Reference Manual

MDS Mercury Series™

MDS MERCURY 900
MDS
PWR
LAN
COM1
GPS
LINK
WARNING - Do not disconnect while circuit is live unless area is known to be nonhazardous.
PWR
LAN
COM1
RX2
TX/RX1

Wireless IP/Ethernet Transceiver

Covering all AP and Remote Units
including Mercury 900, 3650, and Option Set 1 Remotes

05-4446A01, Rev. D
DECEMBER 2008

GE MDS
industrial wireless networks

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Copyright Notice

ISO 9001 Registration

GE MDS adheres to the internationally-accepted ISO 9001 quality system standard.

To our Customers

We appreciate your patronage. You are our business. We promise to serve and anticipate your needs. We will strive to give you solutions that are cost effective, innovative, reliable and of the highest quality possible. We promise to build a relationship that is forthright and ethical, one that builds confidence and trust.

Related Materials on the Internet—Data sheets, frequently asked questions, case studies, application notes, firmware upgrades and other updated information is available on the GE MDS Web site at www.GEmds.com.

About GE MDS

Over two decades ago, GE MDS began building radios for business-critical applications. Since then, we have installed thousands of radios in over 110 countries. To succeed, we overcame impassable terrain, brutal operating conditions and disparate, complex network configurations. We also became experts in wireless communication standards and system applications worldwide. The result of our efforts is that today, thousands of utilities around the world rely on GE MDS-based wireless networks to manage their most critical assets.

The majority of GE MDS radios deployed since 1985 are still installed and performing within our customers' wireless networks. That’s because we design and manufacture our products in-house, according to ISO 9001 which allows us to control and meet stringent global quality standards.

Thanks to our durable products and comprehensive solutions, GE MDS is the wireless leader in industrial automation—including oil and gas production and transportation, water/wastewater treatment, supply and transportation, electric transmission and distribution and many other utility applications. GE MDS is also at the forefront of wireless communications for private and public infrastructure and online transaction processing. Now is an exciting time for GE MDS and our customers as we look forward to further demonstrating our abilities in new and emerging markets.

As your wireless needs change you can continue to expect more from GE MDS. We'll always put the performance of your network above all. Visit us at www.GEmds.com for more information.

OPERATIONAL & SAFETY NOTICES

RF Exposure
(900 MHz models)

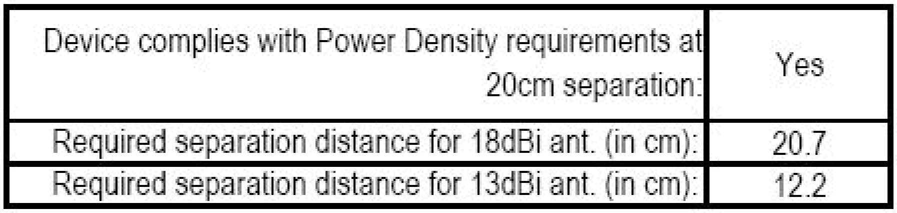
Professional installation required. The radio equipment described in this guide emits radio frequency energy. Although the power level is low, the concentrated energy from a directional antenna may pose a health hazard. Do not allow people to come closer than 23 cm (9 inches) to the antenna when the transmitter is operating in indoor or outdoor environments. More information on RF exposure is on the Internet at www.fcc.gov/oet/info/documents/bulletins.

To meet co-location requirements, the FCC requires a 20cm (7.87 inch) separation distance between the unit’s WIFI and fundamental antenna installations.

RF Exposure
(3650 MHz models)

Professional installation required. The transceiver described here 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 20.7 cm (8.15 inches) to the antenna when the transmitter is operating. This calculation is based on an 18 dBi panel antenna. Refer also to the table below, which lists required separation distances. Additional information on RF exposure is available on the Internet at www.fcc.gov/oet/info/documents/bulletins.

To meet co-location requirements, the FCC requires a 20cm (7.87 inch) separation distance between the unit’s WIFI and fundamental antenna installations.



Device complies with Power Density requirements at 20cm separation:	Yes
Required separation distance for 18dBi ant. (in cm):	20.7
Required separation distance for 13dBi ant. (in cm):	12.2

CSA/us Notice (Remote Transceiver Only)

This product is approved 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 the Canadian Standards Association (CSA) which also issues the US mark of approval (CSA/US). The CSA Certification is in accordance with CSA STD C22.2 No. 213-M1987.

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:

The transceiver must be mounted within a separate enclosure which is suitable for the intended application.

The antenna feedline, DC power cable and interface cable must be routed through conduit in accordance with the National Electrical Code.

Installation, operation and maintenance of the transceiver should be in accordance with the transceiver's installation manual, and the National Electrical Code.

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

A power connector with screw-type retaining screws as supplied by GE MDS must be used.

⚠ WARNING

EXPLOSION HAZARD!

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

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 Part 15 Notices

The transceiver series complies 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. This device is specifically designed to be used under Section 15.247 of the FCC Rules and Regulations. Any unauthorized modification or changes to this device without the express approval of Microwave Data Systems may void the user's authority to operate this device. Furthermore, the Mercury Series 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.

Part 15 rules also require that the Effective Isotropic Radiated Power (EIRP) from a Mercury Series installation not exceed 36 dBm. Refer to this manual for more information.

Industry Canada RSS Notices

Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

To reduce potential radio interference to other users, the antenna type and its gain should be chosen so that the Equivalent Isotropic Radiated Power (EIRP) is not more than that permitted for successful communication.

This device has been designed to operate with the antennas listed on Page 170 and 171. Antennas not included in this list are strictly prohibited for use with this device. The required antenna impedance is 50 ohms.

Manual Revision and Accuracy

This manual was prepared to cover a specific version of firmware code. Accordingly, some screens and features may differ from the actual unit you are working with. While every reasonable effort has been made to ensure the accuracy of this guide, product improvements may also 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. In addition, manual updates can often be found on the GE MDS Web site at www.GEmds.com.

Environmental Information

The manufacture of this equipment has required the extraction and use of natural resources. Improper disposal may contaminate the environment and present a health risk due to hazardous substances contained within. To avoid dissemination of these substances into our environment, and to limit the demand on natural resources, we encourage you to use the appropriate recycling systems for disposal. These systems will reuse or recycle most of the materials found in this equipment in a sound way. Please contact GE MDS or your supplier for more information on the proper disposal of this equipment.

1 PRODUCT OVERVIEW AND APPLICATIONS

Contents

1.1 ABOUT THIS MANUAL

This *Reference Manual* is one of two publications provided for users of the Mercury Series™ transceiver system. It contains detailed product information, an overview of common applications, a screen-by-screen review of the menu system, technical specifications, suggested settings for various scenarios, and troubleshooting information. This manual should be available to all personnel responsible for network design, setup, commissioning and troubleshooting of the radios.

1.1.1 Start-Up Guide

The Mercury Series *Start-Up Guide* (Part No. 05-4558A01) is a companion publication to the Reference Manual. It is a smaller book, with a specific purpose—to guide an installer in the basic steps for getting a transceiver on the air and communicating with other units in a network. It provides only the essential information installers need for getting their equipment up and running in the shortest time possible.

1.1.2 Online Access to Manuals

In addition to printed manuals, many users need access to documents electronically. This is especially useful when you need to access documentation while traveling, or want to share a document with another user in the field. Electronic documents also allow searching for a specific term or subject, especially in larger manuals.

Access manuals for our equipment anytime from our Web site at **www.GEmds.com**. Simply click the **Downloads** tab at the top of the home page and select **Product Manuals** from the drop-down list. A search window appears to help you locate the manual you need.

Online manuals are provided as PDF files in the Adobe® Acrobat® standard. If necessary, download the free reader for PDF files from **www.adobe.com**.

1.1.3 Conventions Used in This Manual

On-Screen Menu Items

On-screen menu items or command entries are presented in a distinctive font to set them apart from regular text (for example: **Network Name**, **IP Address**, **Password**). You will find this font most often in Chapter 3, where the menu system is discussed in detail. When variable settings or a range of options are available for a menu option, the items are presented inside brackets, with the default setting (if any) shown last after a semicolon:

[**available settings or range; default setting**]

Menu Strings

To help show the path to a menu selection, navigation strings are used in several places in this manual. For example, suppose you want to view or set the Network Name assigned to your system. This item is located in the Network Configuration Menu, so the navigation string in the text would appear as shown:

Main Menu>>Network Configuration>>Network Name

By following this order of menus, you can quickly reach the desired menu.

1.2 PRODUCT DESCRIPTION

The GE MDS Mercury Series™ transceiver (Figure 1-1) is an easy-to-install wireless solution offering extended range, secure operation, and multi-megabit performance in a compact and rugged package. The transceiver is ideally suited for demanding applications in fixed or mobile environments, where reliability and range are paramount.

The transceivers are commonly used to convey text documents, graphics, e-mail, video, Voice over IP (VoIP), and a variety of other application data between mobile, fixed-point, and WAN/LAN-based entities.

Based on multi-carrier Orthogonal Frequency Division Multiplexing (OFDM), the transceiver features high speed/low latency, basic Quality of Service (QoS) for prioritizing traffic, Ethernet and serial encapsulation, and network roaming. It also provides enhanced security features including AES encryption and IEEE 802.1x Device Authentication, making the Mercury system the best combination of security, range, and speed of any industrial wireless solution on the market today.

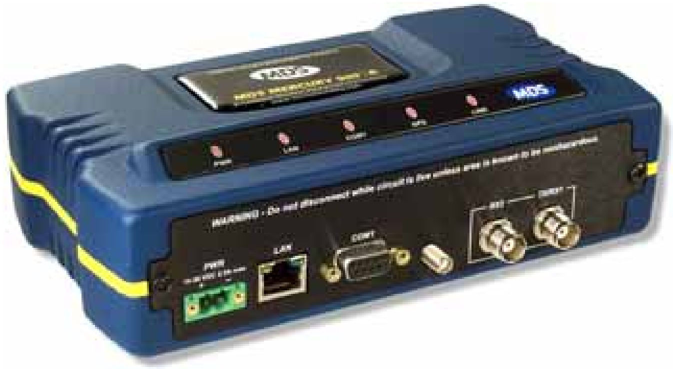


Figure 1-1. The GE MDS Mercury Series™ Transceiver
(Remote unit shown, AP similar in appearance)

Rugged Packaging The transceivers are housed in a compact and rugged die cast-aluminum case that need only be protected from direct exposure to the weather.

This one enclosure contains all necessary components for radio operation and data communications.

Simple Installation

Mercury Transceivers are designed for rapid and trouble-free installation. For basic services, you simply connect the antennas (900 or 3650 MHz as required, and GPS), connect your data equipment, apply primary power, and set some operating parameters. No license is required for 900 MHz operation in the USA, Canada, and many other countries. A simple registration process is required for 3650 MHz operation in the USA. Check requirements for your region before placing the equipment into service.

Most installations employ an omni-directional antenna at the Access Point (AP) location and mobile stations. Fixed Remote stations often employ a directional antenna aimed at the AP. Regardless of the type used, antennas are a vital part of the system and must be chosen and installed correctly. Refer to *INSTALLATION PLANNING* on Page 161 for guidance on choosing suitable antennas and installation sites.

Secure Operation

Data network security is a vital issue in today's wireless world. Mercury transceivers provide multiple tools to help you build a network that minimizes the risk of eavesdropping and unauthorized access. Some are inherent in the radio's operation, such as the use of 900 MHz spread-spectrum transmissions; others include AES data encryption, enabling/disabling channels, IEEE 802.1X port blocking, approved device lists, secure devices management protocols, and password protection.

Security is not a one-step process that can simply be turned on and forgotten. It must be practiced and enforced at multiple levels, 24 hours-a-day and 7 days-a-week. See *"GE MDS CYBER SECURITY SUITE"* on Page 17 for more information about the transceiver's security tools.

Robust Radio Operation

The transceivers are designed for operation in the 900 MHz license-free Industrial, Scientific, and Medical (ISM) band and the 3650-3700 MHz registered band. They provide consistent, reliable coverage over a large geographic area.

Mobile range depends on many factors, including terrain, building density, antenna gain, and speed of travel. The unit is designed for successful application in a variety of mobile environments, and offers the best combination of range, speed and robustness available in an industrial wireless package today. By using multiple Access Points, a network can be created that provides consistent, reliable coverage over a large metropolitan area. See *"SPECIFICATIONS"* on Page 176 for more information on transmission range.

Flexible Services

Users with a mix of equipment having Ethernet and serial data interfaces can use this equipment via a Remote transceiver. The transceiver provides services in data networks that are migrating from legacy serial/EIA-232-based hardware to the faster and more easily interfaced Ethernet protocol.

Flexible Management

You can locally or remotely configure, commission, troubleshoot, and maintain the transceiver. Four different modes of access are available: local RS-232 console terminal, local or remote IP access (via Telnet or SSH), web browser (HTTP, HTTPS), and SNMP (v1/v2/v3) All IP access interfaces are available through the unit's wired Ethernet port and over the air.

The text-based interfaces (RS-232 console, Telnet, and SSH) are implemented in the form of easy-to-follow menus, and the terminal server provides a wizard to help you configure the units correctly.

Transceiver Features

The transceiver's design makes the installation and configuration easy, while allowing for future changes.

- Industrial-Grade Product—Extended temperature range for trouble-free operation in extreme environments.
- Robust Radio Communications—Designed to operate over long distances in dense, high-interference environments.
- Robust Network Security—Prevents common attack schemes and hardware from gaining access or control of the network. Common attack events are logged and reported by alarms.
- Transmission Speed—Operation at 1.5 Mbps is over 100-times faster than 9.6 kbps radios.
- Plug-and-Play Connectivity—AP or Remote configuration requires minimal setup.
- Built-in GPS Receiver—GPS technology is used for timing and location data. The only external equipment needed for this functionality is a GPS antenna available from GE MDS).

1.2.1 Model Offerings

The transceiver comes in two primary models—Access Point and Remote. Unique hardware is used for each model. Of the Remote radios, there are two sub-types available—**Standard Remote** and **Remote with Option Set 1**, both of which support Ethernet and serial services. Table 1-1 summarizes each radio's interface services.

Table 1-1. Transceiver Models and Data Interface Services

Model	Sub-Type	Ethernet/LAN[1]	COM1[1]	USB	Integrated WiFi
Access Point	N/A	Yes	Yes	No	No
Remote	Standard Remote	Yes	Yes	No	No
	Remote w/Option 1 Set	Yes	Yes	Yes	Yes

NOTES
1. COM1 provides access to the embedded Management System for all units.

Available Frequency Bands

At the time of publication, Mercury transceivers are offered in two different frequency bands: 902-928 MHz (Mercury 900) and 3.65–3.70 GHz (Mercury 3650). The 900 MHz unit operates in a license-free spectrum (frequency hopping spread spectrum—FHSS), which may be used by anyone in the USA, provided FCC Part 15 rules are observed. Canada, and certain other countries allow license-free operation in this band—check your country's requirements.

The 3.65–3.70 GHz radio operates in a "registered" band using contention-based protocol, which provides additional protection from interference, but it requires FCC registration before operation can begin. Other restrictions may apply based on your location and "grandfathered" FSS users. Check local requirements before operation. GE MDS has published a whitepaper containing frequently asked questions about the 3.65–3.70 GHz band. To obtain a copy, request publication 05-4734A02.

Operationally, the Mercury 3650 has two key differences from the Mercury 900: First, it operates on a different RF band (3.65–3.70 GHz). Second, it only requires GPS for TDD synchronization of the Access Points, which may or may not be needed for an installation.

Access Point or Remote?—Identification Tip

The outward appearance of AP and Remote radios is nearly identical, however, the hardware for each type is different and they are *not* interchangeable. An quick way to identify them is to observe the color of the gasket seal in the center of the radio case. **APs have a black gasket, while Remote units have a yellow gasket.**

In addition to gasket color, a label on the top of each radio identifies it as an AP or Remote unit. If the label shows an *—A*suffix, it is an AP. If it shows a *—R*suffix, it is a Remote.

1.2.2 Remote Radio with Option Set 1

The "Option Set 1" Remote is similar to and compatible with the standard Mercury Remote. It contains the same 900 MHz radio, user interface, and primary functionality as the Standard Remote. The Standard Remote can be *directly replaced* with the Option Set 1 Remote. The key differences are the additional physical interfaces: an IEEE 802.11b/g WiFi networking module, a USB device port, a USB host port, and a second Ethernet port on the radio enclosure.

The USB ports are used for device management. The host port accepts a flash drive and can be used to transfer firmware and configuration files. The two Ethernet ports are connected to an internal, integrated switch and included in the Layer 2 bridge.

The internal WiFi module has FCC modular approval and may only be operated by connecting one of the GE MDS approved antennas (see *802.11 WiFi Module Specifications* below) to the reverse-SMA connector on the radio's front panel. The WiFi module can operate as an 802.11 Access Point or Infrastructure Station, according to user configuration. The operational mode (**AP**, **Infrastructure RM**) and frequency can be configured through the unit's user interface.

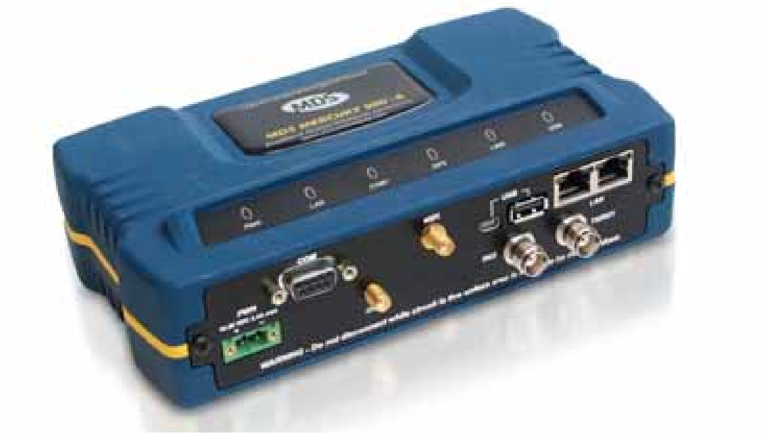


Figure 1-2. Mercury Remote with Option Set 1 (MaxRM)
(Note interface connector differences from Standard Remote)

802.11 WiFi Module Specifications

The specifications listed below are unique to Remotes with Option 1 Set, which contain a 2.4 GHz WiFi module. *SPECIFICATIONS* on Page 176 contains a complete list of general Mercury Series specifications.

Protocol:	IEEE 802.11b/g OFDM 6 to 54Mbps, CCK 1 to 11Mbps
Frequency Range:	2400 to 2500MHz
Maximum Transmit Power:	15 dBm
Permissible Antennas:	PCTEL: BMLPV2400NGP Sagrad: W1037 Sagrad: W1038
FCC:	Part 15C
FCC ID:	VRA-SG9011028
WiFi Antenna Connector:	Female Reverse SMA

1.2.3 GE MDS P23 Protected Network (Redundant) Configuration

For mission-critical applications, a Protected Network Station is also offered. This unit incorporates two Access Points, two power supplies, and a switchover logic board that automatically selects between Transceiver A and Transceiver B as the active radio. Figure 1-3 shows the protected chassis. For system-level information on this product, refer to MDS publication 05-4161A01.

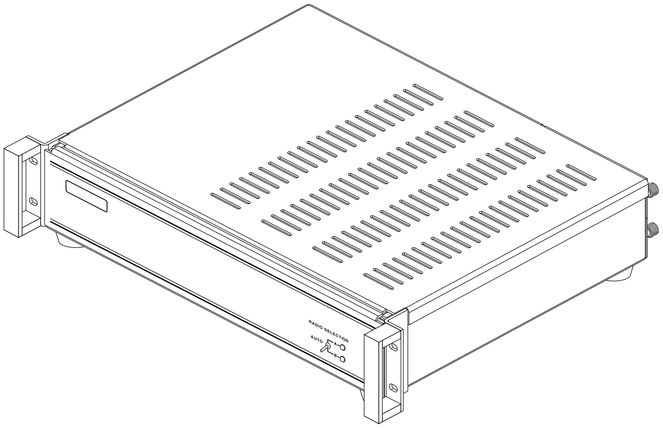


Figure 1-3. MDS P23 Protected Network Station
(incorporates two transceivers, with automatic switchover)

1.2.4 External GPS PPS Option

The External GPS Precise Positioning Service (PPS) option allows for an external GPS device to provide the PPS input to the Mercury. This is useful in installations where multiple radios require GPS timing. This option prevents each Mercury from requiring its own GPS antenna. Refer to the electrical specifications in the *External GPS PPS Option* section on Page 178. This option is only available in hardware revision 1.0.2 or later.

1.3 APPLICATIONS

The following sections provide illustrations of typical transceiver installations. This is an overview only. A Network Administrator should be involved in all installation planning activities.

1.3.1 Mobile/Fixed Data System

Mercury transceivers support high-speed data communications in a mobile environment. In this application, Remote radios “roam” between different Access Points, providing seamless transitions and continuous coverage throughout a municipal area. Figure 1-4 shows an example of an integrated system employing both mobile and fixed Mercury transceivers.

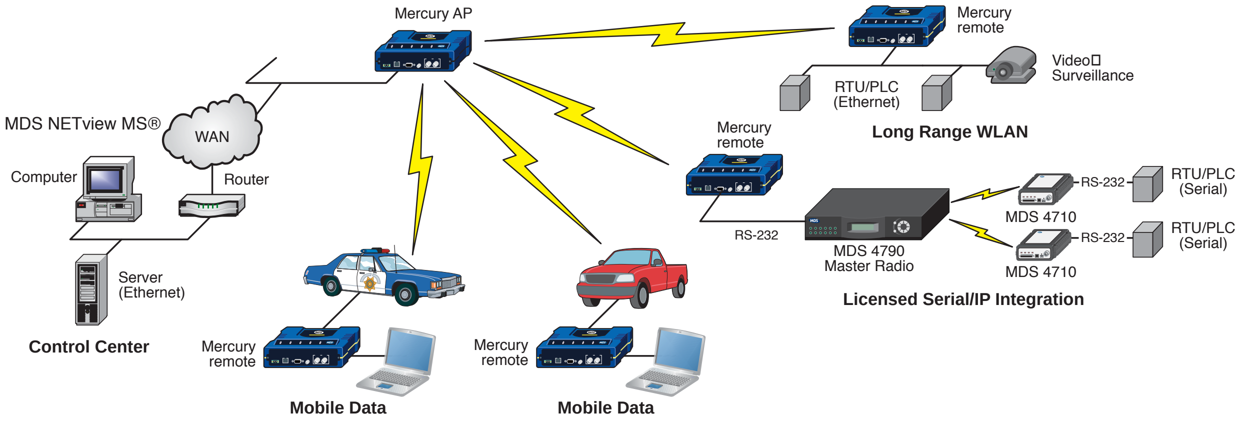


Figure 1-4. Integrated Mobile/Fixed Application

1.3.2 Wireless LAN

The wireless LAN is a common application of the transceiver. It consists of a central control station (Access Point) and one or more associated Remote units, as shown in Figure 1-5. A LAN provides communications between a central WAN/LAN and remote Ethernet segments. The operation of the radio system is transparent to the computer equipment connected to the transceiver.

The Access Point is positioned at a location from which it communicates with all Remote units in the system. Commonly, this is a high location on top of a building or communications tower. Messages are exchanged at the Ethernet level. This includes all types of IP traffic.

A Remote transceiver can only communicate over-the-air to an Access Point (AP). Peer-to-peer communications between Remotes can only take place indirectly via the AP. In the same fashion, an AP can only communicate over-the-air to associated Remote units. Exception: Two APs can communicate with each other “off-the-air” through their Ethernet connectors using a common LAN/WAN.

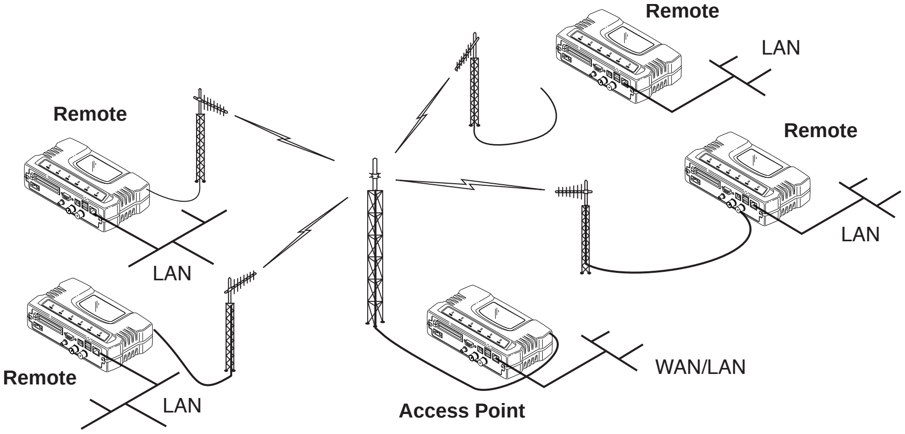


Figure 1-5. Typical Wireless LAN

1.3.3 Point-to-Point LAN Extension

A point-to-point configuration (Figure 1-6) is a simple arrangement consisting of an Access Point and a Remote unit. This provides a communications link for transferring data between two locations.

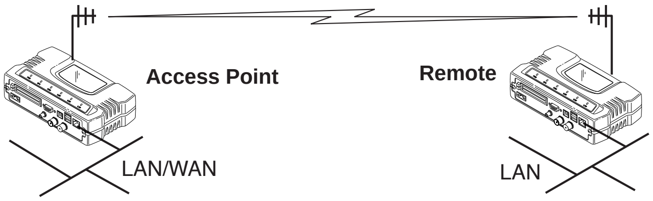


Figure 1-6. Typical Point-to-Point Link

1.3.4 Serial Radio Network Connectivity

The transceiver provides a path for serial devices to migrate to IP/Ethernet systems. Many radio networks in operation today still rely on serial networks at data rates of 9600 bps or less. These networks can use the transceiver as a means to continue using the serial service, while allowing the infrastructure to migrate to an IP format.

A Remote transceiver with its serial port connected to a GE MDS serial-based radio, such as the MDS x790/x710, MDS TransNET and others, provides a path for bringing the data from the older radio into the IP/Ethernet environment of a Mercury-based system.

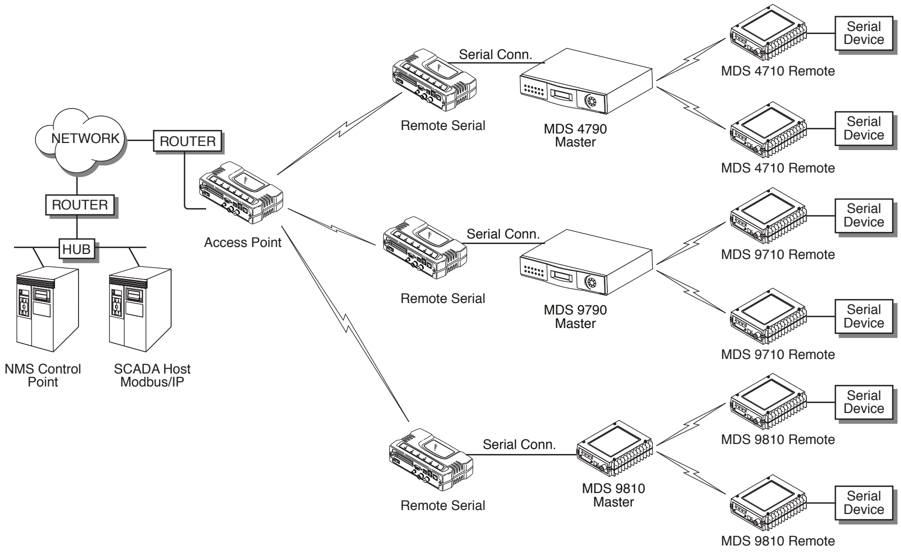


Figure 1-7. Backhaul Network

1.3.5 Multiple Protocols and/or Services

Prior to the introduction of Ethernet/IP-based radios, two radios were often used to service two different types of devices (typically connected to different SCADA hosts). A Mercury radio provides this capability using a single remote unit. The unit's serial port can be connected via IP to different SCADA hosts, transporting different (or the same) protocols. Both data streams are completely independent, and the transceiver provides seamless simultaneous operation as shown in Figure 1-8.

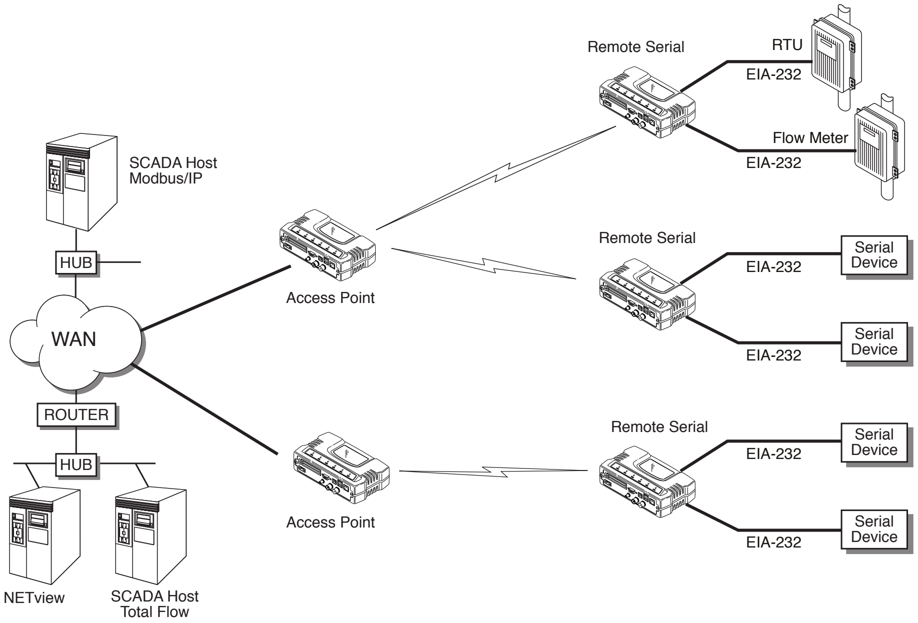


Figure 1-8. Multiple Protocol Network

By using a single radio, the cost of deployment is cut in half. Beyond requiring only one radio instead of two, the biggest cost reduction comes from using half of the required infrastructure at the remote site: one antenna, one feedline, one lightning protector and ancillary hardware. Other cost reductions come from the system as a whole, such as reduced management requirements. And above all, the radio provides the potential for future applications that run over Ethernet and IP, such as video for remote surveillance.

1.3.6 Wireless LAN with Mixed Services

The transceiver is an excellent solution for a long-range industrial wireless LAN. It offers several advantages over commercial solutions, primarily improved performance over extended distances. The rugged construction of the radio and its extended temperature range make it an ideal solution even in harsh locations. In extreme environments, a simple NEMA enclosure is sufficient to house the unit.

The transceiver trades higher speed for longer range. Commercial 802.11a/b/g solutions are designed to provide service to relatively small areas such as offices, warehouses and homes. They provide high data rates but have limited range. The Mercury transmits at a higher power level, uses a different frequency band, has higher sensitivity, and a narrower channel to concentrate the radio energy, reaching farther distances. It is designed for industrial operation from the ground up.

IP-based devices that may be used with the transceiver include new, powerful Remote Terminal Units (RTUs) and Programmable Logic Controllers (PLCs). These, as well as other devices, may be used in applications ranging from SCADA/telemetry monitoring, web-based video, security monitoring, and Voice over IP. Figure 1-9 shows a typical wireless IP network.

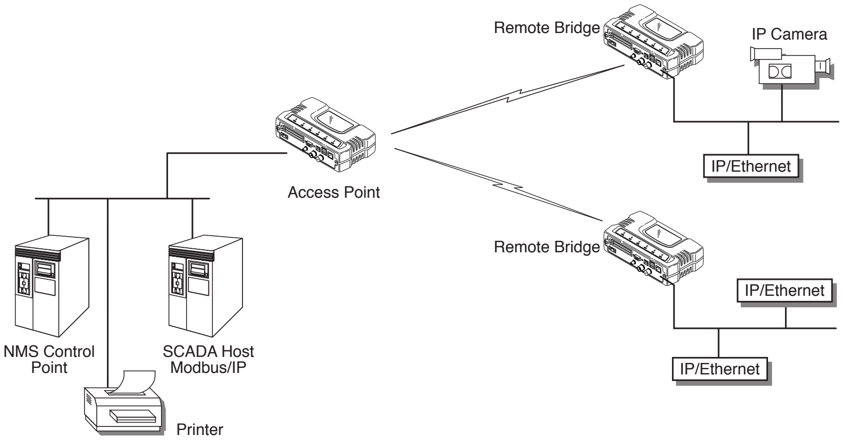


Figure 1-9. Extended-Range LAN with Mixed Applications

1.3.7 Upgrading Older Wireless Network with Serial Interfaces

Millions of wireless data products have been installed in the last two decades for licensed and license-free operation, many of them manufactured by GE MDS. There are several ways that these systems can benefit from incorporating Mercury equipment. The chief advantages are interface flexibility (serial and Ethernet in one unit), and higher data throughput. By taking advantage of its built-in serial and Ethernet interfaces, the transceiver is well suited to replace leased lines, dial-up lines, or existing “multiple address” data transceivers.

Replacing Legacy Wireless Products

In most cases, legacy radio transceivers supporting serial-interface equipment can be replaced with Mercury transceivers. Legacy equipment can be connected to the transceiver through the COM1 port with a DB-25 to DB-9 cable wired for EIA-232 signaling. The COM1 port acts as a Data Communications Equipment (DCE) port.

NOTE: Several previous GE MDS-brand products had non-standard signal lines on their interface connectors (for example, to control sleep functions and alarm lines). These special functions are not provided nor supported by the Mercury transceiver. Consult equipment manuals for complete pinout information.

1.4 NETWORK DESIGN CONSIDERATIONS

1.4.1 Extending Network Coverage with Repeaters

What is a Repeater System?

A repeater works by re-transmitting data from outlying remote sites to the Access Point, and vice-versa. It introduces some additional end-to-end transmission delay but provides longer-range connectivity.

In some geographical areas, obstacles can make communications difficult. These obstacles are commonly large buildings, hills, or dense foliage. These obstacles can often be overcome with a repeater station.

Option A—Using two transceivers to form a repeater station (back-to-back repeater)

Although the range between fixed transceivers can be up to 40 km (25 miles) over favorable terrain, it is possible to extend the range considerably by connecting two units together at one site in a "back-to-back" fashion, creating repeater as shown in Figure 1-10. Use this arrangement whenever the objective is to utilize the maximum range between stations. In this case, using high-gain Yagi antennas at each location provides more reliable communications than their counterparts—omnidirectional antennas.

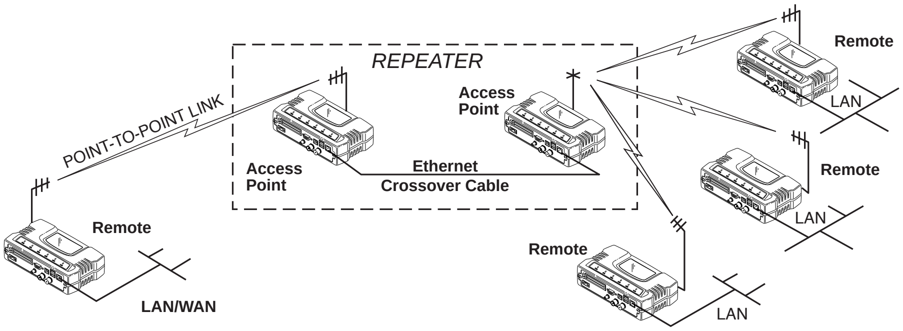


Figure 1-10. Typical LAN with a Repeater Link

Overview

Two transceivers may be connected "back-to-back" through the LAN ports to form a repeater station. If the transceivers are connected directly to each other, you must use an Ethernet cross-over cable. This configuration is sometimes required in a network that includes a distant Remote that would otherwise be unable to communicate directly with the Access Point station due to distance or terrain.

The geographic location of a repeater station is especially important. Choose a site that allows good communication with *both* the Access Point and the outlying Remote site. This is often on top of a hill, building, or other elevated terrain from which both sites can be "seen" by the repeater station antennas. A detailed discussion on the effects of terrain is given in Section 5.1.2, *Site Selection* (beginning on Page 162).

The following paragraphs contain specific requirements for repeater systems.

Antennas

Two antennas are required at this type of repeater station—one for each radio. You must take measures to minimize the chance of interference between these antennas. One effective technique for limiting interference is to employ *vertical separation*. In this arrangement, assuming both antennas are vertically polarized, one antenna is mounted *directly* over the other, separated by at least 10 feet (3 meters). This takes advantage of the minimal radiation exhibited by most antennas directly above and below their driven elements.

Another interference reduction technique is to cross-polarize the repeater antennas. If one antenna is mounted for polarization in the vertical plane, and the other in the horizontal plane, an additional 20 dB of attenuation is achieved. The corresponding stations should use the same antenna orientation when cross-polarization is used.

Network Name

The two radios that are wired together at the repeater site *must* have different network names. For information on how to set or view the network names, see *"STEP 3—CONNECT PC TO THE TRANSCEIVER"* on Page 25.

TDD Sync Mode

To avoid interference between the two APs that form a repeater station, they should be synchronized so that they will transmit at the same time and receive at the same time. This eliminates the possibility of one AP transmitting while another is trying to receive.

This can be accomplished by setting the **TDD Sync Mode** parameter in the **Frequency Configuration** menu to **GPS Required**. See *Frequency Control Menu* on Page 65 for details.

Option B—Using the AP as a Store-and-Forward Packet Repeater

You can extend a wireless network by using the Access Point as a repeater to re-transmit the signals of all stations in the network. (See Figure 1-11 on Page 16.)

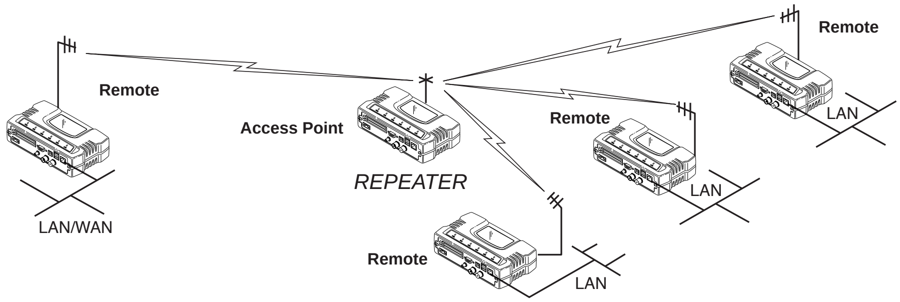


Figure 1-11. Typical Store-and-Forward Repeater Arrangement

As with the conventional repeater described in Option 1 above, the location of a store and forward repeater is also important. A site must be chosen that allows good communication with *both* the Access Point and the outlying Remote site. This can be on the top of a hill, building, or other elevated terrain from which all sites can be "seen" by the repeater station antenna. A detailed discussion on the effects of terrain is given in Section 5.1.2, *Site Selection* (beginning on Page 162).

1.4.2 Protected Network Operation using Multiple APs

Although GE MDS transceivers have a very robust design and have undergone intensive testing before being shipped, it is possible for isolated failures to occur. In mission-critical applications, down time can be virtually eliminated by using some, or all, of the following configurations:

In a point-to-multipoint scenario, the Access Point services multiple remotes. A problem in the Access Point will have an effect on all remotes, since none will have access to the network. When operation of the network does not tolerate any down time, it is possible to set up a protected configuration for the Access Point to greatly reduce the possibility of this occurrence.

Two or more Access Points can be configured identically, each with its own independent antenna. In this scenario, Remotes will associate with one of the available Access Points. In case of a failure of that AP, the Remotes will quickly associate with another Access Point, re-establishing connectivity to the end devices. Because only one Access Point operates at any given time, collisions between APs is not possible.

1.4.3 Collocating Multiple Radio Networks

Many networks can operate in relatively close physical proximity to one another provided reasonable measures are taken to assure the radio signal of one Access Point is not directed at the antenna of the second Access Point**.**

The Network Name and the Association Process

The Network Name is the foundation for building individual radio networks. Remotes in a network with the same network name as an Access Point (AP) unit are "associated" with that AP.

The use of a different Network Name does not guarantee an interference-free system. It does, however, assure that only data destined for a unique network is passed through to that network.

Co-Location for Multiple Networks

It may be desirable to co-locate Access Points at one location to take advantage of an excellent location that can serve two independent networks. Configure each network with a unique Network Name, and install each AP's antenna with at least 10 feet of vertical separation to minimize RFI.

To co-locate APs, configure them with Time Division Duplex (TDD) Sync set to **GPS Required**. Configure all APs that are within range of each other with the same pattern, but with a unique Hop Pattern Offset. For more information, see *"Frequency Control Menu"* on Page 65.

NOTE: Transceivers are shipped with the Network Name set to **MDS-Mercury** as a factory default.

Can radio frequency interference (RFI) disrupt my wireless network?

When multiple radio networks operate in close physical proximity to other wireless networks, individual units may not operate reliably under weak signal conditions and may be influenced by strong radio signals on adjacent bands. This radio frequency interference cannot be predicted with certainty, and can only be determined by experimentation. If you need to co-locate two units, start by using the largest possible vertical antenna separation between the two AP antennas on the same support structure. If that does not work, consult with your factory representative about other techniques for controlling radio frequency interference between the radios. (See *"A Word About Radio Interference"* on Page 168 for more details.)

1.5 GE MDS CYBER SECURITY SUITE

Today, the operation and management of an enterprise is increasingly dependent on electronic information flow. An accompanying concern becomes the cyber security of the communication infrastructure and the security of the data itself.

The transceiver is capable of dealing with many common security issues. Table 1-2 profiles security risks and how the transceiver provides a solution for minimizing vulnerability.

Table 1-2. Security Risk Management

Security Vulnerability	GE MDS Cyber Security Solution
Unauthorized access to the backbone network through a foreign remote radio	• IEEE 802.1x device authentication • Approved Remotes List (local) Only those remotes included in the AP list will associate
"Rogue" AP, where a foreign AP takes control of some or all remote radios and thus remote devices	• IEEE 802.1x device authentication • Approved AP List A remote will only associate to those APs included in its local authorized list of APs
Dictionary attacks, where a hacker runs a program that sequentially tries to break a password.	• Failed-login lockdown After five tries, the transceiver ignores login requests for 5 minutes. Critical event reports (traps) are generated as well.
Denial of service, where Remote radios could be reconfigured with bad parameters, bringing the network down.	• Remote login with SSH or HTTPS • Local console login • Disabled HTTP and Telnet to allow only local management services
Airsnort and other war-driving hackers in parking lots, etc.	• Operation is not interoperable with standard 802.11 wireless cards • The transceiver cannot be put in a promiscuous mode • Proprietary data framing
Eavesdropping, intercepting messages	• AES-128 encryption
Unprotected access to configuration via SNMPv1	• Implement SNMPv3 secure operation
Intrusion detection	• Provides early warning via SNMP through critical event reports (unauthorized, logging attempts, etc.) • Unauthorized AP MAC address detected at Remote • Unauthorized Remote MAC address detected at AP • Login attempt limit exceeded (Accessed via: Telnet, HTTP, or local) • Successful login/logout (Accessed via: Telnet, HTTP, or local)

1.6 ACCESSORIES

The transceiver can be used with one or more of the accessories listed in Table 1-3. Contact the factory for ordering details.

Table 1-3. Accessories

Accessory	Description	GE MDS Part No.
AC Power Adapter Kit	A small power supply module designed for continuous service. UL approved. Input: 120/220; Output: 13.8 Vdc @ 2.5 A	01-3682A02
Omni-Directional Antennas	Rugged antennas well suited for use at Access Point installations. Consult with your factory Sales Representative for details	--
Yagi Antenna (Directional)	Rugged antennas well suited for use at fixed Remote sites. Consult with your factory Sales Representative for details.	--
GPS Receiving Antennas	A variety of fixed and mobile GPS antennas (active and passive) are available. Consult with your factory Sales Representative for details.	--
TNC Male-to-N Female Adapter	One-piece RF adaptor plug.	97-1677A161
TNC Male-to-N Female Adapter Cable	Short length of coaxial cable used to connect the radio's TNC antenna connector to a Type N commonly used on large diameter coaxial cables.	97-1677A159 (3 ft./1m) 97-1677A160 (6 ft./1.8m)
Ethernet RJ-45 Crossover Cable (CAT5)	Cable assembly used to cross-connect the Ethernet ports of two transceivers used in a repeater configuration. (Cable length ≈ 3 ft./1M)	97-1870A21
2-Pin Power Plug	Mates with power connector on transceiver. Screw terminals provided for wires, threaded locking screws to prevent accidental disconnect.	73-1194A39
Ethernet RJ-45 Straight-thru Cable (CAT5)	Cable assembly used to connect an Ethernet device to the transceiver. Both ends of the cable are wired identically. (Cable length ≈ 3 ft./1M)	97-1870A20
EIA-232 Shielded Data Cable	Shielded cable terminated with a DB-25 male connector on one end, and a DB-9 female on the other end. Two lengths available (see part numbers at right).	97-3035L06 (6 ft./1.8m) 97-3035L15 (15 ft./4.6m)
EIA-232 Shielded Data Cable	Shielded cable terminated with a DB-9 male connector on one end, and a DB-9 female on the other end, 6 ft./1.8m long.	97-1971A03
Flat-Surface Mounting Brackets & Screws	Brackets: 2″ x 3″ plates designed to be screwed onto the bottom of the unit for surface-mounting the radio.	82-1753-A01
	Bracket screws: 6-32/1/4″ with locking adhesive. (Industry Standard MS 51957-26)	70-2620-A01
Fuse	Internal fuse, 5.0 Ampere	29-1784A04

Table 1-3. Accessories *(Continued)*

Accessory	Description	GE MDS Part No.
DIN Rail Mounting Bracket	Bracket used to mount the transceiver to standard 35 mm DIN rails commonly found in equipment cabinets and panels.	03-4022A03
COM1 Interface Adapter	DB-25(F) to DB-9(M) shielded cable assembly (6 ft./1.8 m) for connection of equipment or other EIA-232 serial devices previously connected to “legacy” units. (Consult factory for other lengths and variations.)	97-3035A06
Bandpass Filter	Antenna system filter that helps eliminate interference from nearby paging transmitters.	20-2822A02
Ethernet Surge Suppressor	Surge suppressor for protection of Ethernet port against lightning.	29-4018A01

2 TABLETOP EVALUATION AND TEST SETUP

Contents

2.1 OVERVIEW

GE MDS recommends that you set up a “tabletop network” to verify the basic operation of the transceivers. This allows experimenting with network designs, configurations, or network equipment in a convenient location. This test can be performed with any number of radios.

When you are satisfied that the network is functioning properly in a benchtop setting, perform the field installation. Complete information for field installation, including mounting dimensions and antenna selection, is provided in *INSTALLATION PLANNING* on Page 161.

NOTE: It is important to use a “Network Name” that is different from any currently in use in your area during the testing period.

To simulate data traffic over the radio network, connect a PC or LAN to the Ethernet port of the Access Point and PING *each* transceiver several times.

2.2 STEP 1—CONNECT THE ANTENNA PORTS

Figure 2-1 shows the tabletop arrangement. Connect the antenna ports of each transceiver as shown. This provides stable radio communications between each unit and prevents interference to nearby electronic equipment.

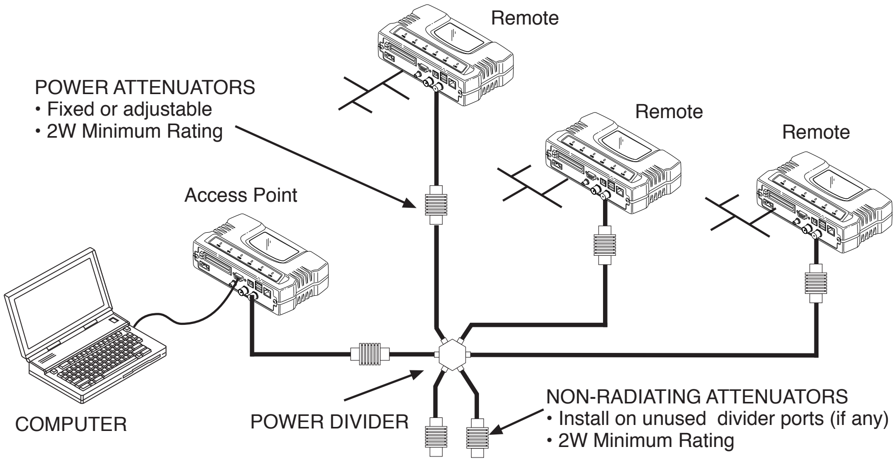


Figure 2-1. Typical Setup for Tabletop-Testing of Radios

NOTE: Use attenuation between all units in the test setup. The amount of attenuation required depends on the number of units tested and the desired signal strength (RSSI) at each transceiver during the test. In no case should a signal greater than –50 dBm be applied to any transceiver in the test setup. GE MDS recommends an RF power output level of +20 dBm from the AP. Remote power is not setable. (See *"Radio Configuration Menu"* on Page 63.)

2.3 STEP 2—CONNECT THE PRIMARY POWER

The primary power at the transceiver's power connector must be within 10.5–30 Vdc and be capable of continuously providing 30 Watts. Typical power consumption for 13.8 Vdc and 24 Vdc operation are listed in *SPECIFICATIONS* on Page 176.

A Phoenix two-pole 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 with the positive lead (+) on the left and negative (–) on the right, as shown in Figure 2-2.

NOTE: The transceiver typically requires about 30 seconds to power up, and might require several minutes to associate with another unit, if GPS is required for time synchronization.

GPS is required for all configurations except when "Free Run" single-channel (non-frequency hopping) operation is used, which might be possible in some low-interference environments.

CAUTION
POSSIBLE
EQUIPMENT
DAMAGE

Only use the transceiver with negative-ground power systems. Make sure the polarity of the power source is correct.

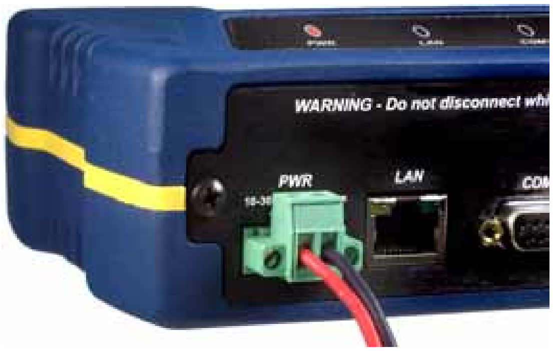


Figure 2-2. **Power Connector (Polarity: Left +, Right —)**

2.4 STEP 3—CONNECT PC TO THE TRANSCEIVER

Connect a PC’s Ethernet port to the LAN port using an Ethernet crossover cable. The LAN LED should light. Alternatively, you can use a serial cable to connect to the COM1 port (Figure 2-3 on Page 27).

2.5 STEP 4—REVIEW TRANSCEIVER CONFIGURATION

2.5.1 Getting Started

Start by logging into the Access Point radio. This is done first because the Remotes are dependent on the AP’s beacon signal to achieve an “associated” state.

Once the Access Point is up and running, move the computer connection to each of the Remote units, log-in at each unit, review their configuration, set their IP addresses, Network Name, and frequency configuration, then wait for each AP to achieve an associated state.

With all units associated, you will be ready to connect and test your data services.

2.5.2 Procedure

The following is a summary of the configuration procedure that must be done on each unit in the system. Key parameters are shown on the Embedded Management System overview (Figure 3-1 on Page 34). A lists of parameters is located in two tables—Table 4-5 on Page 152 and Table 4-7 on Page 154. Detailed information on using the Management System can be found in *INTRODUCTION* on Page 33.

NOTE: The Management System supports the use of “configuration files” to help consistently configure multiple units. These are explained in *Configuration Scripts Menu* on Page 130.

2.5.3 Basic Configuration Defaults

Table 2-1 provides a selection of key operating parameters, their range, and default values. All of these are accessible through a terminal emulator connected to the COM1 serial port or through a Web browser connected to the LAN port (see Figure 5-1 on Page 161 for hookup).

NOTE: Access to the transceiver’s Management System and changes to all parameters requires entering a security password.

Table 2-1. Basic Configuration Defaults

Item	Menu Location	Default	Values/Range
Network Name	Main Menu>> Radio Configuration>> Network Name	MDS-Mercury	• 1–15 alphanumeric characters • Case-sensitive; can be mixed case
IP Address	Main Menu>> Network Configuration>> IP Address	192.168.1.1	Contact your network administrator
RF Output Power	Main Menu>> Radio Configuration>> Transmit Power	+29 dBm (900 model) +23 dBm (3650 model)	AP: -30 to +29 dBm RM: 0 to +29 dBm
Unit Password	Main Menu>> Device Information>> User Password	admin (lower case)	• 1–13 alphanumeric characters • Case-sensitive; can be mixed case

For benchtop evaluation, configure:

- **Frequency Mode** = Single Channel
- **Single Frequency Channel** = 0
- **RF Bandwidth** = 1.75
- **TDD Sync** = Free Run

For more information on configuring these parameters, see *“Frequency Control Menu”* on Page 65.

A unique IP address and subnet are required to access all IP-based management interfaces (telnet, SSH, SNMP, and Web), either through the LAN port or remotely over-the-air.

2.6 STEP 5—CONNECT LAN OR SERIAL DATA EQUIPMENT

Connect a local area network to the LAN port or a serial device to the COM1 (DCE) port. The LAN port supports any Ethernet-compatible equipment. This includes devices that use Internet Protocol (IP).

Figure 2-3 on Page 27 shows the interface connectors on the front panel of the standard transceiver (Remote). The Option 1 Set Remote connectors are shown in Figure 2-4 on Page 28.

NOTE: The use of shielded Ethernet cable is recommended for connection to the radio’s ETH port. The radio meets regulatory emission standards without shielded cable, but shielding reduces the possibility of interference in sensitive environments, and is in keeping with good engineering practice.

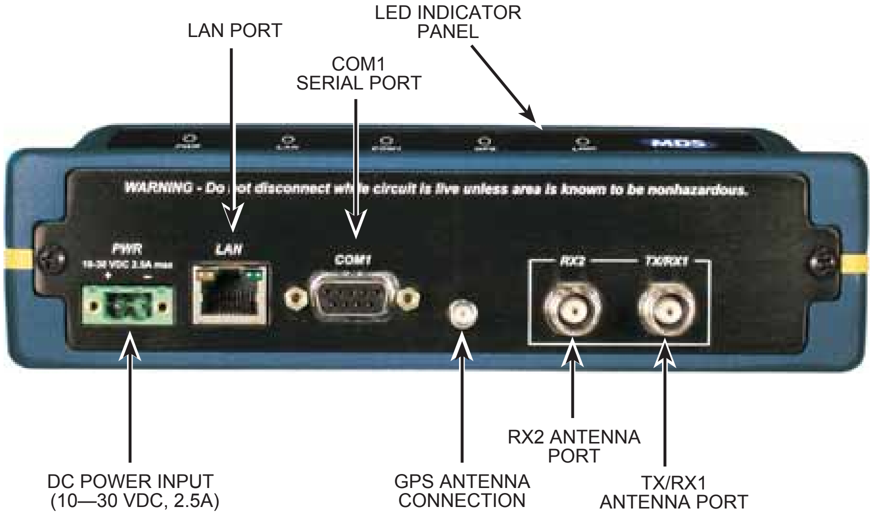


Figure 2-3. Transceiver Interface Connectors
(Standard unit shown; See Figure 2-4 on Page 28 for MaxRM unit)

- **LED INDICATOR PANEL**—Displays the basic operating status of the transceiver. See section 2.7 on Page 29 for detailed information.
- **COM1 SERIAL PORT**— DB-9 connector used for management of the transceiver with a connected PC. *INTRODUCTION* on Page 33 provides complete connection details.
- **LAN PORT**—Connection point for Ethernet Local Area Network. The connector has integrated LEDs to indicate signal activity as follows: A steady green LED indicates that a link has been achieved; a flashing green LED indicates data activity; and a yellow LED indicates 100 Mbps operation.
- **PWR**— DC power connection for the transceiver. Power source must be 10 Vdc to 30 Vdc, negative ground, and capable of providing at least 25 watts.
- **GPS ANTENNA PORT**— Coaxial connector (SMA-type) for connection of a GPS receiving antenna. Provides 3.5 Vdc output for compatibility with powered (active) GPS antennas. The GPS receiving antenna's gain must be 16 dBi or less.

NOTE: GPS functionality is required on all Access Points and Remotes except when "Free Run" single-channel (non-frequency hopping) operation is used, which might be possible in some low-interference environments.

- **RX2 ANTENNA PORT**— Coaxial connector (TNC-type) for attachment of a second receiving antenna used in space diversity arrangements.
- **TX/RX1 ANTENNA PORT**— Coaxial connector (TNC-type) for attachment of the main station antenna (transmit and receive).

2.6.1 Option 1 Set (MaxRM) Connectors

Figure 2-4 shows the interface connectors on the front panel of the Option 1 Set (MaxRM) Remote transceiver.

NOTE: The use of shielded Ethernet cable is recommended for connection to the radio's ETH port. The radio meets regulatory emission standards without shielded cable, but shielding reduces the possibility of interference in sensitive environments, and is in keeping with good engineering practice.

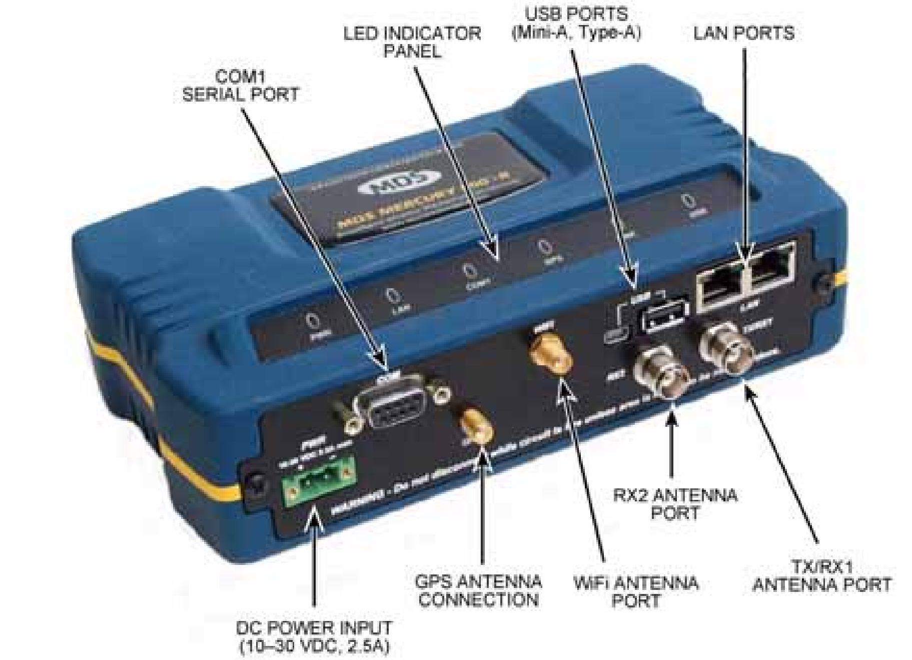


Figure 2-4. Option 1 Set Transceiver Interface Connectors

- **LED INDICATOR PANEL**—Displays the basic operating status of the transceiver. See section 2.7 on Page 29 for detailed information.
- **COM1 SERIAL PORT**— DB-9 connector used for management of the transceiver with a connected PC. *INTRODUCTION* on Page 33 provides complete connection details.
- **LAN PORTS**—Connection point for Ethernet Local Area Network. The connectors have integrated LEDs to indicate signal activity as follows: A steady green LED indicates that a link has been achieved; a flashing green LED indicates data activity; and a yellow LED indicates 100 Mbps operation.
- **PWR**— DC power connection for the transceiver. Power source must be 10 Vdc to 30 Vdc, negative ground, and capable of providing at least 25 watts.

- **GPS ANTENNA PORT**— Coaxial connector (SMA-type) for connection of a GPS receiving antenna. Provides 3.5 Vdc output for compatibility with powered (active) GPS antennas. Do not short this connector, as you might cause damage to the internal power supply. The GPS receiving antenna's gain must be 16 dBi or less.

NOTE: GPS functionality is required on all Access Points and Remotes except when "Free Run" single-channel (non-frequency hopping) operation is used, which might be possible in some low-interference environments.

- **WiFi ANTENNA PORT**— Coaxial connector (SMA-type) for attachment of a WiFi antenna. WiFI is typically used for short range wireless communication at the transceiver site or within a small area around the site.
- **RX2 ANTENNA PORT**— Coaxial connector (TNC-type) for attachment of a second receiving antenna used in space diversity arrangements.
- **TX/RX1 ANTENNA PORT**— Coaxial connector (TNC-type) for attachment of the main station antenna (transmit and receive).

2.7 STEP 6—CHECK FOR NORMAL OPERATION

Once the data equipment is connected, you can check the transceiver for normal operation.

Observe the LEDs on the top cover for the proper indications. In a normally operating system, you will see the following LED indications within 45 seconds of start-up:

- PWR—Lit continuously
- LINK—On, or blinking intermittently to indicate traffic flow
- LAN—On, or blinking intermittently to indicate traffic flow

Figure 2-5 shows a close-up view of the transceiver's LED Indicator panel. Table 2-2 provides details on each LED function.

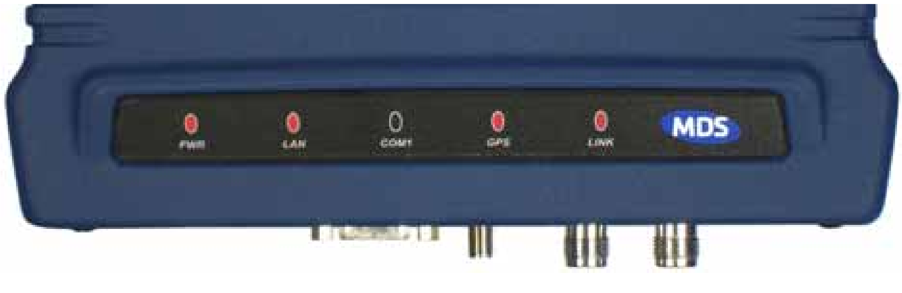


Figure 2-5. LED Indicator Panel

If the radio network seems to be operating properly based on observation of the unit's LEDs, use the **PING** command to verify the link integrity with the Access Point.

Table 2-2. Transceiver LED Functions

LED Label	Activity	Indication
PWR	ON	Primary power (DC) present
	Blinking	Unit in "Alarmed" state
	OFF	Primary power (DC) absent
LAN*	ON	LAN detected
	Blinking	Data TX/RX
	OFF	LAN not detected, or excessive traffic present
COM1 (MGT System)	Blinking	Data TX/RX
	OFF	No data activity
GPS	ON	Internal GPS receiver is synchronized with the satellite network.
	Blinking	AP modem is synchronizing with the GPS timing.
	OFF	Internal GPS receiver is not synchronized with the satellite network.
LINK (Access Point)	ON	Unit is operational
	OFF	Not transmitting. Usually occurs while waiting for GPS sync.
LINK (Remote)	ON	Associated to AP
	OFF	Not associated with AP
USB	ON	USB activity on either port
	OFF	No USB activity

* The LAN connector has two integrated LEDs to indicate signal activity as follows: A steady green LED indicates that a link has been achieved; a flashing green LED indicates data activity, and a yellow LED indicates 100 Mbps operation.

3 DEVICE MANAGEMENT

Contents

3.1 INTRODUCTION

The transceiver's embedded management system is accessible through the COM1 (serial) port, the LAN (Ethernet) port, and using over-the-air Ethernet. Telnet, SSH, HTTP/HTTPS, and SNMP are the Ethernet-based interfaces. Essentially, the same capabilities are available through any of these paths.

For support of SNMP software, a set of MIB files is available for download from the GE MDS Web site at **www.GEmds.com**. An overview of SNMP commands can be found at *SNMP Agent Configuration* section on Page 57 of this manual.

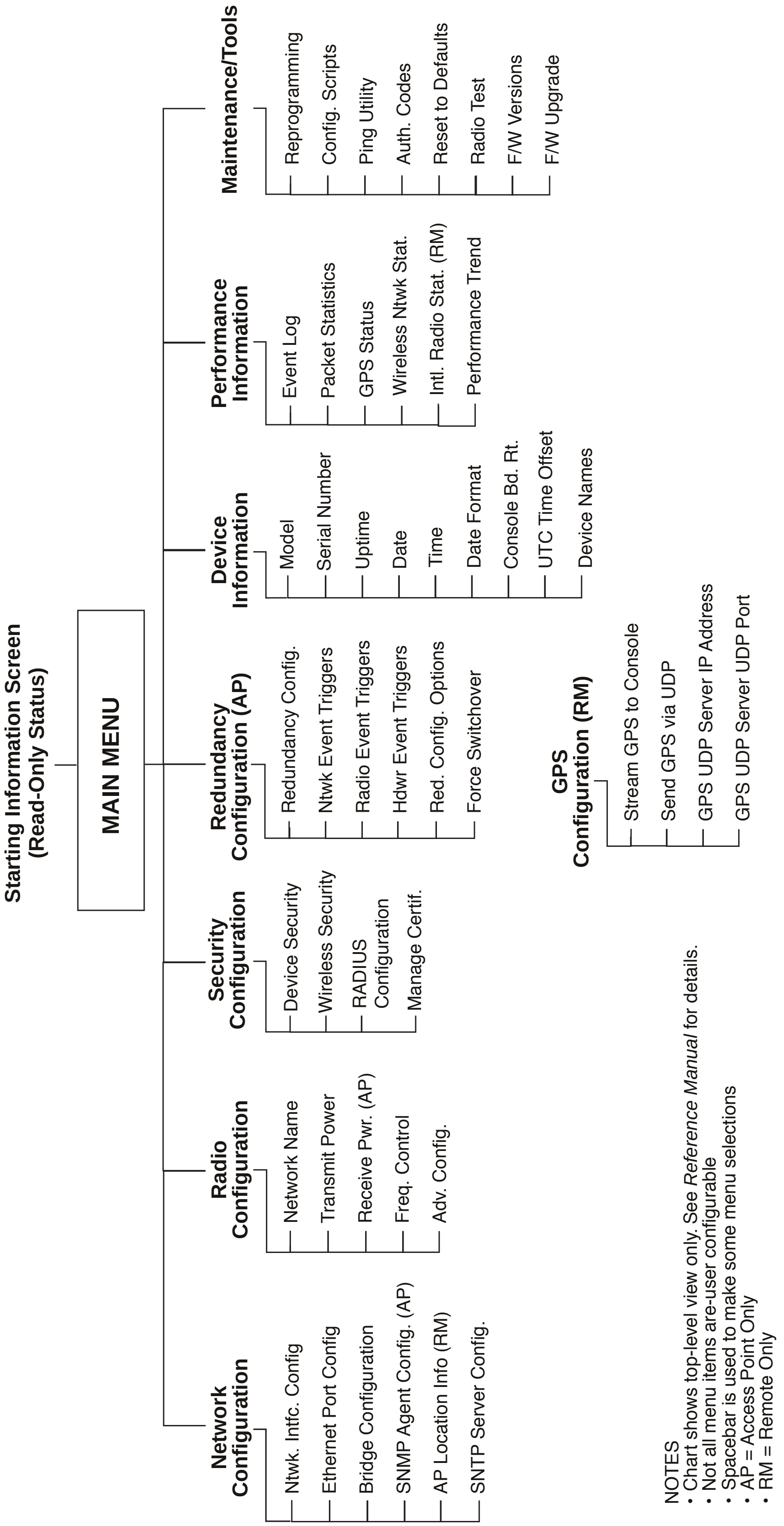
The transceiver's Management System and its functions are divided into seven functional groups as listed below.

- Section 3.3, *BASIC OVERVIEW OF OPERATION* (beginning on Page 42)
- Section 3.4, *CONFIGURING NETWORK PARAMETERS* (beginning on Page 45)
- Section 3.5, *RADIO CONFIGURATION* (beginning on Page 63)
- Section 3.7, *SECURITY CONFIGURATION MENU* (beginning on Page 91)
- Section 3.13, *PERFORMANCE OPTIMIZATION* (beginning on Page 139)
- Section 3.12, *MAINTENANCE/TOOLS MENU* (beginning on Page 122)

Each of these sections has a focus that is reflected in its heading. The section you are now reading provides information on connecting to the Management System, how to navigate through it, how it is structured, and how to perform top-level configuration tasks. Figure 3-1 on Page 34 shows a top-level view of the Management System (MS).

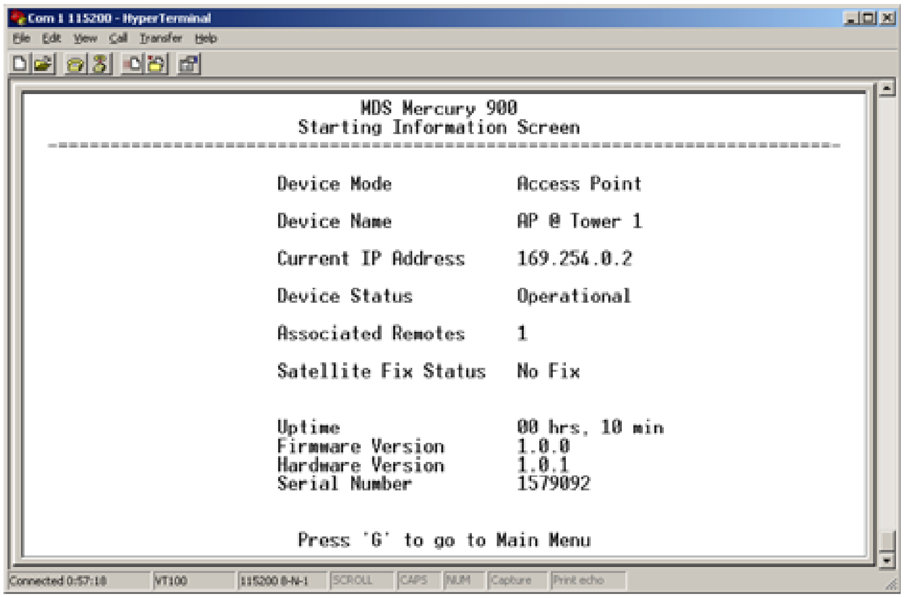
3.1.1 Differences in the User Interfaces

Although there are slight differences in navigation among the user interfaces, the content is very similar. You will notice a few differences in capabilities as the communications tool is driven by limitations of the access channel. Figure 3-2 and Figure 3-3 on Page 35 show examples of the Starting Information Screen as seen through a console terminal and a web-browser, respectively.



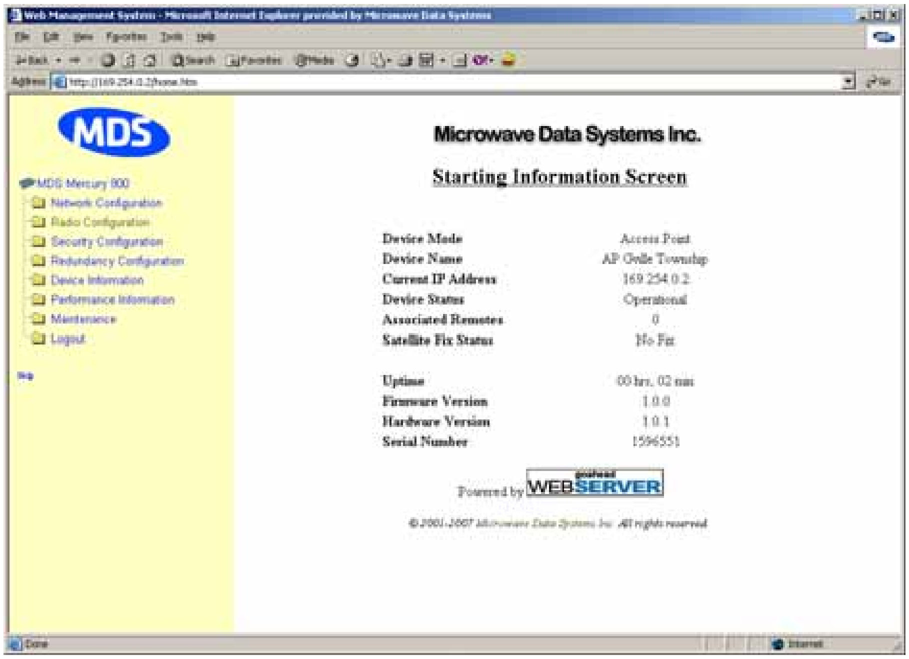
NOTES
- Chart shows top-level view only. See *Reference Manual* for details.
- Not all menu items are-user configurable
- Spacebar is used to make some menu selections
- AP = Access Point Only
- RM = Remote Only

Figure 3-1. Embedded Management System—Top-Level Flowchart



```
                          MDS Mercury 900
                    Starting Information Screen
 -------------------------------------------------------------------------

                   Device Mode            Access Point

                   Device Name            AP @ Tower 1

                   Current IP Address     169.254.0.2

                   Device Status          Operational

                   Associated Remotes     1

                   Satellite Fix Status   No Fix


                   Uptime                 00 hrs, 10 min
                   Firmware Version       1.0.0
                   Hardware Version       1.0.1
                   Serial Number          1579092

                      Press 'G' to go to Main Menu
```

Figure 3-2. View of MS with a text-based program□
(Console Terminal shown□Telnet has similar appearance)



Microwave Data Systems Inc.

Starting Information Screen

Device Mode	Access Point
Device Name	AP Orille Township
Current IP Address	169.254.0.2
Device Status	Operational
Associated Remotes	0
Satellite Fix Status	No Fix
Uptime	00 hrs, 02 min
Firmware Version	1.0.0
Hardware Version	1.0.1
Serial Number	1596551

Powered by goahead WEBSERVER

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Figure 3-3. View of the MS with a Browser
(Selections at left provide links to the various menus)

3.2 ACCESSING THE MENU SYSTEM

The radio has no external controls or adjustments. All configuration, diagnostics, and control is performed electronically using a connected PC. This section explains how to connect a PC, log into the unit, and gain access to the built-in menus.

3.2.1 Methods of Control

Access the unit's configuration menus in one of several ways:

- **Local Console—***This is the primary method used for the examples in this manual*. Connect a PC directly to the COM1 port using a serial communications cable and launch a terminal communications program such as HyperTerminal (found on most PCs by selecting **Start>>Programs>>Accessories>>Communications>>HyperTerminal**). This method provides text-based access to the unit's menu screens. Console control is a hardware-based technique, and is intended for local use only (maximum recommended cable length of 50 ft./15 m).
- **Telnet or SSH*—**Connect a PC to the unit's LAN port, either directly or via a network, and launch a Telnet session. This method provides text-based access to the unit's menu screens in a manner similar to a Local Console session. You can run Telnet sessions locally or remotely through an IP connection.
- **Web Browser*—**Connect a PC to the unit's LAN port, either directly or via a network, and launch a web browser session (*for example*, Internet Explorer, Firefox, etc.). Enter the IP address of the device to be managed into the browser's address field.

  This method provides a graphical representation of each screen, just as you would see when viewing an Internet web site. The appearance of menu screens differs slightly from other methods of control, but the content and organization of screen items is similar. Web browser sessions may be run locally or remotely using an IP connection.

* When connecting directly to a radio, a *crossover* cable is required. When connecting using a network, switch, or router, a *straight-through* cable is required.

3.2.2 PC Connection and Log In Procedures

The following steps describe how to access the radio's menu system. These steps require a PC to be connected to the unit's COM1 or LAN port as shown in Figure 3-4 on Page 37.

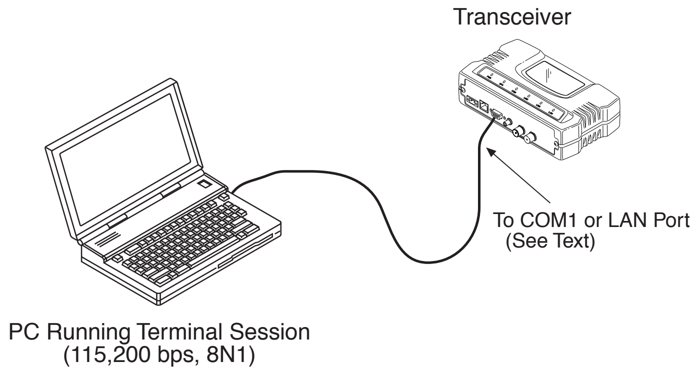


Figure 3-4. PC Configuration Setup

Starting a Local Console Session (Recommended for first-time log-in)

1. Connect a serial communications cable between the PC and the unit's COM1 port. If necessary, a cable may be constructed for this purpose as shown in Figure 3-5.

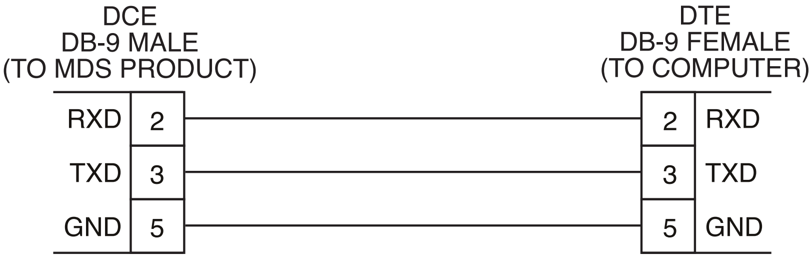


Figure 3-5. Serial Communications Cable (DB-9M to DB-9F)
(Maximum Recommended Cable Length 50 feet/15 meters)

2. Launch a terminal emulation program such as HyperTerminal and configure the program with the following settings:
   - 115,200 bps data rate
   - 8 data bits, no parity
   - One stop bit, and no flow-control
   - Use ANSI or VT100 emulation.

TIP: The HyperTerminal communications program can be accessed on most PCs by selecting this menu sequence: **Start>>Programs>>Accessories>>Communications>>HyperTerminal**.

NOTE: If the unit is powered-up or rebooted while connected to a terminal, you will see a series of pages of text information relating to the booting of the unit's processor. Wait for the log-in screen before proceeding.

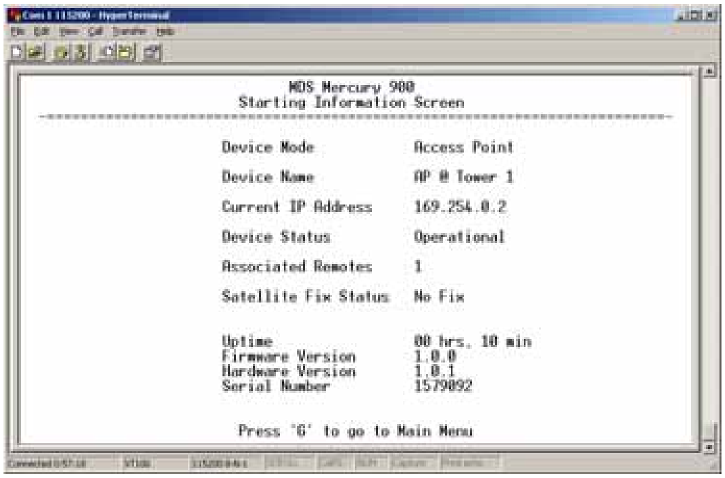
3. Press the ENTER key to receive the **login**: prompt.

4. Enter the username (default username is **admin**). Press ENTER.

5. Enter your password (default password is **admin**). For security, your password keystrokes do not appear on the screen. Press ENTER.

NOTE: Passwords are case sensitive. Do not use punctuation mark characters. You may use up to 13 alpha-numeric characters.

The unit responds with the Starting Information Screen (Figure 3-6). From here, you can review basic information about the unit or press **G** to proceed to the Main Menu.



```
                         MDS Mercury 900
                   Starting Information Screen
-------------------------------------------------------------------------------

                 Device Mode              Access Point

                 Device Name              AP @ Tower 1

                 Current IP Address       169.254.0.2

                 Device Status            Operational

                 Associated Remotes       1

                 Satellite Fix Status     No Fix


                 Uptime                   00 hrs, 10 min
                 Firmware Version         1.0.0
                 Hardware Version         1.0.1
                 Serial Number            1579092

                    Press 'G' to go to Main Menu
```

Figure 3-6. Starting Information Screen□Local Console Session

Starting a Telnet Session

NOTE: This method requires that you know the IP address of the unit beforehand. If you do not know the address, use the Local Console method (above) and access the Starting Information Screen. The address is displayed on this screen.

1. Connect a PC to the unit's LAN port, either directly with a *crossover cable* or via a network with a *straight-through* cable. The LAN LED lights to indicate an active connection.

NOTE: When using Ethernet to access the unit, you might need to change your computer's IP address to be on the same subnet as the radio. You can identify or verify the unit's IP address by using a Local Console session to communicate with the radio through its COM1 Port and viewing the Starting Information Screen.

2. Start the Telnet program on your computer, targeting the IP address of the unit to which you are connected, and press ENTER.

TIP: You can start a Telnet session on most PCs by selecting: **Start>>Programs>>Accessories>>Command Prompt**. At the command prompt window, type the word **telnet**, followed by the unit's IP address (*e.g.*, **telnet 10.1.1.168**). Press ENTER to receive the Telnet log in screen.

NOTE: Never connect multiple units to a network with the same IP address. Address conflicts will result in improper operation.

3. Enter your username (default username is **admin**). Press ENTER.

   Next, the **Password:** prompt appears. Enter your password (default password is **admin**). For security, your password keystrokes will not appear on the screen. Press ENTER.

   The unit responds with a Starting Information Screen (see Figure 3-6 on Page 38). From here, you can review basic information about the unit or press **G** to proceed to the Main Menu.

NOTE: Passwords are case sensitive. Do not use punctuation mark characters. You may use up to 13 alpha-numeric characters.

Starting a Web Browser Session

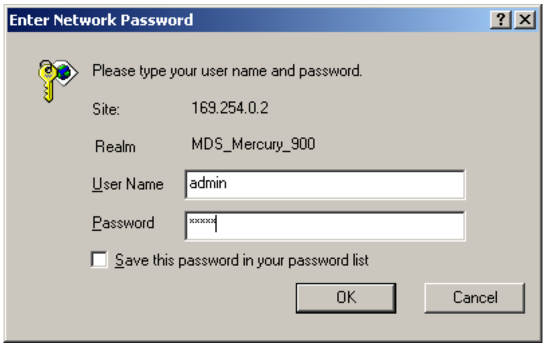
NOTE: Web access requires that you know the IP address of the unit you are connecting to. If you do not know the address, start a Local Console session (see *Starting a Local Console Session (Recommended for first-time log-in)* on Page 37) and access the Starting Information Screen. The IP address is displayed on this screen.

1. Connect a PC to the unit's LAN port, either directly or using a network. If connecting directly, use an Ethernet *crossover* cable; if connecting using a network, use a *straight-through* cable. The LAN LED lights to indicate an active connection.

2. Launch a Web-browser session on your computer (*i.e.*, Internet Explorer, Firefox, etc.).

3. Type the unit's IP address and press ENTER.

4. A log-in screen is displayed (Figure 3-7 on Page 40) where you enter a user name and password to access the unit's menu system. Note that the default entries are made in *lower case*. (Default User Name: **admin**; Default Password: **admin**)



Please type your user name and password.

Site: 169.254.0.2

Realm MDS_Mercury_900

User Name admin

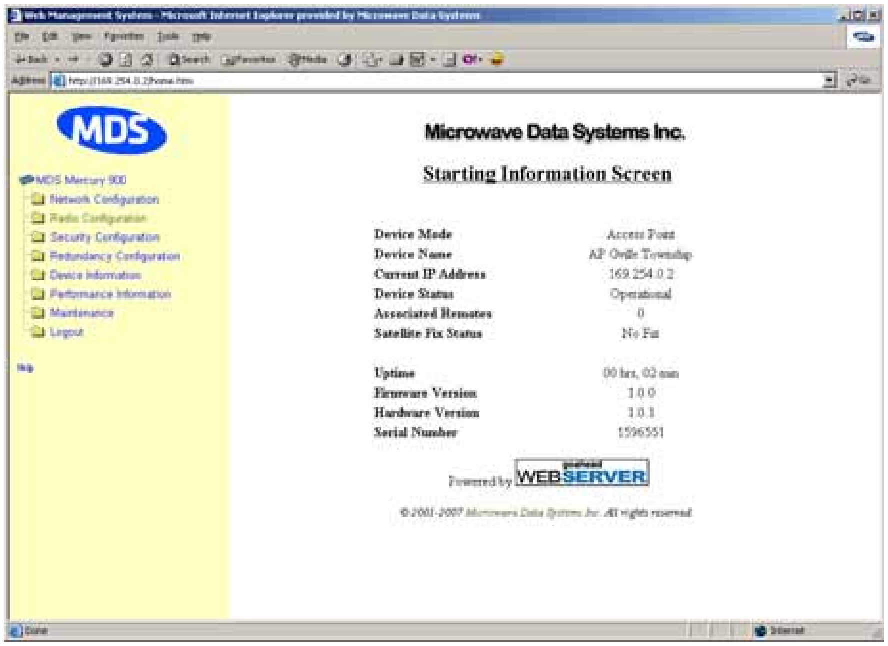
Password *****

□ Save this password in your password list

Figure 3-7. Log-in Screen when using a Web Browser

NOTE: Passwords are case sensitive. Do not use punctuation mark characters. You may use up to 13 alpha-numeric characters.

5. Click **OK**. The unit responds with a startup menu screen similar to that shown in Figure 3-8. From here, you can review basic information about the unit or click one of the menu items at the left side of the screen.


Web Management System - Microsoft Internet Explorer provided by Microwave Data Systems
File Edit View Favorites Tools Help
Back Search Favorites Media
Address http://169.254.0.2/home.htm
Go
MDS
MDS Mercury 900
Network Configuration
Radio Configuration
Security Configuration
Redundancy Configuration
Device Information
Performance Information
Maintenance
Logout
Help
Powered by goahead WEBSERVER
Done
Internet

Microwave Data Systems Inc.

Starting Information Screen

Device Mode	Access Point
Device Name	AP Orille Township
Current IP Address	169.254.0.2
Device Status	Operational
Associated Remotes	0
Satellite Fix Status	No Fix
Uptime	00 hrs, 02 min
Firmware Version	1.0.0
Hardware Version	1.0.1
Serial Number	1596551

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Figure 3-8. Starting Information Screen—Web Browser Example

3.2.3 Navigating the Menus

Via Terminal Telnet or SSH Sessions

Recommended for first-time log-in

Local Console, Telnet, and SSH sessions use multi-layered text menu systems that are nearly identical. To move further down a menu tree, you type the letter assigned to an item of interest. This takes you to an associated screen where settings may be viewed or changed. In most cases, pressing the ESCAPE key moves the screen back one level in the menu tree.

In general, the top portion of menu screens show *read-only* information (with no user selection letter). The bottom portion of the screen contains parameters you can select for further information, alteration of values, or to navigate to other submenus.

NOTE: Early versions of PuTTY might not operate when using SSH to connect to the transceiver. The latest version (0.60 at the time of publication) does work with the transceiver's internal server. Both the latest released and the latest development snapshot can be downloaded from: **www.chiark.greenend.org.uk/~sgtatham/putty/**.

When you arrive at a screen with user-controllable parameter fields, you select the menu item by pressing an associated letter on the keyboard. If there is a user definable value, the field will clear to the right of the menu item and you can type the value you wish to use. Follow this action by pressing the ENTER key to save the changes. If you make a mistake or change your mind before pressing the ENTER key, simply press ESCAPE to restore the previous value.

In some cases, when you type a letter to select a parameter, you will see a prompt at the bottom of the screen that says **Choose an Option**. In these screens, press the keyboard's SPACEBAR to step through the available selections. When the desired option appears, press the ENTER key to choose that selection. In some cases, you can change several parameters and then save them with a single keystroke. Use the ESCAPE key to cancel the action and restore the previous values.

Logging Out Via Terminal Emulator or Telnet

From the Main Menu screen, press **Q** to quit and terminate the session.

NOTE: To maintain security, it is best to log-out of the menu system entirely when you are done working with it. If you do not log out, the session automatically ends after 10 minutes of inactivity.

Navigating via Web Browser

Navigating with a Web browser is straightforward with a framed "home page." The primary navigation menu is permanently located on the left-hand side of this page. Simply click the desired menu item to make it active.

Logging Out Via Web Browser

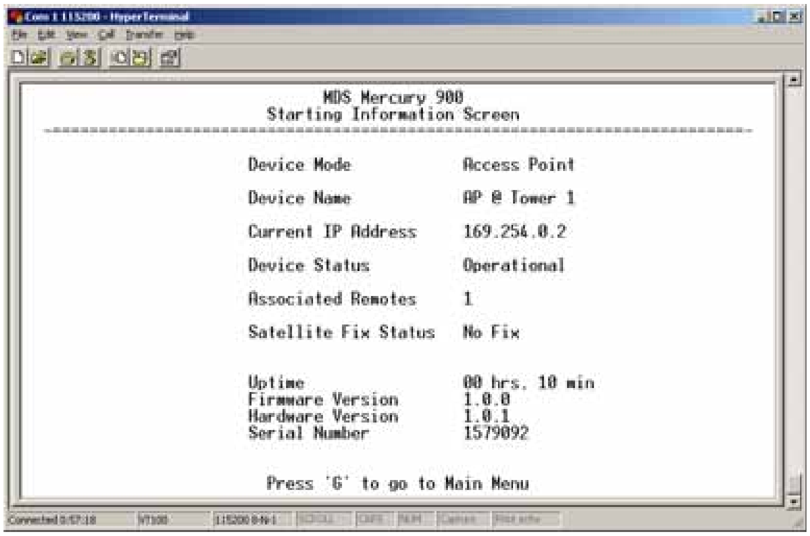
Click **Logout** in the left-hand frame of the browser window. The right-hand frame changes to a logout page. Follow the remaining instructions on this screen.

NOTE: In the menu descriptions that follow, parameter options/range, and any default values are displayed at the end of the text between square brackets. Note that the default setting is always shown after a semicolon:
[**available settings or range; default setting**]

3.3 BASIC OVERVIEW OF OPERATION

3.3.1 Starting Information Screen

Once you have logged into the Management System, the Starting Information Screen (Figure 3-9) appears with an overview of the transceiver and its current operating conditions.



```
                    MDS Mercury 900
              Starting Information Screen
 -------------------------------------------------------------------------

              Device Mode            Access Point

              Device Name            AP @ Tower 1

              Current IP Address     169.254.0.2

              Device Status          Operational

              Associated Remotes     1

              Satellite Fix Status   No Fix


              Uptime                 00 hrs, 10 min
              Firmware Version       1.0.0
              Hardware Version       1.0.1
              Serial Number          1579092

               Press 'G' to go to Main Menu
```

Figure 3-9. Starting Information Screen
(AP screen shown; Remote similar, differences noted below)

- **Device Mode**—Operating mode of the unit as it relates to the radio network.
- **Device Name**—This is a user-defined parameter that appears in the heading of all pages. (To change it, see *Network Configuration Menu* on Page 45.)
- **Current IP Address**—Unit's IP address [**169.254.0.2**]
- **Device Status**—Condition of the unit's operation as follows:

  At Access Point:

  - **Operational**—Unit operating normally.
  - **Initializing**—This is the first phase after boot-up.
  - **Synchronizing**—Unit is waiting for the GPS receiver to obtain a satellite fix and for its internal clock to synchronize to the GPS timing signals.

- **Alarmed**—The unit has detected one or more alarms that have not been cleared.

At Remote:

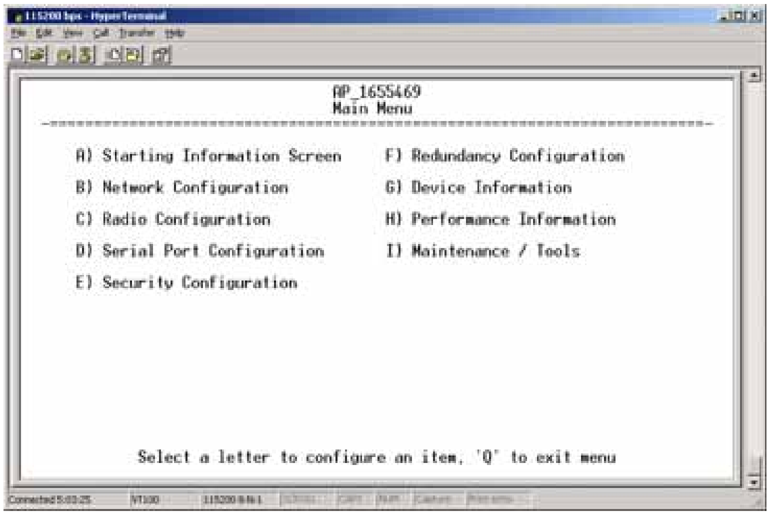
- **Scanning**—The unit is looking for an Access Point beacon signal.
- **Ranging**—Unit is adjusting power, timing, and frequency with an AP.
- **Connecting**—The unit has found a valid beacon signal for its network.
- **Authenticating**—Device is attempting device authentication.
- **Associated** —The unit has successfully synchronized and associated with an Access Point.
- **Alarmed**—The unit is has detected one or more alarms that have not been cleared.

NOTE: If an alarm is present when this screen is displayed, an “A)” appears to the left of the **Device Status** field. Pressing the “A” key on your keyboard takes you directly to the “Current Alarms” screen.

- **Associated Remotes** (AP Only)—Indicates the number of Remotes that have achieved association with the AP.
- **Connection Status** (Remote Only)—Indicates whether the Remote has an RF connection with an AP.
- **Satellite Fix Status**—Indicates whether internal GPS receiver has achieved synchronization with GPS satellite signals.
- **Uptime**—Elapsed time since the transceiver was last booted up.
- **Firmware Version**—Version of firmware that is currently active in the unit.
- **Hardware Version**— Hardware version of the transceiver’s printed circuit board.
- **Serial Number**—Make a record of this number. Provide this number when purchasing Authorization Codes to upgrade unit capabilities in the future. (See *“Authorization Codes”* on Page 135.)

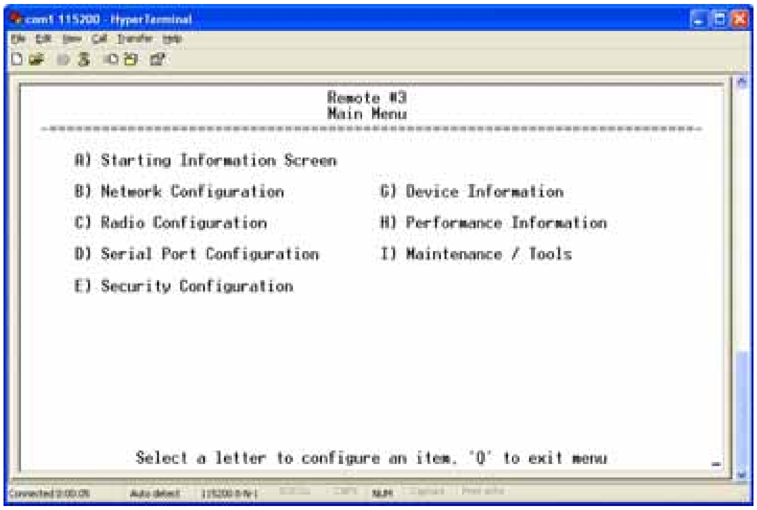
3.3.2 Main Menu

The Main Menu (Figure 3-10/Figure 3-11) is the entry point for all user-controllable features. The transceiver’s **Device Name** appears at the top of this and all other screens as a reminder of the unit you are currently controlling.


115200 bps - HyperTerminal
File Edit View Call Transfer Help
Connected 5:03:25 VT100 115200 8-N-1

```
                          AP_1655469
                          Main Menu
 ------------------------------------------------------------------------

    A) Starting Information Screen      F) Redundancy Configuration

    B) Network Configuration            G) Device Information

    C) Radio Configuration              H) Performance Information

    D) Serial Port Configuration        I) Maintenance / Tools

    E) Security Configuration




               Select a letter to configure an item, 'Q' to exit menu
```

Figure 3-10. Main Menu (AP)
(AP menu shown, Remote similar; Differences noted in text below)


com1 115200 - HyperTerminal
File Edit View Call Transfer Help
Connected 0:00:05 Auto detect 115200 8-N-1 NUM

```
                          Remote #3
                          Main Menu
 ------------------------------------------------------------------------

    A) Starting Information Screen

    B) Network Configuration            G) Device Information

    C) Radio Configuration              H) Performance Information

    D) Serial Port Configuration        I) Maintenance / Tools

    E) Security Configuration




               Select a letter to configure an item, 'Q' to exit menu
```

Figure 3-11. Main Menu (MDS 3650 Remote Only)

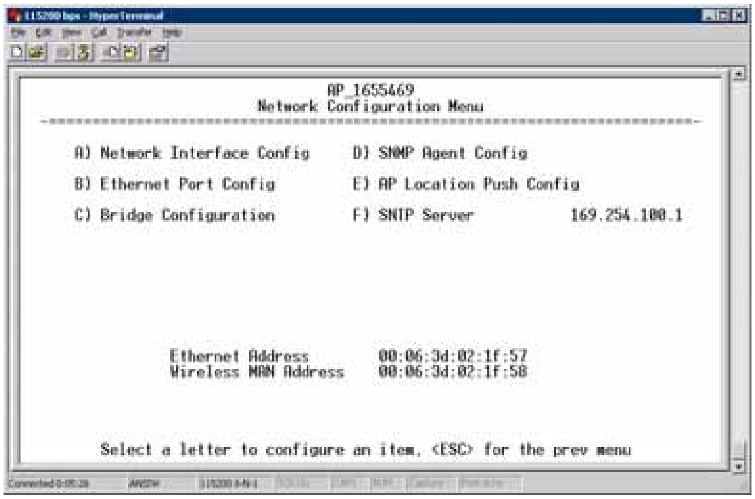
- **Starting Information Screen**—Select this item to return to the Starting Information screen described above.
- **Network Configuration**—Tools for configuring the data network layer of the transceiver. (See *“CONFIGURING NETWORK PARAMETERS”* on Page 45)
- **Radio Configuration**—Tools to configure the wireless (radio) layer of the transceiver. (See *“RADIO CONFIGURATION”* on Page 63)
- **Serial Port Configuration**—Menus for tailoring the COM1 port for data mode operation (data only). (See *“Serial Port Configuration”* on Page 74)

- **Security Configuration**—Tools to configure the security services available with the transceiver's environment. (See *"SECURITY CONFIGURATION MENU"* on Page 91)
- **Redundancy Configuration**—(AP Only) Allows setting of the criteria for switchover in the event of loss of associated Remotes or excessive packet receive errors.
- **GPS Configuration**—(Remote Only; *not* available on MDS 3650 model) View/set parameters related to GPS streaming location output. (See *"GPS CONFIGURATION (REMOTE ONLY)"* on Page 106)
- **Device Information**—Top level device fields such as model, serial number, date/time, etc. (See *"DEVICE INFORMATION MENU"* on Page 108)
- **Performance Information**—Status information relating to the radio and data layer's performance in the radio network. (See *"PERFORMANCE INFORMATION MENU"* on Page 109)
- **Maintenance/Tools**—Tools for upgrading firmware code and testing major unit capabilities. (See *"MAINTENANCE/TOOLS MENU"* on Page 122)

3.4 CONFIGURING NETWORK PARAMETERS

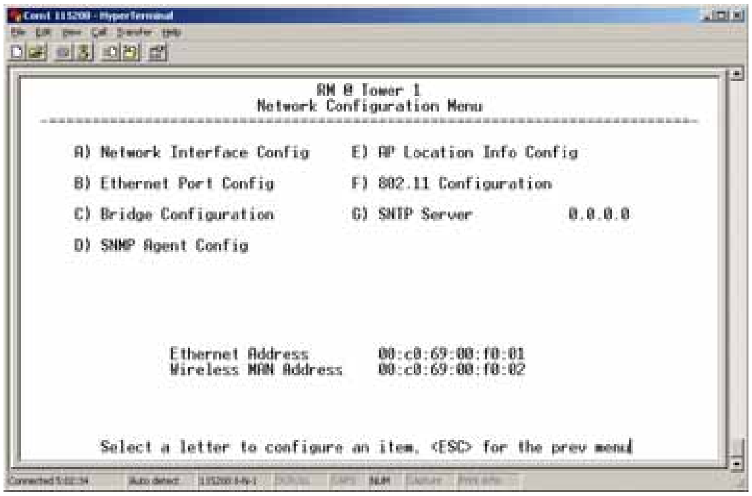
3.4.1 Network Configuration Menu

The *Network Configuration Menu* is the home of several parameters that you should review and set as necessary before placing a transceiver into service.



```
                              AP_1655469
                       Network Configuration Menu
 -=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-

     A) Network Interface Config     D) SNMP Agent Config

     B) Ethernet Port Config         E) AP Location Push Config

     C) Bridge Configuration         F) SNTP Server          169.254.100.1




               Ethernet Address        00:06:3d:02:1f:57
               Wireless MAN Address    00:06:3d:02:1f:58



        Select a letter to configure an item, <ESC> for the prev menu
```

Figure 3-12. Network Configuration Menu
(Standard radio)



```
                            RM @ Tower 1
                     Network Configuration Menu
  ------------------------------------------------------------------------

    A) Network Interface Config     E) AP Location Info Config

    B) Ethernet Port Config         F) 802.11 Configuration

    C) Bridge Configuration         G) SNTP Server           0.0.0.0

    D) SNMP Agent Config




             Ethernet Address         00:c0:69:00:f0:01
             Wireless MAN Address     00:c0:69:00:f0:02


       Select a letter to configure an item, <ESC> for the prev menu
```

Figure 3-13. Network Configuration Menu
(MaxRM radio)

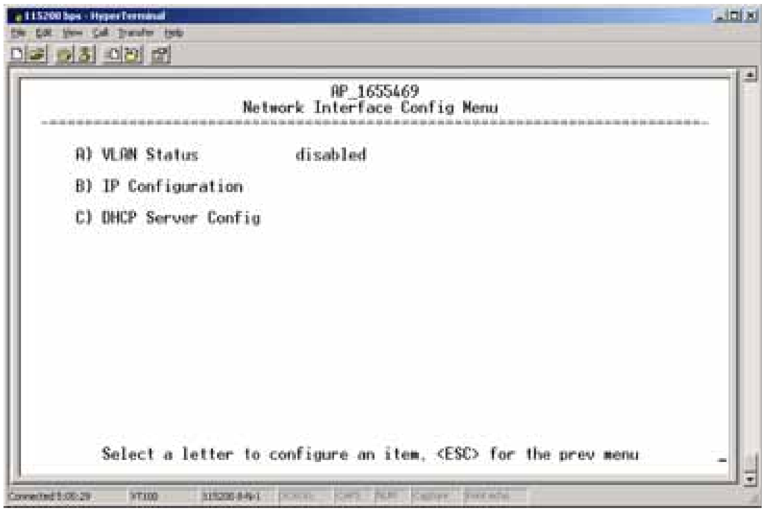
- **Network Interface Config**—Presents a menu where you can view or set various parameters (VLAN Status, IP Configuration, and DHCP Server Configuration).
- **Ethernet Port Config**—Presents a menu for defining the status of the Ethernet port (enabled or disabled), port follows association, and Ethernet filtering configuration. Detailed explanations of this menu are contained in *Ethernet Port Configuration Menu* on Page 55.
- **Bridge Configuration**—View/set options for Ethernet Bridge operation.
- **SNMP Agent Config**—View/set SNMP configuration parameters. See *“SNMP Agent Configuration”* on Page 57 for more information.
- **AP Location Info Config**—On an AP this submenu allows for configuring an AP to automatically download the AP Locations File to its associated Remotes. On a Remote this submenu allows for downloading an AP Locations File. See *“AP Location Push Config Menu”* on Page 59 for additional details.
- **802.11 Configuration**—Presents a submenu for configuring the radio’s internal WiFi module to be an Access Point for other WiFi devices (APs), to connect to a WiFi Access Point at another location (Station), *or* to connect directly to another WiFi device (Ad-Hoc).
- **SNTP Server**—Address of SNTP server (RFC 2030) from which the transceiver will automatically get the time-of-day. You can also manually set the date and time. A Mercury unit tries to get the time and date from the SNTP server only if an IP address is configured. It will continue to retry every minute until it suc-

ceeds.

The transceivers use UTC (Universal Time Coordinated) with a configurable time offset. [**0**]

NOTE: The Mercury gets time of day data from the GPS receiver if the receiver gets a satellite fix.

Network Interface Configuration Submenu



```
                         AP_1655469
                 Network Interface Config Menu
-----------------------------------------------------------------------

     A) VLAN Status              disabled

     B) IP Configuration

     C) DHCP Server Config





        Select a letter to configure an item, <ESC> for the prev menu
```

Figure 3-14. Network Interface Configuration Submenu

- **VLAN Status**—This selection is used to enable or disable virtual LAN operation. For details, refer to *VLAN Configuration Menu* on Page 47. [**enable, disabled; disabled**]
- **IP Configuration**—This selection presents a submenu for configuring the local IP address of the transceiver. Detailed explanations are provided in the section titled *IP Configuration Menu* on Page 53.
- **DHCP Server Config**—Menu for configuration of DHCP services by the Access Point. DHCP provides "on-the-fly" IP address assignments to other LAN devices, including Mercury Series units. For details, refer to *DHCP Server Configuration (Data and Mgmt)* on Page 50.

VLAN Configuration Menu

The VLAN Configuration menu (Figure 3-15) becomes active and visible when you enable **VLAN Status** on the Network Interface Configuration Menu, and you press the Enter key.

CAUTION: The VLAN Status parameter must be consistent at both the Access Point and Remote radios in order for data to flow correctly. Failure to do so might result in data not being transported correctly even when the radios are in an associated state and able to communicate over-the-air.

About Virtual LAN in Mercury

A VLAN is essentially a limited broadcast domain, meaning that all members of a VLAN receive broadcast frames sent by members of the same VLAN but *not* frames sent by members of a different VLAN. For more information, refer to the IEEE 802.1Q standard.

The transceiver supports port-based VLAN at the Ethernet interface and over the air, according to the IEEE 802.1Q standard. When **VLAN Status** is enabled, the wireless port of both AP and Remote radios act, according to user configuration, as either a trunk port or access port.

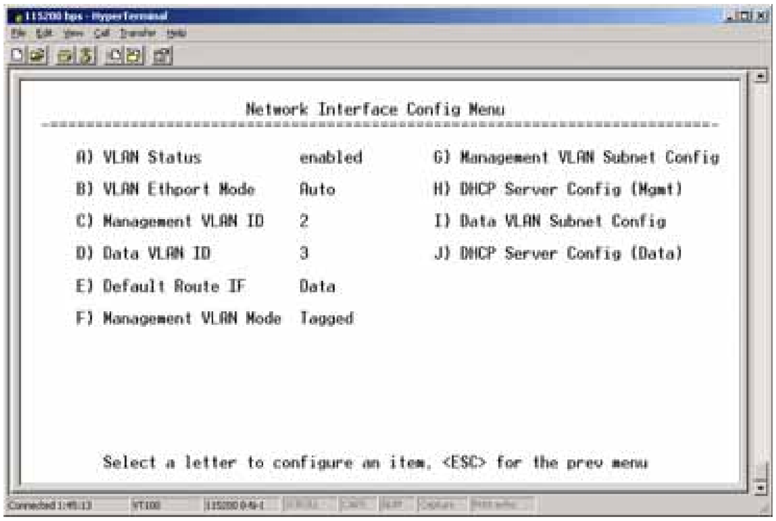
The Ethernet port of an Access Point radio is normally configured as a trunk port. This type of port expects incoming frames to have a **VLAN ID** tag and sends outgoing frames with a VLAN tag as well.

The Ethernet port of a Mercury radio can be configured as an access port or as a trunk port.

When the Ethernet port of a Mercury radio is configured as VLAN Access Port, the radio tags incoming traffic with a VLAN ID, and strips the tag before sending traffic out. This VLAN is known as the DATA VLAN. Additionally, a second VLAN is assigned for other traffic that is terminated at the radio, such as SNMP, TFTP, ICMP, Telnet, and so on. This is known as the MANAGEMENT VLAN. Traffic directed to the integrated terminal server that handles the serial ports is assigned to the DATA VLAN.

When the Ethernet port of a remote radio is configured as a VLAN trunk, the radio expects all incoming Ethernet frames to be tagged, and passes all outgoing frames as received from the wireless link, with the unchanged VLAN tag.

Network Interface Configuration Submenu—VLAN Items

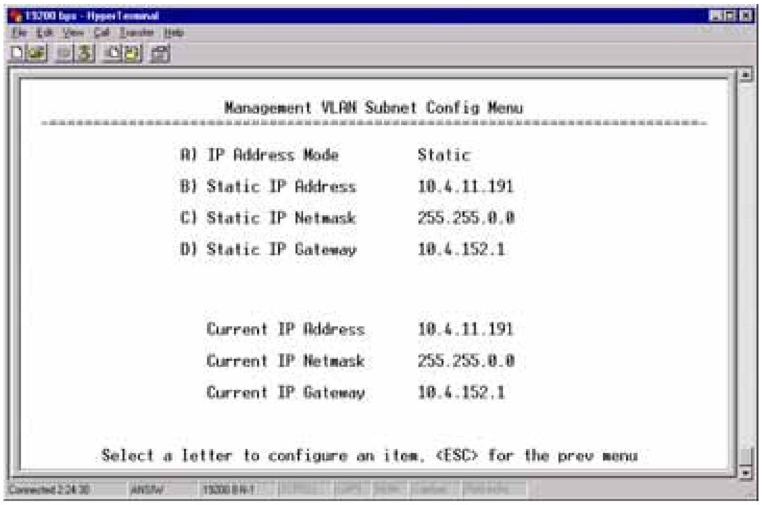


```
                    Network Interface Config Menu
-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-

   A) VLAN Status            enabled      G) Management VLAN Subnet Config
   B) VLAN Ethport Mode      Auto         H) DHCP Server Config (Mgmt)
   C) Management VLAN ID     2            I) Data VLAN Subnet Config
   D) Data VLAN ID           3            J) DHCP Server Config (Data)
   E) Default Route IF       Data
   F) Management VLAN Mode   Tagged



      Select a letter to configure an item, <ESC> for the prev menu
```

Figure 3-15. VLAN Configuration Menu

- **VLAN Status**—Defines whether the radio handles Ethernet frames in “extended” 802.1Q mode or in “normal” mode in the Ethernet port. If configured with a trunk port, the Mercury passes all tagged traffic regardless of the VLAN ID. The Mercury only uses the **Data VLAN ID** parameter when the ETH port is configured as an Access Port.
  [**enabled, disabled; disabled**]
- **VLAN Ethport Mode**—Defines if the Ethernet port acts as a trunk port or as an access port. Auto mode defines the port as a trunk port in an AP, or an access port in a Remote radio.
  [**Auto, Trunk, Access; Auto**]
- **Management VLAN ID**—Defines the VLAN ID for traffic directed to the radio itself, other than the terminal server process. This VLAN ID is used for filtering and for tagging purposes.
  [**1-4094; 2**]
- **Data VLAN ID**—Defines the VLAN ID assigned to traffic directed to and from the Ethernet port and the terminal server process in the radio. This VLAN ID is used for filtering and tagging purposes. [**1-4094; 3**]
- **Default Route IF**—Defines the VLAN that contains the default gateway in the radio. [**MGMT, DATA; MGMT**]
- **Management VLAN Mode**—Applies the VLAN tag to management frames. [**Tagged, Native; Tagged**].
- **Management VLAN Subnet Config**—Presents a screen where you can set the IP Address Mode, Static IP Address, and Static IP Netmask (see Figure 3-16 on Page 50).
- **DHCP Server Config (Mgmt)**—Presents a screen where you can view or set the DHCP server status and address information for management functions (see Figure 3-17 on Page 51).
- **Data VLAN Subnet Config**—Presents a screen where you can view or set the IP mode and address information (see Figure 3-19 on Page 52).
- **DHCP Server Config (Data)**—Presents a screen where you can view or set DHCP server status and address information for data functions (see Figure 3-18 on Page 52).

Management VLAN Subnet Configuration Menu



```
                    Management VLAN Subnet Config Menu
 ---------------------------------------------------------------------------

              A) IP Address Mode          Static
              B) Static IP Address        10.4.11.191
              C) Static IP Netmask        255.255.0.0
              D) Static IP Gateway        10.4.152.1


                 Current IP Address       10.4.11.191
                 Current IP Netmask       255.255.0.0
                 Current IP Gateway       10.4.152.1

          Select a letter to configure an item, <ESC> for the prev menu
```

Figure 3-16. Management VLAN Subnet Configuration Menu

NOTE: Changes to any of the following parameters while communicating over the network (LAN or over-the-air) might cause a loss of communication with the unit you are configuring. You must re-establish communication using the new IP address.

- **IP Address Mode**—Defines the source of the IP address of this device. Only static IP addressing mode is available when VLAN Status is enabled. [**Static**, **Dynamic**; **Static**]
- **Static IP Address**—The IPv4 local IP address. [**192.168.1.1**]
- **Static IP Netmask**—The IPv4 local subnet mask. This value is used when the radio attempts to send a locally initiated message, either from the terminal server, or from a management process. [**255.255.0.0**]

The lower three lines of the screen (**Current IP Address**, **Current IP Netmask**, **Current IP Gateway**) show the current addressing configured at the transceiver. **Current IP Gateway** only displays on this screen if **Default Route IF** on the **Network Interface Config** menu (Figure 3-15 on Page 48) is set to **Management.**

Selecting option I from the menu in Figure 3-15 on Page 48 displays the screen shown in Figure 3-19 on Page 52. Note that the IP address is different even though it is the same physical unit. This is because this IP address is defined for a different VLAN.

DHCP Server Configuration (Data and Mgmt)

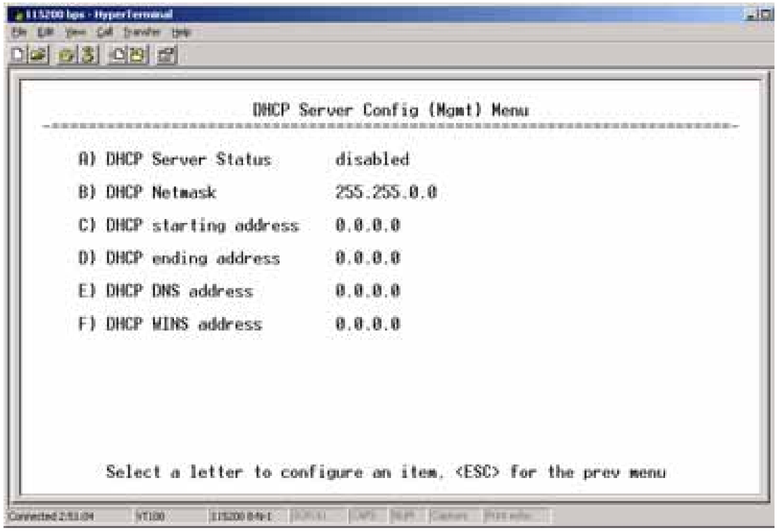
A transceiver can provide automatic IP address assignments to other IP devices in the network by providing DHCP (Dynamic Host Configuration Protocol) services. This service eliminates setting an individual device IP address on Remotes in the network, but it requires some planning of the IP address range. One drawback to network-wide automatic IP address assignments is that SNMP services might become inaccessible as they are dependent on fixed IP addresses.

You can make a network of radios with the DHCP-provided IP address enabled or with DHCP services disabled. In this way, you can accommodate locations for which a fixed IP address is desired.

NOTE: There should be only one active DHCP server in a network. If more than one DHCP server exists, network devices might randomly get their IP address from different servers every time they request one.

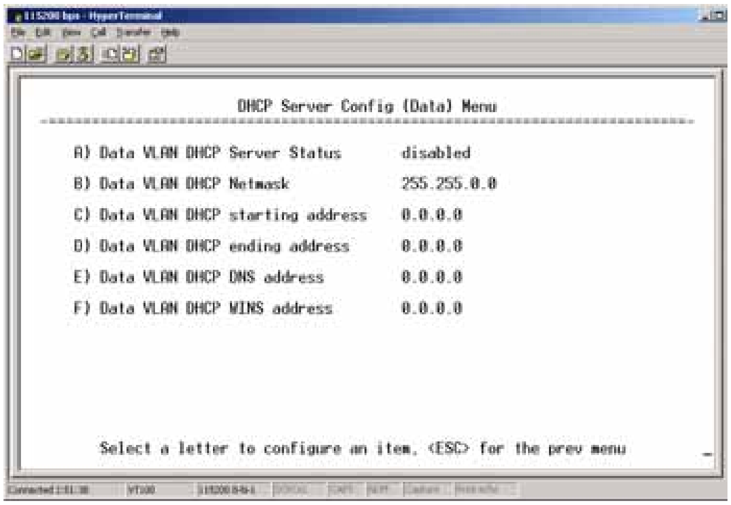
NOTE: Combining DHCP and IEEE 802.1x device authentication might result in a non-working radio if the DHCP server is located at a Remote radio site. If possible, place the DHCP server at the AP location.

A DHCP server can be run at a Remote, but it is not recommended if 802.1x Device Authentication is in use and if the AP gets its IP address from the DHCP server on the Remote. In this case, the Remote cannot authenticate to allow the AP to get its address, because the AP needs an address to perform 802.1x device authentication. This results in an unsolvable condition where the AP needs to get an IP address from DHCP at the Remote, but it can't get the address until it is authenticated.



```
                     DHCP Server Config (Mgmt) Menu
-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-

     A) DHCP Server Status       disabled

     B) DHCP Netmask             255.255.0.0

     C) DHCP starting address    0.0.0.0

     D) DHCP ending address      0.0.0.0

     E) DHCP DNS address         0.0.0.0

     F) DHCP WINS address        0.0.0.0




       Select a letter to configure an item, <ESC> for the prev menu
```

Figure 3-17. DHCP Server Configuration (Mgmt) Menu

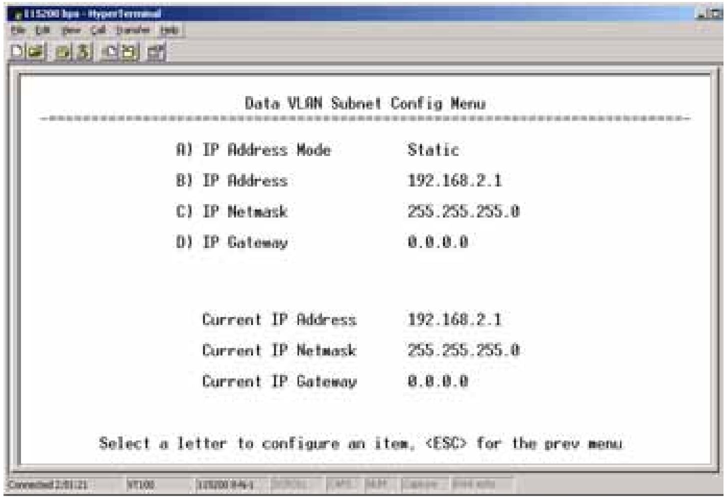


```
                         DHCP Server Config (Data) Menu
 -----------------------------------------------------------------------------

       A) Data VLAN DHCP Server Status       disabled

       B) Data VLAN DHCP Netmask             255.255.0.0

       C) Data VLAN DHCP starting address    0.0.0.0

       D) Data VLAN DHCP ending address      0.0.0.0

       E) Data VLAN DHCP DNS address         0.0.0.0

       F) Data VLAN DHCP WINS address        0.0.0.0




          Select a letter to configure an item, <ESC> for the prev menu
```

Figure 3-18. DHCP Server Configuration (Data) Menu

- **DHCP Server Status**—Enable/Disable the response to DHCP requests to assign an IP address. [**Disabled/Enabled; Disabled**]
- **DHCP Netmask**—IP netmask to be assigned along with the IP address in response to a DHCP request. [**0.0.0.0**]
- **DHCP starting address**—Lowest IP address in the range of addresses provided by this device. [**0.0.0.0**]
- **DHCP ending address**—Highest IP address in the range of addresses provided by this device. A maximum of 256 addresses is allowed in this range. [**0.0.0.0**]
- **DHCP DNS address**—Domain Name Server address provided by this service.
- **DHCP WINS address**—Windows Internet Naming Service server address provided by this service.

Data VLAN Subnet Configuration Menu



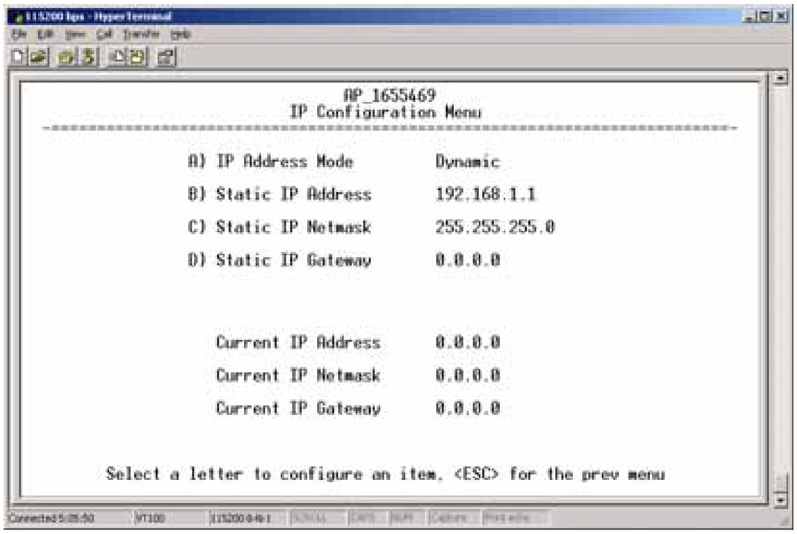
```
                          Data VLAN Subnet Config Menu
 -----------------------------------------------------------------------------

                  A) IP Address Mode         Static

                  B) IP Address              192.168.2.1

                  C) IP Netmask              255.255.255.0

                  D) IP Gateway              0.0.0.0


                     Current IP Address      192.168.2.1

                     Current IP Netmask      255.255.255.0

                     Current IP Gateway      0.0.0.0


          Select a letter to configure an item, <ESC> for the prev menu
```

Figure 3-19. Data VLAN Subnet Configuration Menu

- **IP Address Mode**—Defines the source of this device's IP address. Only static IP addressing mode is available when VLAN Status is enabled [**Static; Static**]
- **IP Address**—The IPv4 local IP address. [**192.168.1.1**]
- **IP Netmask**—The IPv4 local subnet mask. This value is used when the radio attempts to send a locally initiated message, from either the terminal server or the management process. [**255.255.0.0**]
- **IP Gateway**—The IPv4 address of the default gateway device, typically a router. [**0.0.0.0**]

The lower three lines of the screen (**Current IP Address**, **Current IP Netmask**, and **Current IP Gateway**) show the current addressing configured at the transceiver. **Current IP Gateway** only displays on this screen if **Default Route IF** on the **Network Interface Config** menu (Figure 3-15 on Page 48) is set to **Data**.

IP Configuration Menu



```
                         AP_1655469
                   IP Configuration Menu
-----------------------------------------------------------------

            A) IP Address Mode        Dynamic

            B) Static IP Address      192.168.1.1

            C) Static IP Netmask      255.255.255.0

            D) Static IP Gateway      0.0.0.0


               Current IP Address     0.0.0.0

               Current IP Netmask     0.0.0.0

               Current IP Gateway     0.0.0.0


      Select a letter to configure an item, <ESC> for the prev menu
```

Figure 3-20. IP Configuration Menu

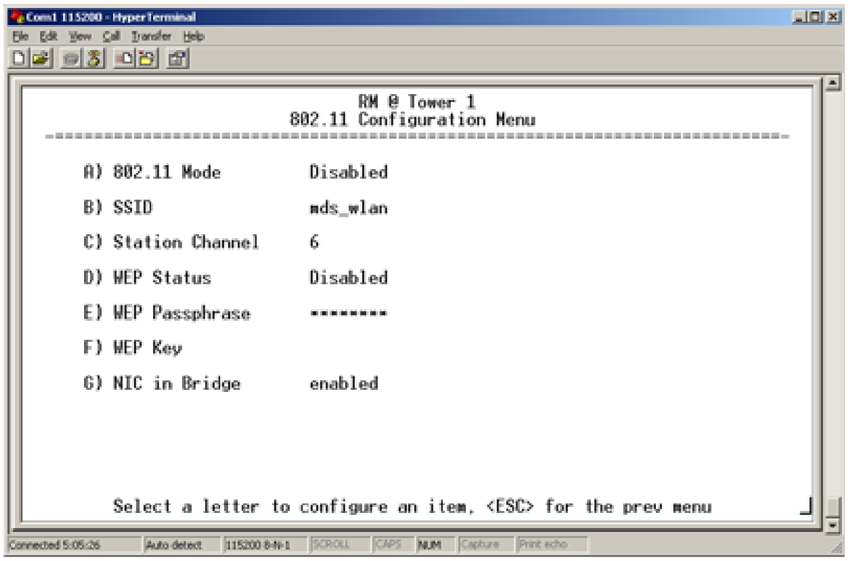
CAUTION: Changes to the following parameters while communicating over the network (LAN or over-the-air) might cause a loss of communication with the unit being configured. You must re-establish communication using the new IP address.

- **IP Address Mode**—Defines the source of this device's IP address. [**Static, Dynamic; Static**]
- **Static IP Address** *(User Review Recommended)*—Essential for connectivity to the transceiver's MS using the LAN port. Enter any valid IP address that is unique within the network. This field is unnecessary if DHCP is enabled. [**192.168.1.1**]
- **Static IP Netmask**—The IPv4 local subnet mask. This field is unnecessary if DHCP is enabled. [**255.255.0.0**]

- **Static IP Gateway**—The IPv4 address of the network gateway device, typically a router. This field is unnecessary if DHCP is enabled. [**0.0.0.0**]

  The lower three items on the screen (Current IP Address, Netmask and Gateway) show the actual addressing at the transceiver whether it was obtained from static configuration or from a DHCP server.

802.11 Configuration Submenu



```
                              RM @ Tower 1
                         802.11 Configuration Menu
-============================================================================-

    A) 802.11 Mode          Disabled

    B) SSID                 mds_wlan

    C) Station Channel      6

    D) WEP Status           Disabled

    E) WEP Passphrase       ********

    F) WEP Key

    G) NIC in Bridge        enabled




       Select a letter to configure an item, <ESC> for the prev menu
```

Figure 3-21. 802.11 Configuration Submenu

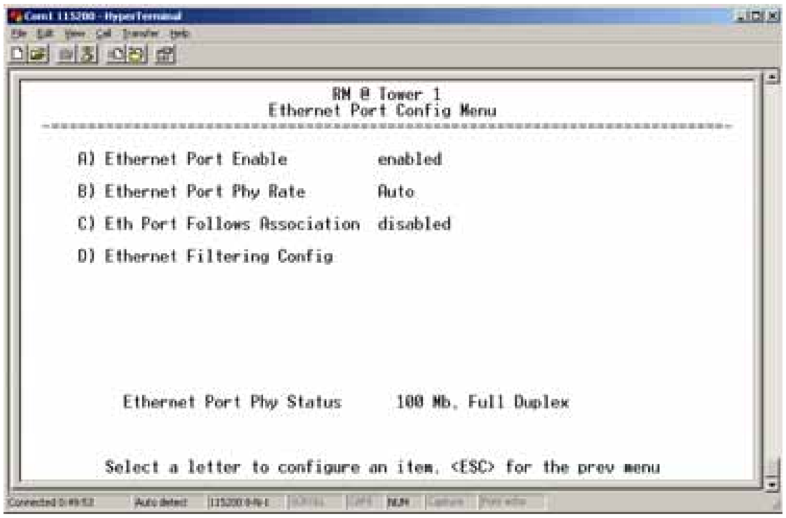
- **802.11 Mode**—Configures the WiFi radio to be an Access Point for other WiFi devices (AP), to connect to a WiFi Access Point at another location (Station), or to connect directly to another WiFi device (Ad-Hoc).
- **SSID**—Service Set Identifier, the name of the wireless LAN to which to connect. This is equivalent to Network Name in GE MDS terminology.
- **Station Channel**—Sets the 802.11 channel the device will use. This can only be set to **Auto** when in Station mode.
- **WEP Status**—The type of WEP encryption being used, if any.
- **WEP Passphrase**—The Passphrase used in WEP encryption.
- **WEP Key**—The key used in WEP encryption. This key should be entered in hexadecimal format preceded by **0x**. The key should be 13 or 26 hexadecimal characters. For example, **0x1a2b3c4d5e6f709a8b7c6d5e4f**.
- **NIC in Bridge**—When enabled, the WiFi interface is added to the network bridge, allowing traffic to pass between the WiFi and the other interfaces (LAN and wireless).

3.4.2 Ethernet Port Configuration Menu

The transceiver allows for special control of the Ethernet interface, to allow traffic awareness and availability of the backhaul network for redundancy purposes.

NOTE: The transceiver's network port supports 10BaseT and 100BaseT connections. Confirm that your hub/switch is capable of auto-switching data rates.

To prevent excessive Ethernet traffic from degrading performance, place the transceiver in a segment, or behind routers.

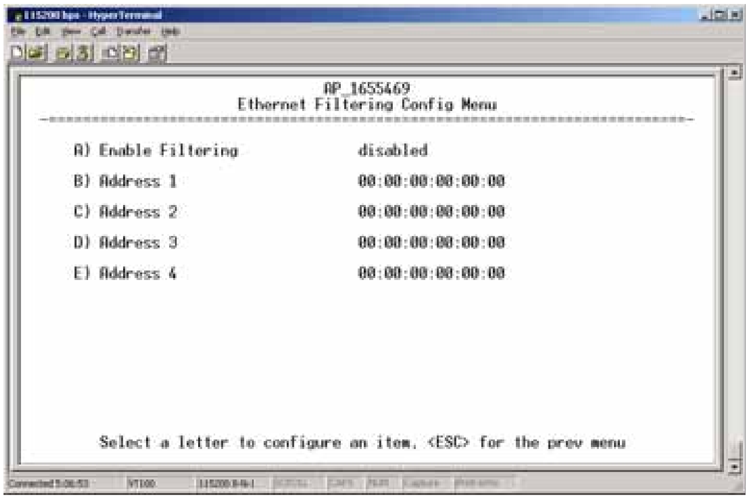


```
                              RM @ Tower 1
                        Ethernet Port Config Menu
-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-

       A) Ethernet Port Enable          enabled

       B) Ethernet Port Phy Rate        Auto

       C) Eth Port Follows Association  disabled

       D) Ethernet Filtering Config





          Ethernet Port Phy Status      100 Mb, Full Duplex


         Select a letter to configure an item, <ESC> for the prev menu
```

Figure 3-22. Ethernet Port Configuration Menu
(MaxRM radio)

- **Ethernet Port Enable**—Allows enabling/disabling Ethernet traffic for security purposes. Setting it to **enabled** enables the port. [**enabled, disabled; enabled**]
- **Ethernet Port Phy Rate**—The Ethernet port's configured speed.
- **Eth Port Follows Association** (Remote Only)—When enabled, the Ethernet port is disabled until the Remote associates. This allows a PC or laptop connected to the Remote to know when the wireless link is available. This feature helps middleware on the laptop in making connectivity decisions. In addition, if the Remote moves between Access Points on different subnets, then the laptop can DHCP for a new address when the link comes back up. [**enabled, disabled; disabled**]
- **Ethernet Filtering Config**—Allows enabling/disabling filtering and specifying of Ethernet addresses.

Ethernet Filtering Configuration Menu



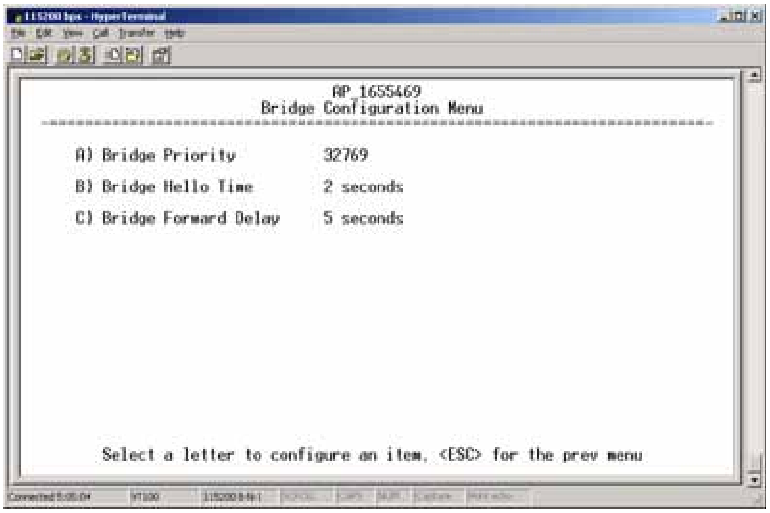
115200 bps - HyperTerminal
File Edit View Call Transfer Help
Connected 5:06:53 VT100 115200 8-N-1

```
                              AP_1655469
                      Ethernet Filtering Config Menu
-==========================================================================-

     A) Enable Filtering               disabled

     B) Address 1                      00:00:00:00:00:00

     C) Address 2                      00:00:00:00:00:00

     D) Address 3                      00:00:00:00:00:00

     E) Address 4                      00:00:00:00:00:00




          Select a letter to configure an item, <ESC> for the prev menu
```

Figure 3-23. Ethernet Filtering Configuration Menu

- **Enable Filtering**—Activates Ethernet filtering. [**enabled, disabled; disabled**]
- **Address 1, 2, 3, 4**—Ethernet address fields. When filtering is enabled, the Mercury only accepts traffic on its Ethernet port from the configured addresses. [**Valid MAC address string**]

3.4.3 Bridge Configuration



115200 bps - HyperTerminal
File Edit View Call Transfer Help
Connected 5:05:04 VT100 115200 8-N-1

```
                              AP_1655469
                       Bridge Configuration Menu
-==========================================================================-

     A) Bridge Priority          32769

     B) Bridge Hello Time        2 seconds

     C) Bridge Forward Delay     5 seconds




          Select a letter to configure an item, <ESC> for the prev menu
```

Figure 3-24. Bridge Configuration Menu

- **Bridge Priority**—View/set the priority of the bridge in the spanning tree. [**0-65535; 32769**]
- **Bridge Hello Time**—View/set spanning tree hello time. This parameter affects how often the bridge sends a spanning tree Bridge Protocol Data Unit (BPDU). [**1-10 seconds; 2 seconds**]

- **Bridge Forward Delay**—View/set spanning tree forwarding delay. Affects how long the bridge spends listening and learning after initialization. [**4-30 seconds; 5 seconds**].

3.4.4 SNMP Agent Configuration

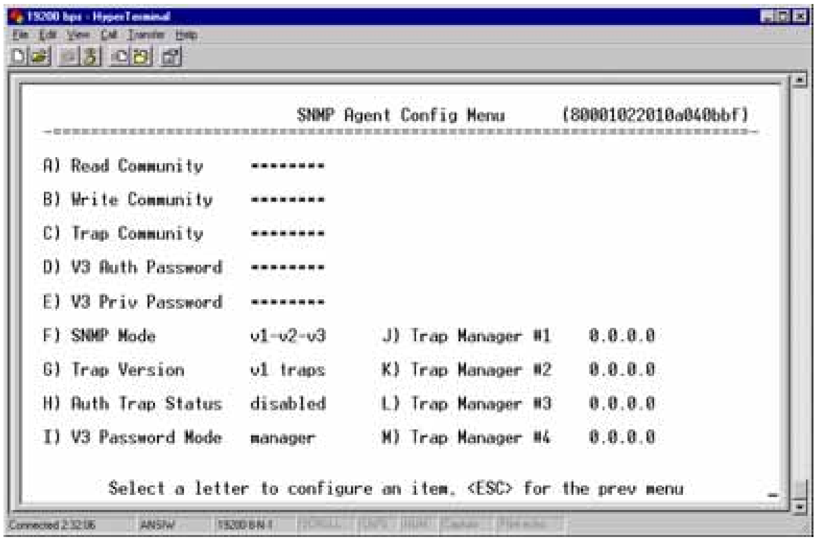
The transceiver contains over 100 custom SNMP-manageable objects as well as the IETF standard RFC1213 for protocol statistics, also known as MIB II. You can use off-the-shelf SNMP managers to access the transceiver's SNMP Agent's MIB, such as Castle Rock Computing *SNMPc*™ and Hewlett Packard *OpenView*™. The transceiver's SNMP agent supports SNMPv1, v2, and v3.

The objects are split into nine MIB files for use with your SNMP manager. There are textual conventions, common files, and specific files. This allows the flexibility to change areas of the MIB and not affect other existing installations or customers.

- **msdreg.mib**—MDS sub-tree registrations
- **mds_comm.mib**—MDS Common MIB definitions for objects and events common to the entire product family
- **mercury_reg.mib**—MDS sub-tree registrations
- **mercurytrv1.mib**—SNMPv1 enterprise-specific traps
- **mercurytrv2.mib**—SNMPv2 enterprise-specific traps
- **mercury_comm.mib**— MIB definitions for objects and events common to the entire Mercury Series
- **mercury_ap.mib**—MIB definitions for objects and events for an Access Point transceiver
- **mercury_rem.mib**—Definitions for objects and events for a Remote radio
- **mercury_sec.mib**—For security management of the radio system

NOTE: SNMP management requires that the proper IP address, network, and gateway addresses are configured in each associated network transceiver.

In addition, some management systems might require that you compile the MIB files in the order shown above.



```
                         SNMP Agent Config Menu      (80001022010a040bbf)
-=============================================================================-

A) Read Community     --------

B) Write Community    --------

C) Trap Community     --------

D) V3 Auth Password   --------

E) V3 Priv Password   --------

F) SNMP Mode          v1-v2-v3      J) Trap Manager #1    0.0.0.0

G) Trap Version       v1 traps      K) Trap Manager #2    0.0.0.0

H) Auth Trap Status   disabled      L) Trap Manager #3    0.0.0.0

I) V3 Password Mode   manager       M) Trap Manager #4    0.0.0.0

      Select a letter to configure an item, <ESC> for the prev menu
```

Figure 3-25. SNMP Server Configuration Menu

This menu provides configuration and control of vital SNMP functions.

- **Read Community String**—SNMP community name with SNMPv1/SNMPv2c read access. This string can contain up to 30 alpha-numeric characters.
- **Write Community String**—SNMP community name with SNMPv1/SNMPv2c write access. This string can contain up to 30 alpha-numeric characters.
- **Trap Community String**—SNMP community name with SNMPv1/SNMPv2c trap access. This string can contain up to 30 alpha-numeric characters.
- **V3 Authentication Password**—Authentication password stored in flash memory. This is used when the Agent is managing passwords locally (or initially for all cases on reboot). This is the SNMPv3 password used for Authentication (currently, only MD5 is supported). This string can contain up to 30 alpha-numeric characters.
- **V3 Privacy Password**—Privacy password stored in flash memory. Used when the SNMP Agent is managing passwords locally (or initially for all cases on reboot). This is the SNMPv3 password used for privacy (DES encryption). This string can contain between 8 and 30 alpha-numeric characters.
- **SNMP Mode**—This specifies the mode of operation of the radio’s SNMP Agent. The choices are: **disabled**, **v1_only**, **v2_only**, **v3_only**, **v1-v2**, and **v1-v2-v3**. If the mode is **disabled**, the Agent does not respond to any SNMP traffic. If the mode is **v1_only**, **v2_only**, or **v3_only**, the Agent responds only to that version of SNMP traffic. If the mode is **v1-v2** or **v1-v2-v3**, the Agent responds to the specified version of SNMP traffic. [**v1-v2-v3**]

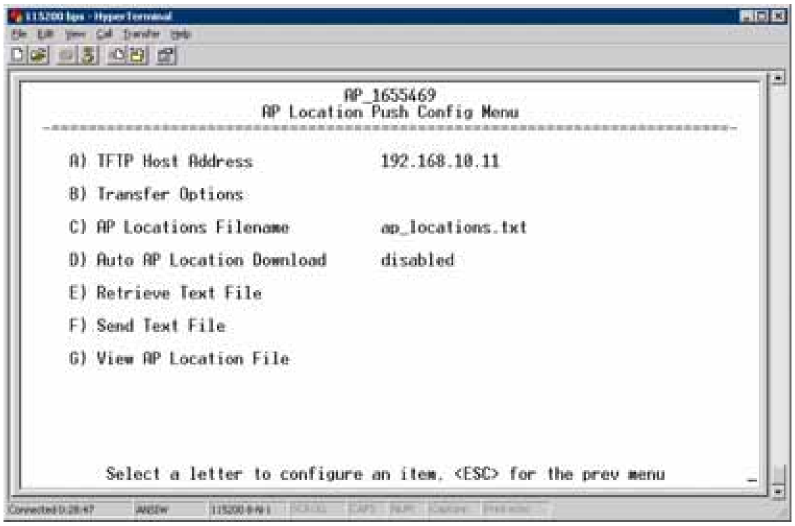
- **Trap Version**—This specifies which version of SNMP is used to encode the outgoing traps. The choices are **v1_traps**, **v2_traps**, and **v3_traps**. When **v3_traps** is selected, v2-style traps are sent, but with a v3 header. [**v1_traps**, **v2_traps**, **v3_traps**]
- **Auth Traps Status**—Indicates whether or not traps are generated for failed authentication of an SNMP PDU. [**Disabled/Enabled; Disabled**]
- **SNMP V3 Passwords**—Determines whether v3 passwords are managed locally or via an SNMP Manager. The different behaviors of the Agent, depending on the mode selected, are described in **SNMP Mode** above.
- **Trap Manager #1—#4**— Table of up to four locations on the network to which traps are sent. [**Any standard IP address**]

NOTE: The number in the upper right-hand corner of the screen is the SNMP Agent's SNMPv3 Engine ID. Some SNMP Managers may need to know this ID in order interface with the transceiver's SNMP Agent. The ID only appears on the screen when SNMP Mode is either **v1-v2-v3** or **v3_only**.

NOTE: For more SNMP information, see *"NOTES ON SNMP"* on Page 178.

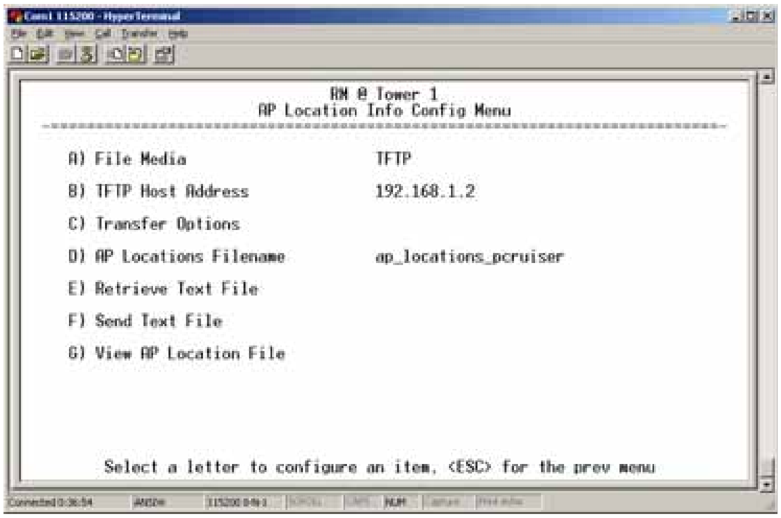
3.4.5 AP Location Push Config Menu

This menu configures the AP for updating connected remotes with the AP Locations File loaded on the AP.



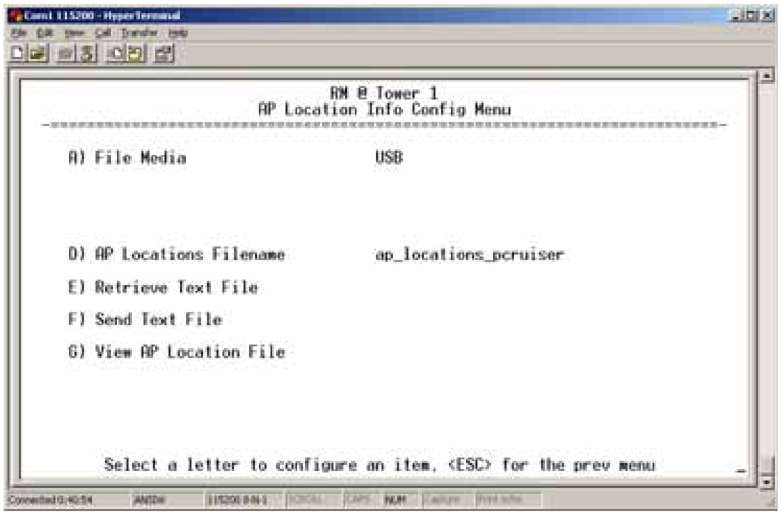
```
                              AP_1655469
                      AP Location Push Config Menu
 -==========================================================================-

   A) TFTP Host Address               192.168.10.11

   B) Transfer Options

   C) AP Locations Filename           ap_locations.txt

   D) Auto AP Location Download       disabled

   E) Retrieve Text File

   F) Send Text File

   G) View AP Location File




       Select a letter to configure an item, <ESC> for the prev menu
```

Figure 3-26. AP Location Push Config Menu


Com1 115200 - HyperTerminal
File Edit View Call Transfer Help

```
                          RM @ Tower 1
                   AP Location Info Config Menu
 -=========================================================================-

   A) File Media                   TFTP

   B) TFTP Host Address            192.168.1.2

   C) Transfer Options

   D) AP Locations Filename        ap_locations_pcruiser

   E) Retrieve Text File

   F) Send Text File

   G) View AP Location File




       Select a letter to configure an item, <ESC> for the prev menu
```

Figure 3-27. AP Location Info Configuration Menu, TFTP Mode
(Firmware version 3.0 only)

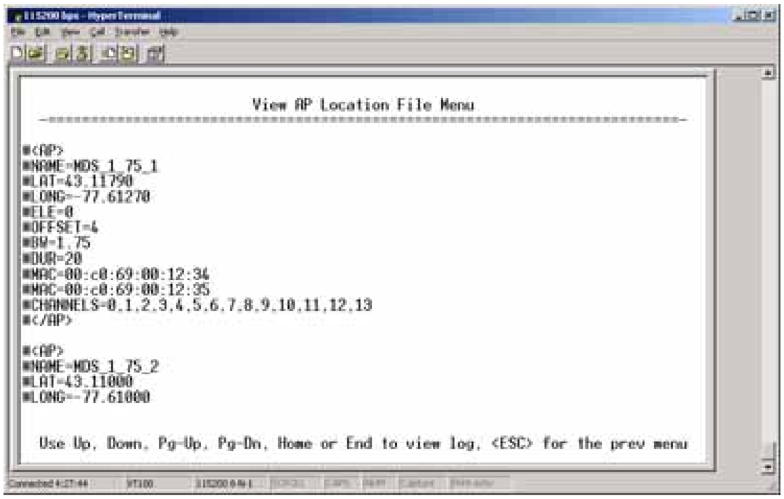

Com1 115200 - HyperTerminal
File Edit View Call Transfer Help

```
                          RM @ Tower 1
                   AP Location Info Config Menu
 -=========================================================================-

   A) File Media                   USB




   D) AP Locations Filename        ap_locations_pcruiser

   E) Retrieve Text File

   F) Send Text File

   G) View AP Location File




       Select a letter to configure an item, <ESC> for the prev menu
```

Figure 3-28. AP Location Info Configuration Menu, USB Mode
(Firmware version 3.0 or later)

- **File Media**—A selection of methods for transferring files to and from the radio available on firmware version 3.0 radios. The options are: **TFTP** and **USB**.
- **TFTP Host Address**—IP address of the TFTP server that holds the AP locations file. [**any valid IP address; 0.0.0.0**]
- **Transfer Options**—Menu for configuring the TFTP transfer.
- **AP Locations Filename**—Name of the AP Locations file on the server. [**any valid filename string; ap_locations.txt**]
- **Auto AP Location Download**—A setting to force connected remotes to download immediately the AP Locations file on the AP. Remotes that associate to an AP with this feature will also download the file.

- **Retrieve Text File**—Download AP Locations text file from the server.
- **Send Text File**—Upload the local AP Locations file to the server.
- **View AP Location File**—Allows on-screen review of the AP Locations file. An example screen is shown in Figure 3-29.



```
                         View AP Location File Menu
 -==========================================================================-

#<AP>
#NAME=MDS_1_75_1
#LAT=43.11790
#LONG=-77.61270
#ELE=0
#OFFSET=4
#BW=1.75
#DUR=20
#MAC=00:c0:69:00:12:34
#MAC=00:c0:69:00:12:35
#CHANNELS=0,1,2,3,4,5,6,7,8,9,10,11,12,13
#</AP>

#<AP>
#NAME=MDS_1_75_2
#LAT=43.11000
#LONG=-77.61000

 Use Up, Down, Pg-Up, Pg-Dn, Home or End to view log, <ESC> for the prev menu
```

Figure 3-29. AP Location Text File

AP Locations File Syntax and Guidelines

The AP Locations file is used by the Remote radio to determine which Access Point to connect to when operating in **Hopping w/ Hand-offs** mode. The AP Locations file is a simple text file containing information about the location and configuration of all Access Points that the Remote can associate with. The file is filled in by creating "AP definition blocks" using tags and labels. The <AP> tag is used to begin a definition block and the </AP> tag ends the block. Within the block, you can declare several parameters using a LABEL=VALUE syntax. The possible labels are:

- **NAME**—The name of the AP. Typically set to the **Device Name** configured on the AP
- **LAT**—GPS Latitude of the AP in decimal degrees
- **LONG**—GPS Longitude of the AP in decimal degrees
- **OFFSET**—Pattern Offset configured on the AP
- **BW**—Bandwidth configured on the AP
- **DUR**—Frame duration (10 or 20) configured on the AP
- **MAC**—The "Wireless MAN Address" configured on the AP
- **CHANNELS**—Specifies which channels are being used by the AP
- **GROUP**—Name of a grouping of Access Points. A Remote configured with **Eth Follows Association** enabled does not disable its wired port when moving between APs of the same group.This is useful when two or more APs are on the same subnet.
- **MODE**—**Single** or **Hopping.** Specifies the Frequency Mode of the AP.

- **SINGLE_CHAN**—Specifies the AP’s Single Frequency mode channel.

The **MAC** label may appear twice if a P23 redundant Access Point is installed at that location. In this case, one **MAC** statement provides the MAC address of the A radio and the other **MAC** statement provides the MAC address of the B radio. The **CHANNELS** statement only needs to be present if the channel selection feature is used at the Access Point to limit which channels are active. If all channels are used, you can leave out the **CHANNELS** statement. You can leave out the **BW** statement for APs that are configured to 1.75 MHz bandwidth. You can also leave out the **DUR** statement for APs that are configured with a 20 millisecond frame duration.

NOTE: MAC filtering on APs should be used only in a stable network or with the complete understanding that devices not listed in the AP filter will not gain access to the Remotes, nor be accessible to the Remotes.

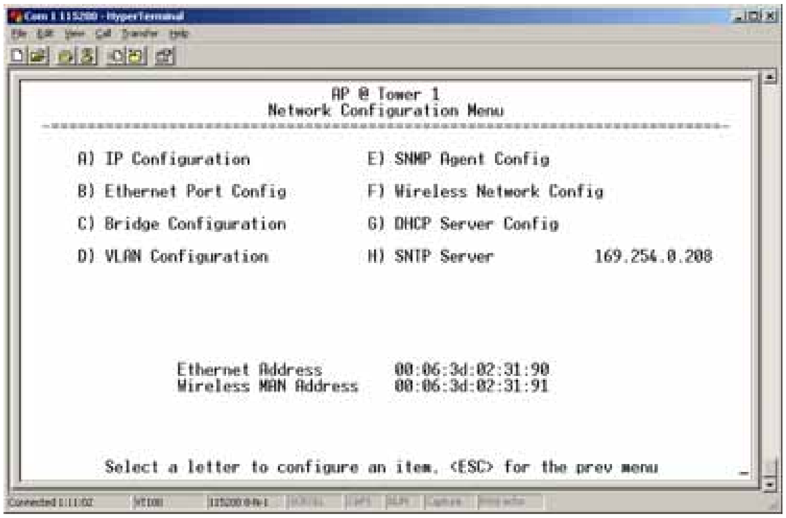
The following shows the syntax of the AP Locations file:

```
# Mercury Remote AP Locations file
# These lines are comments

# The following line defines the beginning of an AP definition block
<AP>
NAME=MyAccessPoint
LAT=43.11790
LONG=-77.61270
OFFSET=3
BW=1.75
DUR=20
MAC=00:06:3D:00:01:23
CHANNELS=1,3,5,7,9,11,13

# The following line defines the end of the AP definition block
</AP>
```

3.4.6 SNTP Server Configuration

The Simple Network Time Protocol (SNTP) allows the Mercury to obtain time of day data from a network server.

NOTE: The Mercury can also obtain time of day data from the GPS receiver, if the receiver has a satellite fix.



```
                              AP @ Tower 1
                        Network Configuration Menu
--------------------------------------------------------------------------------

      A) IP Configuration              E) SNMP Agent Config

      B) Ethernet Port Config          F) Wireless Network Config

      C) Bridge Configuration          G) DHCP Server Config

      D) VLAN Configuration            H) SNTP Server          169.254.0.208




                 Ethernet Address       00:06:3d:02:31:90
                 Wireless MAN Address   00:06:3d:02:31:91



         Select a letter to configure an item, <ESC> for the prev menu
```

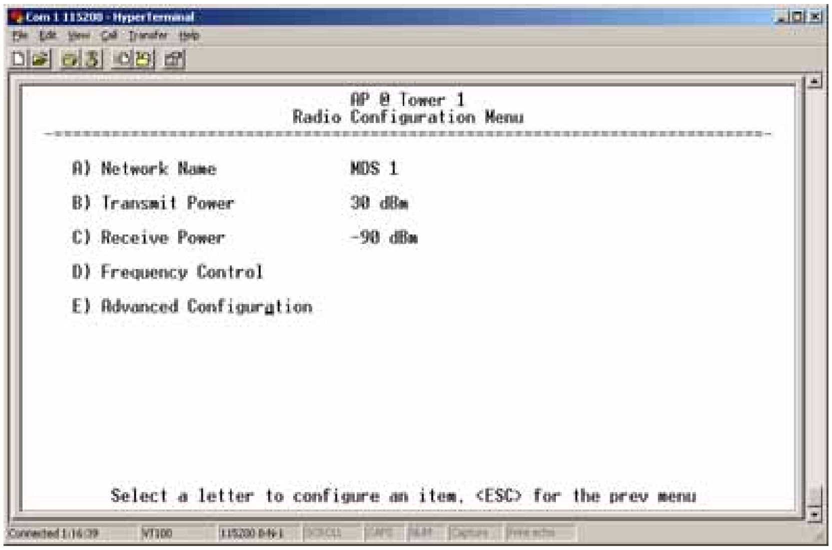
Figure 3-30. SNTP Server Entry (on Network Configuration Menu)

When **SNTP Server** is selected (item H), the area to the right of the parameter becomes active, allowing you to enter a valid SNTP server address. Press the Return key to make the address entry active.

3.5 RADIO CONFIGURATION

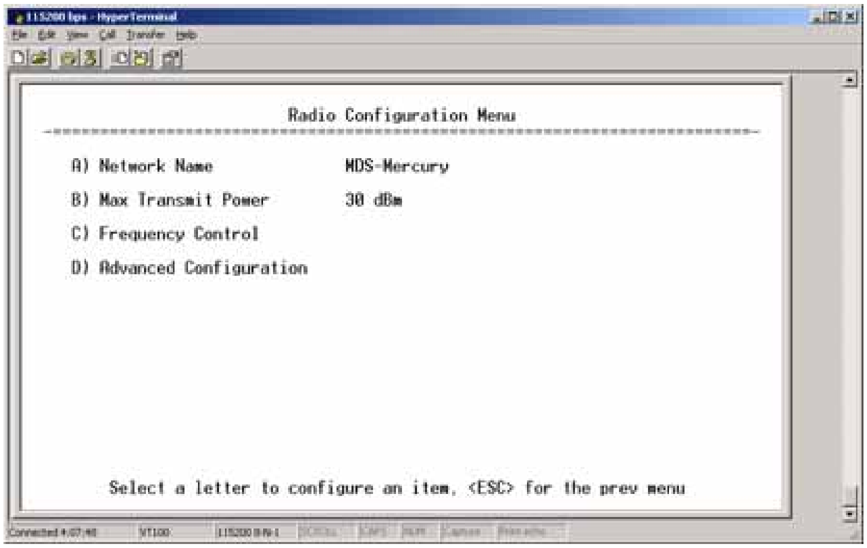
There are two primary layers in the transceiver network—radio and data. Since the data layer is dependent on the radio layer working properly, configure and set the radio items before proceeding. This section explains the *Radio Configuration Menu*, (Figure 3-31 for AP, Figure 3-32 for Remote).

3.5.1 Radio Configuration Menu



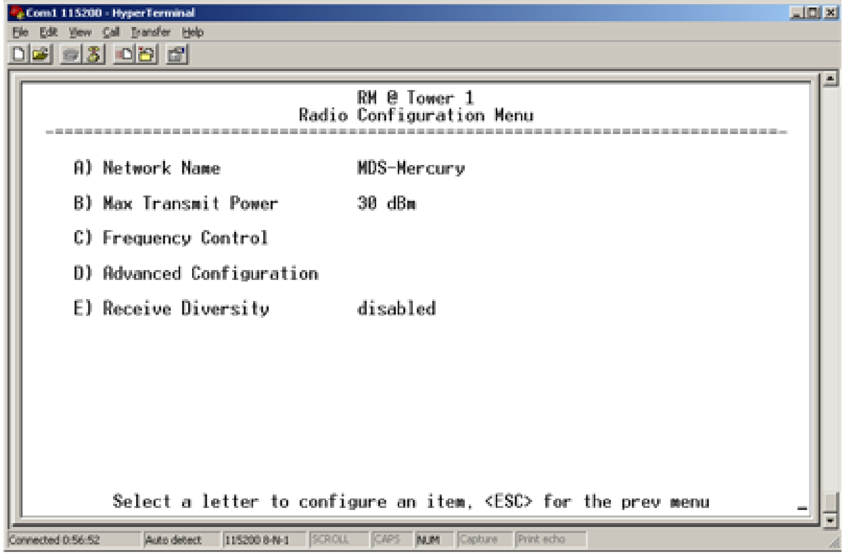
```
                              AP @ Tower 1
                        Radio Configuration Menu
--------------------------------------------------------------------------------

      A) Network Name                MDS 1

      B) Transmit Power              30 dBm

      C) Receive Power               -90 dBm

      D) Frequency Control

      E) Advanced Configuration






         Select a letter to configure an item, <ESC> for the prev menu
```

Figure 3-31. Radio Configuration Menu
(From Access Point)


115200 bps - HyperTerminal
File Edit View Call Transfer Help
Connected 4:07:48 VT100 115200 8-N-1 SCROLL CAPS NUM Capture Print echo

```
                         Radio Configuration Menu
 ------------------------------------------------------------------------------

   A) Network Name                MDS-Mercury

   B) Max Transmit Power          30 dBm

   C) Frequency Control

   D) Advanced Configuration




            Select a letter to configure an item, <ESC> for the prev menu
```

Figure 3-32. Radio Configuration Menu
(From Remote Unit)


Com1 115200 - HyperTerminal
File Edit View Call Transfer Help
Connected 0:56:52 Auto detect 115200 8-N-1 SCROLL CAPS NUM Capture Print echo

```
                               RM @ Tower 1
                         Radio Configuration Menu
 ------------------------------------------------------------------------------

   A) Network Name                MDS-Mercury

   B) Max Transmit Power          30 dBm

   C) Frequency Control

   D) Advanced Configuration

   E) Receive Diversity           disabled




            Select a letter to configure an item, <ESC> for the prev menu
```

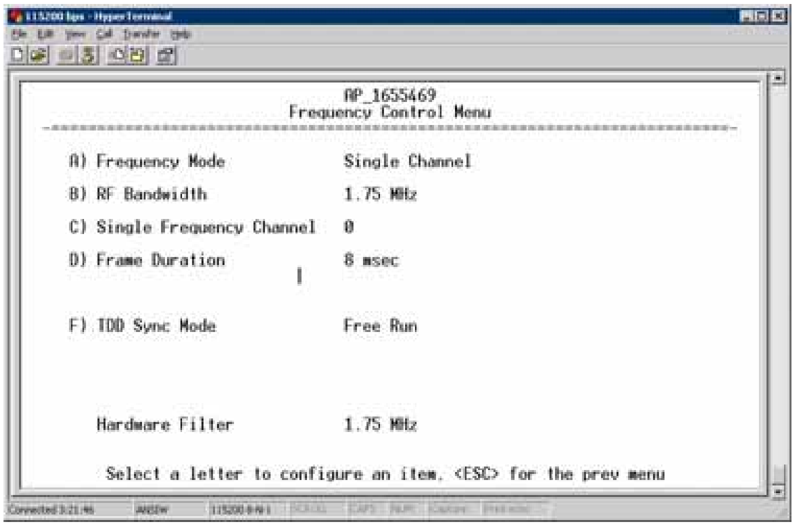
Figure 3-33. Radio Configuration Menu
(From Option Set 1 Remote)

- **Network Name**—The user-defined name for the wireless network. [**Any 40 character string; MDS-Mercury**]
- **Transmit Power** (AP Only)—Sets/displays RF power output level in dBm. This setting should reflect local regulatory limitations and losses in antenna transmission line. (See *“How Much Output Power Can be Used?”* on Page 167 for information on how to calculate this value.) [**0—30; 30**(900 model)] [**0—23; 23**(3650 model)]

- **Max Transmit Power** (Remote Only)—Sets/displays maximum RF power output level in dBm of the Remote. Power level is still controlled by the AP, but it is limited to the maximum level set here. This setting should reflect local regulatory limitations and losses in antenna transmission line. (See *"How Much Output Power Can be Used?"* on Page 167 for information on how to calculate this value.) [**0—30**; **30**(900 model) **0—23**; **23**(3650 model)
- **Receive Power** (AP Only)—View/set the receiver gain setpoint for the expected strength of incoming signals from Remotes. This setting indicates at what level (in dBm) the AP expects to hear the Remote stations. A setting of -70 would set the AP receiver's gain to a relatively low level, while a setting of -85 would be a comparatively high gain setting. [**-100 to -20**; **-75**]
- **Frequency Control**—Opens a submenu where you can view or set frequency mode bandwidth, channel and other parameters as described in *Frequency Control Menu* below.
- **Advanced Configuration**—Opens a submenu where you can view or set modulation, protection/hysteresis margins, data compression, ARQ settings, and other parameters as described in *Advanced Configuration Menu* on Page 72.
- **Receive Diversity** (900 MHz Remote Only)—Allows enabling or disabling the RX2 antenna port for receive operation. The use of two antennas allows "diversity" reception which helps minimize the effects of fading due to multipath reception of signals.

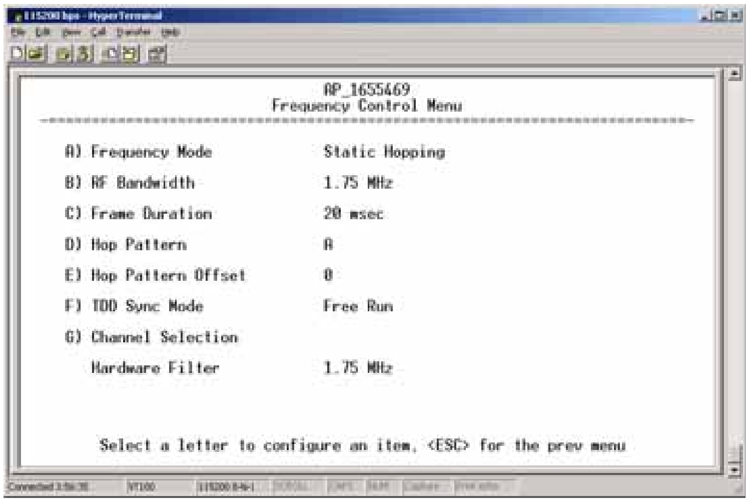
Frequency Control Menu

The items shown on this menu vary depending on the Frequency Mode Selection (**Single Channel**, **Static Hopping**, **Hopping w/Hand-offs**). Examples of all three screens are provided below, followed by a description of the menu items.


115200 bps - HyperTerminal
File Edit View Call Transfer Help
Connected 3:21:46 ANSIW 115200 8-N-1 SCROLL CAPS NUM Capture Print echo

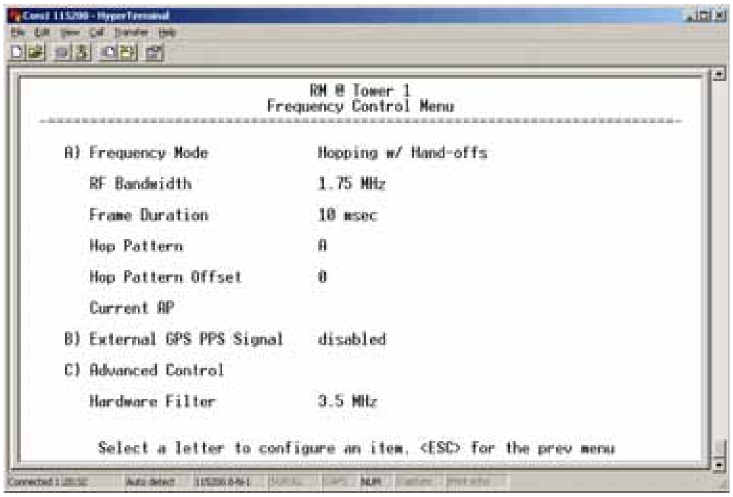
```
                              AP_1655469
                        Frequency Control Menu
-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-

   A) Frequency Mode              Single Channel

   B) RF Bandwidth                1.75 MHz

   C) Single Frequency Channel    0

   D) Frame Duration              8 msec


   F) TDD Sync Mode               Free Run



      Hardware Filter             1.75 MHz

       Select a letter to configure an item, <ESC> for the prev menu
```

Figure 3-34. Frequency Control Menu
(900 MHz AP, Single Channel Freq. Mode)



```
                          AP_1655469
                     Frequency Control Menu
 ---------------------------------------------------------------------------

   A) Frequency Mode              Static Hopping

   B) RF Bandwidth                1.75 MHz

   C) Frame Duration              20 msec

   D) Hop Pattern                 A

   E) Hop Pattern Offset          0

   F) TDD Sync Mode               Free Run

   G) Channel Selection

      Hardware Filter             1.75 MHz


         Select a letter to configure an item, <ESC> for the prev menu
```

Figure 3-35. Frequency Control Menu
(900 MHz AP, Static Hopping Freq. Mode)



```
                          RM @ Tower 1
                     Frequency Control Menu
 ---------------------------------------------------------------------------

   A) Frequency Mode              Hopping w/ Hand-offs

      RF Bandwidth                1.75 MHz

      Frame Duration              10 msec

      Hop Pattern                 A

      Hop Pattern Offset          0

      Current AP

   B) External GPS PPS Signal     disabled

   C) Advanced Control

      Hardware Filter             3.5 MHz

         Select a letter to configure an item, <ESC> for the prev menu
```

Figure 3-36. Frequency Control Menu
(900 MHz Remote, Hopping w/Hand-offs Freq. Mode)