LXE OEM Radio Users Guide

Lucent Technologies
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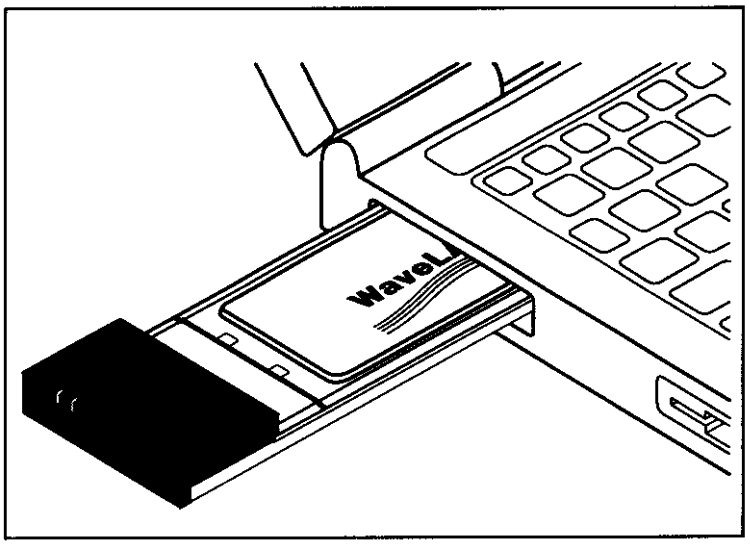

LXE, INC.
KDZ480628-3700
EXHIBIT #: 7

IEEE 802.11 WaveLAN
PC Card User's Guide

FCC ID: KDZ480628-3700

WaveLAN 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. Addresses of Resellers and Sales offices can be found 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	usasupport@wavelan.com	
Caribbean/ Latin America / Canada	calasupport@wavelan.com	
Europe/ Middle-East/ Africa	emeasupport@wavelan.com	
Asia/ Pacific	apasupport@wavelan.com	
WaveLAN Global Support		
U.S.A	Voice:	+1 800 WAVELAN
		+1 937 445 7256
	Fax:	+1 937 445 5552

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 diskette, and on the WaveLAN Support pages of the WaveLAN website.

Regulatory Information

The IEEE 802.11 WaveLAN PCISA 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 139 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.

The radiated output power of the IEEE 802.11 WaveLAN PC Card is far below the FCC radio frequency exposure limits. Nevertheless shall the WaveLAN Antenna be mounted in such a manner to minimize the potential for human contact during normal operation. The antenna shall not be contacted during operation to avoid the possibility of exceeding the FCC radio frequency exposure limits. When using this device in combination with the WaveLAN Range Extender antenna, or WaveLAN Outdoor Antenna products, refer to the Regulatory Statements as identified in the documentation that comes with those products for additional information.

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About IEEE 802.11 WaveLAN

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Kit Contents

The WaveLAN PC Card kit includes the following items as pictured in Figure 1-1:

1. The WaveLAN PC Card
2. WaveLAN Software Diskettes
3. The User's Guide (this document)

Figure 1-1 WaveLAN IEEE Kit Contents

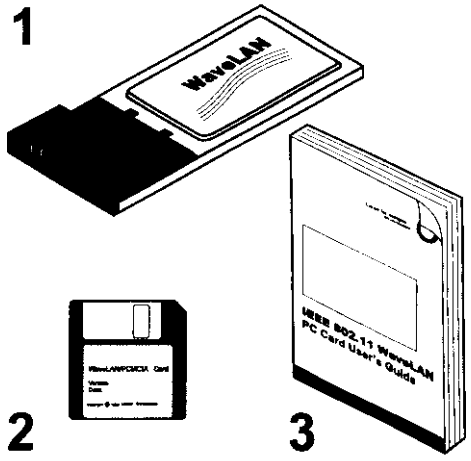
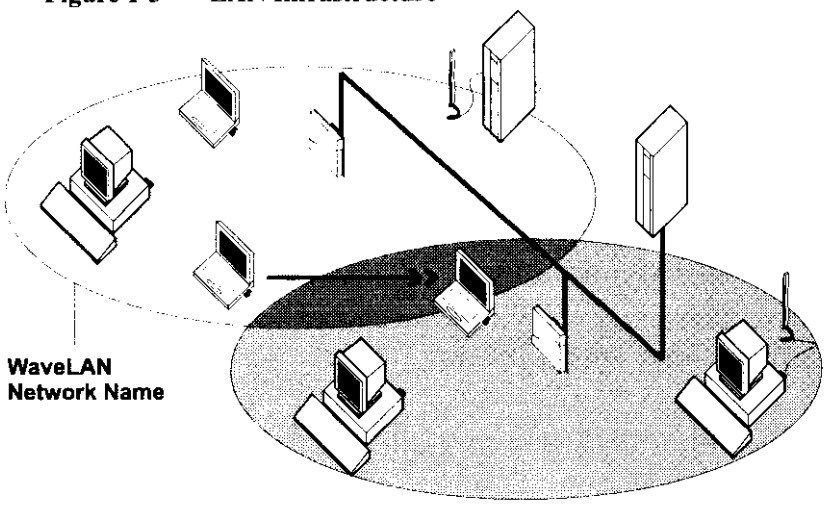


Figure 1-3 LAN Infrastructure



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.

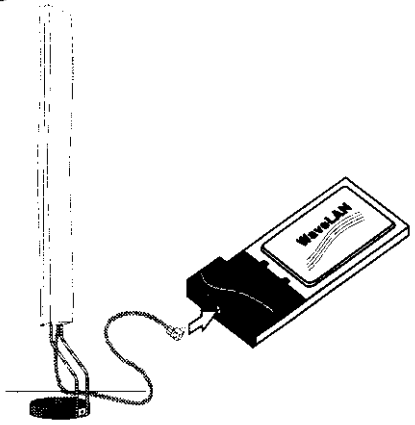
WaveLAN Software

The WaveLAN software diskettes contain:

- The WaveLAN NDIS Miniport Driver, to install the WaveLAN card in computers that run the Microsoft Windows 95, Windows 98 or the Windows NT operating system.
- Drivers to install WaveLAN in MS-DOS based computers and computers that run Microsoft Windows for Workgroups v3.x:
    - The WaveLAN Card Access Driver
    - The WaveLAN DOS ODI Driver
    - The WaveLAN Packet Driver
- WaveMANAGER/CLIENT diagnostic tool for monitoring the quality of wireless communication (this tool runs only on computers that use the Windows 95, Windows 98 or Windows NT operating system).

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

Figure 1-5 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 IEEE 802.11 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 or monitor, a table or filing cabinet, or to hang it on the wall, or ceiling etc.

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 IEEE 802.11 WaveLAN 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 managed to connect to 'any' IEEE 802.11 network system, it will 'stick' to the very same network until you 'restart' the computer again.
During run-time it will not switch dynamically between systems identified by different WaveLAN Network Names.

Security

Wireless network systems that comply to the IEEE 802.11 standard for wireless LANs, allow computing devices to attempt to "Connect to Any IEEE 802.11 LAN" as described on page 1-9.

This connection only refers to the 'physical' connection to the LAN. However to get access to networking data or services, a wireless station will also need to run an appropriate network operating system. Most network operating systems today use the standard security measures such as login names and passwords.

When you follow the standard network security procedures and guidelines as recommended for your network operating system, an unauthorized user should not be able to gain access to network data and/or services without the appropriate user name and password.

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

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 a so-called Access Control Table. The MAC Address of your WaveLAN Card is printed on a label on the backside of your WaveLAN PC Card.

Hardware Installation

2

Hardware Installation

2

Installing the WaveLAN PC Card

This chapter describes how to install the WaveLAN card into the PC Card slot of your computer.

NOTE:
When you intend to use the WaveLAN PC Card in a WavePOINT-II access point, please refer to revision C of WavePOINT-II Getting Started Guide that was shipped with the access point, or that is available for download from the WaveLAN website at ***http://www.wavelan.com***.

Preparation

1. Unpack the WaveLAN PC Card kit and verify if all items are present as described in "Kit Contents" on page 1-1.

   If any of the items described appears to be damaged or missing, please contact your supplier.

2. Insert the WaveLAN PC Card into the PC Card slot of your computer as pictured in Figure 2-1

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 2-5.

Plug & Play Compatible Systems

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

- Windows 95
- Windows 98
- Windows NT version 5.0

When removing the card, these operating systems will:

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

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

Systems that do not Support Plug & Play

Although Windows 95, Windows 98 and Windows NT version 4.0 are similar in appearance, only Windows 95 and Windows 98 support 'Plug & Play'.

When your computer runs one of the operating systems listed below, 'Plug & Play' support or 'Hot Swapping' is not available for your WaveLAN PC Card:

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

To remove your WaveLAN 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 3-1.

Installation for Windows

3

Installation for Windows

3

Introduction

This chapter describes the installation of the WaveLAN Miniport Driver for the following operating systems:

- Microsoft Windows 95
- Microsoft Windows 98
- Microsoft Windows NT (v.4.0)

When you are using Microsoft Windows v3.x, also referred to as Windows for Workgroups, please install the WaveLAN driver as described in Appendix B "Installation for MS-DOS".

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 standard Windows 95, Windows 98 or Windows NT operations and a working knowledge of installing network adapter cards.

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

Windows 95 and Windows 98

For Windows 95 and Windows 98 systems the user profiles only concern 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.

Windows NT (v.4.0)

On Windows NT systems however, user profiles (accounts) are associated with dedicated levels of authority (privileges).

For example:

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

NOTE:
To install (or uninstall) the WaveLAN 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.

Getting Started

As the Windows operating systems differ slightly (see "What You Need to Know" on page 3-1) some of the screens pictured in this chapter may look different from the actual display on your screen. The parameter settings for your WaveLAN Card however will be similar for all Windows operating systems.

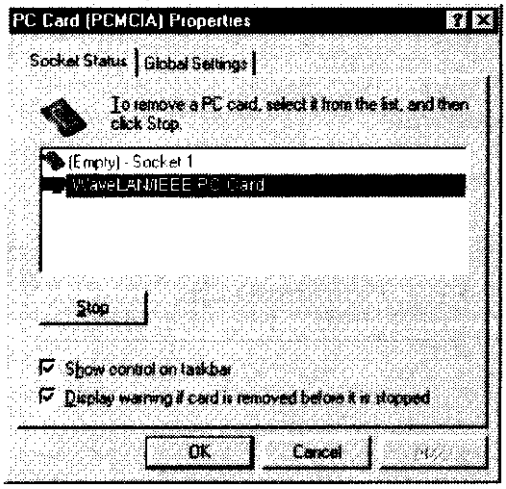
To install the WaveLAN PC Card, proceed as follows:

1. Insert the WaveLAN PC Card into your computer.
2. Power up your computer.

When your computer system runs an operating system that supports 'Plug & Play', the operating system functionality will detect your WaveLAN PC Card and pop-up with a message identifying it is installing the WaveLAN drivers. Skip to "Installing the Miniport Driver" on page 3-14 to proceed with the installation.

When installing the WaveLAN PC Card on a Windows NT operating system (versions 3.51 and 4.0) you will need to perform a set of additional steps as described in "Additional Steps for Windows NT" on page 3-6, before you can install WaveLAN Miniport Driver.

Figure 3-1 Enabling the PC Card Controller



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:

- I/O Port 0340 - 03F7
- IRQ 10
- PC Card Memory Address 000*D*8000 - 000*D*8FFF

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 the possibility of a hardware conflict 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.

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

   The default IRQ value for IEEE WaveLAN 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 PC Card.

2. See whether one of the following values is available (i.e. not listed in the Windows NT Diagnostics window): IRQ 03, 04, 05, 07, 12, 15
3. 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 3-3.

   The default I/O Port value for WaveLAN PC Cards is 0340-03F7.
   Is this value already listed?

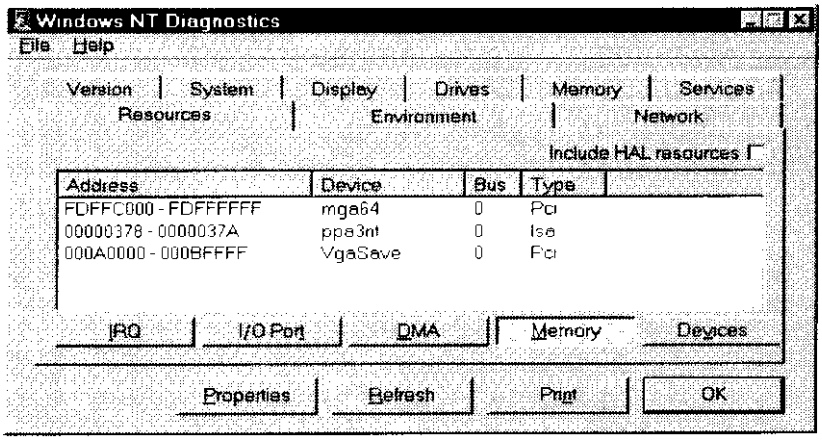
   - If No, you can use the WaveLAN default. Write down I/O Port 0340 and proceed with the next step.
   - If Yes, this means that another device is already using this port address, i.e. you will need to select another value for your WaveLAN PC Card.

Verifying PC Card Memory Address

To display the values of Memory Addresses 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 'Memory'.
   This will display the window pictured in Figure 3-4.

Figure 3-4 Verifying Memory Address Availability



The default Memory Address value for WaveLAN PC Cards is 000*D*8000 - 000*D*8FFF.
Is this value already listed?

- If No, you can use the WaveLAN default. Write down Memory Address 000*D*8000 - 000*D*8FFF 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 PC Card.

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.


Network

1. From the Windows NT Taskbar click the Start button.
2. Point to Settings and click the 'Control Panel' item.
3. In the Control Panel window, double-click the 'Network' icon to open the 'Network Settings' window.
4. If no network has been installed yet, you will be prompted to install it now.
5. Click "Yes" to install Windows NT Networking.

   When Windows NT does not automatically start the network installation, select the 'Adapters' tab, and click the 'Add' button.

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

6. When prompted to select a driver, proceed with "Installing the Miniport Driver" on page 3-14.

- Your computer runs the Windows NT operating system (version 3.51 or 4.0), and you performed the steps as described under "Running Windows NT Diagnostics" on page 3-7.

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 diskette 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.

1. In the 'Select Network Adapter' window click the 'Have Disk' button.
2. Insert the WaveLAN software disk for Windows 95 & NT environments into floppy drive A: of your computer and click the [ ] button to proceed.

   Alternatively use the 'Browse' option to open the folder where you saved the driver files that you downloaded from the WaveLAN website. Click the [ ] button to proceed.

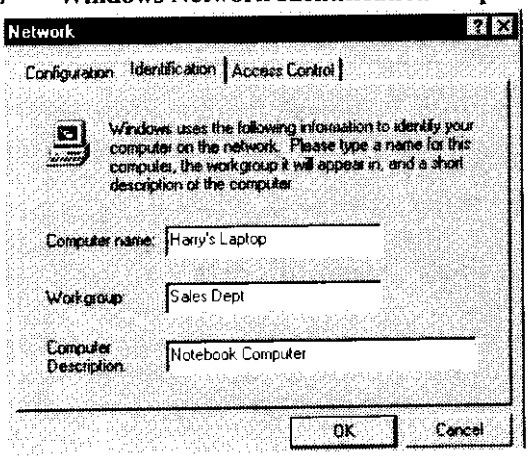
Windows will start copying files from the Windows installation disks or CD-ROM and the WaveLAN installation diskette.

3. If the system prompts you to identify the location of files (see Figure 3-6), enter the correct drive and directory.

Network Installation

When 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 3-7 Windows Network Identification Properties



1. Click the [ ] button to display the window as pictured in Figure 3-7.
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.

Looking at the WaveLAN Parameter window you will also see a set of other parameters. You are advised to leave these "Advanced WaveLAN Parameters" to their default settings, unless there are valid reasons to change the default settings, for example in specific situations upon advice of an IEEE 802.11 WaveLAN expert.

NOTE:
When connecting to an existing network, 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 IEEE 802.11 WaveLAN network 'up and running'. These parameters include:

- WaveLAN Network Name
- Station Name

WaveLAN Network Name

You can set the WaveLAN Network Name to connect your computer to either:

- Any IEEE 802.11 network, or
- A specific IEEE 802.11 network

These options are described in detail in Chapter 1 under "Connecting to a Network" on page 1-8.

Connecting to a Specific Network

When 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.

Valid values are any alphanumeric string in the range of 'a-z' or 'A-Z' and '0-9' with a maximum of 32 characters.
Example: '**MY_WAVELAN_NETWORK**'

NOTE:
The string for a 'WaveLAN Network Name' is case-sensitive. When your network also includes stations that use the WaveLAN DOS ODI Driver, you must select alphabetical characters in 'upper-case' case only, to allow the DOS ODI stations to connect to the network as well.
(see also "DOS ODI Driver Configuration" on page B-8).

AP Density

The Access Point Density parameter controls the roaming sensitivity of your wireless station. This parameter should be set according to the density of the WavePOINT-II access points that have been installed throughout the wireless network area, and the respective setting of this parameter in the configuration of the access points.

Valid values are:

- Low (default)
- Medium
- High

Consult your LAN Administrator for the appropriate values that apply to your network. Using non-matching values may seriously affect wireless performance of your station.

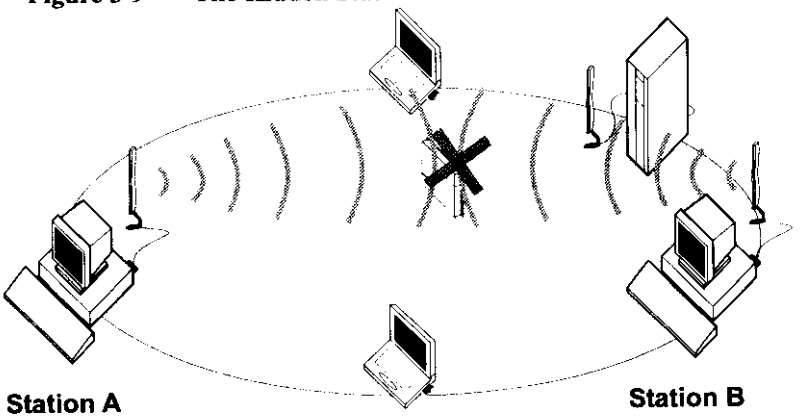
MAC Address

All WaveLAN 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 so-called 'Local MAC Addressing' scheme, you may need to assign a Local Mac Address value to the WaveLAN PC Card of your computer. Valid address values are 12-digit hexadecimal values, where the 2nd digit must be 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.

Figure 3-9 The Hidden Station Problem



The Medium Reservation may provide a solution in this type of situation by handing over 'transmission control' to the WavePOINT-II access point.

Valid values are:

- OFF (default)
- Hidden Station

Using Medium Reservation

When you enable Medium Reservation, the WaveLAN stations and WavePOINT-II access point will use a 'Request to Send (RTS) / Clear to Send (CTS) protocol, based on the length of the WaveLAN message that is to be transmitted.

The length of the message is identified by the Medium Reservation Threshold:

- When a message is shorter than the 'user-defined' Medium Reservation Threshold, your WaveLAN card will transmit the message when it senses that the medium is free.

WavePOINT-II access points is very low, and where you witness poor network performance due to excessive frame collisions at the WavePOINT-II access points.

The WaveLAN Miniport Driver for Windows 95 and Windows 98 systems allows you to set the you Medium Reservation Threshold to 'Hidden Station', which equals the threshold value '500'.

The WaveLAN Miniport Driver for Windows NT systems allows you to specify a user-defined threshold value in the range of '256-2346'. The recommended threshold value for environments that suffer from the 'hidden station' is 500.

Transmit Rate

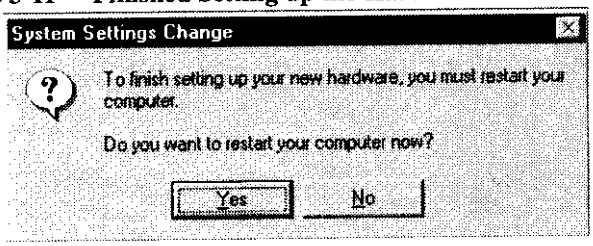
The Transmit Rate identifies the preferred data transmission speed of your WaveLAN PC Card. Where transmissions at lower data speed are usually more reliable, you may prefer higher throughput performance over a greater coverage of the WaveLAN radio signal.

The Transmit Rate selector enables you to balance speed versus reliability by selecting one of the following three options:

- Auto Rate Select (default)
- 2 Mbit/s Fixed
- 1 Mbit/s Fixed

The Auto Rate Select setting will prove most efficient in most networking environments. In normal situations your WaveLAN card will transmit at the maximum speed (2 Mbit/s). When a data transmission fails more than once, the WaveLAN card will retry the transmission at 1Mbit/s.

Figure 3-11 Finished Setting up the Hardware



After Restarting your Computer...

When you have restarted your computer, your Windows operating system should detect the WaveLAN PC Card (usually you can hear this by the sound effect of the PC Card Socket Controller).

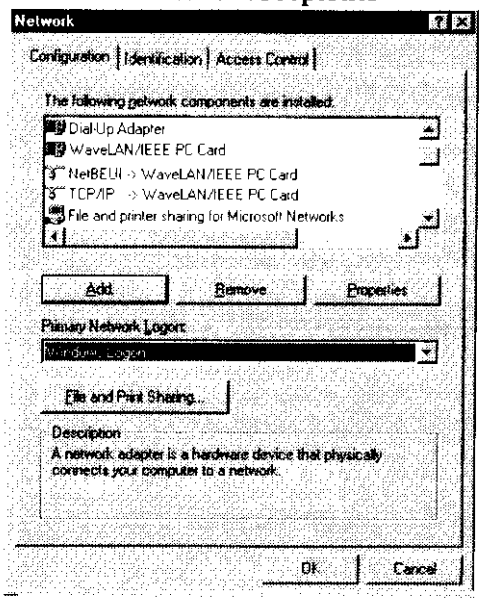
Windows will load the WaveLAN IEEE 802.11 Miniport driver and will open with a dialog box that enables you to enter a user name and a user password. The password you enter here will be the one used to log into the Windows Network Neighborhood.

Windows may display multiple password dialog boxes according to the number of network clients you installed, where each dialog box prompts you for the password of a specific network operating system, for example:

- Microsoft Network logon
- Novell NetWare logon

NOTE:
When you do not like to enter up to 3 passwords or more every time you start-up your computer, you can configure Windows Networking to use Windows Logon as your 'primary logon'.

Figure 3-12 Windows Network Properties



You may consider using the same user name and password for the Windows logon as for your the logon procedure to the network operating systems.

Doing so, the username and corresponding password for the other network systems will be stored in a personal password list (username.pwl).

Upon future reboots, the Windows operating system will only prompt you to enter the Windows user name and password to unlock the personal password list.

From there, the Windows operating system will automatically logon to the other operating systems, using the logon names and passwords in the personal password list.

In exceptional cases, typically upon advice of an IEEE 802.11 WaveLAN expert, you may wish to use a different Transmit Rate value:

- Use 2 Mbit/s Fixed only in networking environments 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 1 Mbit/s Fixed only in networking environments where range is more important than speed.
  This setting will 'instruct' your WaveLAN adapter 'not to waste' any time or resources on attempts to (re-) transmit data at a speed of 2 Mbit/s.

Finishing your 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.

When the Windows operating system prompts you to identify the location of the Windows files, specify the drive and directories of the Windows Installation CD-ROM or diskettes (see also page 3-16).

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

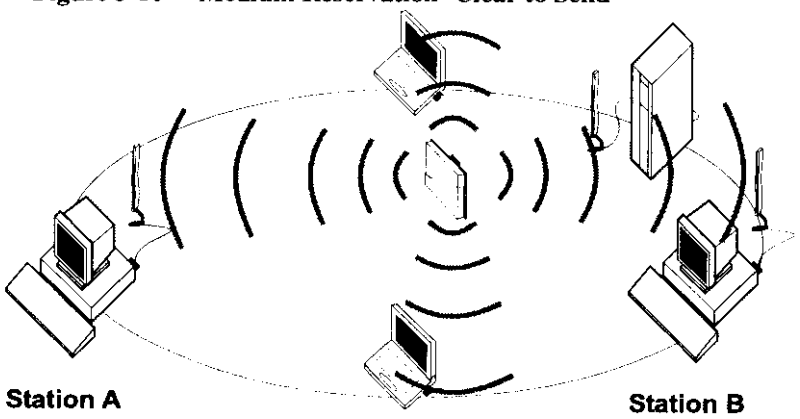
1. Remove the WaveLAN software diskette from drive A:\
2. Click the [OK] button to restart your computer.

- When the length of a message exceeds the 'user-defined' Threshold the station will send an RTS to the WavePOINT-II access point and defer transmission until the WavePOINT-II has responded with a CTS message.

The RTS message will include information about the length of the frame that the station would like to transmit. The WavePOINT-II device will include this information as a 'radio-silence time indicator' in its CTS response message.

This CTS response from the WavePOINT-II device message can be received by all WaveLAN stations within range of the WavePOINT-II device (see Figure 3-10). The CTS message will announce which station will be allowed to transmit its message. All other will defer their transmissions for the radio-silence time identified in the CTS message.

Figure 3-10 Medium Reservation 'Clear to Send'



When to use the Medium Reservation?

The use of Medium Reservation is recommended in networking environments where the density of WaveLAN stations and

NOTE:
The Access Control security feature for WavePOINT-II access points (described on page 1-11) does not work in systems that use Local MAC Addressing. When you would like to use Access Control, you must disable Local MAC Addressing.

When you do not wish to assign a Local MAC Address, you should leave the MAC Address field blank, or enter the value '0'.

Medium Reservation

The default setting for Medium Reservation (OFF) will work just fine in most networking environments as it is normal behavior for WaveLAN stations to defer transmissions when they sense that another WaveLAN device is using the wireless medium for network communication.

The Medium Reservation mechanism enables you to improve wireless performance in network environments where message collisions occur due to the so-called 'hidden station' problem.

Figure 3-9 illustrates an example of the 'hidden station' problem, where both **Station A** and **B** are both within range of the WavePOINT-II access point. However **Station B** 'can not hear' **Station A**; **Station A** is a so-called 'hidden station for **Station B**.

When **Station B** would like to start communications with the WavePOINT-II access point, it might not notice that **Station A** was already using the wireless medium: i.e. messages of both **Station A** and **B** 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.

Station Name

The WaveLAN Station Name 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 name for your WaveLAN computer. Valid values are any 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 the Windows Network Neighborhood Properties (see Figure 3-7 on page 3-17).

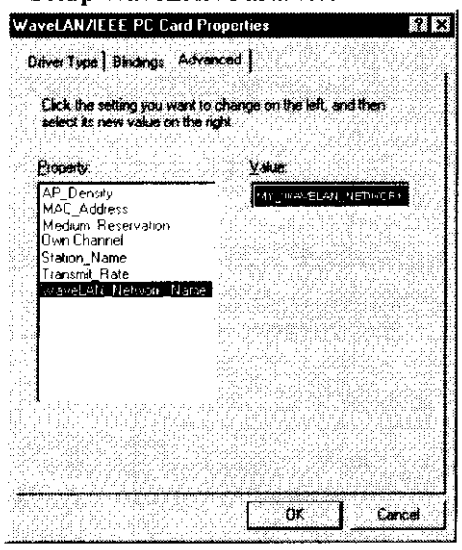
When your computer runs the Windows NT operating system, the Station Name will be copied from the 'Computer Name' field in the Windows Network Neighborhood Properties (see Figure 3-7 on page 3-17). When you did not yet enter a 'Computer Name', you can do this later as well.

Advanced WaveLAN Parameters

Advanced WaveLAN parameters are optional. In most network environments, the default settings for these parameters will prove most efficient for normal network communications.

In special situations, for example upon advice of an IEEE 802.11 WaveLAN expert, you may wish to use alternative values for any of the parameters described on the following pages.

Figure 3-8 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). Doing so, your WaveLAN computer will attempt to establish a radio connection with any IEEE 802.11 network that provides a good communications quality.

You may wish to use this 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 IEEE 802.11 network to which you would like to connect your computer.

Setting the WaveLAN Parameters

When you confirm the Windows Network Identification parameters by clicking the [ ] button, Windows will open the parameter window for your WaveLAN adapter.
When you run the Windows 95 operating system, the window will look as pictured in Figure 3-8.

When you are running the Windows NT operating system, you will be prompted to confirm or modify the settings of the I/O Port address of your WaveLAN Adapter, and its IRQ value.

1. Enter the values that you wrote down when running the Windows NT Diagnostics as described on page 3-7.
2. Click the 'Continue' button, to display the parameter window for your WaveLAN adapter as pictured in Figure 3-8 on page 3-20.

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

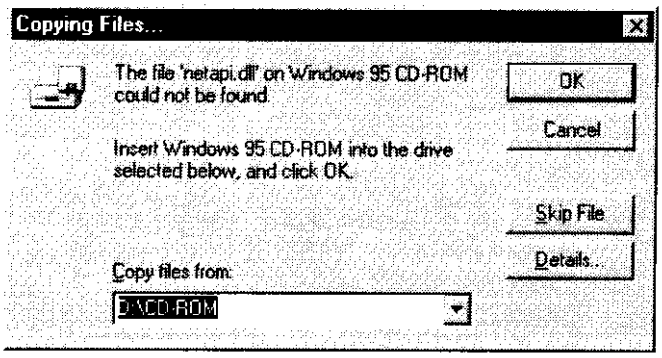
Which Parameters do You Need?

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

- WaveLAN Network Name
- Station Name

In this User's Guide these parameters are described as the Basic WaveLAN Parameters.

Figure 3-6 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 (e.g. the floppy disk drive or directory where you saved 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

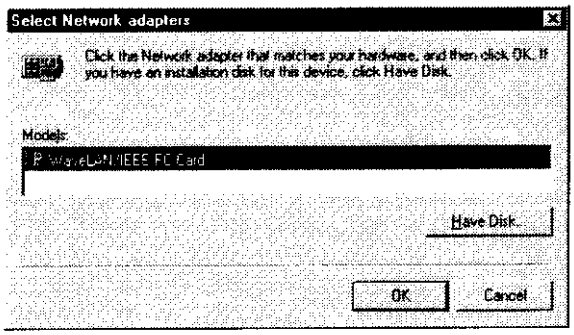
4. Click the [ ] button to proceed.

Installing the Miniport Driver

When your Windows operating system automatically detected your hardware, it will prompt you to select a driver from a list or to 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 3-5).

Figure 3-5 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).

When the default WaveLAN Memory Address has already been assigned to another device:

2. Select an alternative Memory Address value in the range 000C0000 to 000EF000 with increments of 1000. Examples:

   000*C*0000 (- 000*C*0FFF)
   000*C*1000 (- 000*C*2FFF)
   000*C*2000 (- 000*C*3FFF)
   000*E*0000 (- 000*E*0FFF)
   000*E*1000 (- 000*E*1FFF)
   000*E*F000 (- 000*E*FFFF)
   etc.

3. Verify if this alternative value is available (i.e. not listed in the Windows NT Diagnostics window).
4. Write down the alternative Memory value and close the Windows NT Diagnostics Program.

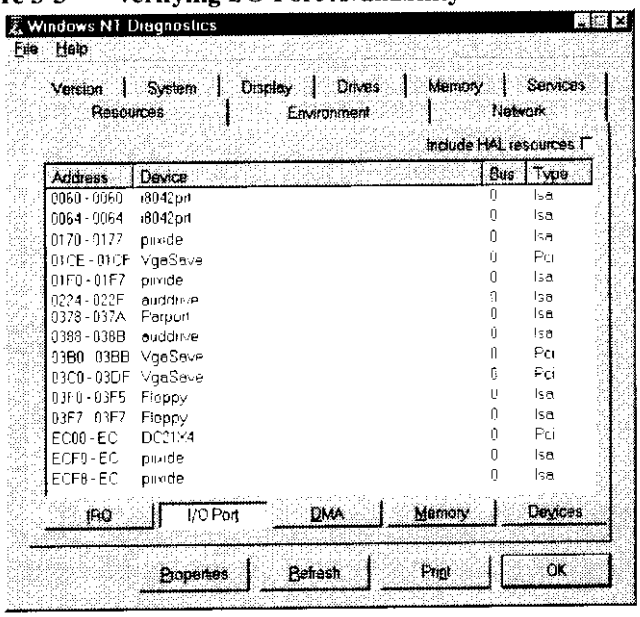
   Having finished these steps, you should now have a note that identifies the following (alternative) values:

   - IRQ value
   - I/O Port Address
   - PC Card Memory Address

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

5. Prior to installing the WaveLAN Miniport Driver, first proceed with the next step, "Enabling Network Support".

Figure 3-3 Verifying I/O Port Availability



When the default WaveLAN I/O Port has already been assigned to another device:

2. Select an alternative I/O Port value in the range 0300 to FFC0 with increments of 40. Examples:

   0300, 0340, 380, 03C0
   0400, 0440, 0480, 04C0
   FF00, FF40, FF80, FFC0 etc.

3. Verify if this alternative value is available (i.e. not listed in the Windows NT Diagnostics window).
4. Write down the alternative I/O Port value and proceed with "Verifying PC Card Memory Address" on page 3-11.

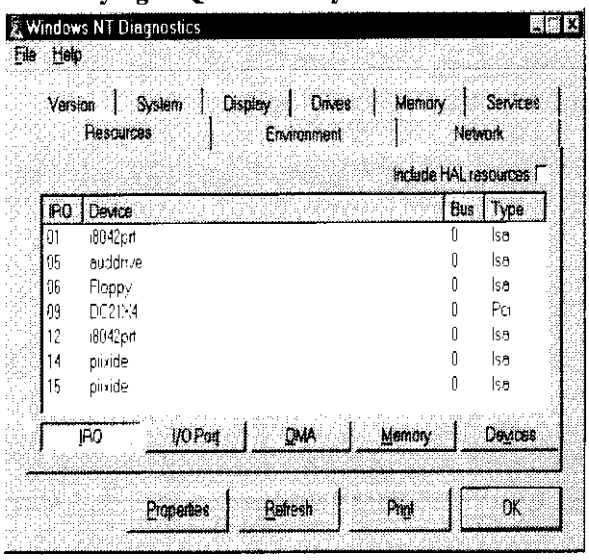
Starting Windows NT Diagnostics

1. Click the Start button on the Windows NT Taskbar.
2. Point to Programs and select the item '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, click the tab 'Resources' on the Windows NT Diagnostics screen. This will display the screen pictured in Figure 3-2.

Figure 3-2 Verifying IRQ Availability



Additional Steps for Windows NT

When your computer runs the Windows NT operating system (version 3.51 and 4.0), you will need to perform a few additional steps to introduce the card to your computer. These steps include:

1. Enabling the PC Card Controller of your computer.
2. Running the Windows NT Diagnostics program.
3. Enabling Network Support for your (client) station.

Enabling the PC Card Controller

In order for your computer to recognize the IEEE 802.11 WaveLAN card, you must enable the PC Card socket interface. To enable the PC Card socket interface, or to verify that it has already been enabled, proceed as follows:

1. Click the Start button on the Windows Taskbar.
2. Point to Settings and click the 'Control Panel' item.
3. In the Control Panel window, double-click the 'PC Card icon' to open the PC Card Properties window (see Figure 3-1).

PC Card (PCMCIA)

4. In the PC Card Properties window, double-click one of the PC Card Sockets.
5. Click the OK button to confirm and close the PC Card Properties window.

Preparing Driver Installation

When installing a WaveLAN PC Card you will typically install:

- The WaveLAN IEEE 802.11 Miniport Driver
- Network (client) Operating Software and Protocols
- (optionally) The WaveMANAGER/CLIENT diagnostics program (described in Chapter 4).

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 at hand. When your computer came with a 'factory-installed' Windows operating system, these files will be stored on your computer's hard disk in files with the format ***.cab**.

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

The major differences are:

- Plug & Play Support
- User Profiles

Plug & Play Support

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 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 2-3).

Windows NT operating systems (versions 3.51 and 4.0) do not support 'Plug & Play' and 'Hot Swapping' of PC Cards.
This means that you will need to 'introduce' the hardware to your computer, in order to install the WaveLAN PC Card as described in "Additional Steps for Windows NT" on page 3-6.

User Profiles

Both Windows 95 and Windows NT operating systems work with user profiles that enable users to specify user-specific settings in computer environments where multiple persons share the same computer terminal.

When re-inserting the card, 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.

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.

NOTE:
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 your computer from the network server, disable the driver properly and disconnect power to the PC Card slot.

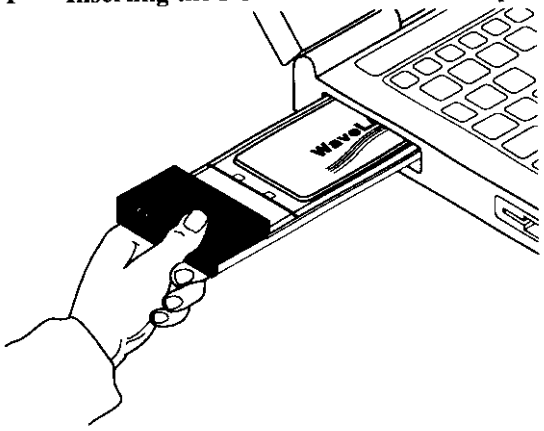
To do so:


PC Card
(PCMCIA)

1. Click the 'Start' button on the Windows Taskbar.
2. Point to 'Settings' and click the '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 PC Card and click the 'Stop' button.
5. Wait for the operating system to acknowledge that the device has been disabled and that you can remove the PC Card form the PC Card slot.

   A shortcut to open the PC Card properties windows is double-clicking the PC Card icon on the right side of the Windows Task bar.

Figure 2-1 Inserting the PC Card into Your Computer



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 an IEEE 802.11 WaveLAN system that supports wireless data encryption. To setup such a system, all devices in your IEEE 802.11 wireless network should be equipped with the Wired Equivalent Privacy (WEP) security feature.

This feature is not yet available for this product release, but is expected to become available later this year.

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 the 'wrong' IEEE 802.11 system(s).

Connecting to a Network

You can use your IEEE 802.11 WaveLAN 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 WaveLAN 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 IEEE 802.11 WaveLAN station and the Infrastructure, the access point must be equipped with a 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 IEEE 802.11 WaveLAN PC Card to:

- "Connect to Any IEEE 802.11 LAN",
- "Connect to a Specific IEEE 802.11 LAN"

Optionally Available

IEEE 802.11 WaveLAN/ISA Cards

The Lucent Technologies IEEE 802.11 WaveLAN ISA Card solution enables you to install a wireless IEEE 802.11 solution into a computer that does not have a PC Card slot, like for example desktop computers. The IEEE 802.11 WaveLAN ISA card consists of:

- A standard IEEE 802.11 WaveLAN PC Card, and
- An ISA to PC Card-bus adapter board.

WaveLAN Range Extender Antenna

The IEEE 802.11 WaveLAN PC Card has been provided with two integrated antennas (see Figure 1-4), which perform best in an open environment with as few obstacles as possible.

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.

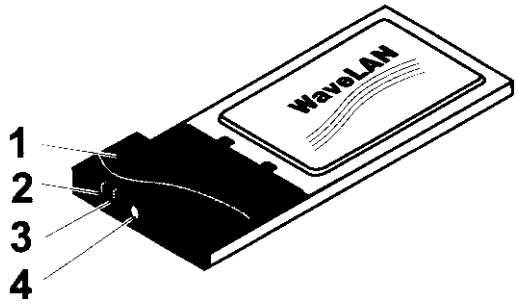
In most situations the IEEE 802.11 WaveLAN Range Extender Antenna may provide a performance increase of up to 15%.

WaveLAN PC Card Features

The IEEE 802.11 WaveLAN PC Card is a standard PC Card that fits into any PC Card Type II slot.

The IEEE 802.11 WaveLAN PC Card has two LED indicators and two integrated antennas. Optionally you can use the IEEE 802.11 WaveLAN PC Card in combination with an external antenna, such as the IEEE 802.11 "WaveLAN Range Extender Antenna" (described on page 1-6).

Figure 1-4 The IEEE 802.11 WaveLAN PC Card



1. Integrated Antennas
2. Transmit/ Receive LED
3. Power ON/OFF LED
4. Connector for optional Range Extender Antenna

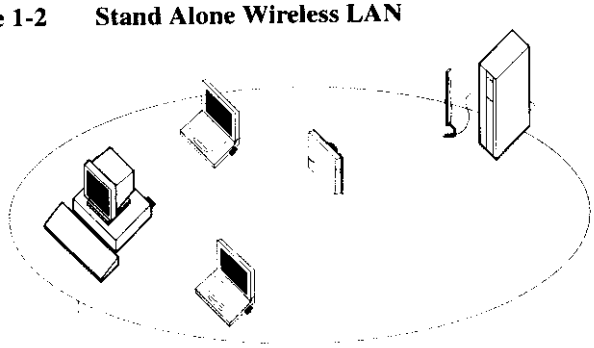
The Power LED will indicate that the card is operational, and that the driver has been loaded. The Transmit/Receive LED will flash upon wireless activity from the WaveLAN card, and when the card's radio senses data traffic from other WaveLAN devices.

About the IEEE 802.11 WaveLAN PC Card

The IEEE 802.11 WaveLAN PC Card is a network interface card that enables you to:

- 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 (previously purchased) WavePOINT-II access points to support wireless devices that have been equipped with IEEE 802.11 adapter cards.

Figure 1-2 Stand Alone Wireless LAN



WaveLAN Network Name

The LAN Infrastructure may either be:

- A stand-alone wireless LAN (see Figure 1-2)
- A wireless network infrastructure that is connected to an existing Ethernet network (see Figure 1-3)
- A wireless network infrastructure that includes both IEEE 802.11 WaveLAN cards and previous generation WaveLAN cards.

Contents

Contents

Interference Statement

There is no guarantee that interference to radio communications will not occur in a particular commercial installation:

- If this device does cause interference, which can be determined by turning the host equipment off and on, the user is encouraged to consult the instruction manual of the host equipment or the local device supplier.
- In case the device does cause harmful interference with an authorized radio service, the user/operator shall promptly stop operating the device until harmful interference has been eliminated.

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.

Country-Specific Radio Approvals:

- Germany: This device complies with CTC R000 008K

- Sweden: Godkänd av Post- och telestyrelsen Ue980035

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, as defined and approved by the Institute of Electrical and Electronics Engineers (IEEE).

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.

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May, 1998

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This personal password list (username.pwl) can only be used by the person that knows the correct username and corresponding password for the Windows logon. It is not possible to open or read a password list file using standard text file viewers, such as ASCII editors or notepad.

Checking the Network Protocol Settings

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.

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

1. Click the Start button from the Windows Taskbar.
2. Point to 'Settings' and click the Control Panel item.

On Windows NT systems you will be prompted to confirm the I/O port address and IRQ value. If your WaveLAN adapter is working OK, just click 'Continue'.

6. (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.

NOTE:
When displaying WaveLAN parameters without intent to change the settings, you are advised always to use the [Cancel] button to close the parameter windows.

Monitoring WaveLAN Performance

4

Monitoring WaveLAN Performance

4

About WaveMANAGER/CLIENT

The WaveMANAGER/CLIENT is a diagnostic tool for WaveLAN wireless networks that you can use to:

- Verify the quality of wireless communications between your WaveLAN station and the WavePOINT-II access point.
- Display information about the configuration settings of your WaveLAN station and the WavePOINT-II access point.
- Perform a site verification to determine or optimize placement of your WaveLAN station and WavePOINT-II access points.

The WaveMANAGER/CLIENT tool runs only on WaveLAN equipped computers that run one of the following operating systems:

- Windows 95 or Windows 98
- Windows NT (version 4.0 or higher)

NOTE:
The WaveMANAGER/CLIENT tool shipped with the IEEE 802.11 WaveLAN adapter does not work for previous generation WaveLAN devices. To monitor networks that include 'WaveLAN/PCMCIA' and 'WaveLAN/ISA', you are advised to install and run the WaveMANAGER/CLIENT that was shipped with those products.

Running WaveMANAGER/CLIENT

To start WaveMANAGER/CLIENT:

1. Click the Start button in the Windows Task bar.
2. Point to 'Programs' and select the item 'WaveLAN'
3. In the list of WaveLAN program files select 'WaveMANAGER CLIENT' 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 which IEEE 802.11 access point was selected by your WaveLAN PC Card to establish a network 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.

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 4-8.

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:

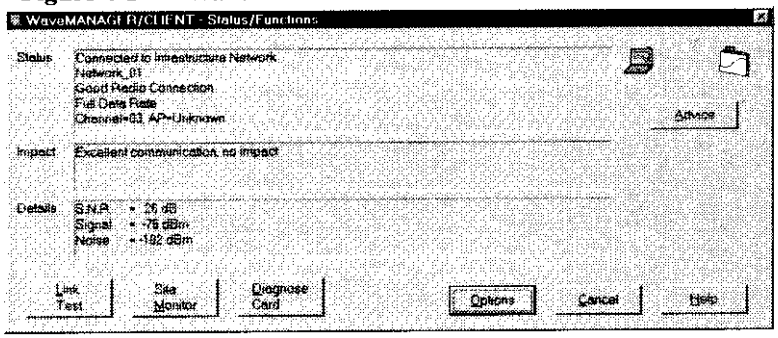
- The 'WaveLAN Status/Function Window', when you are only interested in the general performance of your wireless connection.
- When you are troubleshooting wireless performance, or when you would like to perform more thorough investigations select:

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 4-1 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.

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 acceptable. No intervention is required.
■	Red	Communications quality is poor and requires user-intervention (see Appendix C, "Troubleshooting")

When the SNR is rated as 'Good' or 'Acceptable' the performance of your WaveLAN station will be good as well.
When SNR is rated 'Poor' you may need to consider one of the advices as proposed by the WaveMANAGER/CLIENT tool.

To access WaveMANAGER/CLIENT tips for troubleshooting click the 'Advice' button. Advices may for example 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'.

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 4-13).

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 to use the 'Enhance Mode' of the WaveMANAGER/CLIENT.

The 'Enhanced Mode' 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 specific WaveLAN information such as:

- Display the Configuration Settings of your WaveMANAGER/ CLIENT station and the WavePOINT-II access point.
- Display tallies of standard communication statistics, such as Unicast/Multicast Frames, Fragments or the number of deferred Transmissions or Communication Errors.

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 4-14.

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.

Card Specifications

A

Card Specifications

A

Physical Specifications

Form Factor		PC Card Type-II Extended
Dimensions	(LxWxH)	118 x 54 x 8 mm 170 x 100 x 15 mm[1]
Weight		45 gram
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 As measured without the standard mounting plate for ISA boards

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

Power Characteristics

Doze Mode	9 mA
Receive Mode	280 mA
Transmit Mode	330 mA
Power Supply	5 V

Networking Characteristics

Compatibility	IEEE 802.11 Standard for Wireless LANS (DSSS)

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[1]:	
	FCC	11
	ETS	13
Modulation Technique:	Direct Sequence Spread Spectrum (QPSK)	
Spreading	11-chip Barker Sequence	
Bit Error Rate	Better than 10^{-8}	
Nominal Output Power:	15 dBm	
Range (100 bytes User Data)	**2 Mbit/s**	**1Mbit/s**
Open Environment	365 m (1200 ft.)	425 m (1400 ft.)
Semi-Open Environment	167 m (550 ft.)	198 m (650 ft.)
Receiver Sensitivity	-90 dBm	-93 dBm
Delay Spread (at FER of <1%)	400 ns	500 ns

1 Consult your Authorized WaveLAN Reseller or Lucent Technologies Sales office for information about the radio regulations that apply in your country.

Signal strength can be affected by closeness to metal surfaces and solid high-density materials. The ranges listed above may provide a rule of thumb and may vary according to the actual physical environment where the product will be used.

- 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.

Installation for MS-DOS

B

Installation for MS-DOS

B

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 an working knowledge 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.

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
   ```

The format of the device line is as follows:

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

When for example your device line looks as follows:

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

The WaveCAD will be programmed to use:

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

Table B-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, FF00, FF40, FF80, or FFC0, etc.
/i=nn	IRQ	1- or 2-digit decimal value Valid values: 3, 4, 5, 7, 9, 10, 11, 12, 14, or 15

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.

Table B-2 WaveLAN DOS ODI 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.

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 a '**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 B-18, 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
     STATION_NAME              XXXXXXXX
;ADVANCED PARAMETERS
;    AP_DENSITY                x
;    TRANSMIT RATE             X
;    MEDIUM RESERVATION        XXXX
;    NODE ADDRESS
```

All lines that start with a 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 preferable only be used in special situations, typically upon advice of a WaveLAN IEEE 802.11 expert.

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 B-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 I
   ```

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_NAME              XXXXXXXX
   ;ADVANCED PARAMETERS
   ;   AP_DENSITY                x
   ;   TRANSMIT RATE             X
   ;   MEDIUM RESERVATION        XXXX
   ;   MAC ADDRESS
   ```

Table B-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.

Table B-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.

- 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 of the WaveCAD software as described in "Setup the WaveCAD Program" on page B-4

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 "Setup the WaveCAD Program" on page B-4
- Packet Interrupt 0xXX identifies the value you specified in the '**PACKET.INI**' file.

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 would 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\wavecad.sys /m=xxxx /b=xxxx /i=xx[2]

[CSSS]
REM This menu item will enable Card and Socket Services
```

1 See page B-12
2 See "Setup the WaveCAD Program" on page B-4

Troubleshooting

C

Troubleshooting

C

Windows 95 & Windows NT

Station can not connect to the network

This situation may occur in either one of the following situations:

- Incorrect WaveLAN Network Name
- Card defect
- No driver loaded
- Security mismatch (see "Wireless Access Control" on page 1-11).

Why delete the old driver? The Windows operating systems that support 'Plug & Play' will associate 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 3-1).

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.

To upgrade your WaveLAN Miniport Driver proceed as follows:

1. Close all applications that are currently open, and remove the WaveLAN Card from the PC Card slot.
2. Open the Windows Explorer (File Manager).
3. In the Explorer Menu, point to View and select Options
4. From the View tab, select 'Show all files' and clear the check-box 'Hide MS-DOS file extensions'.
5. Click the Apply button to return to the Explorer (File Manager) window.
6. Back in the Windows Explorer open the folder **c:\windows\system** (**c:\winnt\system32** for Windows NT systems)
7. Delete the files:
   - **wv2_22.sys** and **wv2uif.vxd** when you were running beta software that was shipped with 'Controlled Deployment'
   - **wvlan43.sys** and **wv2uif.vxd** when you were running software that came with your IEEE 802.11 WaveLAN product.
   - (Windows NT only) **wvlan43.dll** and **wvlan43.hlp**

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.

List of Figures

Warranty Repair Card

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 following documents:

- The Warranty Repair card

You are advised to read the Information about "Limited Warranty" as described on the following page.

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	

Return Approval Reference:

Reported Problem:	**Problem Description:**
❑ Out-of-Box Failure	
❑ Other	

Index

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W

This book was created by:

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Wireless Communications & Networking Division (WCND)
Zadelstede 1-10
3431 JZ Nieuwegein
The Netherlands

An electronic copy of this document can be downloaded from the WaveLAN Library on the World Wide Web:

http://www.wavelan.com.

To view or print the electronic document, in Adobe's Portable Document Format (PDF), you will need the freeware 'Acrobat' viewer from Adobe Inc. You can download the Acrobat Reader from the Adobe website at:
http://www.adobe.com/acrobat.

Dear reader,

We value your feedback. If you find errors or omissions in this book, or if you can suggest ways to improve its usefulness, I would like to hear from you.
Please contact me at:

Telephone: + 31 30 609 7471
Fax: + 31 30 609 7636
E-Mail: moolen@lucent.com

Sincerely,

William van der Moolen

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

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.

NOTE:
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.

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1. Close all applications that are currently open, and remove the WaveLAN Card from the PC Card slot.
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6. Back in the Windows Explorer open the folder **c:\windows\system** (**c:\winnt\system32** for Windows NT systems)
7. Delete the files:
   - **wv2_22.sys** and **wv2uif.vxd** when you were running beta software that was shipped with 'Controlled Deployment'
   - **wvlan43.sys** and **wv2uif.vxd** when you were running software that came with your IEEE 802.11 WaveLAN product.
   - (Windows NT only) **wvlan43.dll** and **wvlan43.hlp**

Table C-1 Default Settings

Description	Default Value
AP_Density	Low Density
MAC_Address	none (use Universal MAC Address)[1]
Medium Reservation	OFF
Station Name	none
Transmit Rate	Auto Rate select
WaveLAN_Network_Name	none

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 IEEE 802.11 WaveLAN card
- You installed a newer version of the WaveMANAGER/CLIENT tool.
- Your WaveMANAGER/CLIENT 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 and/ or the Windows NT operating system.

Upgrading to a new driver on a Windows operating system, usually requires physically deleting the old driver file from your hard disk, and re-install the WaveLAN Miniport Driver.

```
DEVICE=c:\csss\socksvce.exe[1]
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[2];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\[3];c:\windows
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.

---

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

2 Path to the '**NET.CFG**' file that contains the parameter values for your WaveLAN card.

3 Path to the second '**NET.CFG**' file that contains the parameter values for an Ethernet card.

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

When 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.

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 Card Access Driver
- xx or xxx identifies the values that you entered upon installation of the WaveCAD software as described in "Setup the WaveCAD Program" on page B-4

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 = xxxxxxxxxxx L
Max Frame 1514 bytes, Line Speed 2 Mbps, Bus ID 3
Board 1, Frame ETHERNET_802.2, LSB Mode

Where:

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 3-24 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 Access Control

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 3-18.
- 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
```

All lines that start with a 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. When your network also includes stations that use the WaveLAN DOS ODI Driver, you are advised to select alphabetical characters in 'upper-case' case only (see also "DOS ODI Driver Configuration" on page B-8).

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 B-3 on page B-15.

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_CLASS          X
;   NOVELL_FLAG           YES/NO
;   PACKET_INTERRUPT      0x XX
```

4. Consult your LAN Administrator to select the appropriate values that apply in your situation from the range as specified in Table B-4 on page B-17.
5. When finished, save the '**PACKET.INI**' file and restart your computer.
6. Proceed with "Finishing Installation" on page B-18.

Table B-2 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 B-18.

Node_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 3-24 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 Access Control

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 '**NET.CFG**' file manually, as described in "About the NET.CFG File" on page B-11.

Table B-2 lists the various WaveLAN parameters with their value ranges and usage. The WaveLAN parameter values are not case-sensitive when entering the values; the WaveLAN DOS ODI Driver will interpret all values as 'upper-case values'.

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 B-5).
  To exclude the Memory Space address, you must add an exclude parameter to '**DEVICE**' statement that activates the memory manager program.

  For example when 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 B-5).
  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

Setup the WaveCAD Program

The WaveLAN Card Access Driver (WaveCAD) must be started before any 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 WaveCAD 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 B-1 on page B-5 to identify valid parameter values that can be included in the WaveCAD '**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**). For more information about this program, 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.

Example DOS commands:

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

The WaveCAD driver will enable you to access the WaveLAN Card via any PC Card slot that is controlled by an Intel 82365 PCIC.

NOTE:
The WaveLAN DOS-ODI Driver and Packet Driver do not support installations that use Card and Socket Services software.
When your computer uses Card and Socket Services to access PC Cards, you will need to disable these services to allow your computer to run the WaveCAD program.
Alternatively you may consider using Start-up Menu Configuration, as described on page B-20.

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
```

Supported Frequency Sub-bands

The IEEE 802.11 WaveLAN PC Card will support a number of factory-programmed channels. The number of available frequencies is subject to local radio regulations as defined by local authorities.

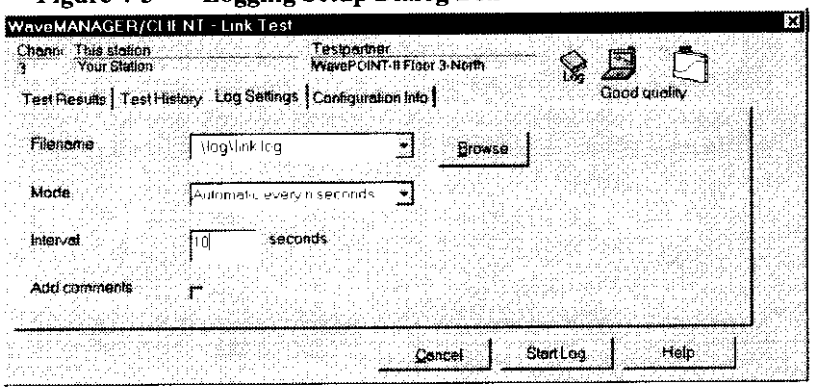
In WaveLAN Infrastructure environments, the WaveLAN card will automatically start operation at the frequency channel that is used by the WavePOINT-II access point. This frequency is controlled by the LAN Administrator that set the WavePOINT-II configuration. The factory-set default value is printed in bold.

Table A-1 IEEE 802.11 WaveLAN Channel 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**

Network Operating System	■ Novell® Client 3.x & 4.x ■ Microsoft Windows® Networking
Host Operating System	Microsoft Windows® 95 and Windows® NT: ■ NDIS Miniport Driver MS-DOS & Microsoft Windows 3.x: ■ DOS ODI Driver ■ Packet Driver
Media Access Protocol	CSMA/CA (Collision Avoidance) with Acknowledgment (ACK)
Data Rate	■ Automatic Transmit Rate Selection (ARS) 2 Mbit/s - 1Mbit/s ■ Fixed Transmit Rate 2 Mbit/s ■ Fixed Transmit Rate 1 Mbit/s

Figure 4-3 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 chose 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 4-15.

- Display Communication Protocol settings.
- Save measurement data to a log file as described in "Logging Measurement Data" on page 4-14.

Enabling/Disabling 'Enhanced Mode'

1. Start the WaveMANAGER/CLIENT program.
2. Open the Status/Functions window (pictured in Figure 4-1 on page 4-7)
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 the WaveMANAGER/CLIENT program to open the 'Status/ Function directly.

Logging Measurement Data

The WaveMANAGER/CLIENT enables you to save measurement results of your Link Test r 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

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 4-1 on page 4-7) 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 the connection.

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

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 Packets Sent/Received/Lost.

When a data transmission fails, the WaveLAN card will automatically retransmit the data. When the number of 'Packets Lost' and/or the number of 'Packets Received after Retry' 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 'Packets 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 'Acceptable' or 'Good' but you still witness a relatively large number of packets received after a 'retry' or packets lost, 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.

WaveLAN Link Test

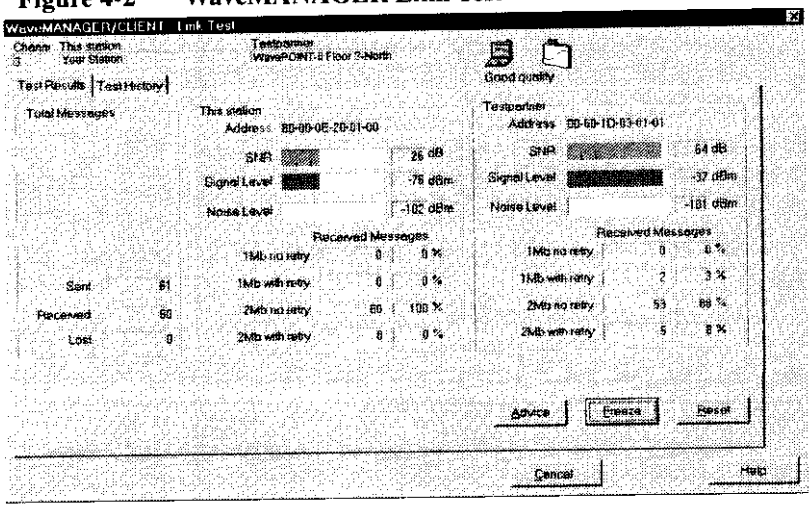
You can use the Link Test to investigate the specific link between a WaveLAN computer and its WavePOINT-II unit in your WaveLAN Infrastructure environment (see Figure 1-3 on page 1-3).

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 4-2 WaveMANAGER Link Test



- Link Test to investigate a specific connection or location in detail, or
- WaveLAN Card Diagnostics, when you suspect a failure of your card.

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.

Data Throughput Efficiency

The Data Throughput Efficiency is largely determined by:

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

Installing WaveMANAGER/CLIENT

To install the WaveMANAGER/CLIENT software:

1. Insert the WaveLAN diskette for Windows 95 and Windows NT environments into floppy drive **A:**
2. Click the Start button on the Windows Task bar.
3. Select 'Run' and type the path to the installation program.

   Example: **A:\setup.exe**

   Alternatively click the 'Browse' button, navigate to the disk drive and directory that contains the WaveLAN software, and double-click the 'setup.exe' program.
4. Click OK to confirm and start the WaveMANAGER/CLIENT installation.
5. Follow the instructions as they appear on your screen.

The Installation program will:

- Create a 'WaveMANAGER' folder on your computer's hard disk (**c:\program files\wavelan\wavemanager\ieee\client**
- Copy the WaveMANAGER/CLIENT program with the associated on-line help files to this folder, and
- Create an icon on the 'Programs' menu.

3. In the Control Panel, double-click the 'Network' icon.
4. Verify if 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 WaveLAN Parameters

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

1. Click the Start button from the Windows Taskbar.
2. Point to 'Settings' and click the Control Panel item.
3. On the Windows Desktop, use the right mouse button to click the 'Network Neighborhood' icon.
4. From the pop-up menu, select 'Properties.
5. In the Network Properties Window, select the WaveLAN PC Card Adapter and click the 'Properties' button.