**software\bridge\accesspt**” contains the software & tools for the WavePOINT-II Access Point.

NOTE:
Prior to copying or installing the software, you are advised to read the Software License Agreement "**license.txt**", located in the root folder of the CD-ROM.
By installing, copying or using the WaveLAN software, you are consenting to be bound by this agreement.
If you do not agree to all of the terms of the Software License Agreement, do not download, copy or install the WaveLAN software.

Figure 1-6 Contents of the Software CD-ROM



NOTE:
It is the policy of Lucent Technologies to improve products as new technology, components, software and firmware become available.
Before you proceed with the installation of this product, we recommend you to consult the WaveLAN website to:

- Verify if newer versions of the software that was shipped with your product are available.
- Download and install the latest software with your purchased product.

You can download the latest software and documentation from the WaveLAN website at: **http://www.wavelan.com.**

Looking again at Figure 1-6 on page 1-11 you will see that the CD-ROM also includes a folder named "**xtras**". This folder contains additional tools, that may help you install and manage your WaveLAN Network.

- The folder "**Acrobat**" includes a copy of the **Adobe Acrobat Reader ®,** required to view and/or print the WaveLAN user documentation included on this CD-ROM.
- The folder "**CopyFile**" includes a set of batch files that allow you to quickly create or copy sets of driver software to:
  - — a floppy diskette
  - — hard-disk drive, and/or
  - — a network drive.

  These files can not be executed independently, but will be started automatically if you run the file "**CopyFile.bat**" that is located in the root of the CD-ROM.

NOTE:
The Adobe Acrobat Reader is owned by and licensed from Adobe Systems Incorporated. This software is provided "as is."

Lucent makes no warranty or representation, express or implied, relating to the completeness, reliability, effectiveness, accuracy, performance, or operation of the Adobe software, or as to its suitability, merchantability or fitness for a particular purpose or against infringement of intellectual property rights of any party.

For more information about Adobe Acrobat software, please consult the Adobe Website at:
"**Http:\\www.adobe.com\acrobat**"

Optionally Available

WaveLAN IEEE Adapter Cards

The Lucent Technologies WaveLAN IEEE solution has been based upon a single wireless PC Card that can be used in a variety of computing systems.

Optionally available are the following adapters for computer systems that do not have a PC Card slot:

- WaveLAN/ISA
  an ISA to PC Card-bus adapter card.
- WaveLAN/PCI
  a PCI to PC Card-bus adapter card.
- WaveLAN/EC (Ethernet Converter)
  A dedicated WaveLAN device that can be used to connect a computer with a standard 10Base-T interface to your WaveLAN network
- WaveLAN/EC-S (Ethernet & Serial Converter)
  A dedicated WaveLAN device that can be used to connect a computer with a standard 10Base-T or serial interface to your WaveLAN network.

External Antennas

The WaveLAN IEEE 802.11 PC Card has been provided with two integrated antennas (see Figure 1-5), which perform best in an open environment with as few obstacles as possible.

Optionally available are the following types of external antennas:

- WaveLAN Range Extender Antenna.
- WaveLAN Vehicle-Mount Antenna.

These antennas have a Lucent Technologies proprietary connector, that allows you to connect the card directly to the socket on the extended side of the your WaveLAN IEEE 802.11 PC Card (pictured in Figure 1-5 on page 1-5).

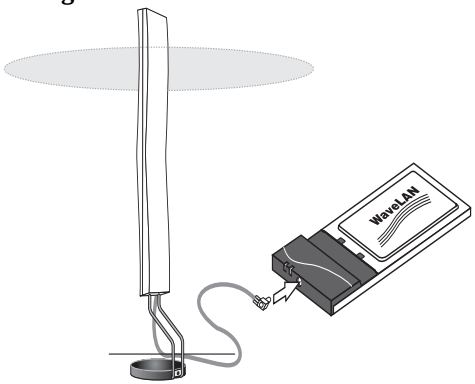
WaveLAN Range Extender Antenna

Use the WaveLAN Range Extender Antenna to ensure optimal transmission and receiving quality for situations in which the integrated antennas are shielded, for example when:

- The WaveLAN PC Card is close to metal surfaces.
- The WaveLAN PC Card is inserted into a WavePOINT-II device or computer that is installed in a “hidden” location, e.g. under a desk or inside a cabinet.
- Objects like thick stacks of books shield the antenna.

In most situations the WaveLAN Range Extender Antenna may provide a performance increase of up to 50%.

Figure 1-7 Range Extender Antenna



You can connect the Range Extender Antenna to the WaveLAN PC Card by inserting the connector into the socket on the

extended side of the PC Card. To protect the socket from dust, it is shielded with a little cap, that should be removed prior to connecting the antenna.

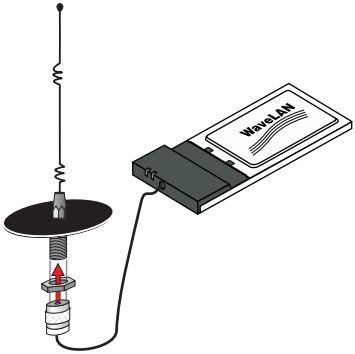
The WaveLAN Range Extender Antenna has a mounting bracket and a base for perfect vertical positioning that allows you to put the antenna on top of on your desktop computer, a table or filing cabinet, or to hang it on the wall, or ceiling etc.

CAUTION:
Many computer monitors today support a degauss option, that can either be enabled manually by the user, but is often also enabled automatically whenever you turn on the monitor. The electromagnetic discharge that may occur when degaussing the monitor may cause damage to the WaveLAN equipment.
To avoid damage to your sensitive WaveLAN equipment, do not place the Range Extender Antenna on top of, or too close to, your monitor.

WaveLAN Vehicle-Mount Antenna

The WaveLAN Vehicle-Mount Antenna enables you to connect vehicles with an on-board terminal to your LAN infrastructure. The ruggedized design of this antenna allows you to mount it on vehicles (for example fork-lift trucks) that need continuous access to networked data, whether inside or outside of the building.

Figure 1-8 Vehicle Mount Omni-Directional Antenna



You can connect the Vehicle Mount Antenna to the WaveLAN PC Card using the special 2.5 m WaveLAN IEEE Mobile Vehicle Solution cable assembly.

Connecting to a Network

You can use your WaveLAN/IEEE Turbo 11 Mb PC Card to connect to Local Area Network (LAN) systems that include Lucent Technologies WavePOINT-II access points.

The WavePOINT-II access point is a transparent bridge between:

- WaveLAN stations that have been equipped with IEEE 802.11 compliant PC Cards.
- WaveLAN stations that have been equipped with previous generation WaveLAN cards such as WaveLAN/PCMCIA and WaveLAN/ISA.
- Ethernet stations that are connected to the WavePOINT-II device via a 10Base-T or 10Base2 backbone.

To allow communication between your WaveLAN IEEE 802.11 station and the Infrastructure, the access point must be equipped with an IEEE 802.11 compliant WaveLAN card.

WaveLAN IEEE 802.11 networks are identified by a unique WaveLAN Network Name. All WavePOINT-II units that belong to the same WaveLAN Infrastructure will share the same WaveLAN Network Name.

You can configure your WaveLAN/IEEE Turbo 11 Mb PC Card to:

- “Connect to Any IEEE 802.11 LAN”
- “Connect to a Specific IEEE 802.11 LAN”, or
- “Create a ‘Stand-Alone’ IEEE 802.11 LAN” (also referred to as "ad-hoc mode").

Connect to Any IEEE 802.11 LAN

This configuration setting is recommended when you intend to use your computer in various networking environments.
When you start up your computer, your WaveLAN IEEE 802.11 station will attempt to establish a radio connection with the first IEEE 802.11 compliant network system that provides a good quality for radio communications.

In situations where multiple IEEE 802.11 compliant systems are operational in the vicinity of the location where you powered-up your computer, the WaveLAN card will connect automatically to the network that provides the best level of communications.

Once your WaveLAN card finds an IEEE 802.11 compliant access point, it will automatically:

- Retrieve the radio channel required to connect to this access point.
- Establish the radio connection to the WavePOINT-II access point that provides the best communications quality

When moving your computer to another location within the network environment, i.e. out of range of the current access point, the WaveLAN roaming functionality will automatically connect your computer to other access points that belong to the same network. This will allow continuous network connectivity as long as your WaveLAN computer remains within range of one or more access points that belong to the same network infrastructure.

NOTE:
Once your computer connects to “ANY” IEEE 802.11 network system, it will remain attached to this network until you restart your computer again.

During run-time it will not switch dynamically between systems identified by different WaveLAN Network Names.

Connect to a Specific IEEE 802.11 LAN

When you would like to connect to a specific IEEE 802.11 network system, you are advised to configure your station to connect only to the IEEE 802.11 network that is identified by the same WaveLAN Network Name.

When your WaveLAN card finds the network with the matching WaveLAN Network Name, it will automatically:

- Retrieve the radio channel required to connect to the specific network.
- Establish the radio connection to the WavePOINT-II access point that provides the best communications quality.

When moving your computer to another location within the network infrastructure, i.e. out of range of the current access point, the WaveLAN roaming functionality will automatically connect your computer to other access points that belong to the same network. This will allow continuous network connectivity as long as your WaveLAN computer remains within range of one or more access points that belong to the same network infrastructure.

NOTE:
We recommend that you use the “Connect to a Specific IEEE 802.11 LAN” option when multiple IEEE 802.11 networks are operational within the same networking environment, or in neighboring buildings.

This will prevent your computer from unintentionally connecting to a different IEEE 802.11 system.

Hardware Installation

2

Contents

Installing your WaveLAN Kit 2-1

Preparation 2-1

Card Removal and Re-insertion 2-2

- Plug & Play Compatible Systems 2-3
- Systems That Do Not Support Plug & Play 2-4

Hardware Installation

2

Installing your WaveLAN Kit

This chapter describes how to install your WaveLAN/IEEE Turbo 11 Mb PC Card into the PC Card slot of your computer.

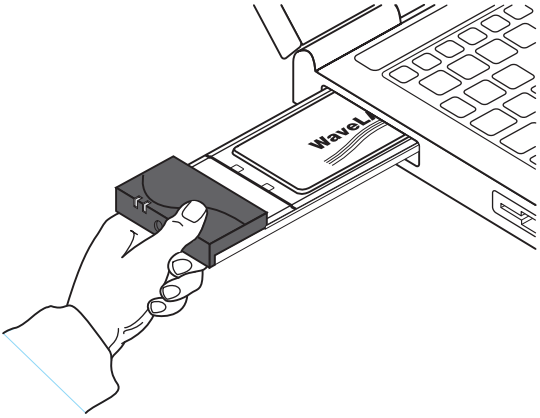
NOTE:
If you intend to use the WaveLAN IEEE 802.11 PC Card in a WavePOINT-II access point, or WaveLAN/EC device, please refer to the User Documentation that was shipped with the device, or that is available for download from the WaveLAN website at **http://www.wavelan.com**.

Preparation

Unpack your WaveLAN PC Card kit and verify that all items are present, as described in “Kit Contents” on page 1-1.
If any of the items described appear to be damaged or missing, please contact your supplier.

Insert the WaveLAN/IEEE Turbo 11 Mb PC Card into the PC Card slot of your computer as pictured in Figure 2-1 on page 2-2.

Figure 2-1 Inserting the PC Card into Your Computer



Card Removal and Re-insertion

WaveLAN adapter cards can be installed on various operating systems, that may show different behavior when installing your using your WaveLAN card:

- Plug & Play Compatible Systems
- Systems That Do Not Support Plug & Play

Depending on the type of operating system installed on your computer, you can remove and re-insert your WaveLAN PC Card whenever you like. This feature, also referred to as “Hot Swapping” for PC Cards is supported by operating systems as described under “Plug & Play Compatible Systems” below.

For systems that do not support “Plug & Play” you are advised to follow the procedure as described under “Systems That Do Not Support Plug & Play” on page 2-4.

Plug & Play Compatible Systems

Plug & Play for WaveLAN PC Cards is supported by the following operating systems:

- MS-Windows 95, Windows 98 and Windows 2000 (formerly known as Windows NT v5.0)
- Windows CE (version 2.0/2.11 and higher)
- Apple/Macintosh PowerBook systems.

When re-inserting the WaveLAN PC Card into your computer, these operating systems will automatically:

1. Recognize the card
2. (Re-)load the driver and activate card operation
3. Attempt to restore the network connection.

When removing the card, these operating systems will:

1. Disable the WaveLAN driver and
2. Disconnect power to the PC Card slot.

CAUTION:
When removing the WaveLAN card you will lose your connection to the network.

Certain network operating systems however may not allow you to restore the network logon automatically. In that case you may need to restart your computer to rerun the network login procedure to restore the network connection.

You are advised to always disable the PC Card ***prior*** to removing the card from the PC Card slot. This will allow the Windows operating system to log off from the network server, disable the driver properly and disconnect power to the PC Card slot.

For example to stop using the WaveLAN PC Card in Ms-Windows environments, proceed as follows:

PC Card
(PCMCIA)

1. Click the “Start” button on the Windows Taskbar.
2. Click on “Settings” and then “Control Panel” item.
3. On the Control Panel double-click the PC Card icon to open the PC Card (PCMCIA) properties window.
4. Select the PC Card socket that contains your WaveLAN/IEEE Turbo 11 Mb PC Card and click the “Stop” button.
5. Wait for the operating system to acknowledge that the device has been disabled and then remove the PC Card form the PC Card slot.

NOTE:
A shortcut to disable the PC Card is clicking once on the PC Card icon on the right side of the Windows Task bar, and select the option "Stop WaveLAM/IEEE PC Card".

Double-clicking the PC Card icon, will open the PC Card properties windows.

Systems That Do Not Support Plug & Play

Although Windows 95/98 and Windows NT version 4.0 are similar in appearance, only Windows 95 and Windows 98 support true “Plug & Play”.

When your computer runs one of the operating systems listed below, neither “Plug & Play” support nor “”Hot Swapping” are available for your WaveLAN/IEEE Turbo 11 Mb PC Card:

- Windows NT version 3.51
- Windows NT version 4.0
- MS-DOS

To remove your WaveLAN/IEEE Turbo 11 Mb PC Card from these systems, you are advised to:

1. Power off your computer
2. Remove the WaveLAN PC Card from the PC Card slot
3. (optional) Restart the computer to proceed working with your computer without the WaveLAN PC Card.

To (re-)insert the WaveLAN PC Card:

1. Power off your computer
2. (Re-)insert the WaveLAN PC Card into the PC Card slot
3. (optional) Restart the computer to proceed working with your computer and the WaveLAN PC Card.

For more information about the differences between the referenced Microsoft operating systems read the section “What You Need to Know” on page 3-2.

Installation for Windows

3

Contents

Introduction 3-1

Before You Start the Installation 3-1
What You Need to Know 3-2

Getting Started in Windows 95/98 3-3

Starting Installation 3-3

Getting Started in Windows NT 3-5

Starting Installation 3-6
- Enabling PCMCIA Services 3-6
- Enabling Network Support 3-7

Installing the Miniport Driver 3-9

Network Installation 3-12

Setting the WaveLAN Parameters 3-13

Which Parameters Do You Need? 3-13
Basic WaveLAN Parameters 3-14
- WaveLAN Network Name 3-14
- Station Name 3-16
- Connecting to an Ad-hoc Network 3-17

WaveLAN Encryption Parameters 3-18

Finishing the WaveLAN Installation 3-20
After Restarting Your Computer 3-20

Working with WaveLAN & Windows 3-21
View Other WaveLAN Stations 3-21
Selecting the Networking Protocol 3-22
■ Infrastructure Networks 3-22
■ Ad-hoc Workgroup Networks 3-22
Verifying the Current Protocol Setting 3-23
Display or Modify WaveLAN Parameters 3-24

Installation for Windows

3

Introduction

This chapter describes the installation of the WaveLAN Miniport Driver for Microsoft Windows 95, 98 & NT v.4.0.

Before You Start the Installation

To install and begin using your WaveLAN IEEE 802.11 PC Card, you will need to install the following items:

- The WaveLAN IEEE 802.11 Miniport Driver.
- Network (client) Operating Software and Protocols.
- (optionally) The WaveMANAGER/CLIENT IEEE program.

The Network client software is included with the Windows operating system software.

Before you start the installation, you are advised to keep the Windows CD-ROM or software diskettes close at hand. If your computer came with a factory-installed Windows operating system, these files will be stored on your computer's hard disk, in the form of ***.cab** files.

NOTE:
If you are upgrading from an earlier version of the WaveLAN Miniport driver, please read the section "Upgrading the WaveLAN Miniport Driver" in Appendix B .

What You Need to Know

Installing a WaveLAN IEEE 802.11 PC Card requires the same level of expertise that you would need to install any other type of standard Ethernet network adapter card. It is assumed that you have a working knowledge of standard Windows 95, 98 or NT operations and of installing network adapter cards.

Although similar in appearance, Windows 95, Windows 98 and Windows NT operating systems show different behavior when installing or operating new hardware on your computer.

The major differences between the operating systems are:

- “Plug & Play” support
- “User Profiles”

That’s why, you will find different “Getting Started” instructions for each of the Microsoft operating systems described in this chapter:

- “Getting Started in Windows 95/98” on page 3-3
- “Getting Started in Windows NT” on page 3-5

The actual setting of the WaveLAN parameters is the same for both type of systems (described on page 3-13).

Getting Started in Windows 95/98

Windows 95 and Windows 98 operating systems support “Plug & Play” for PC Cards. Once you insert the WaveLAN card into your computer, these operating systems will automatically:

- Detect the card, and enable the WaveLAN Miniport Driver, or
- Prompt you to install the driver, when the operating system cannot find the required driver. This would typically occur when inserting the WaveLAN IEEE 802.11 PC Card into your computer for the very first time.

Once the WaveLAN Miniport Driver is installed, you can remove and re-insert the card whenever you like. This is also referred to as “Hot Swapping” (see also “Card Removal and Re-insertion” on page 2-2).

The user profiles in Windows 95 and Windows 98 operating systems are primarily used to customize the visual appearance of your Windows desktop and user-defined preferences. These profiles do not have any impact on the installation of your WaveLAN card.

Starting Installation

To install the WaveLAN IEEE 802.11 PC Card on a computer running either Windows 95 or Windows 98, proceed as follows:

1. Insert the WaveLAN Software CD-ROM in your computer.
2. Insert the WaveLAN/IEEE Turbo 11 Mb PC Card into your computer.
3. Power up your computer.

Because both Windows 95 and Windows 98 support “Plug & Play”, the operating system functionality will automatically detect your WaveLAN IEEE 802.11 PC Card.

Once the operating system has identified the WaveLAN IEEE 802.11 PC Card, a message will be displayed identifying that the WaveLAN drivers are being installed.

Turn to “Installing the Miniport Driver” on page 3-9 to continue the installation of your WaveLAN IEEE 802.11 PC Card.

NOTE:
In some occasions Windows 95/98 operating systems may not detect the new hardware. This may be the case in situations where:

- The laptop computer into which you wish to install the WaveLAN card is a brand-new “out-of-the-box” computer, where the Windows 95/98 operating system was already factory-installed.
- A previous installation of the WaveLAN adapter card was aborted before it was finished.

When any of these situations applies, please consult Appendix B <$paratext> for more information.

Getting Started in Windows NT

Unlike Windows 95/98, Windows NT operating systems (v3.51 and v4.0) do not support “Plug & Play” and “Hot Swapping” of PC Cards:

- In order to start the driver installation for your WaveLAN IEEE 802.11 PC Card, you will need to “introduce” the card to the operating system.
- To swap PC cards, Windows NT machines typically require you to restart the computer in order to recognize the card and load the drivers.

Like Windows 95/98 systems, the Windows NT operating system also identifies user profiles. On Windows NT systems, however, user profiles (accounts) are associated with dedicated levels of authority (privileges) like the ones listed below:

- Users - are allowed to change the visual appearance of the Windows NT desktop and user-defined preferences.
- Power Users - can create “User Accounts” or “User Groups”.
- Administrators - can manage and control the overall configuration of the workstation.

NOTE:
To install (or uninstall) the WaveLAN IEEE 802.11 PC Card in a Windows NT environment, you will need to login as the “Administrator”, or ensure that your login profile provides the same level of privileges.

The privilege settings for each user (account) are set in the Microsoft Windows NT “User Manager” program. Please consult the documentation that was shipped with your Microsoft Windows NT operating system or station for more information.

Starting Installation

To install the WaveLAN IEEE 802.11 PC Card on a computer running Windows NT (version 3.51 or 4.0), proceed as follows:

1. Insert the WaveLAN IEEE 802.11 PC Card into your computer.
2. Power up your computer.
3. Enable PCMCIA Services
4. Enabling Network Support for your (client) station.

NOTE:
To be able to perform the steps as described on the following pages, you will need the privileges of the Windows NT station administrator.
From the Start menu, use the option “Log Off xxxxx” to close all windows” and log on as “Administrator”.

Secondly, you will need to verify that the computer system has at least NT Service pack v4.0 installed (check the blue start-up screen of Microsoft Windows NT).
If the computer on which you plan to install the WaveLAN PC Card is running with Service Pack v3.0 or lower, you will need to download Service Pack v4.0 from the Microsoft website (**http://www.microsoft.com**) and install the Service Pack prior to installing the WaveLAN PC Card.

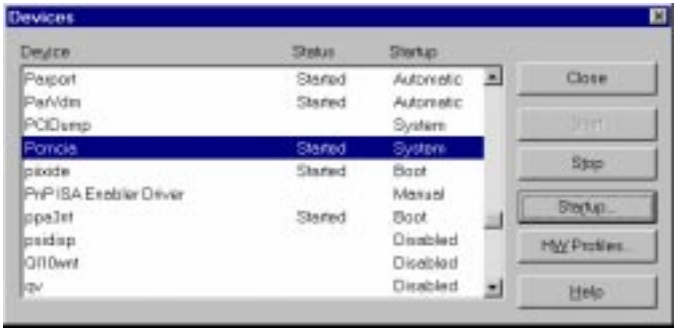
Enabling PCMCIA Services

To allow the Windows NT operating system to detect PC Cards in the computer’s PC Card slot , you must enable the PC Card Socket controller, identified as the PCMCIA device.

Devices

1. Click the Start button, then select “Settings” and then click “Control Panel”.
2. Double-click the “Devices” icon.
3. Scroll down the list of devices and select the item “PCMCIA”.

Figure 3-1 Enable the PCMCIA service for Windows NT



4. Click the button “Startup” on the right side of the “Devices” window, and set the Startup type for the item PCMCIA to “Boot”.
5. Click “OK” to confirm and return to the “Devices” window.
6. Click “Close” to return to the Control Panel.

Enabling Network Support

To introduce your WaveLAN network adapter card to the Windows NT operating system, you will need to enable Network support for your WaveLAN station.

1. From the Windows NT Taskbar, click the Start button.
2. Click on Settings, then Control Panel.
3. In the Control Panel window, double-click the “Network” icon to open the “Network Settings” window.

Network

- If no network has been installed yet, you will be prompted to install it now.

  Click “Yes” to install Windows NT Networking, and follow the instructions as they appear on your screen.

- If networking support was already installed, you will see a window with multiple tabs.

  Select the tab “Adapters”, and click the “Add” button.

Windows NT Networking Setup will determine the type of network adapter card that you will use to connect to the network.

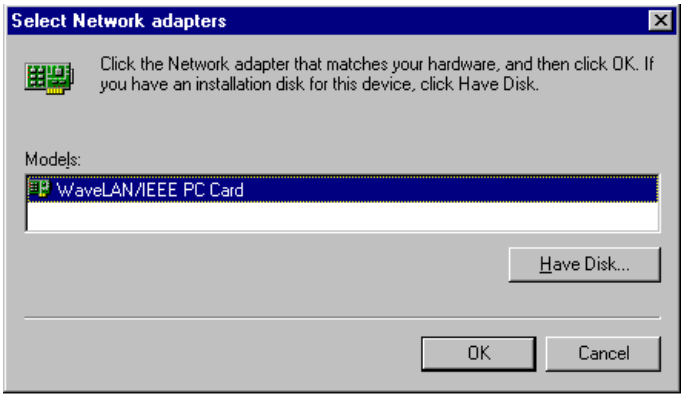
4. When prompted to select a driver, proceed with “Installing the Miniport Driver” on page 3-9.

Installing the Miniport Driver

If your Windows operating system automatically detected your hardware, it will prompt you to select a driver from a list, or install the driver from a “Disk provided by Hardware Manufacturer”.

Some Windows operating systems may prompt you to select the type of network adapter first, to select the appropriate driver (see Figure 3-2).

Figure 3-2 Select WaveLAN Adapter Type



This is usually the case when:

- Your computer came with a factory-installed version of Windows 95 (usually referred to as Windows 95 OSR2).
- Your computer runs the Windows NT operating system (version 3.51 or 4.0), and you performed the steps as described in “Getting Started in Windows NT” on page 3-5.

NOTE:
To make sure you install the latest available driver, always select the “Disk provided by Hardware Manufacturer” or

the “Have Disk” option, to install the driver from the WaveLAN Software CD-ROM that came with your WaveLAN card.

Alternatively, you can use the “Browse” option to navigate to the directory where you stored the set of files that you downloaded from the WaveLAN website.

As Windows operating systems differ slightly (see “What You Need to Know” on page 3-2), some of the screens pictured in this chapter may look different from the actual display on your screen. However, the parameter settings for your WaveLAN IEEE 802.11 PC Card will be similar for all Windows operating systems.

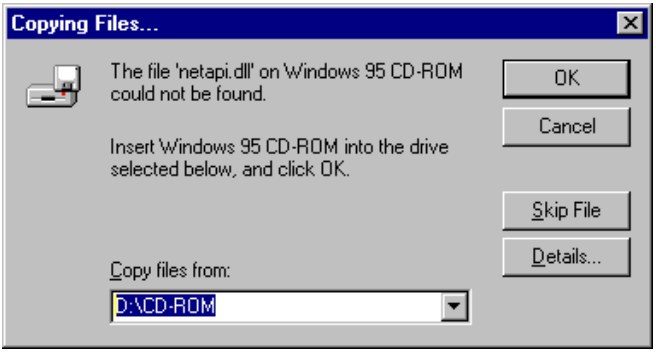
1. In the “Select Network Adapter” window, click the “Have Disk” button.
2. Ensure that the WaveLAN Software CD-ROM has been inserted into your computer, and click the [OK] button to proceed.

   When you downloaded the latest driver files from the WaveLAN website:

   - Use the “Browse” option on Windows 95/98 systems, to navigate to the harddisk drive and folder where you saved the driver files.
   - Windows NT systems will not allow you to “browse” for a harddisk folder as an alternative to a floppy disk. For such systems you will need to extract the downloaded files first, and copy the extracted files to a diskette.

   Windows will start copying files from your Windows installation disks or CD-ROM and the WaveLAN Software CD-ROM.
3. If the system prompts you to identify the location of files (see Figure 3-3 on page 3-11), enter the correct drive and directory, and click the [OK] button to proceed.

Figure 3-3 Identify the Location of Files



- For Windows system files (typically ***.dll**) this is usually the Windows CD-ROM. e.g. **d:\cd-rom**.
- When your computer came with the Windows operating system factory-installed, point to the directory that contains the Windows setup files (***.cab**): e.g. **c:\windows\options\cabs**
- When the system prompts you to identify the WaveLAN Driver files (typically file names starting with the characters **wv*.***), specify the drive and directory that contains your WaveLAN software:
  - — If installing from the WaveLAN CD-ROM **d:\software\adapter\pc_card\drivers\windows** where “d” represents the drive letter of your CD-ROM.
  - — if installing files that you downloaded from the internet point to the floppy disk drive or directory where you saved the downloaded files.

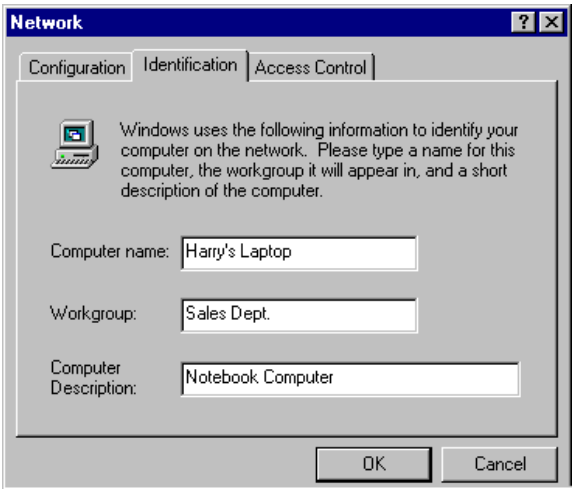
  When you had a network adapter installed on your computer before, most of these files are already available on your hard disk drive. If you do not have the Windows CD-ROM available, you may try replacing the proposed path in the “Copy files from” dialog box with:

  c:\windows\system or **c:\windows**

Network Installation

If this is the very first time that Networking support is installed onto your computer, the Windows operating system will prompt you to enter a computer and workgroup name. These names will be used to identify your computer on the Microsoft Network Neighborhood.

Figure 3-4 Windows Network Identification Properties



1. Click the OK button to display the window as pictured in Figure 3-4.
2. In the “Computer Name” field, enter a unique name for your computer.
3. In the “Workgroup” field, enter the name of your workgroup.
4. (Optional) Provide a description of the computer in the “Computer Description” field.

For more information about setting your Windows Network Properties, consult your Windows documentation or the Windows on-line help information.

Setting the WaveLAN Parameters

When you confirm the Windows Network Identification parameters, Windows will open the parameter window for your WaveLAN adapter as pictured in Figure 3-5.

On computers running the Windows NT operating system, you will see additional tab labeled “Adapter”, that enables you to verify and/or modify the factory-set values for the I/O Port address of your WaveLAN Adapter, and its IRQ value[1].

1. Enter the values that you wrote down when running the Windows NT Diagnostics as described on page B-7.
2. Click the “Continue” button, to display the parameter window for your WaveLAN adapter.

The “WaveLAN Properties” window enables you to specify the WaveLAN specific parameters, required to connect your computer to the WaveLAN IEEE 802.11 network system.

Which Parameters Do You Need?

When connecting your station to an IEEE 802.11 wireless network infrastructure, you will only need to set the following parameters:

- WaveLAN Network Name
- Station Name

In this Quick Installation Guide these parameters are described as the “Basic WaveLAN Parameters”.

Looking at the WaveLAN Parameter window, you will also see a set of Advanced WaveLAN Parameters, and “Power

1 For computers running the Windows 95 or Windows 98 operating system, you do not need to set these parameters. On these systems, the allocation of these device settings is controlled via the “Plug & Play” mechanism.

Management", which are described in the on-line help file of the driver and in Chapter 4 .

You are advised to leave these to their default settings, unless there are special situations, for example, upon advice of a WaveLAN IEEE 802.11 expert.

NOTE:
Always consult your LAN Administrator for the parameter settings that apply to your network environment.

Basic WaveLAN Parameters

The Basic WaveLAN Parameters are the minimum set of parameters that should be set to get your WaveLAN IEEE 802.11 network up and running. These parameters include:

- WaveLAN Network Name
- Station Name

WaveLAN Network Name

When you wish to connect your computer to an IEEE 802.11 Infrastructure as pictured in Figure 1-3 on page 1-3 and Figure 1-4 on page 1-4, you have two options:

- "Connecting to Any Network" as described on page 3-15, or
- "Connecting to a Specific Network" as described on page 3-16.

The WaveLAN Network Name will determine to how your WaveLAN station will behave when powered up in an IEEE 802.11 Infrastructure.

If you are unfamiliar with the two types mentioned above, please consult the section "Connecting to a Network" in Chapter , on page 1-17.

Figure 3-5 Setup WaveLAN Parameters

Connecting to Any Network

To connect to any IEEE 802.11 network in the vicinity of your WaveLAN computer, you can leave WaveLAN Network Name field blank, or enter the name "**ANY**" (all characters in upper-case).

When your WaveLAN Network name is set to "**ANY**", your computer will attempt to establish a radio connection with any IEEE 802.11 network that provides good communications quality.

You may wish to use the "**ANY**" option when:

- You operate your computer in multiple network environments, that are identified by different WaveLAN Network Names.
- You do not know the WaveLAN Network Name of the network to which you would like to connect your computer.

Connecting to a Specific Network

If you would like to connect to one specific WaveLAN Network only, enter the “WaveLAN Network Name” that applies to your network, for example: “**MY_WAVELAN_NETWORK**”.

This is the WaveLAN Network Name that the LAN Administrator programmed into the WavePOINT-II access points. Consult your LAN Administrator for the value that applies to your network.

Setting up a New IEEE 802.11 Infrastructure?

When setting up a new IEEE 802.11 network, you may enter a “WaveLAN Network Name” of your choice. This name should also be programmed into other WaveLAN stations, and (if applicable) the WavePOINT-II access points.

The WaveLAN Network Name can be any alphanumeric string in the range of “a” to “z”, “A” to “Z” and “0” to “9”. This string which can contain from 1 to 32 characters is case-sensitive.

Example: “**MY_WAVELAN_NETWORK**”

Station Name

The Station Name is a name that will be used to identify your WaveLAN station in the WaveLAN diagnostic tools described in Chapter 4.

- When your computer runs the Windows 95 or Windows 98 operating system, enter a string of alphanumeric characters in the range of “a-z”, “A-Z” and “0-9” with a maximum of 32 characters.

  You are advised to use the same name as the one you entered in the “Computer Name” field in your Windows Network Neighborhood Properties (see Figure 3-4 on page 3-12).

- When your computer runs the Windows NT operating system, the Station Name field is not available. On these systems, the diagnostic tools will use the “Computer Name” value from the “Identification” tab.

Connecting to an Ad-hoc Network

In case you do not wish to connect to a network infrastructure, but prefer to setup a small wireless workgroup as pictured in Figure 1-2 on page 1-2, you can enable the “Ad-hoc Demo Mode” tick box.

In Ad-hoc Demo Mode, your computer will:

- Ignore the WaveLAN Network Name
- Ignore WavePOINT-II access points
- Fix the radio to operate at its factory-set default channel.

This means that your WaveLAN IEEE station can communicate with any other WaveLAN IEEE station within its range, provided that these stations have been equipped with cards that have a matching default radio frequency (see Table A-6 on page A-8).

WaveLAN Encryption Parameters

The encryption tab enables you to define the encryption keys that your WaveLAN/IEEE Turbo 11 Mb PC Card should use to:

- Decrypt wireless messages received via its wireless interface.
- Encrypt data that will be transmitted via the wireless interface.

CAUTION:
The encryption feature only works with WaveLAN IEEE Silver and Gold Label PC Cards. If the PC Card in your computer is an an older type WaveLAN/IEEE PC Card which does not support encryption (typically (identified by a Bronze or White Label), do not enable encryption. Doing so may prevent the card from normal operation.

Figure 3-6 Setup WaveLAN Encryption Parameters

You can identify up to 4 different key values to decrypt wireless data, and select one of these keys to encrypt wireless data transmissions.

Subject to the type of WaveLAN PC Card, the key value of your choice may either be:

- 5 alphanumeric characters in the range of “a-z”, “A-Z” and “0-9” for Silver cards.
- 16 alphanumeric characters in the range of “a-z”, “A-Z” and “0-9” for Gold cards.

  The alphabetical characters you select are “case-sensitive”.

  Example: **Secu1** for silver cards, or **Security Key1234** for Gold cards.

Alternatively, you may select to enter a hexadecimal string, preceded by the characters “**0x**”values, being either:

- 10 digit hexadecimal values in the range of “A-F” and “0-9” for Silver cards.
- 32 digit hexadecimal values in the range of “A-F” and “0-9” for Gold cards.

  Example: **0xABCD1234FE** for Silver cards, or **0x1234567890ABCDEF0987654321FEDCBA** for Gold cards

CAUTION:
To allow encrypted data communications, you must set the same encryption key values on all stations and/or access points.
Carefully write down the values you enter here, and keep this note in a secure place.
*The values you enter on the encryption tab, will only be visible the first-time you enter the keys. After closing this tab, all key values will be displayed as “**xxxxxxxxxxx**” every time the tab is displayed again.*

Finishing the WaveLAN Installation

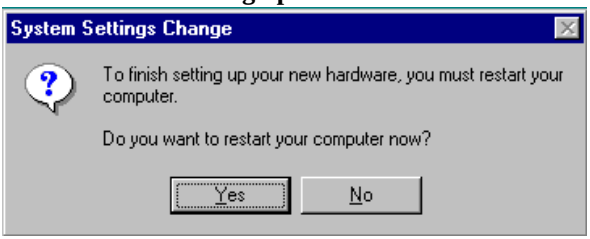
When you have finished “Setting the WaveLAN Parameters”, click the [OK] button to proceed with the installation process. Windows will finish building the driver configuration database and copy some files from your CD-ROM or diskette to your computer’s hard disk.

If the Windows operating system prompts you to identify the location of the Windows files, specify the drive and directory of the Windows Installation CD-ROM or diskettes (see also page 3-11).

When Windows has finished the copying of files, it will prompt you to restart your computer.

1. Remove the WaveLAN software diskette from drive A:\
2. Click the [OK] button to restart your computer.

Figure 3-7 Finished Setting up the Hardware



After Restarting Your Computer

After you have restarted your computer, the Windows operating system should detect the WaveLAN IEEE 802.11 PC Card (you can hear the two-tone sound of the PC Card Socket Controller).

Windows will load the WaveLAN IEEE 802.11 Miniport driver and will open with a dialog box that enables you to enter a user name and password. The password you enter here will be the one used to log into the Windows Network Neighborhood.

Working with WaveLAN & Windows

View Other WaveLAN Stations

When multiple WaveLAN stations are up-and-running in your wireless network, you can use the procedure described below to display the other computers:

1. Start Windows Explorer.
2. Scroll down the list of files and folders to look for the item “Network Neighborhood”.
3. Double-click the “Network Neighborhood” item to display all stations in your Microsoft Networking Group.
4. To display other workgroups in the network environment, double-click the “Entire Network” icon.
5. If there is a second network operating system running in your network environment (for example a Novell NetWare network), the “Entire Network” window, will also display available servers running under the second network operating system.

   If you click on these servers, you may be asked to enter your user name and password that apply to the other network operating system

   If you cannot find other (WaveLAN) networked computers, verify whether or not the other WaveLAN computers are:

   - Powered up and logged on to the network.
   - Configured to operate with an identical:
     - Networking Protocol.
     - WaveLAN Network Name

To verify the radio connection with other stations, you can also run the Monitoring Options as described in Chapter 5 .

Selecting the Networking Protocol

Upon initial installation, your Windows operating system will typically install a basic set of networking protocols.
You may need to check whether the network installation process:

- Truly added the protocols required to communicate with other computers in your network environment.
- Configured the appropriate protocol settings to allow communication within your networking environment.

Infrastructure Networks

When connecting your station to a network infrastructure, you will usually need additional networking protocols, according to the network operating system used within your LAN environment.
The most common protocols are:

- IPX/SPX compatible protocols when your networking environment is using the Novell NetWare network operating system.
- NetBEUI when you would like to use file and printer sharing, as supported by Microsoft Networking for Windows Workgroups.
- TCP/IP when you would like to connect your computer to a network that uses IP addressing, and/or you would like to connect to the internet.

These networking protocols can operate simultaneously with any other networking protocol.

Ad-hoc Workgroup Networks

When connecting your station to an ad-hoc wireless workgroup, you will also need a networking protocol that will allow your station to participate in peer-to-peer networking.

The most common protocols are:

- NetBEUI when you would like to use file and printer sharing, as supported by Microsoft Networking for Windows Workgroups.
- TCP/IP when you would like to use “local webserver” capabilities that allow participants to surf (designated areas of) one-another’s disk-drives using an Internet Browser.

  When using the TCP/IP protocol, each workgroup participant must be identified by a unique IP Address value.

Consult your Microsoft documentation for more information about protocols and peer-to-peer networking.

Verifying the Current Protocol Setting

To verify whether your station has been configured for the correct type of network and networking protocols:

1. Click the Start button from the Windows Taskbar.
2. Click on Settings, then Control Panel.
3. In the Control Panel, double-click the “Network” icon.
4. Verify that the list of network components includes the following items:
   - Client for Microsoft Networks.
   - (optional) Client for NetWare Networks.

   If the item of your choice is already available, click the Cancel button to exit this configuration screen and skip to the next step.

   If the items you require are missing, click the “Add” button and select “Add Client” to add the client software of the networking software that you would like to install.

5. When the proper Client software is installed, but you do not see the required protocols, click the “Add” button, and follow the instructions of the Windows operating system as they appear on your screen.

Consult your LAN Administrator for more help or information about configuring the IPX/SPX and/or TCP/IP properties.

Display or Modify WaveLAN Parameters

If you would like to view or modify WaveLAN parameters, for example because you would like to connect to another network or type of network, proceed as follows:

1. Click the Start button from the Windows Taskbar.
2. Click on Settings, and then on Control Panel.
3. Double-click the “Network” icon.
4. In the Network Properties Window, select the WaveLAN IEEE 802.11 PC Card Adapter and click the “Properties” button.
5. (Optional) Change the parameters you would like to modify, and click
   - the OK button to confirm your changes, or
   - the Cancel button to ignore your modifications.

Advanced WaveLAN Parameters

4

Contents

Introduction 4-1

MAC Address 4-2

AP Density 4-3

Transmit Rate 4-4

The Auto Transmit Rate Select Mechanism 4-4

The User-defined Transmit Rate 4-5

Medium Reservation 4-8

- About the Hidden Station Problem 4-8
- About the Medium Reservation Mechanism 4-11

Power Management 4-13

Enable Power Management: 4-14

- Maximum Sleep Duration 4-15
- Receive All Multicasts 4-15

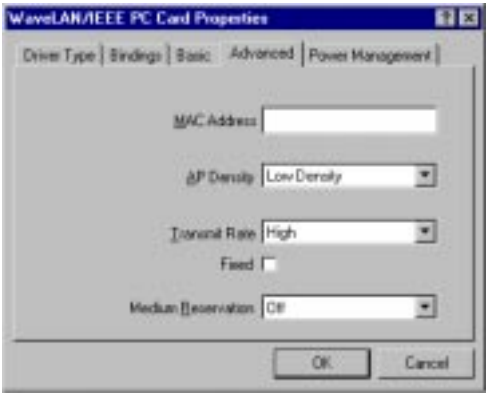
Advanced WaveLAN Parameters

4

Introduction

In most network environments you will not need to change the settings of the Advanced Parameters, as their default settings will prove most efficient for normal network communications.

Figure 4-1 Advanced WaveLAN Parameters



In special situations however, for example upon advice of an IEEE 802.11 WaveLAN expert, you may wish to change the defaults of the parameters described in this chapter.

To display the parameters, follow the instructions as described under “Display or Modify WaveLAN Parameters” on page 3-24.

MAC Address

All WaveLAN IEEE 802.11 PC Cards have a unique Universal MAC Address that is used to identify your computer on the network.

- For most network operating systems, you will not need to change this parameter, i.e. you can leave this field blank.
- When your network system uses a “Local MAC Addressing” scheme, you may need to assign a Local MAC Address value to the WaveLAN IEEE 802.11 PC Card of your computer. Valid address values are 12-digit, hexadecimal values, where the 2nd digit must be either 2, 6, A, or E.

Consult your LAN Administrator to find out whether your network requires Local MAC Addresses, and (if applicable) to obtain a unique Local MAC Address value.

NOTE:
The Access Control security feature for WavePOINT-II access points (described on page 6-3) does not work in systems that use Local MAC Addressing. If you would like to use Access Control, you must disable Local MAC Addressing.

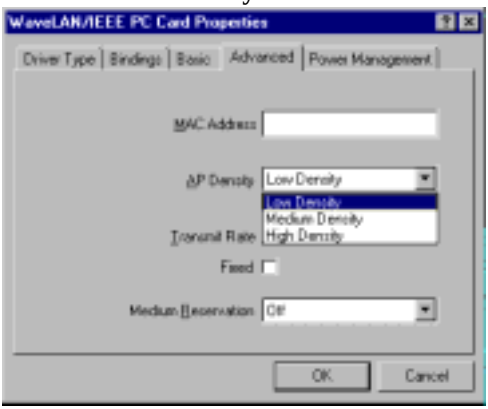
If you do not wish to assign a Local MAC Address, you should leave the MAC Address field blank, or enter the value “0” (zero).

AP Density

The Access Point Density parameter controls the roaming sensitivity of your wireless station. This parameter should be set according to match:

- The density of the WavePOINT-II access points that have been installed throughout the wireless network area, and
- The setting of this parameter in the configuration of the access points.

Figure 4-2 Access Point Density Parameter



Consult your LAN Administrator for the appropriate values that apply to your network. Valid values are:

- Low (default)
- Medium
- High

CAUTION:
Using non-matching values may seriously affect wireless performance of your wireless station.

Transmit Rate

The actual data transmission speed of your WaveLAN device is subject to the following criteria:

- The type of WaveLAN IEEE cards at both ends of the wireless link, being:
  - The card inserted into your computer, and
  - The card inserted into the WavePOINT-II or, the peer-to-peer partner in an Ad-hoc network.
- The communications quality of the wireless link.
- The user-defined preference for the data Transmit Rate.

NOTE:
Transmissions at high data rates do not cover the same distances as wireless data transmitted at Standard or Low data rates (see Table A-4 on page A-5).

When upgrading from standard WaveLAN cards to Turbo cards, you may need to perform a site survey again to verify that the entire coverage area allows for data transmissions at the highest transmit rates.

The Auto Transmit Rate Select Mechanism

In most networking scenarios, you will see that the factory-set default “High” will prove the most efficient. Whenever your card communicates via the wireless medium it will:

- Sense the maximum transmit rate as supported by both communication partners, and switch to that Transmit Rate.
- Determine if the communication quality allows for communicating at this data rate.

Transmissions at lower data speeds are usually more reliable. Therefore when the communications quality drops beneath a certain level, the WaveLAN cards will automatically switch to a lower data rate.

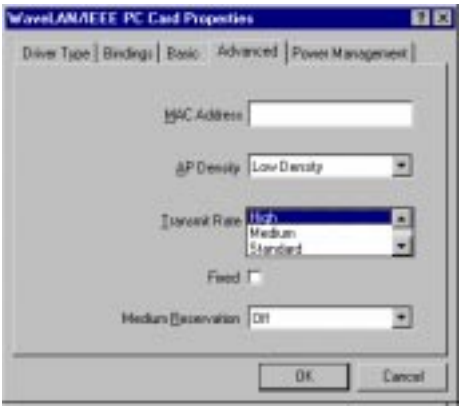
When the communications quality improves again, both WaveLAN cards will gradually increase the data rate again, until they have reached the highest available Transmit Rate as supported by both cards.

The User-defined Transmit Rate

If you wish to balance speed versus reliability, you can also select a user-defined preference from the following four options:

- High (default)
- Medium
- Standard
- Low

Figure 4-3 WaveLAN Transmit Rate



Optionally, you can select to disable the Auto-Transmit Rate Select mechanism, by “fixing” the Transmit Rate to the selected user-defined preference. You are advised however to do so only in special circumstances, typically upon advice of a WaveLAN IEEE expert or WaveLAN Technical Support representative.

- Use the default **“High”** with Auto-Transmit Rate Select rate (i.e. the Fixed tick box is cleared) to in regular networking environments. This setting will allow your WaveLAN card to operate at the maximum data rate as supported by the hardware:
  - — Ethernet equivalent speed for WaveLAN IEEE Turbo cards.
  - — IEEE 802.11 Standard speed for regular WaveLAN IEEE 802.11 cards.
- Use **“High - Fixed”** data rate only in networking environments where:
  - — You are certain that all wireless devices can communicate at the highest Transmit Rate, and
  - — Where performance appears to slow down as a result of many retransmissions, even though the wireless coverage provides an “Excellent Radio Connection”.

    This situation may occur in exceptional cases where for example Microwave ovens in the WaveLAN Signal path interfere with WaveLAN data communication.
- Use **“Standard”** in Ad-hoc wireless workgroups, where the wireless peers in the workgroup have been equipped with standard WaveLAN IEEE adapters, that do not support the Medium and High data rates.
- Use **“Low - Fixed”** only in networking environments where range of the wireless connection is more important than speed.

  This setting will “instruct” your WaveLAN adapter to conserve resources by not attempting to (re-)transmit data at higher data rates.

NOTE:
The actual transmit rates “High” and “Medium” are only supported by WaveLAN IEEE 802.11 Turbo cards.

Regular WaveLAN IEEE 802.11 adapter cards that do not support these transmit rates, will interpret the settings “High” and “Medium” in the same way as the setting “Standard”.

Medium Reservation

It is normal behavior for WaveLAN stations to defer transmissions automatically when they sense that another WaveLAN device is using the wireless medium.

This behavior also referred to as the Carrier Sense Multiple Access/Collision Avoidance protocol (CSMA/CA) will avoid that wireless messages would collide in situations where two or more stations would start transmissions at the same time.

The Medium Reservation mechanism enables you to improve wireless performance in network environments where the CSMA/CA protocol would fail due to the “hidden station” problem as pictured in Figure 4-4 on page 4-9.

Medium Reservation may provide a solution for networks where:

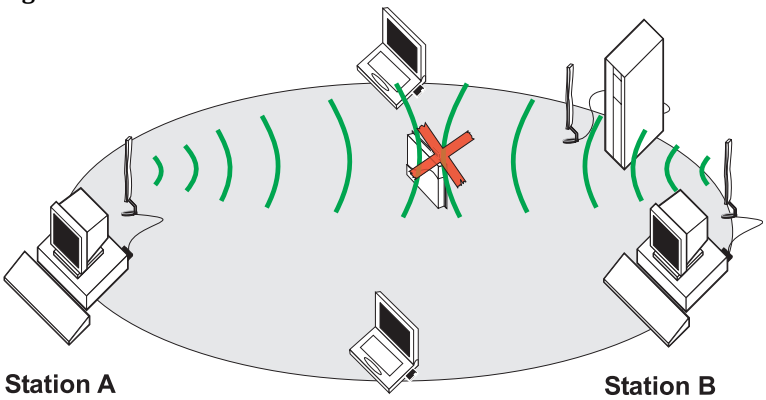
- The density of WaveLAN stations and WavePOINT-II access points is very low.
- You witness poor network performance due to excessive frame collisions at the WavePOINT-II access points.

About the Hidden Station Problem

A hidden station is a situation in which two stations are within range of the same WavePOINT-II, but are not within range of each other.

Figure 4-4 on page 4-9 illustrates an example of the “Hidden Station” problem. Both Station A and Station B are within range of the WavePOINT-II access point however, Station B cannot “hear” Station A, therefore Station A is a “hidden station” for Station B.

Figure 4-4 The Hidden Station Problem



When Station B starts to communicate with the WavePOINT-II access point, it might not notice that Station A is already using the wireless medium. When Station A and Station B send messages at the same time, they might collide when arriving simultaneously at the WavePOINT-II access point. The collision will most certainly result in a loss of messages for both stations.

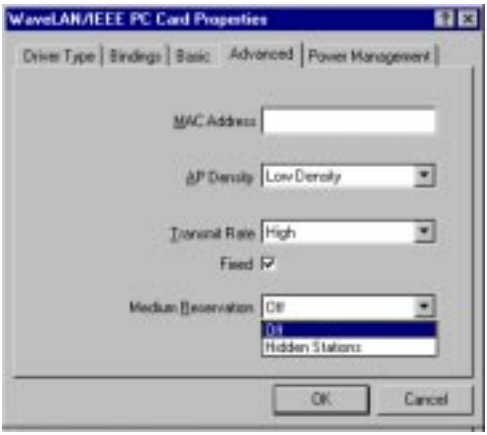
In situations as pictured Figure 4-4, Medium Reservation may provide a solution to prevent message collisions by handing over transmission control to the WavePOINT-II access point.

Troubleshooting a “Hidden Station” problem usually provides the best results when it is performed on the suspected WaveLAN Client stations that suffer from errors as a result of the “hidden station” problem.

When configuring the WaveLAN card parameters (in the PC Card properties window) you can set the Medium Reservation parameter to either:

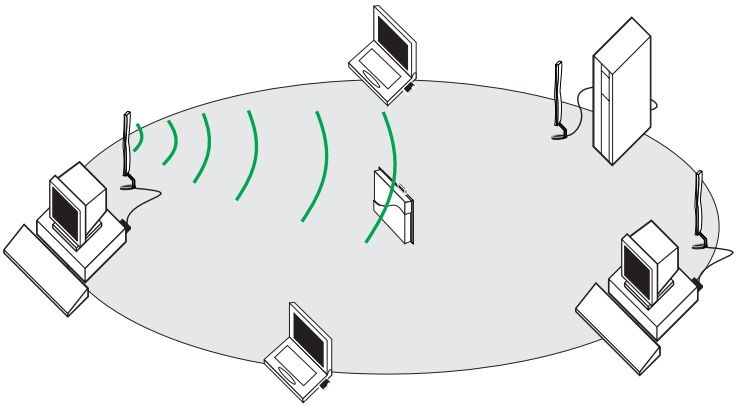
- “Hidden Station”, or
- “Off”

Figure 4-5 Medium Reservation Parameters



You can enable Medium Reservation on individual stations, i.e. the setting of this parameter does not have to be the same for all WaveLAN devices in your network.

Figure 4-6 Medium Reservation “Request to Send”

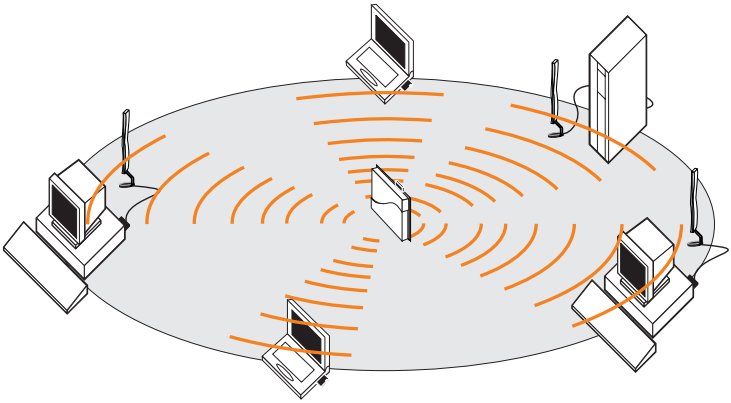


About the Medium Reservation Mechanism

When you enable Medium Reservation on a suspect “hidden station”, this WaveLAN station and its WavePOINT-II access point will use a Request to Send/Clear to Send protocol (RTS/CTS).

- The station will send an RTS to the WavePOINT-II device, that will include information about the length of the frame that the station would like to transmit (see Figure 4-6).
- Upon receipt, the WavePOINT-II device will respond with a CTS message to all stations within its range to:
  - — Notify all other stations to defer transmissions for the time-frame of the requested transmission.
  - — Confirm the requestor station that the WavePOINT-II has checked the medium for availability, and has reserved it for the time-frame of the requested transmission. The CTS process is Figure 4-7 on page 4-11.

Figure 4-7 Medium Reservation “Clear to Send”



NOTE:
In most networking environments it is very unlikely that you will need to enable Medium Reservation on the WavePOINT-II to prevent collisions.

Since all stations connected to a WavePOINT-II device are typically within range of the WavePOINT-II device they should be able to sense whenever the WavePOINT-II is using the medium to transmit messages via the wireless medium.

Enabling Medium Reservation on the WavePOINT-II would require the WavePOINT-II to ask for a CTS for every message that it wishes to forward to stations within its range, even if it is forwarding traffic between stations that belong to the same wireless cell.

This might cause redundant network overhead that could negatively affect the throughput performance instead of providing a remedy.

Power Management

The Power Management option on your WaveLAN IEEE 802.11 PC Card is designed to conserve battery life of your portable computing device. When Power Management is enabled, your WaveLAN card will go into “sleep” mode, to minimize power consumption.

While in “sleep” mode, all network traffic addressed to your station will be buffered in the WavePOINT-II unit. At regular intervals, your WaveLAN card will “wake up” to verify whether there is information buffered at the WavePOINT-II access point.

- If there is no traffic, your WaveLAN card will return to power-saving sleep mode.
- If there is buffered traffic, the station will collect it and return to sleep mode.

The Power Management feature is best suited for transaction-based processing. In network environments characterized by heavy data traffic, enabling Power Management may affect throughput performance as perceived at the wireless station.

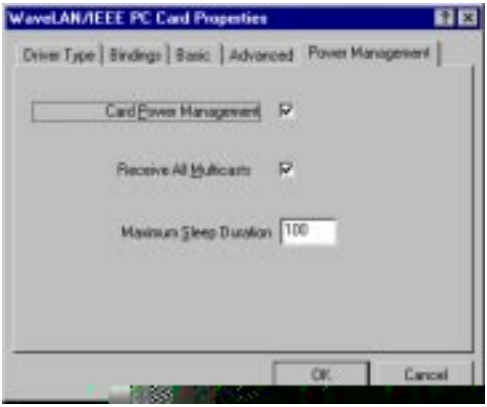
NOTE:
Power Management requires dedicated support from the WavePOINT-II access points. Previously purchased/ installed WavePOINT-II access points may not yet support buffering of traffic for wireless clients in sleep mode.

Before enabling Power Management on your WaveLAN computer, please consult your LAN Administrator to verify whether the WavePOINT-II access points have been upgraded to support this feature.

Enable Power Management:

1. Right click the Network Neighborhood icon, and select “Properties”.
2. Select the WaveLAN/IEEE PC Card, and click “Properties”.
3. Select the “Power Management” tab
4. Enable “Card Power Management”.

Figure 4-8 WaveLAN Power Management Parameters



When Power Management is enabled, the Power LED will “flicker”, as compared to a stable green Power LED for the WaveLAN IEEE 802.11 PC Card not utilizing the Power Management feature.

To manage the power consumption of your WaveLAN card, you will use the following PC Card property settings:

- Maximum Sleep Duration
- Receive All Multicasts

Installing WaveMANAGER/CLIENT

To install the WaveMANAGER/CLIENT IEEE software:

1. Insert the WaveLAN Software CD-ROM in the station that you have designated as the WaveMANAGER Station.

   If you downloaded the software from the web, please refer to the installation instructions found on the web.
2. Select “**Run**” from Windows 95, 98 or Windows NT Start menu.
3. Use the option “Browse” to navigate to the CD-ROM drive and folder that contains the installation files for your WaveMANAGER/CLIENT program:

   This is typically: **software\adapter\pc_card\tools\windows** if you are installing form the WaveLAN Software CD-ROM
4. Select the file “**setup.exe**” and click “OK” to return to the Start menu.
5. Click “OK” again to start the installation program.

   If you had a previous version of the WaveMANAGER/CLIENT IEEE program installed, it will be overwritten.
6. Follow the instructions of the setup program that are displayed on the screen.

   The installation program will:

   - Create a “WaveMANAGER” folder on your computer’s hard disk, typically:

     c:\program files\wavelan\wavemanager\client ieee.
   - Copy the WaveMANAGER/CLIENT IEEE program with the associated on-line help files to this folder, and
   - Create an icon on the “Programs” menu.

Running WaveMANAGER/CLIENT

To start WaveMANAGER/CLIENT IEEE:

1. Click the button in the Windows Task bar.
2. Click on “Programs” and then select “WaveLAN”.
3. In the list of WaveLAN program files select “WaveMANAGER CLIENT IEEE” to start the diagnostic utility.

The opening window of WaveMANAGER/CLIENT will give a general indication of the wireless connection from your WaveMANAGER/CLIENT station to the WaveLAN IEEE 802.11 Infrastructure. Looking at this window you will be able to:

- Determine whether your card is functioning properly.
- Determine the WaveLAN Network to which your WaveLAN IEEE 802.11 PC Card has established a connection.
- Assess the communications quality with the selected IEEE 802.11 network.

Monitoring Options

WaveMANAGER/CLIENT offers you various options to investigate wireless performance of your IEEE 802.11 WaveLAN network:

- The WaveLAN Status/Function Window
- The WaveLAN Link Test
- The WaveLAN Card Diagnostics

This chapter will provide a set of guidelines to determine which tool to use in your situation. For more detailed information about each of the diagnostic options and screens, you are advised to consult the on-line help file of the WaveMANAGER/CLIENT program.

To access context-sensitive help in the WaveMANAGER/CLIENT program file:

- Click the Help button on your screen, or
- Press the F1 function key on your keyboard.

What to Monitor

To analyze wireless performance of your IEEE 802.11 WaveLAN network there are two major diagnostic indicators:

- The Communications Quality of the radio connection.
- The Data Throughput Efficiency of your wireless connection.

Communications Quality

The radio communications quality is expressed in the Signal to Noise Ratio (SNR). When communications quality is good, in most situations the data throughput efficiency will be good as well.

When the communications quality of the radio connection is poor, this is usually the result of:

- A “poor” WaveLAN Signal Level, for example when your wireless station and access points are “too far apart”, or
- A high level of interference (Noise Level), usually caused by other (wireless) devices emitting radio signals in the same frequency band as your WaveLAN adapter card.

To monitor the communications quality of your connection to the network, the Link Test tool in WaveMANAGER/CLIENT IEEE actively exchanges messages to test the quality of the link. If your computer is idle, you can see the Transmit/Receive LED flickering due to these test messages. (These are test messages only; no email or other files are sent as part of the Link Testing).

To quickly view the quality of your communication with the network, open the WaveMANAGER/CLIENT IEEE program, and you can quickly view the quality of the link in two different locations:

- On the opening WaveMANAGER/CLIENT window, there is a visual Green/Yellow/Red indicator along with a text description of the connection (Good, Adequate, Poor).
- On the Windows Taskbar, an icon (in the shape of a dish antenna) will indicate whether the connection is Good (Green), Adequate (Yellow) or Poor (Red).

When you minimize the WaveMANAGER/CLIENT IEEE program, you can still view the communications quality of your connection. You will notice a small icon next in the right corner of your Windows Taskbar. This icon will display either Green (Good connection), Yellow (adequate) or Red (poor)

Data Throughput Efficiency

The Data Throughput Efficiency is largely determined by:

- The communications quality of the radio connection
- The congestion of the medium

A “poor” communications quality will most likely affect the data throughput efficiency. When communications quality is “poor” it is likely that messages may get lost.

Losing some messages is not dramatic, as your WaveLAN network adapter will automatically retransmit lost data frames. Losing many frames however may result in longer network response times, as numerous retransmissions will require more time and bandwidth to maintain successful network communication, while contributing to the congestion of the medium.

When many wireless stations try to communicate simultaneously, the congestion of the medium might slow down network performance. The network performance may slow down because:

- WaveLAN stations defer data transmissions for one another to avoid frame collisions
- WaveLAN stations need to retransmit frames repeatedly because initial transmissions failed, for example due to a frame collision.

How to analyze Data Throughput Efficiency is described under “WaveLAN Link Test” on page 5-8.

Choosing your WaveMANAGER Tool

To monitor performance of your WaveLAN adapter and your IEEE 802.11 network, you can select either one of the following WaveMANAGER/CLIENT options:

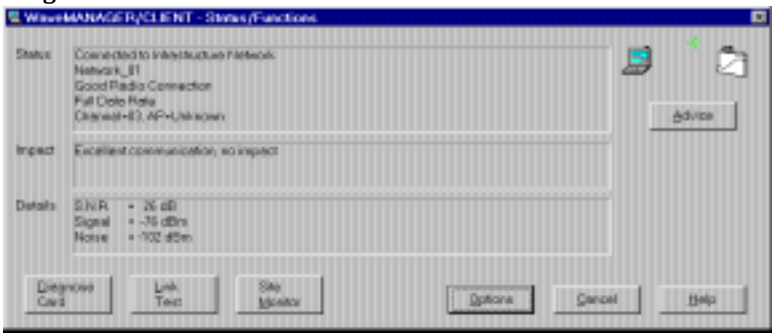
- The “WaveLAN Status/Function Window” when you are only interested in the general performance of your wireless connection.
- When you are troubleshooting wireless performance, or when you would like to perform more thorough investigations select:
  - Link Test to investigate a specific connection or location in detail, or
  - WaveLAN Card Diagnostics, when you suspect a failure of your card.

WaveLAN Status/Function Window

The WaveMANAGER/CLIENT always opens with a general status window, that informs about whether your WaveLAN card managed to connect to an IEEE 802.11 network. This window will display:

- The name of the network to which you are currently connected.
- The communications quality of the radio connection between your station and the network.
- The Impact of the communications quality on your network communication.

Figure 5-1 WaveMANAGER/CLIENT Status Window



Optionally you can use one of the available buttons to:

- Click the “Advice” button to troubleshoot unexpected results.
- Start the WaveLAN Link Test.
- Use the “Card Diagnostics” option when the Status window indicates that the WaveLAN Card is not functioning properly.

WaveLAN Link Test

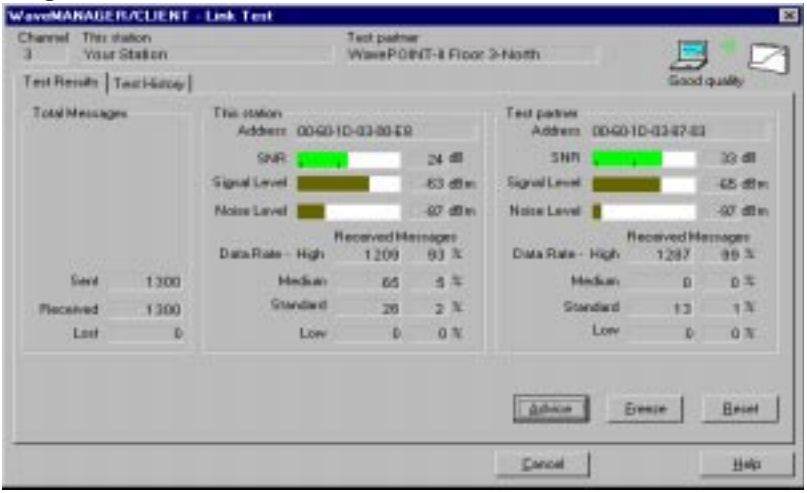
You can use the Link Test to investigate the specific link between a WaveLAN computer and its WavePOINT-II unit in your WaveLAN Infrastructure environment (see Figure 1-3 on page 1-3).

The Link Test mode enables you to investigate:

- The Communications Quality of the radio connection
- The Data Throughput Efficiency of the radio connection.

When you run the Link Test mode while roaming throughout the network environment, you will notice that the ‘Link Test Partner will change according to the WavePOINT-II devices that service the wireless areas that you pass.

Figure 5-2 WaveMANAGER Link Test



Testing Radio Communications Quality

The primary indicator to monitor is the communications quality of the radio connection. This value is expressed in a Signal to Noise Ratio (SNR). The SNR indicator will change color in the range ‘Green, Yellow and Red, according to communications quality result as identified below:

Color	Description
■ Green	Communication quality is “Good”. No intervention is required.
■ Yellow	Communications quality is “Adequate”. No intervention is required.
■ Red	Communications quality is “Poor” and requires user-intervention (see Appendix B ”Troubleshooting”)

When the SNR is rated as “Good” or “Adequate” the performance of your WaveLAN station will be good as well.

When SNR is rated “Poor” you may need to consider one of the options proposed by the WaveMANAGER/CLIENT tool.

To access WaveMANAGER/CLIENT tips for troubleshooting click the “Advice” button. Advice may include:

- Optimizing antenna placement to increase the WaveLAN Signal Level, or
- Eliminating sources of interference to decrease the Noise Level that affects the Signal to Noise Ratio (SNR).

Use the indicators for Signal Level and Noise Level to determine the cause of reduced performance. The panels for “Your Station” and the “Link Test Partner” will help you to identify where you should start “optimizing antenna placement” or “eliminating interference”.

Testing Data Throughput Efficiency

The secondary indicator for wireless performance is the Data Throughput Efficiency of the radio connection. Data Throughput Efficiency is measured in:

- “High, Medium, Standard & Low Data Rates”
- “Sent, Received & Lost Messages”

High, Medium, Standard & Low Data Rates

WaveLAN/IEEE PC Cards use an automatic Transmit Rate Select mechanism to ensure reliable communications:

- When communicating with another wireless IEEE 802.11 compliant LAN device, both devices will automatically synchronize their data rate to the highest compatible transmit rate.
- As data communications at lower speeds may travel larger distances that communications at high speed, the WaveLAN adapters will automatically switch to a lower data rate when one or both of the two link partners are moving away from one another.

NOTE:
When running a network with multiple types of WaveLAN PC Cards, all communications between the different types of PC Cards will be at the Standard speed (see “About Using Different Card Types” on page 1-7).

When running the WaveMANAGER/CLIENT Link Test, the diagnostic tallies will inform you at which speed the both Link test partners synchronized their data transmissions.

You can use these tallies to determine whether you might need to:

- Move wireless stations closer to the WavePOINT-II access point (or together when operating in an Ad-hoc Wireless Workgroup as pictured in Figure 1-2 on page 1-2).
- Verify the type of card installed at both Link Test Partners, for example by displaying the information on the "Configuration Info tab.

Sent, Received & Lost Messages

Messages Sent/Received/Lost, displayed on the left-bottom side of the Link Test window.

When a data transmission fails, the WaveLAN card will automatically retransmit the data. When the number of “Messages Lost” is relatively high, this may indicate a problem that is either related to:

- A poor Signal to Noise Ratio (SNR), or
- Frame collisions, due to a congestion of the medium.

When SNR is low and the number of “Messages Lost” is high, the problem is most likely due to a poor Communications Quality, for example because your station and the Link Test Partner are too far apart, or because the connection suffers from a source of interference (Noise) that affects the quality of your communications.

However when SNR is rated “Good” or “Adequate” but you still witness a relatively large number of lost messages, this might indicate:

- A very busy network, where many stations try to access the WaveLAN medium at the same time.
- A microwave oven in the signal path is causing short bursts of interference. This noise might not be displayed by the Noise Level indicator, but still be forcing the WaveLAN stations to retransmit frames over and over again.

- Another station is suffering from a “Poor” communications quality, and consequently sending many retransmissions
- Numerous frame collisions occur due to a “hidden station” problem.

You are advised to run the WaveMANAGER/CLIENT Link Test from multiple stations to determine whether:

- This problem is a local problem, i.e. for one station only, or
- This problem is experienced by all stations.

When all stations suffer from poor Data Throughput Efficiency, despite a “Good” SNR value, investigate what is causing the heavy traffic load.

Link Test Options

To investigate Link Test results in more detail, you can use one of the following options:

- Freeze the display by clicking the “Freeze” button.
- Display Radio Communications Quality in a line-chart graphic, by selecting the Link Test History window.
- Log measurement results to a disk file (see “Advanced User Options” on page 5-14).

WaveLAN Card Diagnostics

The Card Diagnostics enables you to:

- Run a Card Test.
- Display a set of communication statistics.
- Display the configuration settings of your card (Enhanced Mode only, see Advanced User Options).

You will need to run the Card Test only in situations where the Status window (as pictured in Figure 5-1 on page 5-7) reports a card failure, or when you suspect a configuration mismatch.

CAUTION:
Running the Card Test may temporarily disrupt the communication of your computer with the network. In exceptional cases you may lose your network connection. When this is the case, restart the computer to restore your network connection.

When contacting WaveLAN Technical Support, the Card Test results may help the support representative determine the cause of a malfunctioning device.

Advanced User Options

Basic Mode versus Enhanced Mode

The default configuration of your WaveMANAGER/CLIENT program will provide all the diagnostic information that you would need to perform standard diagnostic routines:

- Verify if the card is functioning properly.
- Verify if your WaveLAN station is within range of the IEEE 802.11 network.
- Determine or optimize placement of WavePOINT-II access points.

This configuration setting also enables you to perform basic troubleshooting routines such as

- Optimizing antenna placement.
- Detecting the occurrence of in-band interference (noise).

When you are an experienced user of WaveLAN IEEE 802.11 products, you may be interested in using the ‘”Enhance Mode” of WaveMANAGER/CLIENT IEEE.

The “Enhanced Mode” option is typically used by skilled LAN Administrators or Network Installation Technicians in situations where you are troubleshooting a problem related to WaveLAN networking. This mode will enable you to:

- Display the Configuration Settings of your WaveMANAGER/CLIENT station and the WavePOINT-II access point.
- Display the tallies of standard communication statistics, such as Unicast/Multicast Frames, Fragments or the number of deferred Transmissions or Communication Errors.
- Display the Communication Protocol settings.
- Save measurement data to a log file as described in “Logging Measurement Data” on page 5-15.

Enabling/Disabling Enhanced Mode

1. Start the WaveMANAGER/CLIENT program.
2. Open the Status/Functions window (pictured in Figure 5-1 on page 5-7)
3. Click the “Options” button.
4. Select or clear the “Enhanced Mode” check box.
5. Click OK to confirm and return to the WaveMANAGER/CLIENT program.

NOTE:
Optionally, you can also place a check-mark in the “Skip Initial Screen” box, when you would like to open the WaveMANAGER/CLIENT IEEE program directly to the “Status/Function” screen.

Logging Measurement Data

The WaveMANAGER/CLIENT enables you to save measurement results of your Link Test session to a log file. You can use this log file for example to:

- Evaluate the results at a later stage.
- Compare the results with previous measurements.
- Send the measurement results to your WaveLAN Support representative when troubleshooting a specific problem.

Comparison of measurement data with previous measurements may help you investigate the performance of your wireless LAN over a period of time, for example to analyze the consequences of relocated network equipment.

WaveMANAGER/CLIENT log files are saved in Comma Separated Value (CSV) file format. You can read these files with any ASCII editor, or import the data into any standard spreadsheet or database application.

Logging Options

To enable logging option, you must set the WaveMANAGER/CLIENT to “Enhanced Mode” as described in “Enabling/Disabling Enhanced Mode” on page 5-15.

Once the WaveMANAGER/CLIENT runs in Enhanced Mode, you can set the log option to store measurement data manually, or automatically at regular intervals.

- Use “manual” when you would like to save measurement data at specific locations and moments, e.g. when you are investigating a particular source of interference.
- Use ‘”automatic” when you would like to collect measurement data on network performance over a longer period of time. This may be useful if you wish to analyze recurring events or variation in values.

  Automatic logging is typically used when the WaveMANAGER/CLIENT station is running a Link Test at a particular location.

Setting the Logging Options

To set the logging options, click the “Log Settings” tab in Link Test window. In both modes, the measurement data will be saved in the file entered in the “Path and file name” field. Each time new data is saved, this information is added to the existing file. If you wish to save the data in a new file, use this field to enter a new file name.

Figure 5-3 Logging Setup Dialog Box

Start or Stop Logging

When you have set the Logging Options, the WaveMANAGER/CLIENT will create a button on the lower-right side of the diagnostic window.

Depending on your choice of logging option, this button will read:

- “Log Once” for the manual log option, or
- “Start” for the automatic log option.

If you selected the manual option, click the “Log Once” button each time you wish to save measurement data.

For the automatic option, click the “Start” button. Click this button again to stop the logging function.

To change the logging option, proceed as described in “Setting the Logging Options” on page 5-16.

WaveLAN Security Options

6

Contents

Introduction 6-1

Closing the Infrastructure 6-2
Wireless Access Control 6-3
Wireless Data Encryption 6-4

WaveLAN Security Options

6

Introduction

Wireless network systems that comply to the IEEE 802.11 standard for wireless LANs, allow computing devices to attempt to establish a wireless (radio) connection to the network, as easy as possible.

Such a wireless connection however, only refers to a “physical” connection to the LAN, similar to a cable that is pulled between an Ethernet station and a hub, or patch panel.

The “physical” connection will not provide access to networking data or services, which would typically require a station to:

- Have the appropriate network operating system software installed.
- Log on to the network, using a login name and password.

Besides standard security measures as supported by most of today’s network operating systems, the WaveLAN IEEE 802.11 system allows you to implement a number of additional security options, that can help to prevent unauthorized access to your network, and network data.

Examples of such additional WaveLAN security measures are:

- “Closing the Infrastructure” described on page 6-2.
- “Wireless Access Control” described on page 6-3.
- “Wireless Data Encryption” described on page 6-4.

For more detailed information on operating system security measures, please refer to the documentation that came with the network operating system, or consult the reseller of your LAN software.l

Closing the Infrastructure

The IEEE 802.11 standard on wireless LANs was designed to allow mobile computing devices to establish a (radio) connection to a Local Area Network (LAN) as easy as possible.

This means that mobile users that do not know the correct WaveLAN Network Name can use the value “ANY”, or use an empty string for the network name to establish a radio connection with the nearest access point.

Although such a physical connection does not provide access to network data without the appropriate username and password, in some occasions, you may wish to restrict access to the network resources in a more stringent way.

Lucent Technologies WavePOINT-II access points, allow you to “close” the wireless infrastructure via a special setting of the access point(s). Doing so, the WavePOINT-II devices will:

- Ignore radio association request from users that have configured their WaveLAN IEEE device to use the value “ANY”
- Ignore radio association request from users that use a non-Lucent WaveLAN adapter.

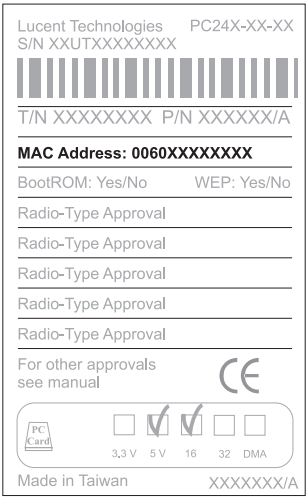
This means that the WavePOINT-II will only allow WaveLAN IEEE stations that have been configured with the correct WaveLAN Network Name to establish a radio connection.

NOTE:
The “Closed” option is not fully compliant with the IEEE 802.11 Standard for Wireless LANs.

For more information please consult the WaveMANAGER IEEE User’s Guide that was shipped with your WavePOINT-II access point(s), or download the latest copy from the WaveLAN website.

Wireless Access Control

When your IEEE 802.11 compliant infrastructure includes WavePOINT-II access points, you are advised to use the WaveLAN “Access Control” feature of your WavePOINT-II access points to restrict wireless access to the network to authorized stations only.



Authorized stations are listed by the MAC Address of their WaveLAN card in an Access Control Table. The MAC Address of your WaveLAN Card is printed on a label on the backside of your WaveLAN PC Card.

To enable the Access Control feature, the LAN Administrator must:

1. Determine which WaveLAN cards will be authorized to communicate with the WavePOINT-II access points.

2. Enter the MAC Address of these cards into an Access Control Table file.
3. Load the Access Control Table file into all WavePOINT-II access points that belong to the network infrastructure.

With the Access Control file loaded, the WavePOINT-II access points will:

- Only forward wireless data to/from “Authorized Stations” that are identified in the Access Control table file, and
- Ignore all request to forward data from/to stations that use a WaveLAN card of which the MAC Address is not listed in the Access Control table file.

Consult your LAN Administrator to verify whether your network infrastructure uses the WavePOINT-II Access Control feature. If this is the case, the LAN Administrator should add the MAC Address of your card to the Access Control Table.

The MAC Address of your WaveLAN card is printed on a label on the back-side of your WaveLAN card.

Wireless Data Encryption

If you would like to add an extra security layer to your wireless communication, you can optionally install a WaveLAN IEEE 802.11 system that supports wireless data encryption.

Two types of WaveLAN PC Cards allow you to build such a system:

- WaveLAN/IEEE Silver Label Cards (described on page 1-6).
- WaveLAN/IEEE Gold Label Cards (described on page 1-7).

To install such a system, all devices in your wireless network, must be equipped with WaveLAN/IEEE PC Cards that support encryption.

- Silver cards support the IEEE compliant "Wired Equivalent Privacy (WEP) data encryption, based upon the 64 bit RC4 encryption algorithm.
- Gold cards support an enhanced type of data encryption, based upon the 128 bit RC4 algorithm.

When enabling encryption, the WaveLAN interface of your wireless stations and/or WavePOINT-II Access Points, will encrypt all data that will be transmitted via the wireless intrerface.

- The encryption feature allows you to define up to four encryption keys to decypher messages received via the wireless interface.
- You can select one of these four keys to encrypt the wireless data tranmissions.

If you plan to use data encryption within your network, all stations and access points must be:

- Equipped with a WaveLAN PC Card that supports encryption.
- Configured with a matchinng set of encryption keys.

  The option to specify up to four decryption keys allows you to refresh the key values at regular intervals (for example starting at the access points) without the necessity to update all station at the same time.

For information about setting encryption key parameters, please consult the section “WaveLAN Encryption Parameters” on page 3-18 as described in Chapter 3.

NOTE:
Early models of the WaveLAN/IEEE Silver PC Cards, (typically shipped prior to July 1999), may need an update of the card firmware to v4.08 or higher, to enable the encryption feature. This update for Silver Cards, is managed via a dedicated "*WaveLAN Station Update*" tool (WSU version 4.08 or higher) that can be downloaded from the WaveLAN website.

Card Specifications

A

Contents

Physical Specifications A-1

Networking Characteristics A-2

Radio Characteristics A-3

Supported Frequency Sub-bands A-7

WaveLAN PC Card Types A-9

About Previously Purchased Cards A-9

- Standard IEEE 802.11 PC Cards 1-9
- About the IEEE 802.11 Turbo Card 1-11
- About the Fixed wireless PC Card 1-11

Can I Upgrade WaveLAN Cards? 1-12

Card Specifications

A

Physical Specifications

Table A-1 Physical Specifications

Form Factor	PC Card Type-II Extended	
Color[1]	■ Black for WaveLAN/IEEE Turbo 11 Mb PC Cards (both Gold and Silver Label) ■ Red for IEEE Fixed Wireless PC Cards	
Dimensions	(LxWxH)	117.8 x 53.95 x 8.7 mm
Weight	45 gram (PC Card)	
Temperature & Humidity		
Operation	0° to 55° C[2]	maximum humidity 95%
Transit	-20° to 70° C	15 to 95% (no condensation allowed)
Storage	-10° to 60° C	10 to 90% (no condensation allowed)

1 Color of the extended antenna is related to the Radio Characteristics described on page A-3

2 Although the card may still operate in the range of -20° to 70° C, operation outside the range of 0° to 55° C may no longer be according to specifications.

Table A-2 Power Characteristics

Doze Mode	10 mA
Receive Mode	180 mA
Transmit Mode	280 mA
Power Supply	5 V

Networking Characteristics

Table A-3 Networking Characteristics

Compatibility	IEEE 802.11 Standard for Wireless LANS (DSSS)	
Network Operating System	■ Novell® Client 3.x & 4.x ■ Microsoft Windows® Networking	
Host Operating System	Microsoft Windows® 95/98 and Windows® NT: ■ NDIS Miniport Driver	
	MS-DOS & Microsoft Windows 3.x: ■ DOS ODI Driver ■ Packet Driver	
	Windows CE ■ Windows CE v.2.0 & 2.11	
	Apple Macintosh Operating Systems: ■ Apple PowerBook G3	
Media Access Protocol	CSMA/CA (Collision Avoidance) with Acknowledgment (ACK)	
Data Rate	■ High	11 Mb/s
	■ Medium	5.5 Mb/s
	■ Standard	2 Mb/s
	■ Low	1 Mb/s
	The cards use an automatic Transmit Rate Select mechanism. Optionally the user can choose the fix the transmit rate at a specific speed.	

Radio Characteristics

Radio Characteristics of WaveLAN adapter cards may vary according to:

- The country where the product was purchased.
- The type of product that was purchased.

Wireless communication is often subject to local radio regulations. Although WaveLAN wireless networking products have been designed for operation in the license-free 2.4 GHz band, local radio regulations may impose a number of limitations to the use of wireless communication equipment.

To comply with such regulations, WaveLAN IEEE 802.11 cards are marketed with dedicated channel-sets with a number of factory-programmed channels identified by the following acronyms:

- ETS for countries that adhere to the regulations as defined by the European Telecommunications Standards Institute (ETSI).
- FCC for countries that adhere to the regulations as defined by the US Federal Communications Commission (FCC).
- FR for France, and
- JP for Japan.

The acronym of the channel-set supported by your card is printed on a label on the back-side of your WaveLAN IEEE 802.11 card (see Table A-6 on page A-8 for a detailed list of channels).

If you plan to install and use WaveLAN adapter cards to connect a WavePOINT-II or other computing device to an outdoor antenna installation, additional regulations may apply.

To comply with such regulations Lucent Technologies offers two types of WaveLAN adapter cards:

- In countries that adhere to the FCC regulations, you can use the standard black-colored WaveLAN IEEE 802.11 card.
- In countries that adhere to the ETSI regulations, including France and Japan, you must select the card-type based upon the antenna that will be used:
  - You can use the black-colored WaveLAN IEEE 802.11 card when connecting the device to standard Lucent omni-directional antennas.
  - You ***must*** use the red-colored IEEE Fixed Wireless PC Card when connecting the device to the standard Lucent 14 dBi directional antenna for outdoor use.

When you ordered a WaveACCESS LINK WP-II kit[1] for outdoor antenna installations, your kit includes the correct card type that complies with the regulations that apply in your country.

WARNING:
At all times, it will be the responsibility of the end-user to ensure that an outdoor antenna installation complies with local radio regulations. The end-user must verify that:

- *The antenna installer is aware of these regulations.*
- *The correct type of WaveLAN card is used to connect the host device to the outdoor antenna installation.*

Lucent Technologies and its resellers or distributors are not liable for any damage or violation of government regulations that may arise from failing to comply with these guidelines.

1 Formerly identified as the WaveLAN IEEE PTP Kit

Table A-4 Radio Characteristics

R-F Frequency Band	**2.4 GHz** (2400-2500 MHz)			
Number of selectable sub-channels	North America (FCC)		11	
	Europe (ETS)		13	
	France (FR)		4	
	Japan (JP)		1	
	Other Countries:		■ FCC 11 ■ ETS 13	
Modulation Technique	Direct Sequence Spread Spectrum ■ CCK for High & Medium Transmit Rate ■ DQPSK for Standard Transmit Rate ■ DBPSK for Low Transmit Rate			
Spreading	11-chip Barker Sequence			
Bit Error Rate (BER)	Better than 10^{-5}			
Nominal Output Power	15 dBm			
Range (100 bytes User Data) / Transmit Rate	**High Speed 11 Mb/s**	**Medium Speed 5.5 Mb/s**	**Standard Speed 2 Mb/s**	**Low Speed 1 Mb/s**
Open Office Environment	160 m (525 ft.)	270 m (885 ft.)	400 m (1300 ft.)	550 m (1750 ft.)
Semi-Open Office Environment	50 m (165 ft.)	70 m (230 ft.)	90 m (300 ft.)	115 m (375 ft.)
Closed Office	25 m (80 ft.)	35 m (115 ft.)	40 m (130 ft.)	50 m (165 ft.)
Receiver Sensitivity	-83 dBm	-87 dBm	-91 dBm	-94 dBm
Delay Spread (at FER of <1%)	65 ns	225 ns	400 ns	500 ns

The range of the wireless signal is related to the Transmit Rate of the wireless communication. Communications at lower Transmit range may travel larger distances.

NOTE:
The range values listed in Table A-4 on page A-5 are typical distances as measured at the Lucent Technologies WaveLAN laboratories. These values may provide a rule of thumb and may vary according to the actual radio conditions at the location where the WaveLAN product will be installed.

- The range of your wireless devices can be affected when the antennas are placed near metal surfaces and solid high-density materials.
- Range is also impacted due to “obstacles” in the signal path of the radio that may either absorb or reflect the radio signal.

Table A-4 lists the typical ranges when used indoors in “office environments” that can be described as follows:

- In **Open Office environments**, antennas can “see” each other, i.e. there are no physical obstructions between them.
- In **Semi-open Office environments**, work space is divided by shoulder-height, hollow wall elements; antennas are at desktop level.
- In **Closed Office environments**, work space is separated by floor-to-ceiling brick walls.

If you intend using the WaveLAN PC Card as part of an outdoor antenna installation, the range of the outdoor antenna installations will be related to:

- Type of outdoor antennas connected to the WaveLAN card.
- Length of antenna cables.
- Clearance of the radio signal path.

For more information please consult the “WaveLAN IEEE Outdoor Antenna Installation Guide”

Table A-5 WaveLAN Fixed Wireless PC Card

R-F Frequency Band	**2.4 GHz** (2400-2500 MHz)	
Number of selectable sub-channels:	Europe (ETS)	13
	France (FR)	4
	Japan (JP)	1
	Other Countries (ETS)[1]	13
Modulation Technique:	Direct Sequence Spread Spectrum ■ CCK for High & Medium Transmit Rate ■ DQPSK for Standard Transmit Rate ■ DBPSK for Low Transmit Rate	
Spreading	11-chip Barker Sequence	
Bit Error Rate (BER)	Better than 10^{-5}	
Nominal Output Power:	8 dBm	
Range	Consult the “WaveLAN IEEE Outdoor Antenna Installation Guide”[2]	

1 The Fixed Wireless PC Card is not available in FCC regulated countries.

2 This card is designed for outdoor antenna installations in countries that adhere to radio regulations as defined by the ETSI.

Supported Frequency Sub-bands

Subject to the radio regulations that apply in your country, your WaveLAN card may support a different set of 2.4 GHz channels (see Table A-6). Consult your Authorized WaveLAN Reseller or Lucent Technologies Sales office for information about the radio regulations that apply in your country.

Table A-6 WaveLAN IEEE 802.11 Channels Sets

Frequency Range	**2400-2500 MHz**			
Channel ID	**FCC**	**ETSI**	**France**	**Japan**
1	2412	2412	-	-
2	2417	2417	-	-
3	**2422**	**2422**	-	-
4	2427	2427	-	-
5	2432	2432	-	-
6	2437	2437	-	-
7	2442	2442	-	-
8	2447	2447	-	-
9	2452	2452	-	-
10	2457	2457	2457	-
11	2462	2462	**2462**	-
12	-	2467	2467	-
13	-	2472	2472	-
14	-	-	-	**2484**

When installing WaveLAN adapter cards the channel configuration is managed as follows:

- For wireless clients that operate in a WaveLAN IEEE 802.11 Infrastructure, the WaveLAN card will automatically start operation at the channel identified the WavePOINT-II access points. When roaming between different access points the station can dynamically switch to another channel if required.
- For WaveLAN cards installed into wireless clients that operate in a “Ad-hoc Demo Mode”, the WaveLAN card will use the factory-set default channel (printed in bold).
- When inserted into a WavePOINT-II access point, the WaveLAN card will use the factory-set default channel (printed in bold), unless the LAN Administrator selected a different channel when configuring the WavePOINT-II device.

Troubleshooting

B

Contents

LED Activity B-1

Windows Operating Systems B-4

Generic Problems B-4
- Windows does not detect my new card B-4
- Enabling the PC Card Controller 2-4
- Station Cannot Connect to the Network B-5

Hardware Conflict B-6
- Running Windows NT Diagnostics B-7
- Despite NT Diagnostics, still facing problems B-11
- PC Card Conflict B-12

Upgrading the WaveLAN Miniport Driver B-14
- Upgrading the driver for Windows 98 B-15
- Upgrading the driver for Windows NT B-17
- Upgrading the driver for Windows 95 B-18

Removing the WaveLAN Miniport Driver B-20
- Deleting the WaveLAN Driver Files B-21

MS-DOS Systems B-23

Error Messages B-23
- No PACKET.INI found B-23

Can Not Connect To The Network B-23

Troubleshooting

B

LED Activity

If you encounter difficulty using and/or installing your WaveLAN product, the error may be related to various causes:

- Out-of range situation, which prevents the WaveLAN PC Card from establishing a wireless connection with the network.
- Configuration mismatch, which prevents the WaveLAN PC Card from establishing a wireless connection with the (correct) network.
- Absence of, or conflict of the WaveLAN Driver.
- A problem or conflict with the PC Card slot which prevents the PC Card from powering on.
- A conflict of the WaveLAN hardware with another device.

The starting point to troubleshoot problems with your WaveLAN card is looking at the LED activity of the WaveLAN PC Card.

Table B-1 on page B-2 provides an overview of the various modes of operation and the associated LED activity. Table B-1 also includes a number of troubleshooting hints, if required, that may help you solve the problem.

Table B-1 LED Activity Table

Power LED	Transmit Receive LED	Description/Action
Continuous Green	Blinking	Standard operational mode. ■ Card is powered on. ■ Sensing/transmitting wireless data.
	Off	■ Card is powered on. ■ No wireless activity. No action is required.
Flicker	Flicker	Power Management mode: ■ Card is powered on, but set to power saving mode, to conserve battery life. ■ Flashes indicates that the card wakes up at regular intervals to verify if there is wireless data addressed to your computer.
Both LEDs blink once every 10 seconds		WaveLAN card works fine, but did not yet succeed establishing a wireless connection with the wireless Infrastructure. Actions: ■ Contact the LAN Administrator to verify the WaveLAN Network Name assigned to the wireless infrastructure. ■ Contact the LAN Administrator to verify the correct value(s) of the encryption keys. ■ Contact the LAN Administrator to verify whether the network infrastructure has been closed (see page 6-2). ■ Change the configuration of your WaveLAN PC Card to enter the correct WaveLAN Network Name ■ If there are no WavePOINT-II devices available, change the configuration of your WaveLAN PC Card to run in “Ad-hoc Demo mode.

Table B-1 LED Activity Table—*Continued*

Power LED	Transmit Receive LED	Description/Action
Off	Off	Card is not powered on, so it can not transmit/receive data. The cause may either be: ■ No Driver loaded/installed ■ Card - Driver mismatch which prevented the driver from loading ■ Device conflict which prevented the driver from loading Actions: ■ Verify if a driver has been installed, if not install the driver. ■ Verify the device settings of the PC Card to determine the occurrence of a conflict with another device. If so, change the settings of either your WaveLAN or the conflicting device to resolve the problem. ■ Verify the versions of the driver, and the embedded software in the WaveLAN card (also referred to as Station firmware). ■ Consult the WaveLAN website to see if newer versions are available and if so, upgrade both the embedded software and driver to the latest available version.

Windows Operating Systems

Generic Problems

Windows does not detect my new card

- Windows NT operating systems v3.51 and v4.0 do not support “Plug & Play”. On such systems, you will need to manually introduce the card to your operating system as described in Chapter 3 under “Getting Started in Windows NT” on page 3-5 .
- In some occasions, Windows 95 and/or Windows 98 do not detect a new card either. This may be the case in one of the following situations:
  - The laptop computer into which you wish to install the WaveLAN card is a brand-new “out-of-the-box” computer, where the Windows 95/98 operating system was already factory-installed (see “Enabling the PC Card Controller” on page B-4).
  - A previous installation of the WaveLAN adapter card was aborted before it was finished.

Enabling the PC Card Controller

Today, most brand-new “out-of-the-box” laptop computers come with the Windows 95/98 operating system factory-installed. On some of these computers, a number of options like PC Card & Socket Services have been disabled by default to save on disk and memory space. In order to use such options you must first finalize the Windows 95/98 installation in order to enable such options.

If a Windows 95/98 computer does not detect your WaveLAN PC Card, proceed as described below, to enable the PC Card socket interface, or to verify that it has been enabled, proceed as follows:

PC Card
(PCMCIA)

1. Click the button on the Windows Taskbar.
2. Click on Settings, then Control Panel.
3. In the Control Panel window, double-click the “PC Card icon” to open the PC Card Properties window (see Figure B-1).

Figure B-1 Enabling the PC Card Controller

4. In the PC Card Properties window, double-click one of the PC Card Sockets.

   If the PC Card socket interface was not yet enabled, the Windows operating system will display a message that it is finalizing the PC Card Socket installation.
5. Click the button to confirm and close the PC Card Properties window.

Station Cannot Connect to the Network

This situation may occur in any of the following situations:

- Incorrect WaveLAN Network Name
- No driver loaded

- “Closed” System (see “Closing the Infrastructure” on page 6-2).
- Station not authorized to access network (see “Wireless Access Control” on page 6-3).
- Card defect
- “Hardware Conflict” on page B-6

Hardware Conflict

When installing adapter cards or peripheral devices on a computer you may occasionally run into hardware conflict that may:

- prevent your WaveLAN card from working properly, or
- disturb operation of other devices after the installation of the WaveLAN drivers.

Such problems are most of the times caused when multiple devices installed onto your computer are using identical values for I/O Base Address and/or Interrupt Request (IRQ).

The factory-set values of your WaveLAN cardhave been set to use the following defaults:

Table B-2 Default Strappings of the WaveLAN Hardware

Device	Resource	Default Value
WaveLAN IEEE 802.11 PC Card[1]	I/O Port	0400-0437
	IRQ	10

1 For older driver versions the default I/O Base Address value is 0300

Unlike the Windows 95 or Windows 98 operating systems, Windows NT is not able to check automatically whether the proposed values are already used by another device.

To avoid or troubleshoot hardware conflicts with another device, you are advised to use the Windows NT Diagnostic program, to determine whether the default I/O port and IRQ for your WaveLAN card are available, and if not to select an alternative value.

NOTE:
Sometimes it may be pretty difficult to determine where a device conflict is locared. As a rule of thumb, you can use the following troubleshooting hint:

- When the conflict is related to an conflcitng I/O Base setting, in most cases the WaveLAN card will not work at all: i.e. you will not see any LED activity.
- If the problem is related to a conflicting IRQ value, LEDs may flicker, but you can notconnect to the network.

  In a number of cases you may be able to verify that the card succeeded in establishing a radio connection with a WavePOINT-II device, but fails to really connecting to the network operating system.

Running Windows NT Diagnostics

When installing the WaveLAN card, the Windows NT operating system will prompt you to confirm or modify the factory-set device values for your WaveLAN card:

Starting Windows NT Diagnostics

1. Click the Start button on the Windows NT Taskbar.
2. Click on Programs, and then “Administrative Tools”.

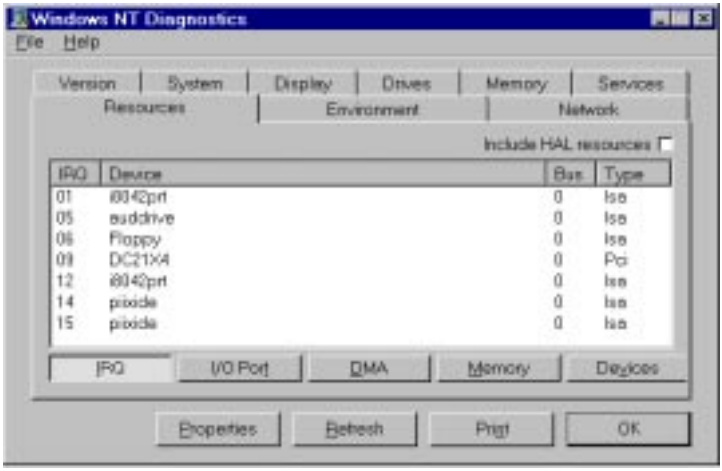
3. From the list of “Administrative Tools”, click the item “Windows NT Diagnostics”.

Verifying IRQ Settings

To display the IRQ values that are already in use by other devices installed on your computer:

1. Click the “Resources” tab on the Windows NT Diagnostics screen. This will display the screen pictured in Figure B-2.

Figure B-2 Verifying IRQ Availability



2. Click the “IRQ” button to display the Interrupt Request (IRQ) vectors currently in use by other devices in your computer.

   The default IRQ value for WaveLAN IEEE 802.11 PC Cards is 10. Is the value 10 already listed?

   - If No, you can use the WaveLAN default. Write down IRQ 10 and proceed with the next step.

- If Yes, this means that another device is already using the IRQ, i.e. you will need to select another value for your WaveLAN IEEE 802.11 PC Card.

3. See whether one of the following values is available (i.e. not listed in the Windows NT Diagnostics window):
   03, 04, 05, 07, 09, **10**, 11, 12, 15.
4. Select one non-listed value and write it down before you proceed with “Verifying I/O Port Settings”.

Verifying I/O Port Settings

To display the values of I/O Ports that are already in use by other devices installed on your computer, proceed as follows:

1. On the “Resources” screen of the Windows NT Diagnostics program, click the button “I/O Port”. This will display the window pictured in Figure B-3.

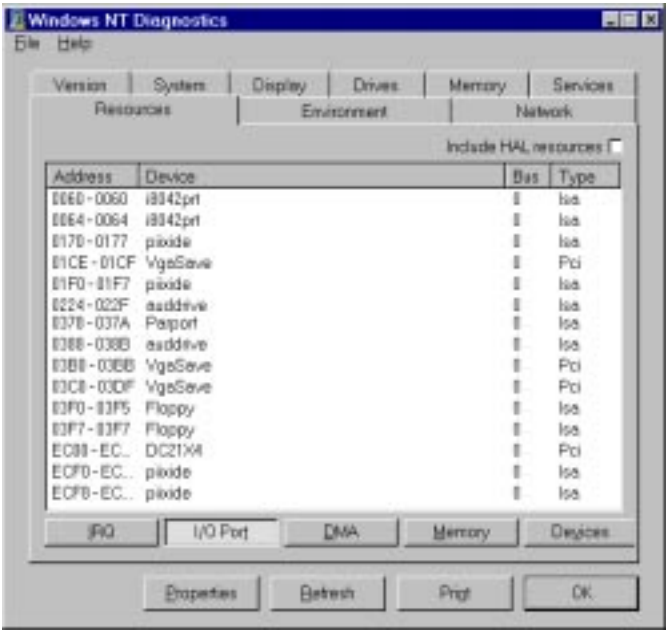
   The default I/O Port value for WaveLAN IEEE 802.11 PC Cards is 0400[1].

   Is this appropriate value already listed for your version of the Miniport driver?

   - If No, you can use the WaveLAN default. Write down I/O Port 0400 and proceed with the next step.
   - If Yes, this means that another device is already using this port address, i.e. you will need to select another value for your WaveLAN IEEE 802.11 PC Card.

1 This applies to WaveLAN/IEEE Miniport driver version 1.33 and higher. For earlier versions of this driver, the default I/O Base Address is 0300. If you are unsure about the version of the Miniport driver that is currently installed, use the WaveMANAGER/CLIENT IEEE tool. Use the option “Diagnose Card” to display the “Version Info” tab which will list the version numbers of the card’s hardware, embedded software and driver.
For the latest WaveLAN Miniport driver, consult the WaveLAN website at: **http://www.wavelan.com**.

Figure B-3 Verifying I/O Port Availability



If the default WaveLAN I/O Port has already been assigned to another device, select an alternative I/O Port value from the range listed below:

0200	**0300***	**0400****	0500	0600	0700
-	-	0440	0540	0640	0740
0280	0380	0480	0580	0680	0780
-	-	04C0	05C0	06C0	07C0

* For driver versions 1.32 or earlier, the default was 0300.

** For version 1.33 or higher, the default setting is 0400.

2. Verify that the alternative value is available (i.e. not listed in the Windows NT Diagnostics window).

3. Write down the alternative I/O Port value and close the Windows NT Diagnostics Program.

   Having finished these steps, you should now have a note that identifies the following (alternative) values:

   - IRQ value
   - I/O Port Address

   You can use these values to install the WaveLAN Miniport Driver as described later in this chapter.

Despite NT Diagnostics, still facing problems

The Windows NT Diagnostics program is not “bullet-proof”. Occasionally you may run into a hardware conflicts despite the fact that the Windows NT Diagnostics program displayed resources as being available to your WaveLAN card.

This may be the case when your computer has one or more devices and/or peripherals installed which claimed an I/O Base Address and/or IRQ value without notifying the Windows NT operating system: Your Windows NT Diagnostics program will not be able to display these values, simply because it “doesn’t know”.

If this is the case, a value you perceived as being available to your WaveLAN card, had already claimed by a conflicting device resulting in:

- A WaveLAN card that does not work, and/or
- A conflicting device that does not work properly.

It will depend on your preferences and the configuration options supported by each of the conflicting devices to determine which device settings should be changed to allow flawless operation.

In most situations the WaveLAN Miniport driver will prove most flexible to select alternative settings for I/O Base Address or IRQ

values. However since the conflicting device apparently did not communicate its System Resource claims to Windows NT, you may need to try multiple values before the problem will be resolved.

- Consult the documentation that came with your computer and/ or the conflicting device to find out which values are used by the conflicting device that have not been listed in the Windows NT Diagnostics.

CAUTION:
To isolate the problem, you are advised to change only one parameter at a time. For example: first try to resolve a possible conflict with the I/O Base Address. If that does not work, try to resolve a possible IRQ conflict.

PC Card Conflict

When your WaveLAN PC Card installation has completed successfully, but it does not become operational, it is possible that there is an I/O Port conflict.

The Windows Resource Manager may not have been able to detect the conflict, allowing the installation to complete successfully, but not allowing the PC Card to operate properly because another device has been assigned the specified port.

The default I/O Base address used by your WaveLAN IEEE 802.11 PC Card is 0400 (when using Miniport driver version 1.33 or higher) and 0300 (when using Miniport version 1.32 or earlier).

You are advised to try different I/O Port values, as described in “Verifying I/O Port Settings” on page B-9.

Table B-3 Default Configuration Settings

Description	Default Value
Station Name	(none)
Connect to Network Type	IEEE 802.11 Infrastructure ■ Connect via access points ■ Ad-hoc Demo disabled
WaveLAN Network Name	(none)
MAC Address	(none: use Universal MAC Address)[1]
AP Density	Low Density
Transmit Rate	High - Auto Rate Select
Medium Reservation	OFF
Card Power Management	OFF
■ Receive All Multicasts	Enabled
■ Maximum Sleep Duration	100
Encryption	OFF

1 The Universal MAC Address of your WaveLAN card is printed on a label on the backside of the card.

Upgrading the WaveLAN Miniport Driver

Upgrading the WaveLAN Miniport Driver installed may be required in one of the following situations:

- You would like to use new features that have become available for your WaveLAN IEEE 802.11 PC Card.
- You installed a newer version of the WaveMANAGER/CLIENT IEEE tool.
- Your WaveMANAGER/CLIENT IEEE Card Diagnostics reported a Driver/Firmware mismatch.

CAUTION:
Upgrading the WaveLAN Miniport Driver should only be done by a skilled LAN Administrator or support engineer that has a working knowledge of the Microsoft Windows 95, 98 and/or the Windows NT operating system.

The procedure to upgrade device drivers differs between the various Windows operating systems:

- Windows 98 and Windows NT systems feature an “update driver” function that allows you to easily replace the current driver with a more recent version.
- Windows 95 systems usually require you to first to completely remove the driver from your computer, prior to installing the latest driver. This is described on page B-18.

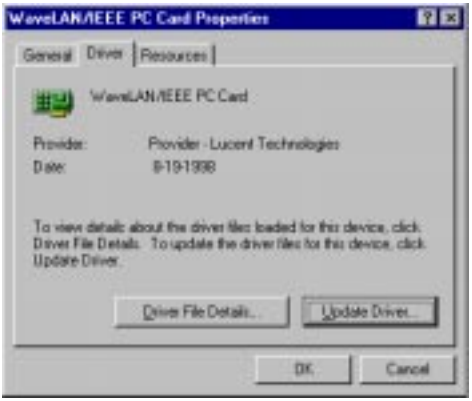
Upgrading the driver for Windows 98

1. On the Windows Taskbar, click the Start button.
2. Click on Settings, and then click Control Panel.
3. In the Control Panel window, double-click the System icon.
4. In the System Properties window, select “Device Manager” tab.

Figure B-4 The Windows 98 Device Manager

5. In the top section of the Device Manager tab, select the option “View devices by type” as pictured in Figure B-4 on page B-15.
6. In the list of computer devices, double-click ”Network Adapters”.
7. Select the item “WaveLAN/IEEE PC Card” and click the “Properties” button.
8. In the WaveLAN/IEEE PC Card Properties window, select the “Driver” tab to display the window pictured in Figure B-5.

Figure B-5 Windows 98 Update Driver Window



- To display information about the currently installed driver, click the “Driver File Details” button.
- To upgrade your current driver to a newer version click the “Update Driver” button and follow the instructions as displayed on your screen.

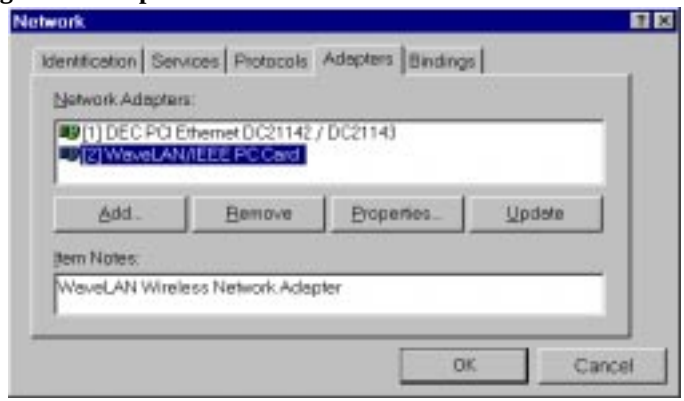
9. Restart your computer to finish the driver upgrade procedure and to have the new driver loaded by the operating system.
10. (Optional) Upgrade the WaveMANAGER/CLIENT program.

NOTE:
The procedure described above may look familiar to users of computers that run Windows 95 operating systems which are identified as OSR2 versions. Although such systems may also show an “Update Driver” button, thorough testing in the Lucent Technologies WaveLAN labs have proven that this procedure does not work for the Windows 95 systems (the operating system will NOT replace the current driver). For Windows 95 systems, proceed as described on page B-18.

Upgrading the driver for Windows NT

1. On the Windows Taskbar, click the Start button.
2. Click on Settings, then click Control Panel.
3. In the Control Panel, double-click “Network Neighborhood”.
4. Select the “Adapters” tab to display the window as pictured in Figure B-6 on page B-17
5. Select the “IEEE WaveLAN Adapter” and click “Update”.
6. Follow the instructions as they appear on your screen.

Figure B-6 Update Driver in Windows NT



Upgrading the driver for Windows 95

To upgrade the WaveLAN Miniport driver on a Windows 95 system, you will typically need to perform the following three steps:

1. Remove the current WaveLAN Miniport Driver.
2. (Optional) Physically delete the driver file from your hard disk.
3. (Re-)install the latest WaveLAN Miniport Driver.

Step 2 is optional, subject to the type of driver you have currently installed:

- When the interface of your current driver looks as displayed in Figure B-7 on page B-18, you ***must*** delete the driver files from the hard-disk, ***prior*** to installing the new drivers.
- When the interface of your current driver looks as pictured in Figure B-8 on page B-19, you may, but do not need to delete the driver files from the hard-disk.

Figure B-7 Interface of early WaveLAN Drivers

Why delete the old driver? The “Plug & Play” support of Windows 95 operating systems associates a specific driver with specific hardware. When you select the option “Remove Driver” from the Network (Neighborhood) Control Panel, the operating system will only disable the driver, but will not delete the driver from your harddisk (see also “What You Need to Know” on page 3-2).

When trying to upgrade a driver, the Windows operating system will recognize your WaveLAN card as a piece of hardware that had been installed before and will attempt to re-install the old driver: i.e. when the operating system finds the appropriate driver files on your hard disk, it will not bother copying the files from the diskette with the new drivers.

Figure B-8 Setup WaveLAN Parameters

Removing the WaveLAN Miniport Driver

1. Close all applications that are currently open
2. On the Windows Taskbar, click the Start button.
3. Click on Settings, then click Control Panel.
4. In the Control Panel window, double-click the “Network” icon.
5. Select the IEEE WaveLAN Adapter and click the “Remove” button.

   The Windows operating system will disable the Miniport driver and update the driver configuration files. It will not delete the driver from your computer’s harddisk.

   This means that when you would re-insert the WaveLAN card, your Windows operating system will attempt to activate the same driver files again (see also “What You Need to Know” on page 3-2).
6. When prompted to “Restart your computer” select:
   - Yes, if you don’t mind that the driver and configuration files reside on your hard disk (the restart will finish your procedure to disable the driver).
   - No, if you would like to physically remove the drivers from your hard disk (typically required to upgrade the driver on a Windows 95, 98 operating system).

     Proceed as described under “Deleting the WaveLAN Driver Files” on page B-21 to delete the driver and its information and configuration files from your harddisk.

Deleting the WaveLAN Driver Files

The procedure to physically remove the WaveLAN Miniport Driver files from your harddisk is similar for all Windows operating systems.

CAUTION:
Prior to deleting the files from your harddisk, it is important to remove the drivers as described on page B-20. Failing to do so prevents the Windows operating system from cleaning the Windows Registry, which might lead to complications when you try to re-install the WaveLAN driver in the future.

1. Open the Windows Explorer.
2. In the Explorer menu, click on “View” and select “Options”
3. From the “View” tab, select “Show all files” and clear the check-box “Hide MS-DOS file extensions”.
4. Click the “Apply” button to return to the Explorer window.
5. Back in the Explorer, open the Windows System folder:
   - **c:\windows\system** for Windows 95 and 98
   - **c:\winnt\system32\drivers** for Windows NT systems
6. Delete the WaveLAN driver files listed below, as identified for your operating system:
   - For Windows 95/98 delete the following files from the folder **c:\windows\system**:
     - **wvlan41.sys**
     - **wvlanuif.vxd**

     If present (subject to the driver version you had previously installed) also delete the files:
     - **wv41int.dll**
     - **wvlan41.hlp**
     - **wvlan41.cnt**

- For Windows NT systems delete the files listed below from the folder **c:\windows\system32**:
  - **wvlan41.dll**
  - **wvlan41.hlp**
  - **wvlan41.cnt**

  From the folder **c:\windows\system32\drivers** delete:
  - **wvlan41.sys**

7. Next delete the inf files:
   - For Windows 95 open the folder **c:\windows\inf** and delete the file: **wvlan41.inf**
   - For Windows 98 delete the file: **Provider - Lucent Technologies WVLAN41** from the folder **c:\windows\inf** and/or **c:\windows\inf\other**
8. Close the Windows Explorer and Restart your computer.

When deleting the WaveLAN Miniport Driver files was part of an “Upgrade Driver” routine, you can now (re-)install the new WaveLAN Miniport Driver as described in Chapter 3 ”Installation for Windows”.

MS-DOS Systems

Error Messages

No PACKET.INI found

The WaveLAN Packet Driver will display this error message in one of the following two situations:

- The driver could not find the file **PACKET.INI**
- The file **PACKET.INI** contained invalid parameter values that prevented the driver from loading.

Subject to the type of error, the driver may either load using the factory-set defaults or not load at all.

You are advised to verify the path statement in the “AUTOEXEC.BAT” file. You may need to add a statement to your “AUTOEXEC.BAT” file that will make the directory that contains the WaveLAN Packet driver the active directory. When the PACKET.INI file is stored in the same directory as the WaveLAN Packet Driver, the driver should be able to automatically find the PACKET.INI file.

Can Not Connect To The Network

The WaveLAN Netwrok Name is case-sensitive. When you entered this name, the value should have been placed between quotation marks e.g. "**My WaveLAN Network**".

If you omitted the quotation marks, the driver will interpret the value as all upper-case e.g. **MY WAVELAN NETWORK**.

If your access points have been configured with both lower- and uppre-case characters, the driver will not be able to establish a radio connection.

Installing in Windows CE

C

Contents

Introduction C-1

Installing the WaveLAN Driver C-2

- What you Need C-2
- Running the Installation Program C-3

Using WaveLAN with Windows CE C-4

- Monitoring Wireless Performance C-4

Modifying Configuration Parameters C-5

Installing in Windows CE

C

Introduction

Windows CE devices are most commonly used on hand-held computing devices also referred to as H/PC devices.

Subject to the type and brand of the device, you will see that multiple versions of the Windows CE operating system exist today, where each CE device may also use a specific type of processor.

The WaveLAN/IEEE drivers will only work with CE devices that:

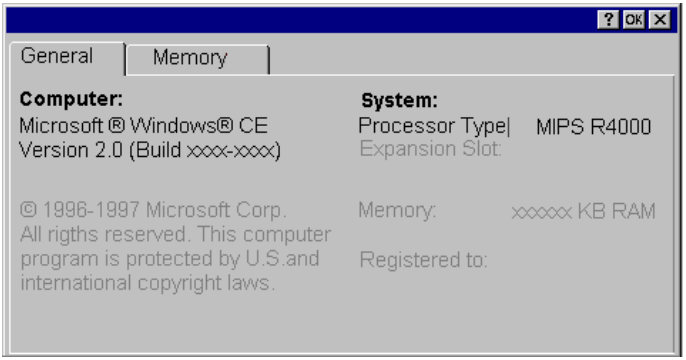
- Run the MS-Windows CE operating system version 2.0 in combination with a MIPS, SH3 and X86 processor, or
- Run the MS-Windows CE operating system version 2.11[1] in combination with a SH4, ARM or X86 processor.

To determine whether your Windows CE device satisfies these requirements:

1. Click the button on the Windows Taskbar.
2. Click on Settings, then Control Panel.
3. On the Control Panel, double-click the “System” icon to display the window pictured in Figure C-1.

1 v2.11 is sometimes also referred to as MS-Windows CE HPC PRO v3.0.

Figure C-1 Windows CE CPU Type



Installing the WaveLAN Driver

What you Need

Windows CE devices are typically used in combination with desktop computers running ‘Windows CE Services’ to transfer data between the desktop computer and the H/PC device.
To use WaveLAN IEEE 802.11 in your Windows CE device, you will need to:

1. Run the WaveLAN installation file “setup.exe” for Windows CE to copy the Miniport driver and configuration files from the floppy disk to the “synchronization folder” for Windows CE services on your desktop computer, and
2. Use the Windows CE Services to transfer files to your H/PC device.

   The default location of the Windows CE “synchronization folder is: **C:\Program Files\Windows CE Services\wavelan**

Please refer to the Microsoft Handheld PC Companion booklet and the user documentation of your H/PC device for more information about installing the Windows CE Services.

Running the Installation Program

To install the WaveLAN drivers on your Windows CE device, simply do the following:

1. Insert the WaveLAN CD-ROM into the desktop computer.
2. Browse to the CD-ROM folder that includes the Windows CE driver files. For example:

   e:\software\adapter\pc_card\drivers\win_ce

   Where "e" represents the drive letter of your CD-ROM drive.
3. Double-click the "setup2xx.exe" file that matches the version of the Windows CE operating system on the handheld device:
   - Use **setup200.exe** when your handheld device runs Microsoft Windows CE version 2.0
   - Use **setup211.exe** when your handheld device runs Microsoft Windows CE version 2.11
   - When finished, use the serial cable and/or docking station to connect your Windows CE device to the desktop computer.

   Once the computers have been connected, the Windows CE services will automatically copy the files and drivers from your desktop computer to the Windows CE device.

NOTE:
If you encounter difficulty copying the WaveLAN driver files to your Windows CE device, please refer to the Microsoft Handheld PC Companion booklet and the user documentation of your H/PC device for more information about installing and/or troubleshooting the Windows CE Services.

If you encounter difficulty establishing a network connection after you installed the WaveLAN drivers successfully, consult the **readme.txt** of the WaveLAN driver files for Windows CE for troubleshooting hints.

Using WaveLAN with Windows CE

When you insert the WaveLAN card into your Windows CE device, it will start operation with the following factory-set defaults:

- Connect to a Network Infrastructure
- Use the WaveLAN Network Name “ANY” to connect to the first access point that provides a communications quality that is acceptable or better.

On the Control Panel of your Windows CE device, you will also find a WaveLAN icon, to view or modify the WaveLAN parameters.

Monitoring Wireless Performance

The WaveLAN software for Windows CE devices, does not include diagnostic tools. This is partially due to the memory limitations of Windows CE devices.

However you can use other WaveLAN stations to monitor wireless communications between the other station and your Windows CE device.

- For Independent Network environments, you should start the WaveMANAGER/CLIENT IEEE program on a WaveLAN computer running either the Windows 95, 98 or Windows NT operating systems.

  The Link Test mode of this utility enables you to analyze the communications quality between the “Initiator” station and your Windows CE device (identified as the “Remote Station”).
- In Infrastructure Networks, consult the LAN Administrator to run the WaveMANAGER/AP tool. The “Remote Link Test” of this utility enables the LAN Administrator to analyze the communications quality between the WavePOINT-II (identified as the “Initiator” station) and your Windows CE device (identified as the “Remote Station”).

Modifying Configuration Parameters

To view or modify the WaveLAN configuration parameters, open the Control Panel on your Windows CE device and double-click the WaveLAN icon.

For more information about these parameters, please consult:

- The WaveLAN help system for your Windows CE drivers by clicking the "**?**" help icon, or
- The chapters about other Windows operating systems described earlier in this User's Guide.

Installation for MS-DOS

D

Contents

Introduction D-1

What You Need to Know D-1
Driver Types D-1
Installation Overview D-2

Copy the WaveLAN Software D-3

Setup the WaveCAD Program D-4

Card & Socket Services D-4
Intel 82365 PCIC D-5

Install the Network Client Software D-9

Setup the WaveLAN Parameters D-10

DOS ODI Driver Configuration D-10
■ About the NET.CFG File D-17
Packet Driver Configuration D-19
■ Setup the WaveLAN Packet Driver D-19

Finishing Installation D-25

Advanced Options D-27

Dual Card Configuration D-27
Start-up Menu Configuration D-27

Installation for MS-DOS

D

Introduction

What You Need to Know

Installing an IEEE 802.11 WaveLAN PC Card requires the same level of expertise that you would need to install any other type of standard Ethernet network adapter card. It is assumed that you have a working knowledge of MS-DOS operations and of installing network adapter cards and network client software.

Driver Types

When your computer runs the MS-DOS operating system, or Microsoft Windows for Workgroups (usually referred to as Windows 3.x), you can use one of the following network drivers:

- WaveLAN DOS ODI Driver (WVLAN43.COM)
- WaveLAN Packet Driver (WVLAN42.COM)

To install these network drivers, you will also need a program called the “WaveLAN Card Access Driver” (WaveCAD).

The WaveCAD software is included with the MS-DOS Driver software that was shipped with your IEEE 802.11 WaveLAN Card. The WaveCAD driver (wvlancad.sys) will enable you to access the

WaveLAN Card via any PC Card slot that is controlled by an Intel 82365 PCIC or computers that support Card & Socket Services.

Installation Overview

To install the IEEE 802.11 WaveLAN PC Card in an MS-DOS environment, you will need to:

1. Copy the WaveLAN software manually to the hard disk of your computer.
2. Setup the WaveCAD program.
3. Install the Network Client Software for your network operating system.
4. Setup the WaveLAN configuration parameters.
5. Restart the computer to verify that the WaveCAD executes successfully and the network driver is loaded.

To setup the various configuration parameters, you may need to edit a number of system files. You can use any MS-DOS line editor to edit these files, for example the MS-DOS '**EDIT**' command.

Example DOS commands:

```
c:\
edit config.sys
```

Copy the WaveLAN Software

The IEEE 802.11 WaveLAN PC Card disk includes a small batch file (**CPY2HDSK.BAT**). This file will:

- Create a new directory on your hard disk, and
- Copy the IEEE 802.11 WaveLAN PC Card software to this new directory.

To copy the WaveLAN software, proceed as follows:

1. Choose a name for the hard disk directory where you would like to store the WaveLAN software: e.g. **c:\wavelan**
2. Place the WaveLAN software diskette in drive **A:**
3. Make drive **A:** the current drive
4. Run the batch file **CPY2HDSK.BAT** with the chosen hard disk directory name as parameter.

   Example DOS commands:

   ```
   a:\
   cpy2hdsk c:\wavelan
   ```

Setup the WaveCAD Program

To allow MS-DOS-based computers to “identify” the presence of a PC Card in the PC Card slot, the computer needs dedicated software that will enable it to do so. For your WaveLAN IEEE 802.11 card this can either be:

- Card & Socket services software as provided by various software vendors, or
- The WaveLAN Card Access Driver (wlancad.sys), a Lucent Technologies proprietary driver, that was designed specifically for WaveLAN cards.

The card software must be loaded before any other program (network driver or utility) tries to access the WaveLAN card.

In this section, we describe the proper WaveCAD installation procedure and settings for the following systems:

- Computers using Card & Socket Services
- Intel 82365 PCIC based computers

Card & Socket Services

To ensure the WaveCAD is always run at start-up time, you must edit the system file “**CONFIG.SYS**” to include a “**DEVICE**” statement that will identify the path and filename of the WaveCAD program.

Example DOS commands:

```
c:\
edit c:\config.sys
```

The format of the device line is as follows:

```
DEVICE = [path name]wvlancad.sys
```

When for example your device line looks as follows:

DEVICE = c:\wavelan\wavecad\wvlancad.sys

With Card & Socket Services, you do not need to set any parameters (Memeory, IRQ, I/O Port) in the "**DEVICE**" statements. However, if you would like to overrride the default settings, follow the directions for "Intel 82365 PCIC" on page D-5, using Table D-1 on page D-7 to identify valid parameter values that can be included in the wvlancad.sys "**DEVICE**" statement.

Intel 82365 PCIC

For Intel 82365 PCIC based computers, you must start the WaveLAN Card Access Driver (wvlancad.sys) before any other program (network driver or utility) can access the WaveLAN card.

To ensure the WaveCAD is always run at start-up time, you must edit the system file "**CONFIG.SYS**" to include a "**DEVICE**" statement that will identify the:

- Path and file name of the wvlancad.sys program
- Memory Address of the WaveLAN card
- I/O Port Address of the WaveLAN card
- Interrupt Request Line number (IRQ) of the WaveLAN card.

Use Table D-1 on page D-7 to identify valid parameter values that can be included in the wvlancad.sys "**DEVICE**" statement.

In order for your card to function properly, you will need to verify whether the values that you select to include in the "**DEVICE**" statement are not already used by another device that has been installed in your computer. Consult your LAN Administrator or a computer expert to determine an available Memory Address, I/O Port Address and IRQ value that you can use to install the WaveCAD driver.

Alternatively you can use the Microsoft Diagnostics program (**MSD.EXE**) to determine the available values. For more information about Microsoft diagnostics, please refer to the documentation that came with your MS-DOS operating system.

You can use any MS-DOS line editor to edit the **CONFIG.SYS** file.

The format of the device line is as follows:

DEVICE = [path name]wvlancad.sys /m=xxxx /b=xxxx /i=nn

For example, if your device line looks as follows:

DEVICE = c:\wavelan\wavecad\wvlancad.sys /m=d100 /b=0340 /i=11

The WaveCAD will be programmed to use:

- Memory Address d100 - dFFF
- I/O Port Address 0340H and
- IRQ 11

Table D-1 WaveCAD Configuration Parameter Values

Parameter	Description	Valid Values
<path>	Disk drive and directory containing WaveCAD program **wavecad.sys** (do not type brackets)	
/m=xxxx	Memory Address	4-digit hexadecimal value Valid range: C000 - EF00 in increments of 100 For example: C000, C100, C200, or C300, etc.
/b=xxxx	I/O Port Address	4-digit hexadecimal value Valid range: 0300 - FFC0 in increments of 40 For example: 0300, 0340, 0380, 03C0 or FF00, FF40, FF80, or FFC0
/i=nn	IRQ	1- or 2-digit decimal value Valid values: 3, 4, 5, 7, 9, 10, 11, 12, 14, or 15

NOTE:
When editing the "**CONFIG.SYS**" file, please note the following:

— Remove any other PCMCIA-related "**DEVICE**" statement from the "**CONFIG.SYS**" file. When for example the "**CONFIG.SYS**" file includes "**DEVICE**" statements for "Card Services" or "Socket Services" you must remove these statements.

You are advised to consult the documentation that came with your computer or other PCMCIA device to help you to identify these statements.

— When your computer has a memory manager program installed, for example "**EMM386.EXE**", you must exclude the Memory Address space that you assigned to the WaveCAD program in the previous step (see page D-6).

  To exclude the Memory Space address, you must add an exclude parameter to "**DEVICE**" statement that activates the memory manager program.

  For example, if your computer uses the "**EMM386.EXE**" memory manager program, your "**DEVICE**" statement could look as follows:

  DEVICE=c:\dos\emm386.exe noems x=d100-d1ff

— When your computer runs Microsoft Windows 3.x, you must also edit the Windows "**SYSTEM.INI**" to protect the Memory Address space that you assigned to the WaveCAD program in the previous step (see page D-6). You can use any ASCII text editor, such as Windows Notepad to edit the "**SYSTEM.INI**" file and add the following statement to the section "**386Enh**":

  Example:

  = [386Enh] ... EMMExclude=D100-D1FF

Install the Network Client Software

To use the WaveLAN card in a network environment, you will need to install Network Client software.

If you already had Network Client software installed, you are advised to remove this software, and run the Network Client installation program again.

1. Make the directory that contains the Network Client software the active directory.

   For example when installing the Network Client software from a floppy disk:

   a. Insert the disk into floppy drive **A:**, and

   b. Make drive **A:** the active drive.

2. Proceed as described in the User documentation that came with the Network Client software to start the installation.
3. When prompted to select a driver use the option “Other driver”. Sometimes this option is referred to as “updated” or “OEM” driver, or “driver provided by other vendor”.
4. Remove the Network Client software disk from the floppy disk drive and insert the WaveLAN disk for MS-DOS environments.
5. Follow the instructions as they appear on your screen.

Setup the WaveLAN Parameters

To connect your IEEE 802.11 WaveLAN PC Card to a WaveLAN network system, you must configure the WaveLAN parameters to match the values of the network.

In LAN Infrastructure environments, these values should typically match the values as set for the WavePOINT-II access points. Consult your LAN Administrator for the values that apply in your network.

This section describes how to set the parameters for the following IEEE 802.11 WaveLAN Drivers:

- WaveLAN DOS ODI Driver
- WaveLAN Packet Driver

DOS ODI Driver Configuration

When you are installing the Network Client software for Novell NetWare, the installation program will prompt you to enter the WaveLAN parameters, and save your parameter settings in the Novell network configuration file "**NET.CFG**".

If your Network Client Software did not prompt you to enter the parameters, or if you wish to modify the WaveLAN parameter settings you may need to edit the "**NET.CFG**" file manually, as described in "About the NET.CFG File" on page D-17.

Table D-1 lists the various WaveLAN parameters with their value ranges and usage.

NOTE:
Alphabetical character values are case-sensitive and should be entered between "quotation marks ". Values without quotes will be interpreted as UPPERCASE only.

Table D-2 WaveLAN DOS ODI Driver Parameters

Parameter	Description
1 Station Name	Alphanumeric string with a maximum of 32 ASCII characters that will identify your computer on the network when using the WaveMANAGER/CLIENT diagnostics tool. Valid Values: any character in the range of “A-Z”, “a-z” and “0-9”. Enter your value between “quotes”.
2 Network Type	Use this parameter to select the type of network to which you wish to connect your computer. Valid values: 1 or 3. ■ 1 will connect your computer to an anonymous Ad-hoc workgroup (BSS) ■ 3 Will connect your computer to an IEEE 802.11 Infrastructure (ESS) identified by parameter 2a “WaveLAN Network Name”.
2a WaveLAN Network Name	Alphanumeric string with a maximum of 32 ASCII characters that identifies the network to which you would like to connect your computer. This parameter is only used when you selected the Network Type “Infrastructure”. Valid Values: any character in the range of “A-Z”, “a-z” and “0-9” where: ■ The value “**ANY**” enables your station to connect to any IEEE 802.11 compliant network (see also “Closed System”). ■ A “user-defined name” allows your station to connect to a specific network only. This value should match the value as set for the WavePOINT-II access points in your network.

Table D-2 WaveLAN DOS ODI Driver Parameters—*Continued*

3 Transmit_Rate[1]	Controls the data rate at which your WaveLAN card will transmit its data. Valid Values: 1. Fixed Low 2. Fixed Standard 3. Auto Select High-Medium-Standard-Low (default). 4. Fixed Medium (Turbo cards only) 5. Fixed High (Turbo cards only) 6. Auto Select Standard-Low 7. Auto Select Medium-Standard-Low
4a Card Power Management	Enables/disables Power Management Valid Values: ■ Y - Yes, enable Power Management ■ N - No, disable Power Management (=default). When enabling Power Management you will also need to set the Maximum_Sleep_Duration, and Receive_All_Multicasts parameter. When you disable Power Managment, these two parameters will be disabled as well.
4b Maximum Sleep Duration	This parameter specifies the maximum time the station is allowed to spend consecutively in DOZE state. Valid Values: any numerical value in the range of 1-65535 (default value is 100). This parameter determines the Listen Interval of the station's Power Management scheme. If 4a Card Power Management is disabled, this parameter will be ignored

Table D-2 WaveLAN DOS ODI Driver Parameters—*Continued*

4b Receive All Multicasts	This parameter specifies whether the station must receive all multicast frames when in Power Management mode. Valid Values: ■ Y - Yes, receive all Mulitcasts (= default) ■ N - No, do not receive all Multicast When this parameter is enabled, the WaveLAN station will wake up at regular intervals to receive the multicast frames. Although enabling this option may yield less optimal power savings, you are advised to leave this parameter enabled when using your computer in regular networking environments. If 4a Card Power Management is disabled, this parameter will be ignored.
5 AP Density	Parameter that controls the Roaming sensitivity of your computer (must be set according to the settings of the WavePOINT-II access points). Valid Values: 1. Low Density (default) 2. Medium Density 3. High Density

Table D-2 WaveLAN DOS ODI Driver Parameters—*Continued*

6 Medium Reservation	Enables/disables the RTS/CTS Mechanism Valid Values: ■ 2347 (default) Disables Medium Reservation ■ Numeric value in the range of “0-2346” Enables the RTS/CTS Mechanism, and sets the frame length threshold from which the station should start using the RTS/CTS Mechanism (recommended value is “500”). See “Medium Reservation” on page 4-8 for more information.
7 Node Address (MAC Address)	To be used only when your network system requires Local MAC Addressing. Valid Values: ■ “None” to use the card’s factory installed Universal MAC address (=default) ■ 12 hexadecimal digits that identify the user-defined Local MAC Address.[2] The 2nd digit of the first digit-pair must be 2, 6, A, or E.

Table D-2 WaveLAN DOS ODI Driver Parameters—*Continued*

8 Enable Encryption	Enables/disables WEP encryption. Valid values: ■ Y - Yes, enable WEP encryption ■ N - No, do not enable WEP encryption (=default). When this parameter is enabled, you can: ■ Select up to four key for decrypting data received via the wireless interface. ■ Select one Transmit key (8e) for encryptiing data that will be transmitted via the wireless interface. This parameter should only be enabled when using WaveLAN IEEE Silver cards. If you decide to enable encryption, please note that all stations will be configured with identical WEP key values.
8a WEP Key 1	Identifies one of the four keys that your waveLAN card can use to decrypt data received via its wireless interface. Valid values for Silver cards: ■ 5-character ASCII key or 10-digit hexadecimal key. Valid values for Gold cards: ■ 5-character ASCII key or 10-digit hexadecimal key. ■ 13-characterASCII key or 26-digit hexadecimal key. The key value is case-sensitive. Hexadecimal values must be preceded by “0x”. All wireless clients and access points should be configured with identical key values.

Table D-2 WaveLAN DOS ODI Driver Parameters—*Continued*

8b WEP Key 2	See 8a WEP Key 1
8c WEP Key 3	See 8a WEP Key 1
8d WEP Key 4	See 8a WEP Key 1
8a WEP Transmit Key	Use this parameter to select one of the identified WEP decription keys for encrypting data that will be transmitted via the wireless interface. Valid values: ■ 1 - to use WEP Key 1 ■ 2 - to use WEP Key 2 ■ 3 - to use WEP Key 3 ■ 4 - to use WEP Key 4
9 Media Frame Type	Use this parameter to select the frametype that is used within the network to which you wish to connect the computer. Consult your LAN Administrator for the value that applies in your network. Valid values: ■ Ethernet 802.2 (=default) ■ Ethernet 802.3 ■ Ethernet 802.II ■ Ethernet 802.SNAP

1 This parameter does not influence at which data rate the station will be able to receive data. I.E. When the transmit rate is locked to Fixed Low, the station may still receive messages that were transmitted at Standard speed.

2 Note: The Access Control security feature of WavePOINT-II access points does not recognize Local MAC addresses. When the WavePOINT-II devices in your network infrastructure have been programmed to use this feature, leave this parameter Access Control

About the NET.CFG File

The WaveLAN configuration parameters for the DOS ODI driver are stored in a network configuration file called "**NET.CFG**".
A sample of the "**NET.CFG**" file is included on the IEEE 802.11 WaveLAN software diskette.

If you installed the Novell Network Client software as described earlier in this chapter, this file was created automatically. You may skip this section and proceed with "Finishing Installation" on page D-25, unless you would like to modify the WaveLAN parameter settings or wish to learn more about the "**NET.CFG**" file.

A "**NET.CFG**" file must always include a "Link Driver" statement that refers to the appropriate network driver, and a list of parameters and parameter values that apply to the referenced driver. For the IEEE 802.11 WaveLAN driver the "**NET.CFG**" file will look as follows:

```
LINK DRIVER WVLAN43
; BASIC PARAMETERS
WAVELAN_NETWORK_NAME XXXXXXXX
PORT_TYPE X
STATION_NAMEXXXXXXXX
;ADVANCED PARAMETERS
;AP_DENSITYx
;TRANSMIT RATEX
;MEDIUM RESERVATIONXXXX
;NODE ADDRESS
```

All lines that start with a semi-colon (;) are informational comments to the user, i.e. the driver will ignore this information.

The basic parameters that you should set are:

- WaveLAN Network Name
- Station Name for your station
- Port Type - to identify the type of network to which you wish to connect your computer.

All other parameters are optional and should preferable only be used in special situations, typically upon advice of a WaveLAN IEEE 802.11 expert.

Table D-2 on page D-11 lists the various WaveLAN parameters with their value ranges and usage. The WaveLAN parameter values for the WaveLAN DOS ODI driver are not case-sensitive: the WaveLAN DOS ODI Driver will interpret all values as upper-case values.

When the installation program of your Network Client software did not prompt you to identify a driver or specify the WaveLAN parameters you may need to identify the proper location of the WaveLAN DOS ODI driver and the "**NET.CFG**" file. This will allow your Network Client software to find the correct driver.

You are advised to copy the WaveLAN DOS ODI Driver and the "**NET.CFG**" file to the same directory that you selected to install the network operating system software. For example, when you selected the directory "**c:\network**" use the following copy commands:

```
c:\
cd\wavelan\drivers\dosodi
copy wvlan43.com c:\network
copy net.cfg c:\network
```

1. Edit the "**NET.CFG**" file to add the statement "**Link Driver WVLAN43**".
2. Enter the WaveLAN parameter values on a new line, directly after the "link driver" statement.

   Consult your LAN Administrator for values that apply in your network environment.

NOTE:
When modifying the "**NET.CFG**" file ensure that all WaveLAN parameter lines will be indented. Use the TAB key of your keyboard to create an indent at the beginning of each line that will contain a WaveLAN parameter.

3. When finished, save the "**NET.CFG**" file and restart your computer.
4. Proceed with "Finishing Installation" on page D-25.

Packet Driver Configuration

The installation of the WaveLAN Packet Driver is a procedure that requires you to edit a number of system files manually.

To ensure that the WaveLAN Packet Driver is loaded at start-up, you will need to add a few command line statements to the **"AUTOEXEC.BAT"** file.
These statements should include:

- A path to the directory that contains the Packet Driver.
- A "load driver" statement.

The WaveLAN parameters will be identified in a network configuration file called "**PACKET.INI**".
The WaveLAN Packet Driver and the "**PACKET.INI**" file must reside in the same directory on the hard disk of your computer. When you used the commands as identified "Copy the WaveLAN Software" on page D-3, this directory is typically **c:\wavelan\drivers\packet**.

Setup the WaveLAN Packet Driver

1. Edit the "**AUTOEXEC.BAT**" file of your computer to add the path and file name of the WaveLAN Packet Driver, and the "load driver" statement:

```
cd\wavelan\packet
lh=wvlan42.com l
```

2. To set the WaveLAN parameters, edit the "**PACKET.INI**" file. The structure of the "**PACKET.INI**" file is as follows:

```
; BASIC PARAMETERS
WAVELAN_NETWORK_NAME XXXXXXXX
STATION_NAMEXXXXXXXX
;ADVANCED PARAMETERS
;AP_DENSITYx
;TRANSMIT RATEX
;MEDIUM RESERVATIONXXXX
;MAC ADDRESS
```

All lines that start with a semi-colon (;) are informational comments to the user, i.e. the driver will ignore the information.

The basic parameters that you should set are:

- WaveLAN Network Name
- Station Name for your station.

All other parameters are optional and should preferably only be used in special situations, typically upon advice of a WaveLAN IEEE 802.11 expert.

NOTE:
The string for a "WaveLAN Network Name" is case-sensitive. If your network includes stations that also use the WaveLAN DOS ODI Driver, you are advised to select upper-case characters only (see also "DOS ODI Driver Configuration" on page D-10).

3. To set a parameter value, remove the semi-colon (**;**) preceding the parameter name and enter a value within the range as specified in Table D-3 on page D-22.

At the end of the "**PACKET.INI**" file you will find an additional set of generic Packet Driver parameters that are not directly related to WaveLAN operation.

```
;DRIVER_CLASSX
;NOVELL_FLAGYES/NO
;PACKET_INTERRUPT0x XX
```

4. Consult your LAN Administrator to select the appropriate values that apply in your situation from the range as specified in Table D-4 on page D-24.
5. When finished, save the "**PACKET.INI**" file and restart your computer.
6. Proceed with "Finishing Installation" on page D-25.

Table D-3 WaveLAN Packet Driver Parameter Values

Parameter	Description
WaveLAN_Network_Name	Alphanumeric string with a maximum of 32 ASCII characters that identifies the network to which you would like to connect your computer. Valid Values: any character in the range of “a-z” and “0-9” (no spaces allowed) where: ■ The value “**ANY**” enables your station to connect to any IEEE 802.11 network. ■ A user-defined name allows your station to connect to a specific network only. This value should matches the value as set for the WavePOINT-II access points in your network.
Station_Name	Alphanumeric string with a maximum of 32 ASCII characters that will identify your computer on the network, e.g. when using the WaveMANAGER/CLIENT diagnostics tool. Valid Values: any character in the range of “a-z” and “0-9” (no spaces allowed).
AP_Density	Parameter that controls the Roaming sensitivity of your computer (must be set according to the settings of the WavePOINT-II access points). Valid Values: 1. Low Density (default) 2. Medium Density 3. High Density
Transmit_Rate[1]	Controls the data rate at which your WaveLAN card will transmit its data. Valid Values: 1. Fixed 1 Mbit/second 2. Fixed 2 Mbit/second 3. Auto Rate Select 2 Mbit/s -1 Mbit/s (default)

....continued on following page.

MAC_Address	To be used only when your network system requires Local MAC Addressing. Valid Values: ■ “None” to use the card’s factory installed Universal MAC address (=default) ■ 12 hexadecimal digits that identify the user-defined “Local MAC Address”.[2] The 2nd digit of the first digit-pair must be 2, 6, A, or E.
Medium_Reservation	Enables/disables the RTS/CTS Mechanism Valid Values: ■ 2347 (default) Disables Medium Reservation ■ Numeric value in the range of “0-2346” Enables the RTS/CTS Mechanism, and sets the frame length threshold from which the station should start using the RTS/CTS Mechanism (recommended value is “500”). See “Medium Reservation” on page 4-8 for more information.

1 This parameter does not influence at which data rate the station will be able to receive data. I.E. When the transmit rate is locked to 1 Mbit/s, the station may still receive messages that were transmitted at 2 Mbit/second.

2 Note: The Access Control security feature of WavePOINT-II access points does not recognize Local MAC addresses. When the WavePOINT-II devices in your network infrastructure have been programmed to use this feature, leave this parameter blank.

For more information about each of the WaveLAN parameters:

■ Consult the description for the WaveLAN parameters as described in “Setting the WaveLAN Parameters” on page 3-13.

- Alternatively type the following command lines at the MS-DOS prompt to display help for the WaveLAN Packet Driver.

  cd\wavelan\drivers\packet
  wvlan42.com h

Table D-4 Packet Driver Specific Parameters

Driver_Class	A specific “Packet Driver” parameter that controls the frame format. Valid Values: 1. DIX Ethernet (v2.0) frame format (Default) 11. IEEE 802.3 with 802.2 headers frame format.
Novell_Flag	Enables support the Novell IPX 802.3 frame format. Valid Values: Y. Convert all 802.3 type packets to 8137 type packets. N. No, do not use the NovellFlag (=default)
Packet_Interrupt	This parameter identifies the software interrupt number that the Packet Driver should use. Valid Values (hexadecimal): ■ 0x60 (default) ■ 0x70 Enter the value without the 0x prefix.

Finishing Installation

To finish the installation insert your IEEE 802.11 WaveLAN PC Card and restart your computer. Carefully read the messages that appear on your screen, to verify that:

- The WaveCAD program executes correctly, and
- Your computer loads the correct driver parameter settings of your IEEE 802.11 WaveLAN PC Card.

Correct execution of the WaveCAD program is confirmed with the message (example):

WaveLAN/IEEE Card Access Driver, Variant X, Version XX.XX
Memory: xxxx, I/O Base: xxxx, IRQ xx
Card Access Driver Installed

Where:

- XX.XX identifies the version of the WaveLAN Driver
- xx or xxx identifies the values that you entered upon installation of the WaveCAD software as described in “Intel 82365 PCIC” on page D-5

A successful load of the WaveLAN Driver is confirmed with either one of the following messages:

Example WaveLAN DOS ODI Driver:

WaveLAN/IEEE DOS ODI Driver Variant X, v0.0x (yymmdd)
Desired SSID = AAAAAAAAAA
Driver loaded successfully
IRQ xx, Port xxxx, Node Address = xxxxxxxxxxxx L
Max Frame 1514 bytes, Line Speed 2 Mbps, Bus ID 3
Board 1, Frame ETHERNET_802.2, LSB Mode

Where:

- AAAAAAAAA identifies the WaveLAN Network Name that you entered in the NET.CFG file,

- xx or xxx identifies the values that you entered upon installation as described in “Intel 82365 PCIC” on page D-5

Example WaveLAN Packet Driver:

WaveLAN/IEEE Packet Driver, Variant X, Version X.XX
Novell Flag NOT set
IO Base=xxxx IRQ=xx MAC Address=xxxxxxxxxxxx
Packet Interrupt=0xXX

Where:

- Version X.XX identifies the version of the WaveLAN Packet Driver
- xx or xxx identifies the values that you entered upon installation of the WaveCAD software as described in “Intel 82365 PCIC” on page D-5
- Packet Interrupt 0xXX identifies the value you specified in the “**PACKET.INI**” file.

Advanced Options

Dual Card Configuration

When you intend to use multiple WaveLAN PC Cards in a single computing device, for example a wireless server, the **CONFIG.SYS** file should contain a **DEVICE** statement with unique parameter values for each card.
Example:

```
DEVICE = c:\wavelan\wavecad\wavecad.sys /m=d100 /b=0340 /i=11
DEVICE = c:\wavelan\wavecad\wavecad.sys /m=e300 /b=04C0 /i=14
```

Start-up Menu Configuration

If you intend to use your computer in combination with multiple PC Cards, an MS-DOS Start-up Menu may provide a useful solution in one or more of the following situations:

- You are using your computer in combination with another PC Card that requires “Card & Socket Services”, or
- You would like to use your computer with either your WaveLAN card or an Ethernet adapter card.

The Start-up Menu will enable you to setup your computer to prompt the computer user to select a specific configuration. Subject to the selected menu option, the computer will automatically load the drivers and programs required for each specific option.

The Start-up Menu is a standard MS-DOS feature that is described in the Microsoft MS-DOS User’s Guide.

NOTE:
When using Multiple Boot options to swap WaveLAN with Ethernet adapters and vice versa, you will need to install the Network Client software twice, selecting separate directories for each of the Network Client configurations. The start-up Menu should identify which Network Configuration file will be loaded for each item subject to the selected menu-item.

Failing to do so could lead to a situation where the Network Client install programs would simply overwrite the configuration settings of the card you installed first.

Example of a Start-up Menu Configuration

This section includes samples of the system files "**CONFIG.SYS**" and "**AUTOEXEC.BAT**" that enable you to setup a Start-up Menu.
The names and values printed do not necessarily correspond with the actual path and file names or parameter values that apply in your situation.

CONFIG.SYS File

```
[MENU]
menuitem=WaveLAN
menuitem=CSSS
[COMMON]
DEVICE=c:\dos\himem.sys
```

```
DEVICE=c:\dos\emm386.exe noems x=xxxx-xxxx[1]
DEVICE=c:\dos\setver.exe

[WaveLAN]
REM This menu item will enable WaveLAN Card Access Driver
DEVICE = c:\wavelan\wavecad\wvlancad.sys /m=xxxx /b=xxxx /i=xx[2]

[CSSS]
REM This menu item will enable Card and Socket Services
DEVICE=c:\csss\socksvce.exe[3]
DEVICE=c:\csss\cardsvce.exe

[COMMON]
DEVICE=c:\windows\ifshlp.sys
```

AUTOEXEC.BAT File

```
SET TEMP=c:\temp
PROMPT $P$g
SET DIRCMD=/O/P
GOTO %config%

:WaveLAN
REM This section contains WaveLAN related commands
PATH  c:\dos;\c:\wavelan;c:\network\wavelan[4];c:\windows
c:\network\wavelan\startnet
goto end

:CSSS
REM This section contains Card and Socket Services related commands
PATH  c:\dos;\c:\wavelan;c:\network\ethernet\[5];c:\windows
```

1 See page D-19

2 See “Intel 82365 PCIC” on page D-5

3 The program path and file names should match the actual path and file names of your Card Services and Socket Services (CS&SS) software.

4 Path to the “**NET.CFG**” file that contains the parameter values for your WaveLAN card.

5 Path to the second “**NET.CFG**” file that contains the parameter values for an Ethernet card.

```
c:\network\ethernet\startnet
goto end

:end

LH c:\windows\smartdrv.exe
LH c:\dos\doskey.com
LH c:\mouse\mouse.com
LH c:\windows\odi.hlp
c:\windows\net start
win
```

For more information about MS-DOS Start-up Menus, please consult the user documentation that came with your computer or MS-DOS software.

Installing in Apple Macintosh

E

Contents

Introduction E-1

Installing the WaveLAN Driver E-2

Installing Networking Protocols E-2
Enabling your WaveLAN Card E-3

Using WaveLAN with PowerBooks E-5

Basic Parameters E-6
- Type of Network E-6
- WaveLAN Network Name E-7

Advanced Parameters E-7
Monitoring Wireless Performance E-9
Modifying Configuration Parameters E-9

Removing the WaveLAN Driver E-10

Installing in Apple Macintosh

E

Introduction

To connect your Apple PowerBook to a wireless network, you will need to:

1. Install the WaveLAN card software
2. Install one or more networking protocols to allow your WaveLAN computer to communicate with other wireless and/ or wired computers on the network.
3. Power up the computer with the WaveLAN card.
4. Configure the networking protocols of your MAC operating system to select the WaveLAN interface for network communication.

NOTE:
Before you proceed, please note the following:

- When upgrading from previous driver versions, always remove previously installed WaveLAN drivers as described on page E-10.
- When installing a new driver, always do so *without* the card inserted into the computer.
- New WaveLAN drivers must be installed *prior* to inserting the card!

Installing the WaveLAN Driver

1. Insert the WaveLAN diskette for the MAC operating system into your Apple PowerBook.
2. Double-click the diskette icon on the “desktop” of your computer, to display the contents of this WaveLAN diskette.
3. Now double-click the file called “WaveLAN Installer” to start the installation program.
4. In the welcome window click the button “Continue” to proceed.
5. From the list of options select “Easy Install”.

   If you have any applications open during the WaveLAN installation process, you will be prompted to close these applications.

   - Click “No” to abort installation, or
   - Click “Continue” to proceed and have the MAC operating system close all the open applications.
6. Follow the instructions as they appear on your screen and restart your computer.

NOTE:
Now that you have installed the WaveLAN driver, you will need to add a networking protocol to allow communication with other networking devices.

Installing Networking Protocols

Subject to the type of networking environment, you should install one or more of the following protocols:

- AppleTalk, most commonly used to connect a number of Apple workstations to a networking environment identified as the “Applezone”
- TCP/IP to connect to larger network infrastructures, and/or allow connections to the internet via the network.

Optionally you can install and enable both networking protocols. For more information about installing protocols, please consult the “balloon help” and User’s Manual that came with your Apple PowerBook.

To finish the installation of the WaveLAN drivers and networking protocols, please restart your Apple PowerBook computer.

Enabling your WaveLAN Card

Insert the WaveLAN PC Card into your computer. Once your computer has restarted, you will see the WaveLAN/IEEE icon appear on the desktop of your Apple PowerBook.

NOTE:
If this icon is not displayed, verify if the PC Card is properly inserted into the PC Card slot of your Apple PowerBook.

To enable your WaveLAN connection, you will need to configure the AppleTalk protocol to use the WaveLAN card for its network communication.

1. Double-click the WaveLAN/IEEE icon to launch the AppleTalk installation.
2. In the top side of the AppleTalk window, open the pull-down list of the item “Connect via:”
3. Select the item WaveLAN/IEEE as pictured in Figure E-1.

Figure E-1 Setting the AppleTalk Parameters

4. Use the button on the top right side of the window to confirm your changes and close the window again.

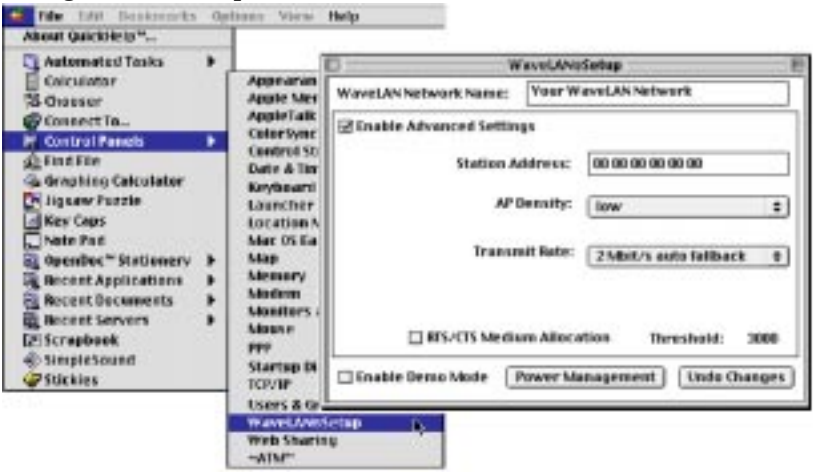
Using WaveLAN with PowerBooks

When you insert the WaveLAN card into your Apple PowerBook computer, it will start operation with the following factory-set defaults:

- Connect to a Network Infrastructure.
- Use the WaveLAN Network Name “ANY” to connect to the first access point that provides a communications quality that is acceptable or better.

To view or modify the WaveLAN parameters, open the WaveLAN Setup window that is listed under the Apple Menu, as an item in the Control Panels (see Figure E-2 below).

Figure E-2 Setup WaveLAN Parameters



Basic Parameters

For standard operation of your WaveLAN IEEE PC Card, you will only need to set the following parameters, characterized as the Basic Parameters:

- Type of network to which you wish to connect your WaveLAN computer.
- The WaveLAN Network Name of the network.

Type of Network

IEEE 802.11 compliant LANs identify two types of networks:

- **IEEE 802.11 Infrastructures** - Wireless networks that include (WavePOINT-II) access points to allow the wireless stations to connect to other wired or wireless stations, and provide seamless wireless connectivity to roaming mobile stations.
- **Ad-hoc wireless workgroups** - small stand-alone workgroups of wireless computers, which do not include access point devices.

To connect to an infrastructure network, clear the “Enable Demo Mode” tick box and enter the name of the IEEE 802.11 wireless infrastructure.

To connect to an ad-hoc workgroup of wireless stations, place a check mark in the “Enable Demo Mode” tick box. Inthis mode your WaveLAN card will:

- Ignore the WaveLAN Network Name value.
- Ignore WavePOINT-II access points.
- Fix the radio channel to operate at its factory-set default channel.

This means that your WaveLAN IEEE station can commmunicate with any other WaveLAN IEEE station within its range, provided

that these stations have been equipped with cards that have a matching defualt radio frequency (see Table A-6 on page A-8).

WaveLAN Network Name

If you selected to connect to an infrastructure network, you will need to identify the name of that network. Consult your LAN Administrator for the value that applies in your situation.

- Valid values are any alphanumeric string in the range of “a-z”, “A-Z” and “0-9” including spaces, with a maximum of 32 characters. For example: “Your WaveLAN Network”.
- Alternatively, you can use the value “ANY” (all-uppercase). This might be the preferred option when:
  - You operate your computer in multiple network environments that are identified by different WaveLAN Network Names.
  - You do not know the WaveLAN Network Name of the network to which you would like to connect your computer.

NOTE:
If you select the value “ANY” please note that the LAN Administrator may have selected to “close” the network infrastructure as described on page 6-2.

Advanced Parameters

The other parameters listed on the WaveLAN DSetup window, are advanced parameters that will work most efficient when you leave the settings to these parameters to their factory-set defaults.

You may only need to modify these parameters only when troubleshooting WaveLAN performance upon advice of a WaveLAN IEEE expert, or a WaveLAN Technical Support representative.

A detailed description of these parameters can be found in Chapter 4 ”Advanced WaveLAN Parameters”. Although Chapter 4 is basically oriented at Microsoft Windows operating systems, this chapter will provide you sufficient information to learn more about the setting fo these parameters.

NOTE:
The parameter names described in Chapter 4 are slightly different from the names in the WaveLAN Setup window for MAC operating systems. Please use the list below to identify which section in Chapter 4 corresponds with the parameter for your computer:

- **Station Address** - see “MAC Address” on page 4-2.
- **RTS/CTS Medium Allocation** - see .
- **Power Management** - “Power Management” on page 4-13.

Figure E-3 WaveLAN Power Managment Setup

Monitoring Wireless Performance

The WaveLAN software for Apple PowerBook devices, does not include diagnostic tools to validate the radio link quality.

However if your network also includes MS-Windows 95/98 or MS-Windows NT v4.0 computers, you can use such stations to monitor wireless communications between the other station and your Apple PowerBook device.

- For Independent Network environments, you should start the WaveMANAGER/CLIENT IEEE program on a WaveLAN computer running either the MS-Windows 95, 98 or Windows NT operating system.

  The Link Test mode of this utility enables you to analyze the communications quality between the “Initiator” station and your Apple PowerBook device (identified as the “Remote Station”).
- In Infrastructure Networks, consult the LAN Administrator to run the WaveMANAGER/AP tool.

  The “Remote Link Test” of this utility enables the LAN Administrator to analyze the communications quality between a WavePOINT-II device (identified as the “Initiator” station) and your Apple PowerBook (identified as the “Remote Station”).

Modifying Configuration Parameters

To view or modify the WaveLAN parameters, open the WaveLAN Setup window that is listed under the Apple Menu, as an item in the Control Panels (see Figure E-2 on page E-5).

- Click the button at the top-right side of the window to confirm changes and close the window.
- Click the button “Undo Changes” at the lower left-side of the window to restore any modification, and cick the button at the top-right side of the window to close the window again.

Removing the WaveLAN Driver

If you wish or need to remove previously installed WaveLAN drivers, you can do so using the WaveLAN Installer program.

Removing previously drivers is mandatory if you wish to:

- Upgrade a driver
- Change the type of driver (e.g. migrate from “Apple Classic” to Apple “Open Transport”.

To remove the drivers, proceed as follows:

1. Insert the WaveLAN diskette for the MAC operating system into your Apple PowerBook.
2. Double-click the diskette icon on the “desktop” of your computer, to display the contents of this WaveLAN diskette.
3. Now double-click the file called “WaveLAN Installer” to start the installation program.
4. In the welcome window click the button “Continue” to proceed.
5. From the list of options select “Custom Remove”.

   If you have any applications open during the WaveLAN installation process, you will be prompted to close these applications.

   - Click “No” to abort the process, or
   - Click “Continue” to proceed and have the MAC operating system close all the open applications.
6. Follow the instructions as they appear on your screen and restart your computer.

Warranty Repair Card

W

About Warranty and Repair

In case your IEEE 802.11 WaveLAN product is not working properly, you are advised to consult the Troubleshooting hints, prior to contacting WaveLAN Technical Support.

In case your IEEE 802.11 WaveLAN product is defective, return it to your Dealer/Distributor in the original packaging.

Warranty Repairs:

When returning a defective product for Warranty, always include the following documents:

- The Warranty Repair card, and
- A copy of the invoice/proof of purchase

All other Repairs:

When returning a defective product for Repair, always include the the Warranty Repair card

You are advised to read the Information about “Limited Warranty” as described on the following page.

Limited Warranty

Lucent Technologies extends a limited warranty from date of purchase of:

- Thirty-six (36) months for WaveLAN hardware products
- Twelve (12) months for WavePOINT access points
- Twelve (12) months for for the media on which the software is furnished and the reproduction of the software on the media.

Upon proof-of-purchase Lucent Technologies shall at its option, repair or replace the defective item at no cost to the buyer.

Defective items shall be returned to the dealer/distributor:

- Freight prepaid.
- Accompanied by a copy of proof-of-purchase.
- Accompanied by a filled out Warranty/Repair card.

This warranty is contingent upon proper use in the application for which the products are intended and does not cover products which have been modified without the seller's approval or which have been subjected to unusual physical or electrical demands or damaged in any way.

This Warranty constitutes the sole and exclusive remedy of any buyer or seller's equipment and the sole and exclusive liability of Lucent Technologies in connection with the products and is in lieu of all other warranties, express, implied or statutory, including, but not limited to, any implied warranty of merchantability of fitness for a particular use and all other obligations or liabilities of Lucent Technologies.
In no event will Lucent Technologies Inc. or any other party or person be liable to you or anyone else for any damages, including lost profits, lost savings or other incidental or consequential damages, or inability to use the software provided on the software media even if Lucent Technologies or the other party person has been advised of the possibility of such damages.

To be filled out by the User

Product Description	:
COMCODE (Product ID)	:
Serial Number:	
Invoice Date:	(dd/mm/yyyy)
Name:	
Title:	
Company:	
Address:	
City/State/Zipcode:	
Country:	
Telephone:	
Fax:	
Email:	

To be filled out by the Dealer/Distributor

Dealer Name:	
Address:	
City/State/Zipcode:	
Country:	
Telephone:	
Fax:	
Warranty?	Comment:
❑ Yes	
❑ No	
RMA Reference	

Reported Problem:	**Problem Description:**
❑ Out-of-Box Failure	
❑ Other	

List of Figures

Figure 1-1	WaveLAN IEEE 802.11 Kit Contents	1-1
Figure 1-2	Ad-hoc Wireless Workgroup	1-2
Figure 1-3	Stand Alone Wireless LAN	1-3
Figure 1-4	LAN Infrastructure	1-4
Figure 1-5	The WaveLAN/IEEE Turbo 11 Mb PC Card	1-5
Figure 1-6	Contents of the Software CD-ROM	1-11
Figure 1-7	Range Extender Antenna	1-14
Figure 1-8	Vehicle Mount Omni-Directional Antenna	1-16
Figure 2-1	Inserting the PC Card into Your Computer	2-2
Figure 3-1	Enable the PCMCIA service for Windows NT	3-7
Figure 3-2	Select WaveLAN Adapter Type	3-9
Figure 3-3	Identify the Location of Files	3-11
Figure 3-4	Windows Network Identification Properties	3-12
Figure 3-5	Setup WaveLAN Parameters	3-15
Figure 3-6	Setup WaveLAN Encryption Parameters	3-18
Figure 3-7	Finished Setting up the Hardware	3-20
Figure 4-1	Advanced WaveLAN Parameters	4-1
Figure 4-2	Access Point Density Parameter	4-3
Figure 4-3	WaveLAN Transmit Rate	4-5
Figure 4-4	The Hidden Station Problem	4-9
Figure 4-5	Medium Reservation Parameters	4-10
Figure 4-6	Medium Reservation “Request to Send”	4-10
Figure 4-7	Medium Reservation “Clear to Send”	4-11
Figure 4-8	WaveLAN Power Management Parameters	4-14
Figure 5-1	WaveMANAGER/CLIENT Status Window	5-7
Figure 5-2	WaveMANAGER Link Test	5-8
Figure 5-3	Logging Setup Dialog Box	5-17
Figure B-1	Enabling the PC Card Controller	B-5
Figure B-2	Verifying IRQ Availability	B-8

Figure B-3	Verifying I/O Port Availability	B-10
Figure B-4	The Windows 98 Device Manager	B-15
Figure B-5	Windows 98 Update Driver Window	B-16
Figure B-6	Update Driver in Windows NT	B-17
Figure B-7	Interface of early WaveLAN Drivers	B-18
Figure B-8	Setup WaveLAN Parameters	B-19
Figure C-1	Windows CE CPU Type	C-2
Figure E-1	Setting the AppleTalk Parameters	E-4
Figure E-2	Setup WaveLAN Parameters	E-5
Figure E-3	WaveLAN Power Managment Setup	E-8

List of Tables

Table A-1	Physical Specifications	A-1
Table A-2	Power Characteristics	A-1
Table A-3	Networking Characteristics	A-2
Table A-4	Radio Characteristics	A-5
Table A-5	WaveLAN Fixed Wireless PC Card	A-7
Table A-6	WaveLAN IEEE 802.11 Channels Sets	A-8
Table B-1	LED Activity Table	B-2
Table B-2	Default Strappings of the WaveLAN Hardware	B-6
Table B-3	Default Configuration Settings	B-13
Table D-1	WaveCAD Configuration Parameter Values	D-7
Table D-2	WaveLAN DOS ODI Driver Parameters	D-11
Table D-3	WaveLAN Packet Driver Parameter Values	D-22
Table D-4	Packet Driver Specific Parameters	D-24

Index

A

Access Control 6-4, D-16, D-23
Ad-hoc workgroup
  MS-DOS D-11
Advanced Parameters
  Medium Reservation 4-8
  Transmit Rate 4-4
AP Density
  default B-13
  DOS ODI Driver D-13, D-22
  Miniport Driver 4-3
Apple E-1
AppleTalk E-2

B

BSS
  MS-DOS D-11

C

Carrier Sense Multiple Access/
  Collission Avoidance 4-8
CSMA/CA 4-8
CTS
  see Medium Reservation 4-11

D

Data Encryption 6-4
Data Speed 4-4
Display Parameter Settings 3-24
Documentation Updates i
Driver_Class
  Packet Driver D-24
Drivers
  DOS ODI Driver D-10
  Miniport Driver 3-9
  Packet D-19
DSSS ii

E

Encryption 3-18
Enhance Mode
  WaveMANAGER/CLIENT 5-14
Enhanced Mode
  Disabling 5-15
  Enabling 5-15
ESS
  MS-DOS D-11

G

Gold Label Cards 1-7

H

Hot Swapping 2-2, 2-4

I

I/O Base (see I/O Port) B-6, D-7

I/O Port
default B-6
DOS D-7
IEEE ii
Standard on Wireless LANs ii
Information
World Wide Web i
Infrastructure
MS-DOS D-11
Installation, network operating system D-9
Interoperability ii
Interrupt Request
DOS D-7
IRQ
Display B-8
DOS D-7
ISA Card (Windows 95/98 only) B-6
PC Card defaults B-6
verify availability B-8

L

LED
activity B-2
Logging Measurement Data
stop 5-17

M

MAC Address 6-4
default B-13
DOS ODI D-14, D-23
Miniport Driver 4-4
Macintosh E-1
Manual Logging 5-16
Measurement Data
automatic logging 5-16
logging options 5-16
Medium Reservation
default B-13
DOS ODI D-14, D-23
Miniport Driver 4-4
Memory Address
DOS D-7
Message Fragmentation
Miniport Driver 4-4
MS-DOS D-1

N

Novell Flag
Packet Driver D-24

P

Packet_Interrupt
Packet Driver D-24
PCIC
MS-DOS systems D-2
Plug & Play 2-3, 2-4, 3-5
Protocol
verify current setting 3-23
Protocols
ad-hoc workgroup 3-22
infrastructure networks 3-22

R

Radio
Safety ii

Technology ii
RTS
see Medium Reservation 4-11

S

Security 6-3, 6-4
Access Control 6-3
Silver Label Cards 1-6
Software Updates i
SOHO 1-2
SSID
see WaveLAN Network Name 1-19, 3-14
Station Address
DOS ODI Driver D-14, D-23
Miniport Driver 4-2
Station Name 3-16
default B-13
DOS ODI Driver D-11, D-22
Miniport Driver 3-16
Packet Driver D-20
System Scale (AP Density) 4-3

T

TCP/IP
Macintosh environments E-2
Technical Support i
Transmit Rate
default B-13
DOS ODI Driver D-12, D-22
Miniport Driver 4-4
Transmit Rate Select 5-10

U

Updates i

W

WaveCAD D-1
WaveLAN Network Name 3-14
default B-13
DOS ODI Driver D-11
Miniport Driver 3-14
Packet Driver D-20, D-22
WaveLAN Parameters
Advanced 4-1
Basic 3-14
WaveMANAGER/CLIENT 5-15
Windows 95, OSR2 B-16
WVLAN42.COM D-1
WVLAN43.COM D-1