

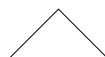
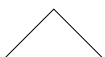
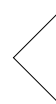


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Serviceability of this Manual

Every reasonable effort has been made to ensure the accuracy of this manual, however product improvements may result in minor differences between the manual and the product shipped to you. If you have additional questions or need an exact specification for a product, please contact our Customer Service Team using the information at the back of this guide. Microwave Data Systems Incorporated reserves its right to correct any errors or omissions. Updated information may also be available on our Web site at www.microwavedata.com. This manual is for the use of professionals to guide them in the installation, operation and basic system maintenance of the equipment covered.

OPERATIONAL & SAFETY NOTICES

RF Exposure



The radio equipment described in this guide emits radio frequency energy. Although the power level is low, the concentrated energy from a directional antenna may pose a health hazard. Do not allow people to come closer than 20 centimeters (8 inches) to the antenna when the transmitter is operating in indoor or outdoor installations.

This manual is intended to guide a *professional installer* in installing, operating and performing basic system maintenance on the described equipment.

FM/UL/CSA Notice

This product is available for use in Class 1, Division 2, Groups A, B, C & D Hazardous Locations. Such locations are defined in Article 500 of the National Fire Protection Association (NFPA) publication NFPA 70, otherwise known as the National Electrical Code.

The transceiver has been recognized for use in these hazardous locations by three independent agencies —Underwriters Laboratories (UL), Factory Mutual Research Corporation (FMRC) and the Canadian Standards Association (CSA). The UL certification for the transceiver is as a Recognized Component for use in these hazardous locations, in accordance with UL Standard 1604. The FMRC Approval is in accordance with FMRC Standard 3611. The CSA Certification is in accordance with CSA STD C22.2 No. 213-M1987.

FM/UL/CSA Conditions of Approval

The transceiver is not acceptable as a stand-alone unit for use in the hazardous locations described above. It must either be mounted within another piece of equipment which is certified for hazardous locations, or installed within guidelines, or conditions of approval, as set forth by the approving agencies. These conditions of approval are as follows:

1. The transceiver must be mounted within a separate enclosure that is suitable for the intended application.
2. The antenna feedline, DC power cable and interface cable must be routed through conduit in accordance with the National Electrical Code.
3. Installation, operation and maintenance of the transceiver should be in accordance with the transceiver's installation manual, and the National Electrical Code.

4. Tampering or replacement with non-factory components may adversely affect the safe use of the transceiver in hazardous locations, and may void the approval.



Do not disconnect equipment unless power has been switched off or the area is known to be non-hazardous.

**EXPLOSION
HAZARD!**

Refer to Articles 500 through 502 of the National Electrical Code (NFPA 70) for further information on hazardous locations and approved Division 2 wiring methods.

FCC Notice, U.S.A.

The MDS iNET 900 transceivers comply with Part 15 of the FCC 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.

Only install this device in accordance with the instructions outlined in this manual. Failure to comply with these instructions may also void the user's authority to operate this device.

Furthermore, this device is intended to be used only when installed in accordance with the instructions outlined in this manual. Failure to comply with these instructions may also void the user's authority to operate this device.

FCC Information

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

ABOUT THIS MANUAL

This guide presents installation and initial operating instructions for the MDS iNET 900™ transceiver. Following installation, we suggest keeping this guide near the equipment for future reference.

The scope of this manual is limited to the safe and effective installation of the unit in typical office or non-hazardous industrial settings. Users who require optimization of the equipment's capabilities and operating range should read the *MDS iNET 900 Network Administrator's Manual*, P/N 05-2806A01. This manual provides more in-depth information on antenna selection and optimization, and extensive coverage on user-controllable parameters and diagnostic tools.

The most essential installation information is contained on the *Installation Reference Chart* found at the center of this manual.

PRODUCT DESCRIPTION

The MDS *i*NET 900 transceiver is designed to provide network managers with a easy-to-install wireless local area network (LAN) services with plug-and-play hardware.

The unit can be reconfigured for any one of three standard operating arrangements; some require the use of authorization keys (alphanumeric code) purchased from MDS. The model descriptions reflect their operating mode capabilities. Supported data interface services are one of three arrangements: 1. Ethernet, 2. Serial, and 3. Ethernet and Serial. (See Table 1 on page 4 for a summary of core interface services.)

Table 1. *i*NET 900 Models and Data Interface Services

Model	Variation	LAN Data ³ (IP/Ethernet)	COM1 Data	COM1 Local MGT	COM2 Data
Access Point	N/A	Yes	Yes	Yes	Yes
Remote...	Bridge ¹	Yes	No	Yes	No
	Serial Gateway ¹	No	No	Yes	Yes
	Dual Gateway ^{1&2}	Yes	Yes	Yes	Yes

NOTES

1. Alternate configurations available via authorization key.
2. Able to be converted to Access Point without authorization key.
(Not currently available.)
3. LAN port provides access to Management System on all models and variations.

The MDS *i*NET 900 transceivers serve as either an “Access Point” or “Remote”. An Access Point (AP) is a wireless hub that usually provides connectivity into a wired Ethernet LAN/WAN. From a radio perspective, an Access Point also serves as the radio network’s “master station” providing synchronization signaling to all associated *i*NET 900 Remotes (RMT) within its radio network.

INSTALLATION PLANNING

This section provides tips for selecting an appropriate site, choosing an antenna system, and reducing the chance of harmful interference.

General Requirements

There are three main requirements for installing the radio—adequate and stable primary power, a good antenna system, and the correct interface between the transceiver and the data device. The center *Installation Reference Chart* shows a typical Remote installation. Access Point stations typically use omnidirectional antennas whereas Remotes, typically use directional antennas such as Yagis.

INSTALLATION

A typical transceiver product shipment consists of an *iNET 900* transceiver, a power connector and a manual. Check the contents against the packing list attached to the outside of the shipping box.

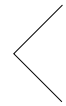
Below are the basic steps for installing an *iNET 900* transceiver. Should further information be required, see “TECHNICAL ASSISTANCE” on page 18 of this manual for information on contacting the MDS Customer Service Department. You will also find support information at the Microwave Data System Web site at www.microwave-data.com on the Internet.

It is highly recommended that the Access Point unit be installed *first*. With this plan, it will be possible to quickly check the operation of each associated Remote unit as it is placed on the air.

NOTE: MDS *iNET 900* transceivers are shipped from the factory set to the “Remote Serial Gateway” mode unless they are marked differently.

Step 1—Mount the Transceiver

Mount the transceiver to a stable surface. (Fasteners/anchors/screws are not supplied unless specified on the purchase order.) Four threaded holes are located on the bottom of the radio that are suitable for connecting mounting hardware. Use 6-32 x 1/4 inch screws to attach mounting hardware to the bottom of the radio.



CAUTION
POSSIBLE
EQUIPMENT
DAMAGE

Screws used to hold the mounting brackets to the radio case should be SAE 6-32 and should not extend farther than 1/4 inch (6 mm) into case. This will prevent damage to the iNET's internal PC board.

Step 2—Install the Antenna

Mount the iNET 900's antenna at least six inches (15 cm) from metallic objects and other electrical or electronic equipment. General information on the selection and installation of antenna systems is provided in the *MDS iNET 900 Network Manager's Manual*.

NOTE: Radio frequency energy generated by the iNET 900 can interfere with the operation of nearby low-level electronic devices and change the reported values of the data being monitored. For this reason, the antenna should be mounted at least 10 feet (> 3 meters) from connected device(s), sensors and other components of the system.

Step 3—Measure & Connect Primary Power

The primary power at the transceiver's power connector must be within 10.5–30 Vdc and be capable of continuously providing up to 500 mA. The optimum voltage is 13.8 Vdc. A power connector with screw-terminals is provided with each unit. Strip the wire leads to 6 mm (0.25"). Be sure to observe proper polarity as shown in Figure 1 with the positive lead (+) on the left.

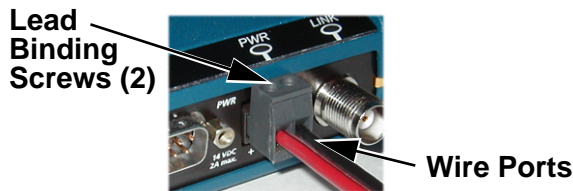
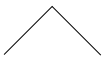
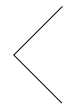


Figure 1. Power Connector
Polarity: Left +, Right –

CAUTION
POSSIBLE
EQUIPMENT
DAMAGE

The iNET 900 must be used only with negative-ground systems. Make sure the polarity of the power source is correct. The unit is protected from reverse polarity by an internal diode and fuse.



The power supply used with the transceiver should be equipped with overload protection (NEC Class 2 rating), to protect against a short circuit between its output terminals and the transceiver power connector.

NOTE: It typically takes about 60 seconds for the *iNET 900* to power up and be ready for operation.

Step 4—Review the *iNET 900*'s Configuration

Two essential settings for *iNET 900* transceivers should be known before placing the unit into service. They are:

- **Device Mode**—Access Point, or Remote (Default)
- **Network Name**—Unique name of the *iNET 900* units associated with the network (Required)

The Network Name must be programmed to enable *iNET 900* Remote units to associate with the Access Point unit.

Several other parameters commonly need to be reviewed and altered if necessary. They are:

- **IP Address**—Must be a unique number to allow for IP access through the LAN Port (Ethernet).
- **RF Output Power Level**—Check and adjust as necessary for compliance with FCC guidelines. (Default = 1 Watt/+30 dBm)
- **Password**—Used for remote access and to use certain *iNET* Management System features.

NOTE: The default password is **admin**

A unique IP address in the subnet is important if the unit's LAN port will be used to access the browser-based *iNET* Management System either locally or by way of a LAN/WAN.

How to Review the iNET's Configuration

The following is a summary of the installation procedure. For more detailed instructions on using the HTTP (LAN Port) and text-based (COM1) Management System, please read the *MDS iNET 900 Network Administrator's Handbook*. Key parameters are highlighted on the Management System flowchart on the *Installation Reference Chart*.

- a. Connect a computer's serial communications port (COM1 or COM2) to the iNET COM1 Port connector. (Data defaults: 19,200 bps/8N1)
- b. Launch a terminal emulator program, such as HyperTerminal, on the computer.
- c. Depress the **ENTER** key. The radio will respond with the start-up screen of the iNET Management System.

A password will be required to make any changes to the radio. (Default = **admin**)

- d. Program the iNET Network Name.
- e. Review other settings and make changes if necessary, such as the unit password and IP address.

Repeat the above steps for each transceiver in the network. (See following note)

NOTE: The Management System supports the use of “configuration scripts” which can hold complex parameter arrangements. These scripts aid in uniformly configuring multiple iNET units. These are detailed in the *MDS iNET 900 Network Administrator's Handbook*.

Basic iNET Configuration Defaults

The Basic Configuration Defaults table on the *Installation Reference Chart* provides a summary of selected operating parameters' range and default values. All of these are available through the iNET's Management System accessible through a terminal emulator connected to the COM1 port or through a browser connected to the LAN Port.

Step 5—Connect the Data Equipment

Connect IP/Ethernet-compatible equipment data equipment to the transceiver's LAN port (10BaseT), or one of the serial ports, depending on the capability of your iNET model. (See Table 1 on page 4.)

Use only the required pins for the application—do not connect anything to unused pins. For Ethernet, use a straight-through Ethernet cable to connect to a hub or a crossover cable to connect directly to an

Ethernet station or data communication equipment. See the *Installation Reference Chart* for pinout information.

Step 6—Check for Normal Operation

The first priority is to check the basic operation of data communications between MDS iNET 900 units in the network. When that seems OK, connect the user data equipment and verify its proper operation through the iNET network. Below are some quick-checks that can be performed at various points in the iNET network.

At All iNET Units

The LEDs are a good place to look for indications of normal operation. Observe the transceiver LED panel (See the *Installation Reference Chart*) for the proper indications. In a normally operating system, reliable LED operation will usually appear within two minutes of start-up.

At the iNET Access Point Unit

- If the Access Point unit is the first you are installing, try sending a ping request to the iNET unit from a local or remote computer. This will verify basic LAN connectivity.
- If you have already installed a Remote iNET unit, try sending a ping to that unit through the iNET Management System ping utility.

At iNET Remote Units

- Look for the LINK LED to turn on and remain on. This indicates the unit has successfully associated with the network's Access Point unit. (The association process may take up to several minutes.)
- If the iNET network seems to be operating properly based on observation of the unit's LEDs, connect a computer to the iNET's data port that will be used by the local RTU/data communication equipment. Use the ping command to verify the communications link integrity with the Access Point unit.
- If the ping command is successful, connect the RTU/data communication equipment to the iNET data port and verify normal operation.

If all checks out OK, you are done with the installation at this site.

Performance Optimization

After the basic operation of the *i*NET network has been established, you may wish to optimize its performance using some of the suggestions given here. The effectiveness of these techniques will vary with the design of your system and the format of the data being sent.

- **Optimize Received Signal Strength**—Check the received signal strength indicator (RSSI) for an adequate signal level from the radio network's Access Point. (RSSI is available through the *i*NET Management System) In the absence of interference, signal levels of -80 dBm or stronger are sufficient for reliable operation.

If the signal levels are lower, it may be necessary to reposition the Remote's antenna for better reception/signal strength, or if a directional antenna is used, align it so that the signal is optimized.

- **Reduce Bit-Error Rate (BER)**—If the bit-error rate of the data network is unacceptably high, several techniques can be used to improve the BER.

These include identifying interference and taking corrective steps such as skipping some radio frequencies from the hopping pattern, increasing the gain of the Remote unit's antenna system, relocating the Remote's antenna, or installing an *i*NET repeater system.

USING RSSI TO AIM REMOTE ANTENNAS

The MDS *i*NET 900 network integrity is depends partially on stable radio signal levels being received at each end of a data link. In general, signal levels stronger than -80 dBm will provide the basis for reliable communication. As the distance between the Access Point and Remotes increases, the influence of terrain, foliage and man-made obstructions become influential and the use of directional antennas as Remote locations becomes necessary. Directional antennas usually require some fine-tuning of their bearing to optimize the received signal strength. The MDS *i*NET 900 unit has a built-in received signal strength indicator (RSSI) that can be used to tell you when the antenna is in a position that provides the optimum received signal.

There are several techniques that can be used to measure RSSI at *i*NET Remote units. The technique you choose to use will depend on your available manpower and the need to maintain data traffic on the *i*NET network. It is recommended that this process be completed before the network is placed on-line.

Consider using the Method 1 procedure if the *i*NET Remote is receiving a weak or unstable signal. If that is not feasible, a bit-error rate measurements may prove to be the best alternative under difficult conditions.

The measurement and antenna alignment process will usually take 10 or more minutes at each *i*NET unit.

NOTE: RSSI readings are based on multiple signal samples over a period of several seconds. The average of this measurements will be displayed by the *i*NET Management System.

Method 1—For New Network Installations

Background

The Access Point and Remote gateway units must be placed into the test mode. This requires a data connection to each location to remotely control the state of the distant unit outside of the *i*NET network. If this connectivity is available, the *i*NET Management System may be used via HTTP or Telnet and controlled by one person. The alternative is two people with telephone or radio communications between each location to coordinate the process.

- Use of the Radio Test Mode:
 - Placing the Access Point in this mode *will disrupt the entire network operation.*
 - All *i*NET Remotes in the network will need to re-associate themselves with the Access Point before they can handle normal data traffic.
 - The Test Mode has a 10 minute timer, after which it will return the *i*NET unit to normal operation.
 - The *i*NET Access Point and Remote units must be on the same frequency. The user can choose any frequency within the 902–928 MHz band. Default = 915.0000
- The test mode and your ability to change operating parameters will time-out after 10 minutes. You do not need to login again to continue to navigate through the Management System. You will

be prompted for a password when you request a parameter change after your session has timed-out.

NOTE: Path to menu item shown in bold text below step.

Procedure

1. Verify the iNET Remote is associated with an Access Point unit. Observe the condition of the LINK LED.

LINK LED = On or Blinking

This will indicate that you have an adequate signal level for the measurements and it is safe to proceed.

2. Place the Access Point unit into the Radio Test Mode.
Main Menu>Diagnostic Tools>Radio Test>Test Mode>Y>ON

Verify the frequency is the same as that which will be used at the Remote.

3. Turn on the Access Point transmitter.
Main Menu>Diagnostic Tools>Radio Test>Test Mode>TxKey>Enable

User the spacebar to key and unkey the transmitter ON and OFF. (Enable/Disable)

4. Place the Remote in the Radio Test Mode.
Main Menu>Diagnostic Tools>Radio Test>ON

Verify the frequency is the same as that used at the Access Point.

5. Read the RSSI level at the Remote.
Main Menu>Diagnostic Tools>Radio Test>RSSI

6. Optimize RSSI (less negative) by adjusting direction of antenna.

7. Turn off Radio Test Mode at the Access Point
Main Menu>Diagnostic Tools>Radio Test>Test Mode>Disable

End of procedure

Method 2—Adding iNET units to an existing network

Background

This method will not disrupt traffic through other iNET units in the network and does not require the Access Point's operating state to be changed.

If the Access Point is left on-line in an associated state with other iNET units in the network, the iNET Remote under test will not be able to differentiate the signals received from the Access Point and any other radio signal sources in the 900 MHz band. This could lead to confusion and possibly misdirecting of the antenna.

Procedure

1. Verify the iNET Remote is associated with an Access Point unit. Observe the condition of the LINK LED.
LINK LED = On or Blinking

This will indicate that you have an adequate signal level for the measurements and it is safe to proceed.

2. View and record the bit-error rate (BER).
Main Menu>Performance Information>Bit-Error Rate

This information will be used later.

3. Read the RSSI level at the Remote.
Main Menu>Performance Information>RSSI by Zone

4. Optimize RSSI (less negative) by slowly adjusting direction of antenna.

Watch the RSSI indication for several seconds after making each adjustment so that the RSSI accurately reflects the link signal strength.

5. View and record the bit-error rate (BER) at the point of maximum RSSI level. The BER should be the same or better than the previous reading. If not, the antenna may be aimed at an undesired signal source.
Main Menu>Performance Information>Bit-Error Rate

End of procedure

TROUBLESHOOTING

It is best to begin troubleshooting at the Access Point station, as the rest of the system depends on the Access Point for network synchronization and configuration. If the Access Point station has problems, the operation of the entire network will be affected.

All radios in the network must meet these basic requirements:

- Adequate and stable primary power
- An efficient and properly aligned antenna system
- Secure connections (RF, data & power)
- Proper programming of the radio's operating parameters, especially Device Mode selection (Access Point/Remote), Network Name, and often IP Network Address
- The correct interface between the radio and the connected data equipment (proper cable wiring, data format and timing).

Table 2 on page 15 provides suggestions for resolving common system difficulties. If problems persist, review the MDS Web site's technical support area for recent software/firmware updates, general troubleshooting help, and service information. Additional help is available through the MDS Customer Service Department. (See "TECHNICAL ASSISTANCE" on page 18.)

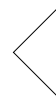
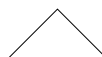
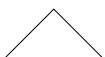
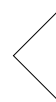


Table 2. Troubleshooting Techniques

Difficulty	Problem/Recommended System Checks
The PWR LED does not turn on.	<ul style="list-style-type: none"> a. Voltage too low.—Check for the proper supply voltage at the power connector. b. Microprocessor Locked Up—Cycle the power and wait for the unit to reboot. (≈ 30 seconds)
Interference is suspected.	<ul style="list-style-type: none"> a. If omnidirectional antennas are used, consider changing to directional antennas. This will often limit interference to and from other stations. b. The installation of a filter in the antenna feedline may be necessary. Consult the factory for further assistance.
The LINK LED does not turn on.	<ul style="list-style-type: none"> a. Network Name of Remote not identical to desired Access Point—Verify that the system has a unique Network Name. b. A nearby system (Access Point unit) with the same Network Name causing interference. a. Not yet associated with an Access Point. Check the “Status” of the unit’s process of associating with the Access Point. Use the <i>i</i>NET Management System. d. Loose Connection—Check for secure interface connections at the radio and the connected device. c. Poor Antenna System—Check the antenna, feedline and connectors. Reflected power should be less than 10% of the forward power reading (SWR ≈2:1 or lower).
Cannot pass IP data to WAN.	<ul style="list-style-type: none"> a. Use the PING command to test communication with <i>i</i>NET units in the local radio system. b. If successful with local PING, attempt to PING an IP unit attached to an <i>i</i>NET radio. c. If successful with the LAN PINGs, try connecting to a known unit in the WAN.



FUSE REPLACEMENT PROCEDURE

The iNET unit is protected by an internal fuse. The fuse will be blown by a reverse polarity of the primary DC power, an over-voltage transient or an internal failure. The fuse should not be replaced until you are certain you are in a safe environment

1. Remove the iNET unit from service.
2. Disconnect the primary power source and all other connections to the unit.
3. Place the iNET unit on its back and remove the four Phillips screws at the corners of the bottom cover.
4. Carefully separate the top and bottom covers. There is a flat ribbon cable between the top cover's LEDs and the unit motherboard. You do not need to disconnect the ribbon cable.
5. Locate the fuse and fuse holder between the COM1 port and the power connector. Figure 2 is a photograph of the fuse assembly.
6. Loosen the fuse from the holder using a very small screwdriver. Use a small pair of needle-nose pliers to pull the fuse straight up and remove it.
7. Install a new fuse by reversing the process.

Littelfuse P/N: 0454002; 452 Series, 2 Amp SMF Slo-Blo
(MDS P/N: 29-1784A03)

8. Replace the covers, interface cables and check the iNET unit for proper operation.

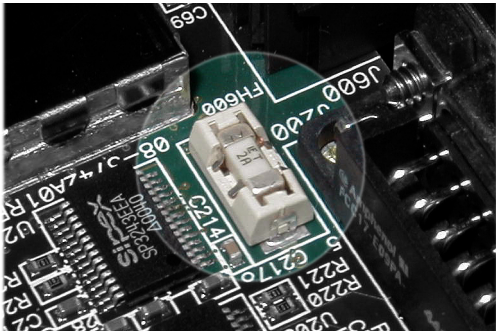


Figure 2. Fuse Location

iNET SPECIFICATIONS

GENERAL

Temperature Range:	-30°C to +70°C (-22° F to 158° F)
Humidity:	95% at +40°C (104° F); non-condensing
Primary Power:	10.5–30 Vdc (13.8 Vdc Nominal)
External Power Supply Options:	48 Vdc; 110–120/210–220 Vac
Supply Current (typical):	(@1 Watt RF Output)
Transmit:	500 mA @ 13.8 Vdc
Size (Excluding mtg. hardware):	1.5" x 6" x 4" (H x W x D) 3.8 x 15.2 x 10.2 cm
Weight:	0.9 kg / 2 lb
Case:	Cast Aluminum
Shock and Vibration:	Meets MIL STD 202F, 810E, 202D

RADIO CHARACTERISTICS

GENERAL:

Frequency Range:	902–928 MHz ISM Band
Mode:	Freq. Hopping Spread-Spectrum (FHSS)

TRANSMITTER:

Power Output (at antenna connector):	0.1 to 1.0 watt (+20 dBm to +30 dBm) Increments of 1.0 dB, set <i>by user</i>
Duty Cycle:	Continuous
Output Impedance:	50 Ohms

RECEIVER:

Type:	Double conversion superheterodyne
Sensitivity:	-92 dBm @ 512 kbps < 1x10 ⁻⁶ BER -100 dBm @ 256 kbps < 1x10 ⁻⁶ BER
Time Required to Synchronize with Access Point:	< 1.4 minutes after boot (typical)

TECHNICAL ASSISTANCE

Technical assistance for MDS products is available from our Customer Support Team during business hours (8:00 A.M.–5:30 P.M. Eastern Time). When calling, please give the complete model number of the radio, along with a description of the trouble symptom(s) that you are experiencing. In many cases, problems can be resolved over the telephone, without the need for returning the unit to the factory.

Telephone 1+ 585-242-8510 for product assistance or visit the technical support area of the Microwave Data Systems' Web site at www.microwavedata.com.

FACTORY SERVICE

If return of the equipment is necessary, please contact the MDS Customer Support Team. You will be issued a Returned Material Authorization (RMA) number. The RMA number will help expedite the repair so that the equipment can be repaired and returned to you as quickly as possible. Please be sure to include the RMA number on the outside of the shipping box, and on any correspondence relating to the repair. *No equipment will be accepted for repair without an RMA number.*

A statement should accompany the radio describing, in detail, the trouble symptom(s), and a description of any associated equipment normally connected to the radio. It is also important to include the name and telephone number of a person in your organization who can be contacted if additional information is required.

The radio must be properly packed for return to the factory. The original shipping container and packaging materials should be used whenever possible. All factory returns should be addressed to:

Microwave Data Systems Inc.
Customer Service Department
(RMA No. XXXX)
175 Science Parkway
Rochester, NY 14620 USA

When repairs have been completed, the equipment will be returned to you by the same shipping method used to send it to the factory. Please specify if you wish to make different shipping arrangements.

