Air·I/O

Air-I/O MN (900 and 2.4 DS)
User's Guide and Technical Reference

TELX◍◍N.

TELX*|||)N*

Air-I/O MN (900 and 2.4 DS)
User's Guide and Technical Reference

Contents

Regulations 1

FCC statement

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

- Reorienting or relocating the receiving antenna.

- Increasing the separation between the equipment and the receiver.

- Connecting the equipment to an outlet on a circuit different from that to which the receiver is connected.

- Consulting the dealer or an experienced radio/TV technician.

This device complies with Part 15 rules. Operation is subject to the following two conditions: 1) this device may not cause harmful interference, and 2) this device must accept any interference received, including interference that may cause undesired operation.

DOC statement

This Class B digital apparatus meets all the requirements of the Canadian Interference-causing Equipment Regulations.

Cet appareil numerique de Classe B respecte les Standards Canadiens d'emissions et perturbations electromagnetiques.

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

ETSI statement

This equipment has been tested and found to comply with the European Telecommunications Standard ETS 300.328. This standard covers wide-band data transmission systems referred to in CEPT recommendation T/R 10.01.

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

Council Directive 89/336/EEC electromagnetic compatibility statement of compliance

The EC conformity mark is affixed to this equipment to indicate that the equipment conforms to the appropriate requirements of the Council Directive 89/336/EEC.

Council Directive 73/23/EEC low-voltage directive statement of compliance

The EC conformity mark is affixed to this equipment to indicate that the equipment conforms to the appropriate requirements of the Council Directive 73/23/EEC.

4

Safety information 2

The FCC with its action in ET Docket 96-8 has adopted a safety standard for human exposure to radiated frequency (RF) electromagnetic energy emitted by FCC-certified equipment. The Air-I/O MN 802.11-compatible Mobile Nodes meet the uncontrolled environmental limits found in OET-65 and ANSI C95.1, 1991. Proper operation of this radio, according to the instructions found in this manual, will result in the user exposure to be substantially below the FCC recommended limits.

- Do not touch or move the mobile node's antenna while the unit is transmitting or receiving data.

- Do not hold any component containing a radio such that the antenna is very close to or touching any exposed parts of the body, especially the face or eyes, while transmitting.

- Do not operate a portable transmitter near unshielded blasting caps or in an explosive environment unless it is a type especially qualified for such use.

- Do not operate the radio or attempt to tarnsmit data unless the antenna is connected; otherwise, the radio may be damaged.

Snap-on antennas

Always orient snap-on antennas at least 2 inches (5 centimeters) away from your body.

Dipole antennas

Always orient dipole antennas at least 6 inches (15 centimeters) away from your body.

High-gain wall-mount and mast-mount antennas

High-gain wall-mount and mast-mount antennas are designed to be professionally installed and should be located at a minimum distance of 12 inches (30 centimeters) or more from your body. Contact your professional installer, VAR, or antenna manufacturer for proper installation requirements.

Other devices in the wireless network

Refer to the user's guide for your universal access point or wireless hub for additional important safety information.

Scope of the manual 3

This guide covers the installation, configuration, operation, and maintenance of your Telxon Air-I/O MN 900-MHz or 2.4-GHz 802.11-compatible Direct-Sequence Mobile Node.

Chapter summaries

This guide is arranged into the following chapters.

Chapter 1 - Regulations

Provides regulatory information governing the use of the mobile node.

Chapter 2 - Safety information

Provides safety information for use of the mobile node.

Chapter 3 - Scope of the manual

Summarizes each chapter's content and lists document conventions.

Chapter 4 - Overview of the mobile node

Provides a general introduction to the mobile node and direct-sequence and frequency-hopping radio technology and explains the various configurations you can use when operating the mobile node in your infrastructure.

Chapter 5 - Installing the mobile node hardware

Describes the physical installation of the mobile node and its standard antenna(s).

Chapter 6 - Installing the mobile node software

Describes the installation and configuration of the various network drivers.

Chapter 7 - Using utilities

Provides detailed procedures for using the utilities to perform link tests and site surveys as well as loading new firmware versions.

Chapter 8 - Error messages and troubleshooting

Provides detailed descriptions of LED messages and error codes and general procedures for correcting common problems.

Appendix A

Details the mobile node's specifications.

Appendix B

Provides detailed descriptions on using the WinDGS utility.

Appendix C (DS version only)

Provides channel identifiers and channel center frequencies for various area regulatory agencies.

Document conventions

The following conventions are used throughout this manual.

Warnings

Warnings indicate potential bodily injury or death. They are set off in the left-hand columns of this manual by the following symbol: ⚠.

Cautions

Cautions indicate potential damage to equipment. They are set off in the left-hand columns of this manual by the following symbol: !.

Notes

Notes provide supplementary information. They are set off in the left-hand columns of this manual and are not preceded by a symbol.

Overview 4

The Air I/O MN 900-MHz or 2.4-GHz
802.11-compatible Direct-Sequence Mobile Node
inserts into any notebook or Personal Computer fitted
with a Type 11 PCMCIA slot. The Mobile Node
combined with the supplied network adapter drivers,
and one of the major local area network programs,
provides transparent, wireless communications
through the following Telxon products to network
nodes:

- Radio modules - provide wireless communication in
  any portable or fixed computer.

- Access points - provide wireless data
  communication between an Ethernet network and
  fixed, portable or mobile wireless computers.

- Bridges - provide wireless bridges between two or
  more Ethernet LANs and can also function as
  access points.

- Mobile nodes - adapter cards that are installed in
  ISA and MCA computers to allow wireless
  communications.

The Mobile Node contains random access memory
(RAM), and a coprocessor to transfer data to and from
the PC's operating system. (See Figure 1). An
accompanying Radio Module with an integrated
Antenna attaches to the Mobile Node via a tether
cable, and can be mounted on the computer to ensure
the best radio range.

Figure 1. Mobile Node block diagram
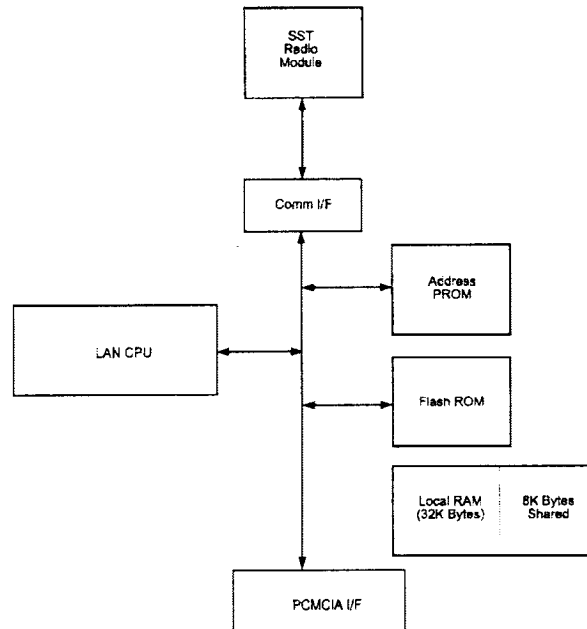
The Telxon Mobile Node package contains a

- Mobile Node,
- Telxon configuration diskette, and
- a radio module.

Telxon configuration diskette

Before performing any task, make a copy of the Telxon Configuration diskette and store the original diskette in a safe place. Use the DOS DISKCOPY command, that is, "desktop a: b:". Do not use the DOS COPY command since the diskette contains subdirectories.

The Telxon configuration diskette contains network software drivers for Novell, NDIS, ODI, TCP/IP, OS/2 and Microsoft LAN Manager, as well as diagnostic utilities.

System requirements

Installation of the Telxon Mobile Node requires:

- A computer with a Type 11 PCMCIA slot

- MSDOS 2.0 or higher

- One free 8K expansion memory address block (ranges betweenm OxCOOO and OxDEOO)

- A PCMCIA card and socket services compliant with revision 2.10 of the PCMCIA specification (or higher)

- Free memory capacity to load a LAN operating system. Depending on the LAN operating system, you will need additional free memory. Consult the relevant LAN documentation for the exact memory requirements.

Networking Compatibility

The Telxon Mobile Node is designed for use with industry standard network operating systems. The following network software drivers are supplied on the Telxon configuration diskette:

- Novell Netware including SFT/Advanced Netware 286 version 2.1 and up, Entry Level SystemLevel 2 (8 users), Netware 386 version 3.1 or later.

- NDIS Drivers for NDIScompliant LAN operating systems such as Microsoft LAN Manager and PC LAN, Windows for WorkGroups, Windows 3.1, and Windows 95.

- ODI Drivers for Novell Netware Lite and other ODIcompliant networking systems.

- TCP/IP Packet driver for use with third party TCP/IP products.

For information on the availability of drivers for other Network Operating Systems please contact Telxon,

Radio Characteristics

The Telxon Mobile Node uses a radio modulation technique known as spread spectrum transmission (SST). This modulation technique provides high data bandwidth and excellent immunity from interference and multipath effects.

Two versions of the radio module are offered which differ in their frequency band of operation:

- Air-I/O MN 900 900 MHz band (902 928 MHz range).

- Air-I/O MN 2.4 DS 2.4 GHz band (2.400 2.485 GHz range).

Data is transmitted over a halfduplex radio channel operating at data rates up to 860 kb/s (900 version) and 2 Mb/s (2.4 DS version).

Radio Ranges

The Telxon Mobile Node radio module is used in indoor wireless radio networks. The radio range achieved depends on the following:

- Data bit rates - better receiver gain at lower data bit rates

  Lower bit rate links have an advantage over higher bit rate links. There is a decrease in receiver threshold as the radio data rate increases. The maximum radio range is achieved at the lowest workable data bit rate.

- Antenna type and placement - increased range with antenna height.

  The key to maximizing range indoors is to place the access point antenna above obstacles such as cabinets, shelves, etc. An antenna mounted on the ceiling provides excellent coverage.

- Openness of the environment - open areas are better than closed areas.

  The less cluttered the work environment, the greater the range.

- Building materials -drywall vs concrete.

  Floor-to-floor radio penetration depends on the building materials used between floors. For example, the range will be greater if the signal is passing through drywall rather than concrete blocks.

Table 1 provides a summary of typical radio ranges to be expected for different situations.

Indoor range		Air-I/O (900)	Air-I/O (2.4 DS)
All antennas at desktop height	Open office	250 to 400 feet (76 to 122 meters)	125 to 200 feet (38 to 61 meters)
	Cluttered office	150 to 250 feet (45 to 76 meters)	75 to 125 feet (23 to 38 meters)
Cnetral antenna elevated 6 feet (x meters)	Open office	300 to 600 feet (91 to 182 meters)	150 to 300 feet (45 to 91 meters)
	Cluttered office	200 to 300 feet (61 to 91 meters)	100 to 150 feet (30 to 45 meters)

Radio antenna

The Telxon Radio Node comes supplied with an integrated dipole antenna and provides omnidirectional (360 degree) coverage.

Security features

The Telxon Mobile Node provides secure and highly reliable data communications by employing spread spectrum technology, previously developed for military "antijamming" and "low probability of intercept" radio systems. Additional security is

achieved through the use of a system identifier (SID). The SID is a unique, 6 hexadecimal digit value that is attached to each packet sent out over the radio. With over 8 million possible SID settings, a high degree of privacy and security can be assured. See Chapter X for detailed information on setting the SID.

Radio network terminology

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

Network tree

Conceptually, Telxon's advanced radio local area network is designed like an upsidedown tree, (see Figure 2) with a root unit at the top, and repeaters and radio nodes branching down and out from the root.

Figure 2. Network tree

Wired LAN

Root Unit

Repeater

End Node

End Node
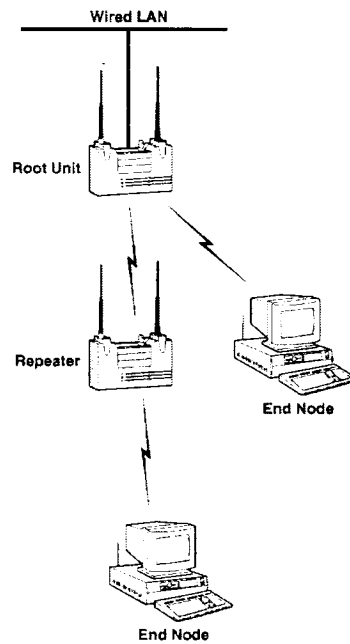
Root unit

An access point which is located at the top of a network tree. The root unit is the starting point in the network and contains information in its registration table regarding all nodes on the network.

Repeaters

A repeater is a wireless access point which is used to extend the radio range of your network. A single access point is limited to a specific RF range. If your system configuration includes nodes outside this range, you will need to add a repeater in order for them to communicate.

Radio node

A PC, notebook computer, etc. containing a radio card.

End node

A radio node that is located at the end of the network tree.

Parent/child node

Refers to the relationships between nodes on the network tree. For example, the root unit (at the top of the tree) would be the parent of the repeater and the repeater would be the parent of the end nodes. Conversely, the end nodes would be the children of the repeater and the repeater would be the child of the root unit.

Registration

Each access point (repeater or root unit) on the radio network contains a registration table, used to control the routing of packets from the Ethernet and the radio network. The table controls the routing of packets by maintaining entries for all radio nodes situated below the access point on the Network tree.

Power saving protocol (PSP) and Nonpower saving protocol

The power saving protocol allows computers (usually portable computers) to power up only part of the time to conserve energy. If a radio node is using PSP to communicate with the network, the access points must be aware of this mode and implement additional features such as message store and forward. While the PSP mode does provide greater battery life, it does increase the response time for the data.

Registration modes

The Telxon Mobile Node can be used in either ARLAN (default), PSP or NonARLAN registration mode.

ARLAN mode (microcellular architecture)

A hightraffic radio network with one or more access points placed on a cabled backbone LAN, and Telxon Mobile Nodes installed in remote radio nodes (PCs and notebook computers).

Each radio node registers to and communicates with the closest, or userspecified Telxon access point. The access points perform routing functions by moving data packets to and from the cabled LAN and remote radio nodes. This mode provides automatic circuit handoff and message forwarding, as a Telxon Mobile Node user roams between LAN access point microcells. In this way, largescale, wireless LANs are configured.

PSP

Same as ARLAN Mode, except that it is used for Telxon Mobile Nodes installed in remote batterypowered radio nodes such as notebook computers. The power saving protocol conserves battery power at the cost of decreased throughput by periodically turning off the radio (See the Power saving protocol section in this chapter.)

NonARLAN mode

Note that NonARLAN mode does not support Power Saving Protocol on Radio end nodes (see Figure 3).

A low-traffic radio network comprised strictly of radio nodes (PCs, file servers, notebook computers, etc.) fitted with the Telxon Mobile Node.

Telxon Radio Node network system configurations

In Non-ARLAN mode, access points are not used, and ARLAN microcellular architecture is not utilized, since data is transmitted directly between the radio nodes. The radio nodes can operate in a peertopeer, or in a clientserver network relationship depending on the network operating system being used.

The Telxon Mobile Node can be used in a variety of network system configurations. Examples of some common system configurations are outlined below, and shown on the pages that follow, along with a brief description of each. All configurations shown can be created with either 900 or 2.4 DS versions.

- 2.4 GHz wireless network without an access point (Non-ARLAN mode)

- 900 MHz wireless workstations off an Ethernet LAN

- 2.4 GHz All wireless LAN

- 900 MHz multiple microcells on an Ethernet LAN

- Multiple access points to extend the range of your 2.4 GHz Network

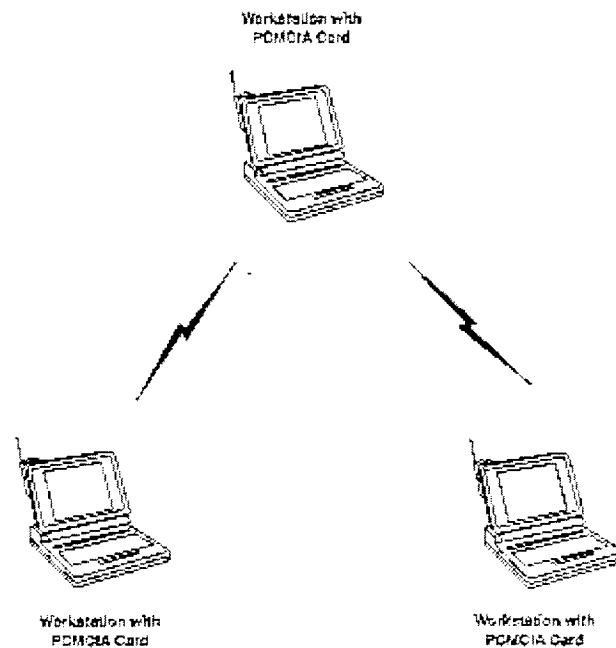## Figure 3. 2.4 DS wireless network without an access point

Figure 3 shows three Telxon Mobile Nodes (in non-ARLAN mode) operating in a peer-to-peer network relationship.

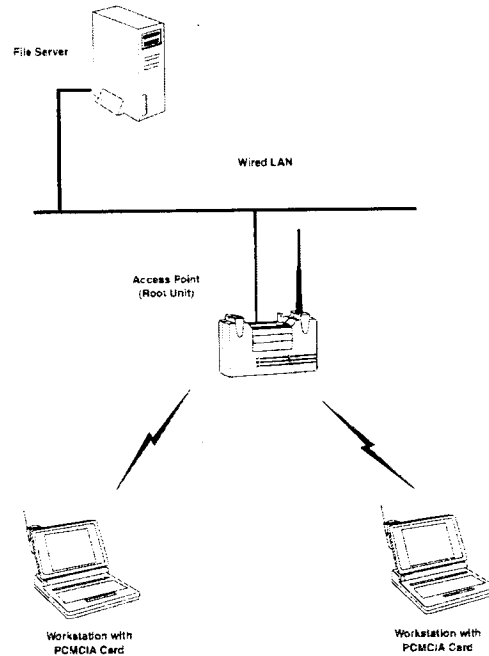**Figure 4. 900 MHz wireless workstations off a wired LAN**

Figure 4 shows two Telxon Mobile Nodes (in ARLAN mode) registered to an access point. The access point is connected to an Ethernet LAN allowing the Telxon Mobile Nodes to communicate with the LAN file server.

Figure 5. 2.4 GHz all wireless LAN

Access Point
(Root Unit)

**Workstation with
PCMCIA Card**

**Workstation with
PCMCIA Card**

**Workstation with
PCMCIA Card**
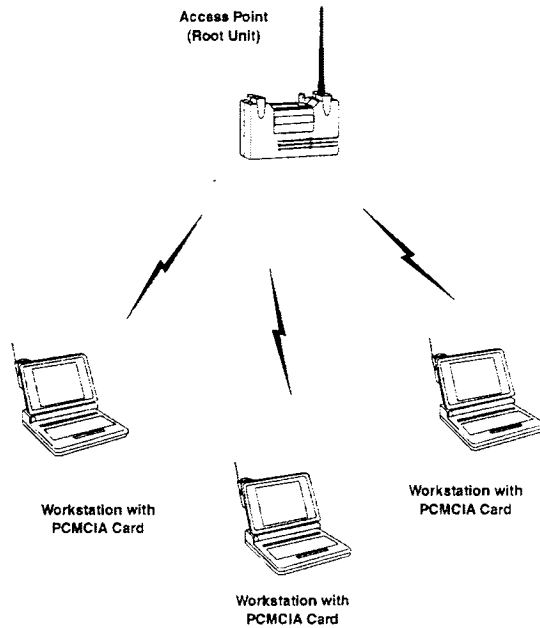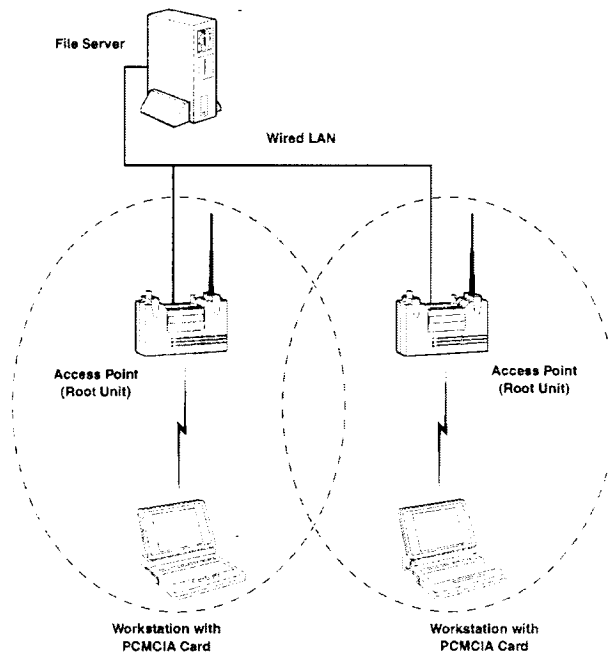
**Workstation with
PCMCIA Card**

Figure 5 shows three Telxon Mobile Nodes (in ARLAN mode) registered to an access point. The access point acts as a hub. allowing communications between each of the Mobile Nodes.

Figure 6. Multiple 900 MHz microcells on a wired LAN

A microcellular network can be created by placing two or more access points on an Ethernet LAN, and allowing remote workstations equipped with Telxon Mobile Nodes to register to the access points. The ARLAN protocols allow remote workstations to move from the domain of one microcell to another. The process is seamless and transparent, and the connection to the file server or host is maintained without disruption. This configuration is particularly useful with portable or mobile workstations.

Figure 6 shows multiple microcells created by placing two access points on the Ethernet LAN. The two remote Telxon Mobile Nodes then register with the access points allowing communication with each other or with the file server on the LAN.

Figure 7. Using access points to extend a wireless LAN

File Server

Wired LAN
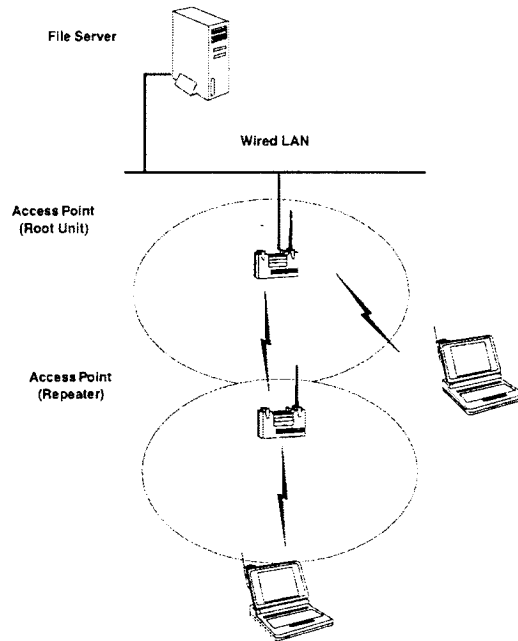
Access Point
(Root Unit)

Access Point
(Repeater)

Figure 7 shows how a Telxon access point can be configured as a standalone repeater to extend the range of a network, or to overcome an RF blocking obstacle. The repeater will support remote workstations equipped with an Telxon Mobile Node. The repeater will forward traffic between the workstations and the Ethernet LAN by sending packets to either another repeater, or to an Telxon access point configured as a backbone root unit. Multiple repeater hops (up to 8) are supported in the path to the Ethernet.

Installation 5

This chapter describes how to install the Air-I/O (900 and 2.4 DS) Mobile Node. Please refer to the documentation that came with your computer if you need additional information on how to install third-party cards.

Here's what you will find in this chapter:

- Before you start
- Installing the radio module and client card
- Mounting the radio module
- Removing the client card and radio module
- Viewing the LED Display

Before You Start

The Telxon Mobile Node consists of two components a client card and a radio module with attached tether cable (see figure 8). The radio module attaches to the client card and the adapter is inserted into any Type 11 PCMCIA slot on a notebook or personal computer.

The installation steps to follow for proper operation are as follows:

- Attach the radio module tether cable to the client card
- Insert the client card into the computer's Type 11 slot
- Mount the radio module onto the computer

(See Installing the radio module and client card section in this chapter for detailed installation instructions.)

Before installing the client card make sure your computer's user manual or guide for your computer is available.

## Figure 8. The Telxon Mobile Node
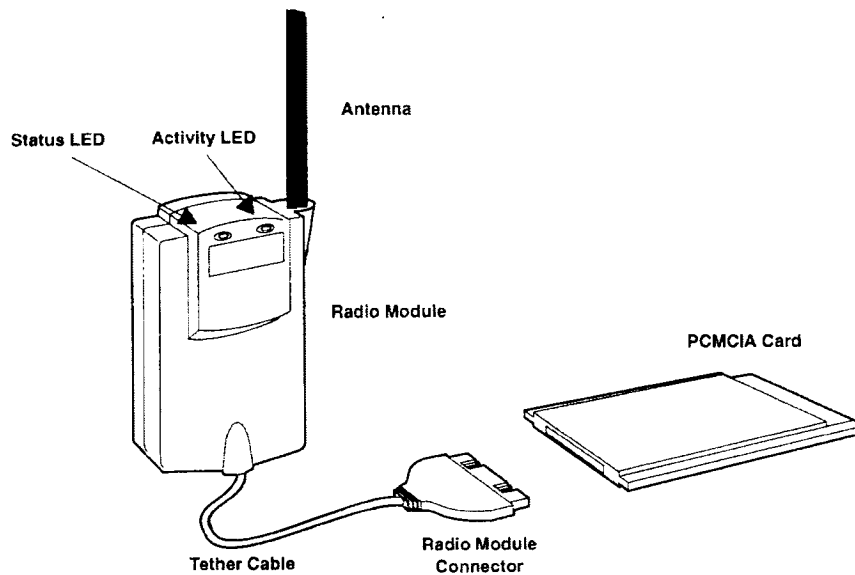
Installing the radio module and client card

Before mounting the radio module, install the client card and verify that it is working properly with your computer. This step will also provide you with a better idea of where to mount the radio module so that the tether cable is never strained.

To mount the radio module:

1. Slide the mounting plate off of the bracket on the back of the radio module.

2. Peel the plastic from the back of the mounting plate to expose the glued surface.

3. Position the mounting plate on the computer so that when the radio module is attached, the antenna will point in an upward direction, and where possible, above the top edge of the computer. This ensures the best radio range during normal operations.

4. Slide the back of the radio module onto the mounting plate until the radio module is positioned firmly in place. See Figure 9.

Figure 9. Mounting the radio module
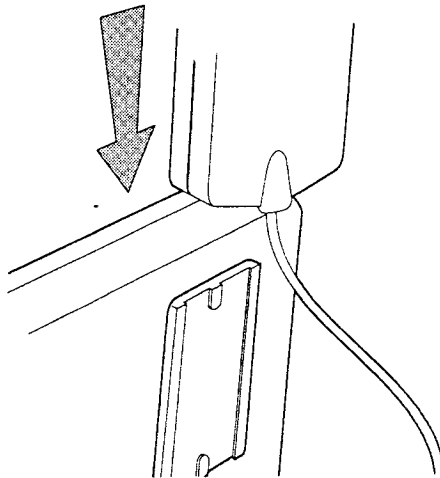


Installing the radio module and client card

The radio module is power bearing and should be attached to the client card before inserting the

adapter into the computer. NEVER attach the radio module to the client card if the adapter is in the computer and the computer is powered on.

To Install the radio module and the client card:

1. Turn the computer off.

2. Attach the radio module tether cable connector into the end slot of the PCMCIA Card as shown in Figure 10.

Figure 10. Attaching the radio module to the client card
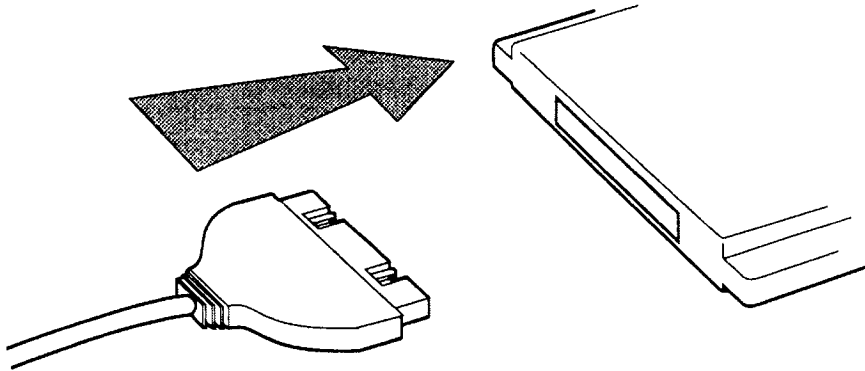
3. Locate the Type 11 PCMCIA slot on your computer.

4. Hold the client card with the labelside up and the arrow pointing toward the slot.

5. Insert the client card into the Type 11 slot as shown in Figure 11. Make sure you insert the

card firmly into the slot until it clicks into
position.

Figure 11. Installing the client card
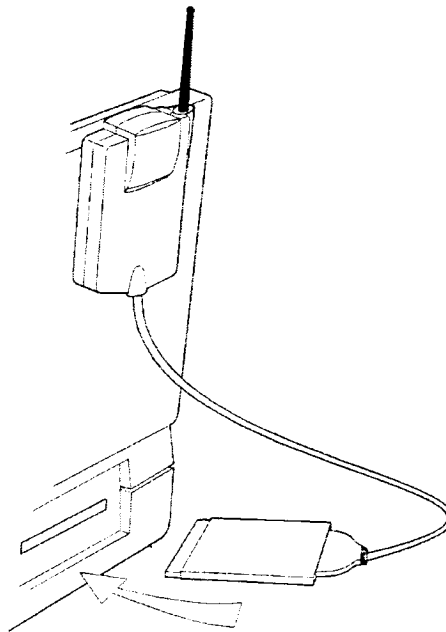
6. Turn on your computer.

    a. If the computer powers up properly, see
Chapter 7: Utilities.

    b. If the computer does not power on properly,
see Chapter 8 Troubleshooting and
Performance.

    c. If the problem cannot be resolved contact the
Telxon Customer Support Center.

Removing the client card and radio module

When not in use, the client card and radio module
should be removed from the computer, and the card
stored in a safe place away from excessive heat and
electrostatic environments.

To remove the client card and radio module:

1. Turn off the computer.

2. Eject the client card PCMCIA card.

3. Remove the radio module from the mounting
    plate.

4. Detach the radio module tether cable from the
    client card.

Viewing the LED display

The LED display is located on the front of the radio
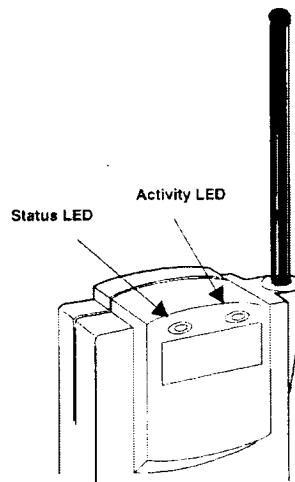module as shown in Figure 12 and as described in
Table 2.

Figure 12. LED display

32

Table 2. LED Display

Status LED	Activity LED	Description
Amber	Amber	The Telxon Mobile Radio Node is functional but the non-volatile memory is not configured. (See Chapter X, Utilities for system configuration.)
Blinking green	Green flash	The Telxon Mobile Radio Node is not registered to an access point.
Green	Off	Normal idle state. No data transmission or receive activity.
Green	Green flash	Normal active state. Sending or receiving data or registration maintenance packet.
Red	Amber	Hardware failure.
Red	Red	Radio module failure.

When viewing the LED Display, keep the following in mind:

- When the PC is initially powered up, all LEDs will be off, unless a network driver was loaded during power up. After a driver is loaded, the Status LED is either steady or flashing and the Activity LED is off. If the power on selftest finds a failure, then one of the two failure indicators will be displayed instead.

- A flashing green Activity LED indicates the successful reception or transmission of a packet over the radio.

- When configured in ARLAN mode, the PCMCIA Status LED will blink green until the card has registered with an access point. Once registered, the Status LED glows steady green.

- If the LEDs indicate a suspected problem, run either the ARLANDGS or WinDGS diagnostic utility (see Chapter 7, Utilities).

```
2 3 9 0 1 - 0 0 0 - 0 1
```

TELX⬤N.