LEDR Series
Digital Microwave Radios

Covering LEDR 400S/F, 700S, 900S/F, 1400S/F Models

Including Protected (1+1) and Space Diversity Versions

P/N 05-3627A01, Rev. F
MAY 2008

GE MDS
industrial wireless networks

Reference Manual

QUICK-START GUIDE

LEDR Series radios are typically supplied from the factory in matched pairs and are configured to user's specifications. There are a few steps necessary to place the pair on-the-air communicating with each other. Once this is done, system-specific parameters will need to be reviewed and changed to match your requirements. Below are the basic steps for installing the LEDR radio. For more detailed instructions, please see "INITIAL STARTUP AND CONFIGURATION" on Page 22. When making cable connections, refer to Section 2.6, *Rear Panel Connectors*, on Page 14 for a rear panel view of the radio.

1. Connect a suitable RF load to the antenna connector of the radio

- Load must be 50 Ohms, non-inductive, and be capable of handling at least 1 Watt continuously.

2. Connect the data equipment to the rear panel data interface

- The data interface should be an RJ-45 connector for Fractional-T1, Fractional-E1, or E1, and a DB-25 connector for EIA-530.
- Verify the customer premises data equipment is configured as DTE. (By default, the LEDR radio is configured as DCE.)

3. Apply DC power to the radio

- Verify that the supply voltage matches the radio's input range, typically 24 Vdc or 48 Vdc.
- The power connector is a three-pin keyed connector. The power source can be connected with either polarity. The center pin is not connected inside the radio.
- Ensure the GROUND lug on the rear chassis is connected to an appropriate safety ground point.

4. Change the SUPER password and set up user access

- Login to Network Management System, using the password **SUPER**.
  (See "login" on Page 71.)
- Change the password using the **PASSWD** command. (See "passwd" on Page 76.)
- Set up required users, passwords and access levels using the **USER** command, as required.
  (See "user" on Page 90.)

5. Set the radio's operating frequencies using front panel or console interface

- Set the transmit/receive frequencies (**TX xxx.xxxx**/**RX xxx.xxxx**) if they need to be changed from the factory settings. (See "freq" on Page 61.)

6. Verify and set the following parameters as necessary to allow data throughput and interconnection with the network.

- Radio modulation type and data rate parameters. (See "modem" on Page 74.)
- Data interface: clocking (See "clkmode" on Page 57.)
  interleave depth (See "interleave" on Page 65.)
- Data framing. (See "fstruct" on Page 61.)

Quick-Start instructions continued inside rear cover of this manual.

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Copyright Notice

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.

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.

ISO 9001 Registration

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

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.

RF Emissions

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules or ETSI specification ETS 300 385, as appropriate. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area may to cause harmful interference in which case users will be required to correct the interference at their own expense.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Antenna Installation Warning

1. All antenna installation and servicing is to be performed by **qualified technical personnel** only. When servicing the antenna, or working at distances closer than those listed in the tables below, *ensure the transmitter has been disabled*.

2. Typically, the antenna connected to the transmitter is a directional (high gain) antenna, fixed-mounted on the side or top of a building, or on a tower. Depending upon the application and the gain of the antenna, the total composite power could exceed 20 to 50 watts EIRP. The antenna location should be such that only qualified technical personnel can access it,and that under normal operating conditions no other person can touch the antenna or approach within **2.68 meters** of the antenna.

Antenna Gain vs. Recommended Minimum Safe Distances

RF Exposure

	Antenna Gain			
Safe Distance from Antenna	**0–5 dBi**	**5–10 dBi**	**10–20 dBi**	**20–30 dBi**
LEDR 400:	0.15 Meter	0.26 Meter	0.85 Meter	2.68 Meters
LEDR 700:	0.11 Meter	0.19 Meter	0.59 Meter	1.85 Meters
LEDR 900:	0.1 Meter	0.17 Meter	0.54 Meter	1.71 Meters
LEDR 1400:	0.1 Meter	0.13 Meter	0.42 Meter	1.32 Meters

Manual Revision and Accuracy

While every reasonable effort has been made to ensure the accuracy of this manual, product improvements may result in minor differences between the manual and the product shipped to you. If you have additional questions or need an exact specification for a product, please contact our Customer Services group using the information at the back of this guide. Microwave Data Systems reserves its right to correct any errors and omissions. Updated information may also be available on our Web site at www.GEmds.com.

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.

Distress Beacon Warning

In the U.S.A., the 406 to 406.1 MHz band is reserved for use by distress beacons. Since the LEDR 400 radio is capable of transmitting in this band, take precautions to prevent the radio from transmitting between 406 to 406.1 MHz.

1.0 INTRODUCTION

This manual is intended to help an experienced technician install, configure, and operate one of the digital radios in the MDS LEDR Series: 400S/F, 700S, 900S/F or 1400S/F. LEDR is an acronym for "Licensed Enhanced Data Rate."

This manual begins with an overall description of product features and is followed by the steps required to install the radio and place it into normal operation. After installation, we suggest keeping this guide near the radio for future reference.

1.1 Product Description

The LEDR radio (Figure 1) is a full-duplex, point-to-point digital radio operating in one of three radio frequency bands and at several bandwidths as summarized in Table 1.

Table 1. Key LEDR Radio Characteristics

MODEL(S)	BANDWIDTH(S)	FREQ. RANGE	INTERFACE
LEDR 400S	25/50/100/200 kHz	330-512 MHz	FE1 FT1 EIA-530
LEDR 400F	0.5/1/2 MHz	330-512 MHz	E1/G.703
LEDR 700S	25/50/100/200 kHz	746-794 MHz	EIA-530
LEDR 900S	25/50/100/200 kHz	800-960 MHz	FE1 FT1 EIA-530
LEDR 900F	0.5/1/2 MHz	800–960 MHz	E1/G.703
LEDR 1400S	25/50/100/200 kHz	1350–1535 MHz	FE1 FT1 EIA-530
LEDR 1400F	0.5/1/2 MHz	1350–1535 MHz	E1/G.703

With the addition of an optional Fractional-T1 Interface card, a LEDR 700S or 900S Series radio can be connected to industry-standard T1 data interface equipment. See Page 120 for a complete description of the Fractional-T1, Fractional-E1 and Full-Rate E1 options.

All LEDR Series radios (with the exception of the 700S) are available in a protected "1+1" configuration. The protected configuration consists of two identical LEDR radios and a Protected Switch Chassis (Figure 2). The protected configuration performs automatic switchover to a secondary radio in the event of a failure in the primary unit. See "PROTECTED CONFIGURATION" on Page 108 for detailed information on this mode.

In addition, the LEDR Series is available in a space-diversity configuration to allow dual receive paths to improve system availability. See "SPACE DIVERSITY OPERATION" on Page 115 for detailed information.

1.2 LEDR Features

- General—*Common to all models*
  - Network Management via SNMPc version 1
  - Protected Operation (1+1) Compatible
  - 1.0 Watt Transmit Power
  - Space-Efficient Rack Size (1RU)
  - Rugged, Reliable Design
  - Voice Orderwire (DTMF compliant)
  - Service Channel (Data)

- Subrate Models—LEDR 400S/700S/900S/1400S
  - 64, 128, 256, 384, 512* and 768* kbps Data Rates
  - 12 x 64 kbps Data Rate with the FT1 or FE1 Interface Board (LEDR radio with optional PCB installed)

  * *Contact factory for availability of these rates on the LEDR 700S.*

- Fullrate Models—LEDR 400F/900F/1400F
  - 1 x E1 to 4 x E1 data rates

Figure 1. The LEDR Digital Radio

1.3 Typical Applications

- Point-to-point transmission applications
- Cost-effective, “thin route” applications
- Long haul telecommunications links
- Cellular backhaul
- Last-mile links
- Trunked radio links
- SCADA systems

1.4 Protected Configuration

A second configuration of the LEDR product is the *protected configuration* in which two LEDR radios are monitored and controlled by a third unit, the Protected Switch Chassis shown in Figure 2. This unit provides a gateway for data and radio frequency paths to the LEDR data radio transceivers. Unit performance is continuously measured. Should it fall below user-definable standards, the offline radio is automatically placed online and an alarm condition is generated that can be remotely monitored. Additional details for protected configurations are given in Section 10.0 on Page 108.

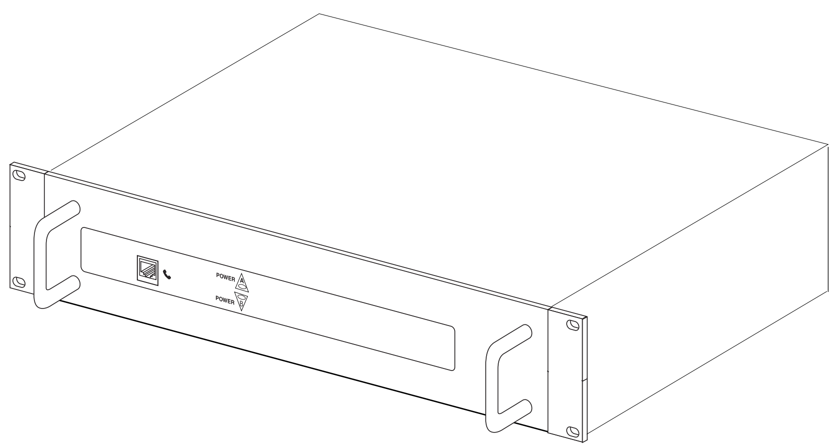


Figure 2. LEDR Protected Switch Chassis (PSC)

1.5 Single-Channel Simulcast Communications System

LEDR radio-modems can serve as an integral part of a system providing simultaneous radio coverage to an extended geographic area using multiple overlapping transmitters operating on a single set of frequencies.

Simulcasting allows municipalities to cover their entire service area with a single radio frequency channel using multiple smaller towers and lower power transmitters. For example, in a public safety environment, a municipality may have just one set of frequencies available for fire, police, or ambulance services. These services need mobile units which operate on a single channel throughout their service area without lapses in coverage. A simulcast system allows the remote units to move between coverage areas using the same frequency.

An application note is available from GE MDS that deals with Simulcast operation of LEDR radios. Contact GE MDS Technical Services for more information.

2.0 HARDWARE INSTALLATION AND BASIC INTERFACE REQUIREMENTS

2.1 Introduction

Installation of the LEDR radio transceiver is not difficult, but it does require some planning to ensure optimal efficiency and reliability. There are two major installation objectives; first, obtain good radio communications between LEDR sites, and second, configure the data interface to complement your data equipment.

This section provides information to assist you in successfully completing the first phase of installation. You will find tips for selecting an appropriate site, choosing antennas and feedlines, minimizing the chance of interference, and the basics of equipment installation. This material should be reviewed before beginning the radio hardware equipment installation.

When the radio installation is successfully complete, you will need to address the data interface and operational configuration of the LEDR radio. It is likely that the radio has been configured by the factory to meet your basic data interface requirements. Review the factory documentation accompanying your shipment for the radios current configuration.

Whatever your situation, it is recommended you review the material in the rest of the manual to gain insight to additional configuration options and user functions.

2.2 General Requirements

There are four main requirements for installing the radio transceiver—a suitable installation environment, adequate and stable primary power, a good antenna system, and the correct interface between the transceiver and the external data equipment. Figure 3 shows a typical station arrangement

.Site Selection

For a successful installation, careful thought must be given to selecting proper sites for the radios and antenna systems. Suitable sites should offer:

- An antenna location that provides an unobstructed path in the direction of the associated station
- A source of adequate and stable primary power
- Suitable entrances for antenna, interface or other required cabling
- Adequate clearance around the radio for ventilation

These requirements can be quickly determined in most cases. A possible exception is the first item—verifying that an unobstructed transmission path exists. Microwave radio signals travel primarily by line-of-sight, and obstructions between the sending and receiving stations will affect system performance.

If you are not familiar with the effects of terrain and other obstructions on radio transmission, the following discussion will provide helpful background information.

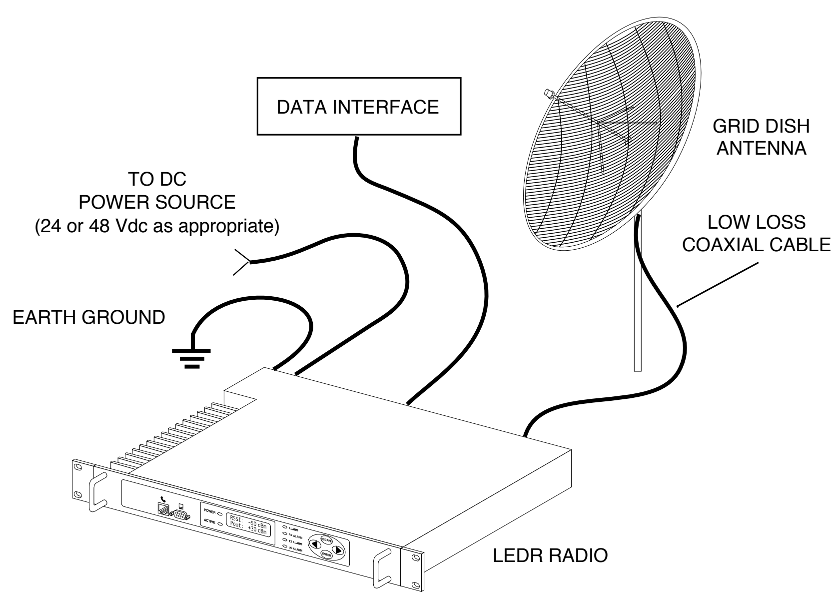


Figure 3. Typical Station Arrangement

Terrain and Signal Strength

A line-of-sight path between stations is highly desirable, and provides the most reliable communications link in all cases. A line-of-sight path can often be achieved by mounting each station antenna on a tower or other elevated structure that raises it to a level sufficient to clear surrounding terrain and other obstructions.

The requirement for a clear transmission path depends upon the distance to be covered by the system. If the system is to cover only a limited distance, say 5 km (3.1 miles), then some obstructions in the transmission path may be tolerable. For longer-range systems, any obstruction could compromise the performance of the system, or block transmission entirely.

The signal strength at the receiver must exceed the receiver sensitivity by an amount known as the fade margin to provide reliable operation under various conditions.

Detailed information on path planning should be reviewed before beginning an installation. Computer software is also available for this purpose that can greatly simplify the steps involved in planning a path.

GE MDS offers path analysis (for paths in the USA) as an engineering service. Contact the factory for additional information.

On-the-Air Test

If you've analyzed the proposed transmission path and feel that it is acceptable, an on-the-air test of the equipment and path should be conducted. This not only verifies the path study results, but allows you to see firsthand the factors involved at each installation site.

The test can be performed by installing a radio at each end of the proposed link and checking the Received Signal Strength Indication (RSSI) value reported at the front panel LCD screen of each radio. If adequate signal strength cannot be obtained, it may be necessary to mount the station antennas higher, use higher gain antennas, or select a different site for one or both stations.

A Word About Interference

Interference is possible in any radio system. However, since the LEDR radio is designed for use in a licensed system, interference is less likely because frequency allocations are normally coordinated with consideration given to geographic location and existing operating frequencies.

The risk of interference can be further reduced through prudent system design and configuration. Allow adequate separation between frequencies and radio systems.

C/I Curves

A carrier to interference (C/I) curve can help in frequency and space coordination. The information in this curve can aid greatly in helping plan geographic locations and frequency usage for radio systems. Contact the factory for additional information on carrier to interference curves. A white paper (publication no. 05-3638A01) on the subject is available from the factory at www.GEmds.com. Search for the term “LEDR” under the manuals download area to see this, and all other publications pertaining to the LEDR series.

Keep the following points in mind when setting up your point-to-point system:

1. Systems installed in lightly populated areas are least likely to encounter interference; those in urban and suburban environments are more likely to be affected by other devices operating in the radio’s frequency band and adjacent services.

2. Directional antennas must be used at each end of a point-to-point link. They confine the transmission and reception pattern to a comparatively narrow beam, which minimizes interference to and from stations located outside the pattern. The larger the antenna, the more focused the transmission and reception pattern and the higher the gain.

3. If interference is suspected from another system, it may be helpful to use antenna polarization that is opposite to the interfering system’s antennas. An additional 20 dB (or more) of attenuation to interference can be achieved by using opposite antenna polarization. Refer to the antenna manufacturer’s instructions for details on changing polarization.

2.3 Antenna and Feedline Selection

Antennas

The antenna system is perhaps the most crucial part of the system design. An antenna system that uses poor quality feedline, or is improperly aligned with the companion site, will result in poor performance, or no communication at all.

A directional antenna must be used for point-to-point systems to minimize interference both to and from nearby systems. In general, cylindrical or dish type antennas with a parabolic reflector must be used. Yagi or corner reflector types may be acceptable in some applications. Check government regulations for your region.

The exact style of antenna used depends on the size and layout of a system. In most cases, a directional “dish” type of antenna is used with the radio (Figure 4). Dish antennas maximize transmission efficiency and restrict the radiation pattern to the desired transmission path.

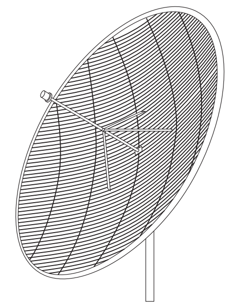


Figure 4. Typical Grid Dish Antenna

Table 2 lists common grid dish antenna sizes and their approximate gains. Each antenna is designed to operate within only one frequency band.

Table 2. Dish antenna size vs. approximate gain (dBi)

Antenna Size Meters (feet)	400 MHz Gain	700 MHz Gain	900 MHz Gain	1400 MHz Gain
1.2 Meters (4 feet)	13.1 dBi	15.85 dB	18.4 dBi	23.7 dBi
2.0 Meters (6 feet)	16.3 dBi	19.05 dB	22.0 dBi	26.1 dBi
3.0 Meters (10 feet)	19.6 dBi	22.35 dB	26.4 dBi	30.6 dBi
4.0 Meters (12 feet)	22.2 dBi	24.95 dB	28.0 dBi	32.1 dBi

GE MDS can furnish antennas for use with your LEDR radio. Consult your sales representative for details.

Feedlines

For maximum performance, a good quality feedline must be used to connect the radio transceiver to the antenna. For short-range transmission, or where very short lengths of cable are used (up to 8 Meters/26 Feet), an inexpensive coax cable such as Type RG-213 may be acceptable.

For longer cable runs, or for longer-range communication paths, we recommend using a low-loss cable suited for the frequency band of operation. Helical transmission lines, such as Andrew Heliax™ or other high-quality cable will provide the lowest loss and should be used in systems where every dB counts. Whichever type of cable is used, it should be kept as short as possible to minimize signal loss.

Remember that cable loss increases in direct proportion to the transmission frequency used. This means that a system operating at 900 MHz will experience more cable loss than one operating at 400 MHz.

The following tables (3, 4, 5 and 6) can be used to select an acceptable feedline. A table is provided for each of the three bands for which the LEDR radios are available.

Table 3. Feedline Loss Table (450 MHz)

Cable Type	3.05 Meters (10 Feet)	15.24 Meters (50 Feet)	30.48 Meters (100 Feet)	152.4 Meters (500 Feet)
RG-8A/U	0.5 dB	2.5 dB	5.1 dB	25.4 dB
1/2 in. HELIAX	0.1 dB	0.8 dB	1.5 dB	7.6 dB
7/8 in. HELIAX	0.1 dB	0.4 dB	0.8 dB	4.2 dB
1-1/4 in. HELIAX	0.1 dB	0.3 dB	0.6 dB	3.1 dB
1-5/8 in. HELIAX	0.1 dB	0.3 dB	0.5 dB	2.6 dB

Table 4. Feedline Loss Table (700 MHz)

Cable Type	3.05 Meters (10 Feet)	15.24 Meters (50 Feet)	30.48 Meters (100 Feet)	152.4 Meters (500 Feet)
RG-8A/U	0.7 dB	3.4 dB	6.8 dB	34.0 dB
1/2 in. HELIAX	0.2 dB	1.0 dB	1.9 dB	9.5 dB
7/8 in. HELIAX	0.1 dB	0.5 dB	1.1 dB	5.3 dB
1-1/4 in. HELIAX	0.1 dB	0.4 dB	0.8 dB	3.9 dB
1-5/8 in. HELIAX	0.1 dB	0.3 dB	0.7 dB	3.3 dB

Table 5. Feedline Loss Table (960 MHz)

Cable Type	3.05 Meters (10 Feet)	15.24 Meters (50 Feet)	30.48 Meters (100 Feet)	152.4 Meters (500 Feet)
RG-8A/U	0.9 dB	4.3 dB	8.5 dB	unacceptable loss
1/2 in. HELIAX	0.2 dB	1.2 dB	2.3 dB	11.5 dB
7/8 in. HELIAX	0.1 dB	0.6 dB	1.3 dB	6.4 dB
1-1/4 in. HELIAX	0.1 dB	0.5 dB	1.0 dB	4.8 dB
1-5/8 in. HELIAX	0.1 dB	0.4 dB	0.8 dB	4.0 dB

Table 6. Feedline Loss Table (1.4 GHz)

Cable Type	8 Meters (26 Feet)	15 Meters (49 Feet)	30 Meters (98 Feet)	61 Meters (200 Feet)
RG-8A/U	*RG-8A/U not recommended for use at 1.4 GHz*			
RG-213	3.0 dB	6.0 dB	12.1 dB	24.1 dB
1/2 in. HELIAX	0.7 dB	1.5 dB	2.9 dB	5.9 dB
7/8 in. HELIAX	0.4 dB	0.8 dB	1.7 dB	3.3 dB
1-5/8 in. HELIAX	0.3 dB	0.3 dB	1.1 dB	2.1 dB

2.4 Radio Mounting

The radio can be mounted either in a 19-inch equipment rack or on a table top. It should be located in a relatively clean, dust-free environment that allows easy access to the rear panel connectors as well as front panel controls and indicators. Air must be allowed to pass freely over the ventilation holes and heat sink on the side panel.

The dimensions of LEDR Series radios are:

- 305 mm (12 in) deep
- 426 mm (16.75 in) wide—Excluding rack mounting brackets
- 45 mm (1.75 in) high—1RU

Maximizing RSSI

For newly installed systems, one of the first tasks is to orient the station antenna for a maximum Received Signal Strength Indication (RSSI) as shown on the LCD screen. See "Performance" on Page 40 for details. A maximum RSSI ensures the antenna is properly aimed at the associated station. Move the antenna slowly while an assistant observes the RSSI display for a maximum reading. There may be a time delay between moving the antenna and updating of the RSSI display. Be sure to allow adequate time between antenna movements and observations.

Attaching the Rack Mounting Brackets

The radio is normally shipped with the rack mounting brackets uninstalled. To attach them, select the desired mounting position on the sides of the chassis. (The brackets may be mounted in one of two locations—flush with the front panel, or near the middle of the chassis.)

NOTE: Both short and long screws are provided with the brackets. Use the long screws for the heatsink (left) side of the chassis and the short screws for the right side of the chassis. Tighten the screws securely.

2.5 Front Panel

Indicators, Text Display and Navigation Keys

Figure 5 shows the details of the LEDR radio's front panel indicators, LCD text display, and menu navigation keys.

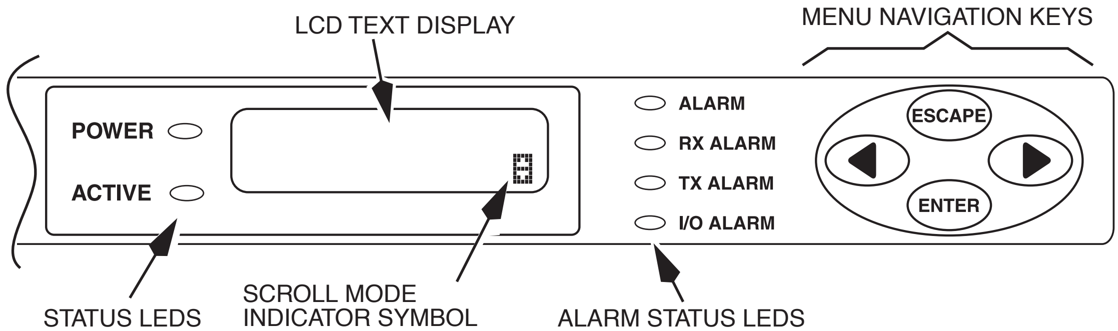


Figure 5. Front Panel Indicators, Text Display and Keys

LED Indicators

The front panel LEDs indicate various operating conditions as outlined in Table 7.

Table 7. Front Panel LED Functions

LED	Indications
POWER	Primary power is applied to radio
ACTIVE	This radio is the on-line/active unit in a protected/redundant configuration.
ALARM	A general alarm condition is present
RX ALARM	The modem is not locked to a receive signal
TX ALARM	There is a problem with the transmitter
I/O ALARM	There is a payload data interface error

LCD Display & Keys

The LCD display provides a two line by 16-character readout of radio status and parameter settings. It is used with the menu navigation keys on the right side of the front panel to control the radio's operation and access diagnostic information.

Use of the navigation keys (Figure 6) is simple, and allows many basic operating tasks to be performed without connecting an external terminal or using additional software.

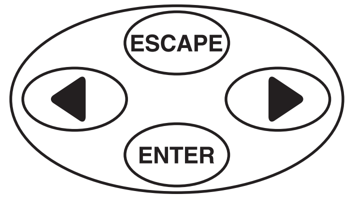


Figure 6. Menu Navigation Keypad

The keys can be used for two tasks—navigating through menus, and editing user controllable parameters. The functions of the keys are automatically selected according to the screen that is being viewed by the user.

Menus

The LEDR radio contains 16 primary menus as listed below. These primary menus serve as entry points to a variety of submenus that can be used to view or adjust operating parameters and diagnose the radio link.

- Login
- Logout
- Network
- General
- RF Config(uration)
- IO Config(uration)
- Line Config(uration)
- Performance
- G.821
- Diagnostics
- Orderwire
- Front Panel
- Redundant
- Remote Status

See "Front Panel LCD Menu Descriptions" on Page 31 for detailed descriptions of all menu items.

Menu Navigation

The left and right keys (◀ ▶) provide navigation through the available top level menus (see menu tree, Figure 6) and through a series of subordinate menus.

The ENTER key allows entry into each primary menu's subordinate menus, exposing another menu level. The ESCAPE key always exits the current screen, causing the program to "pop up" one level in the hierarchy.

Parameter Selection and Data Entry

With an editable menu, such as **Login**, pressing the ENTER key puts the screen into a data entry mode. Front panel keys are used in one of three ways: 1. character and string creation/selection, 2. scrolling through lists, and 3. adjusting horizontal slider bars.

1. Character and String Creation/Selection— With some menus, it is necessary to enter a string of alphanumeric characters. A good example is entering a password at the user **login** menu. In this example, the string is built one character at a time, and the string is built from left to right on the display.

The left and right arrow keys move the cursor in the corresponding direction. When the cursor is below the character you wish to change, press ENTER. The arrow keys are then used to step though the character set, beginning with numbers, then uppercase letters and finally lowercase letters. Each time you press one of the arrow keys, the display will step to the next character. If you press and hold the arrow key for several seconds, the characters will scroll by very quickly.

After you have built the string of characters you need, press the ENTER key to save the string on the display and return to cursor navigation mode. To save all changes you have made, place the cursor under the special carriage return symbol (↵) and press ENTER. Pressing ESCAPE will revert the arrow keys to the cursor navigation mode. Pressing ESCAPE in cursor navigation mode cancels character edit mode without saving any changes.

2. Scrolling Lists/Values— Uses left and right keys (◀ ▶) to scroll through a list of choices or adjust a numeric value, such as `Power Out`. When you are in a menu with a series of fixed parameters, the vertical scroll character (↕) will appear while you are in the editing/selection mode. If you are asked to select or change more than one character, you will see a horizontal scroll symbol (↔) in the bottom right-hand corner of the display and a cursor will appear under the character being edited or changed.

When the desired parameter is in view, move the cursor to the right as far as it will go, until a carriage return symbol (↵) appears. Pressing the ENTER key will save the selection to its left, if your access privileges permit. Pressing ESCAPE cancels the selection and exits without saving the change.

3. Slider Bar Adjustment—Some menus display a horizontal bar that changes its length to indicate the level for parameters that use relative values such as the Orderwire Volume and VOX threshold. (See Orderwire on Page 39.) Press the ▶ key to increase the value and the ◀ to lower the value. Press ENTER to save the current setting.

Connectors

The front panel of the LEDR radio (Figure 7) has two connectors; both of them are located on the left hand side of the panel.

Orderwire

The RJ-11 jack with the telephone symbol above it is to connect an orderwire handset. The orderwire is used by service personnel to communicate through the Service Channel to coordinate system activities with personnel at another site in the network. The orderwire will not interrupt the normal data flow through the LEDR data communication channel, however, it will reduce the throughput efficiency of any data communications on the Service Channel during periods of voice transmission. See “USING ORDERWIRE” on Page 103 for more information.

CONSOLE

The second connector is a DB-9 type with a computer icon over it. This is where you can connect a computer’s serial port for unit configuration, diagnostics and firmware upgrades to the radio.

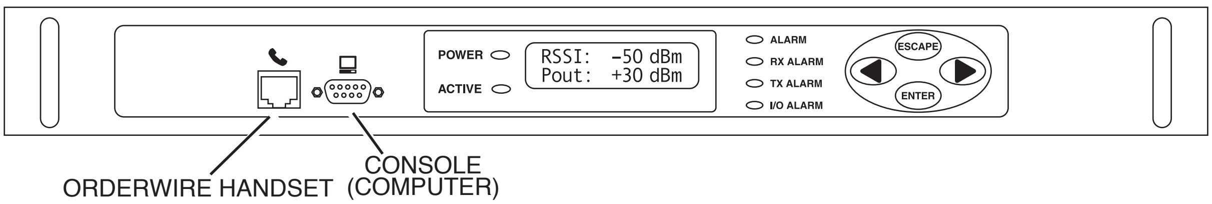


Figure 7. LEDR Front Panel
(All models Identical)

2.6 Rear Panel Connectors

The rear panel of the LEDR radio transceiver contains a number of connectors to interface with the radio’s antenna system, data equipment, and user remote data network monitoring and control equipment.

Connector Locations

LEDR “S” Series

The rear panel of the LEDR “S” Series radios is shown in Figure 8. Refer to the descriptions that follow for specific information regarding rear panel connections.

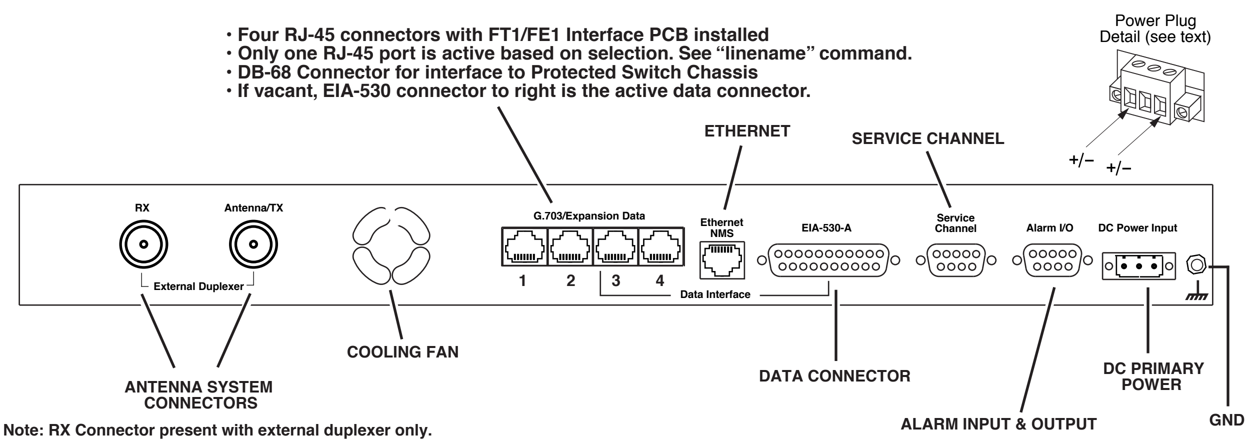


Figure 8. LEDR 400S/700S/900S/1400S Rear Panels
(Shown with Optional FT1/FE1 Interface PCB Installed)

LEDR "F" Series

The rear panel of the LEDR "F" Series radios is shown in Figure 9. Refer to the descriptions that follow for specific information regarding rear panel connections.

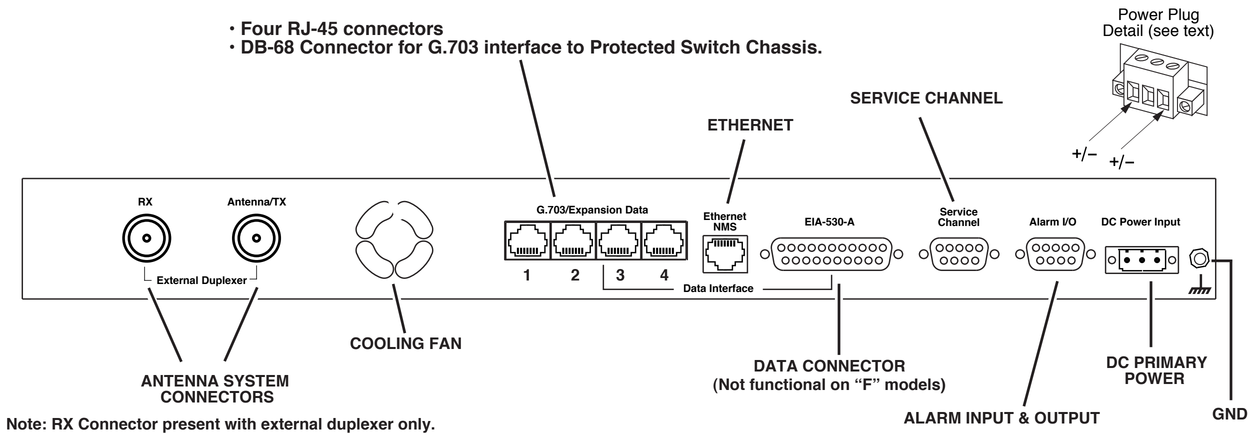


Figure 9. LEDR 400F/900F/1400F Rear Panel

Ground Stud

The ground stud on the rear panel provides a point to connect the radio's chassis to an Earth ground.

NOTE: A ground connection is important for proper operation of the radio. Do not rely on a ground connection being made through the rack mounting brackets or other radio cabling.

Antenna/TX—RF Connector

The ANTENNA/TX connector is an N-type coaxial connector. When an *internal* duplexer is installed, it serves as the connection point for the station antenna. When an *external* duplexer is used, it acts as the transmitter RF output (TX) connector to the duplexer.

RX—RF Connector

The RX (receive) connector is an N-type coaxial connector. It is only installed if the radio is supplied for use with an external duplexer. It carries receive signals (RX) from the duplexer to the LEDR radio's receiver.

When an external duplexer is used, ensure that the higher frequency (transmit or receive) is connected to the duplexer connector marked HI and the lower frequency (transmit or receive) is connected to the duplexer marked LO.

G.703/Expansion Data

The type of connector(s) at this location on the rear panel depends on several factors: the type of interface required by the customer premises equipment (CPE) and whether or not the radio is part of a protected (redundant) configuration. See Table 8 for details.

Table 8. G.703/Expansion Data Connector

Model(s)	Configuration	Data Interface	G.703/Expansion Connector
LEDR 400S LEDR 700S LEDR 900S LEDR 1400S	Standalone	EIA-530	Blank. No connector(s) installed.
LEDR 900S	Standalone	FT1	4 x RJ-45—Only one port is active based on **linemap** selection. (See Note 2)
LEDR 400S LEDR 900S LEDR 1400S	Standalone	FE1	4 x RJ-45—Only one port is active based on **linemap** selection. (See Note 2)
LEDR 400F LEDR 900F LEDR 1400F	Standalone	4E1	4 x RJ-45—All four jacks (A, B, C & D) are active. (See Notes 1 & 2)
LEDR 400F/S LEDR 900S LEDR 1400F/S	Protected	All	DB-68 (See Note 3)

NOTES:

1. The capacity of the 4E1 interface can be reduced to one (1E1) or two circuits (2E1). See **linemap** command on Page 69, for configuration information.
2. For RJ-45 pinout information, see Figure 33 on Page 136.
3. This 68-pin interface connector is used only to pass the user data interface, the Service Channel, and the orderwire circuits to the Protected Switch Chassis for distribution. Fully-wired DB-68 computer cables (commonly used to interconnect SCSI computer devices) can be used with this data port connector.

NOTE: The terms “Protected” and “Redundant” are used interchangeably in this manual to discuss the LEDR’s ability to automatically switch from a failed unit to an operational unit.

Ethernet

The ETHERNET connector provides access to the embedded SNMP agent and other elements of the TCP/IP network-management interface. The connector is a standard 10Base-T connection with an RJ-45 modular connector. The LEDR Ethernet connections are provided for remote equipment management (NMS).

NOTE: Avoid permanently connecting the LEDR chassis to a Ethernet network with a high volume of traffic not related to the LEDR network. The LEDR modem can become overloaded and cause slowdowns in payload throughput or an undesired reboot.

Ethernet in a Repeater Configuration

At a repeater site with two LEDR radios, the ETHERNET connectors of each chassis must be connected to each other through a cross-connect cable or using standard cables to an Ethernet hub. This inter-chassis Ethernet connection must be made in order for the Orderwire and Service Channel to function properly. (See Figure 10 on Page 18 for further information.)

Ethernet in a Protected Configuration

The Ethernet connections on the LEDR radio chassis in a protected configuration should *not* be used. The Ethernet connector of the Protected Switch Chassis (PSC) provides a connection to the two radio units. Each radio has a unique IP address and is individually addressable/controllable using SNMP over IP. See "PROTECTED CONFIGURATION" on Page 108 for general information and Figure 31 on Page 135 for ETHERNET connector pinout details.

EIA-530-A

The EIA-530-A connector is the main data input/output connector for the subrate radio. The EIA-530 interface is a high-speed serial data connector. For detailed pin information, See "EIA-530-A Data—Rear Panel" on Page 136.

NOTE: This connector is not operational on LEDR "F" Series (full-rate) models.

Service Channel

The Service Channel provides a transparent ASCII "pipe" to which any RS-232/EIA-232 device can be connected at data rates between 300 and 9600 (default) bps. Whatever ASCII data is entered onto the network through the Service Channel Port will be sent to the local radio and broadcast to any other device connected to the Service Channel Port on other associated LEDR radios in the network.

The Service Channel's function is identical for all LEDR configurations—standalone, repeater, or data-protected/hardware-redundant.

NOTE: Use of the orderwire will slow down data communications on the Service Channel. It will not effect data traffic on the primary data interface.

NOTE: Service channel activity can cause data loss or repeats in systems using packet-size-dependent protocols. For optimum reliability turn "Transparency" on in the service channel settings. (See "svch" on Page 86 and "Service Channel" on Page 44 for details.)

For detailed information on this 9-pin connector, See "Service Channel—Rear Panel" on Page 137.

Repeater Configuration

Data and RF cabling for the repeater station configuration is shown in Figure 11.

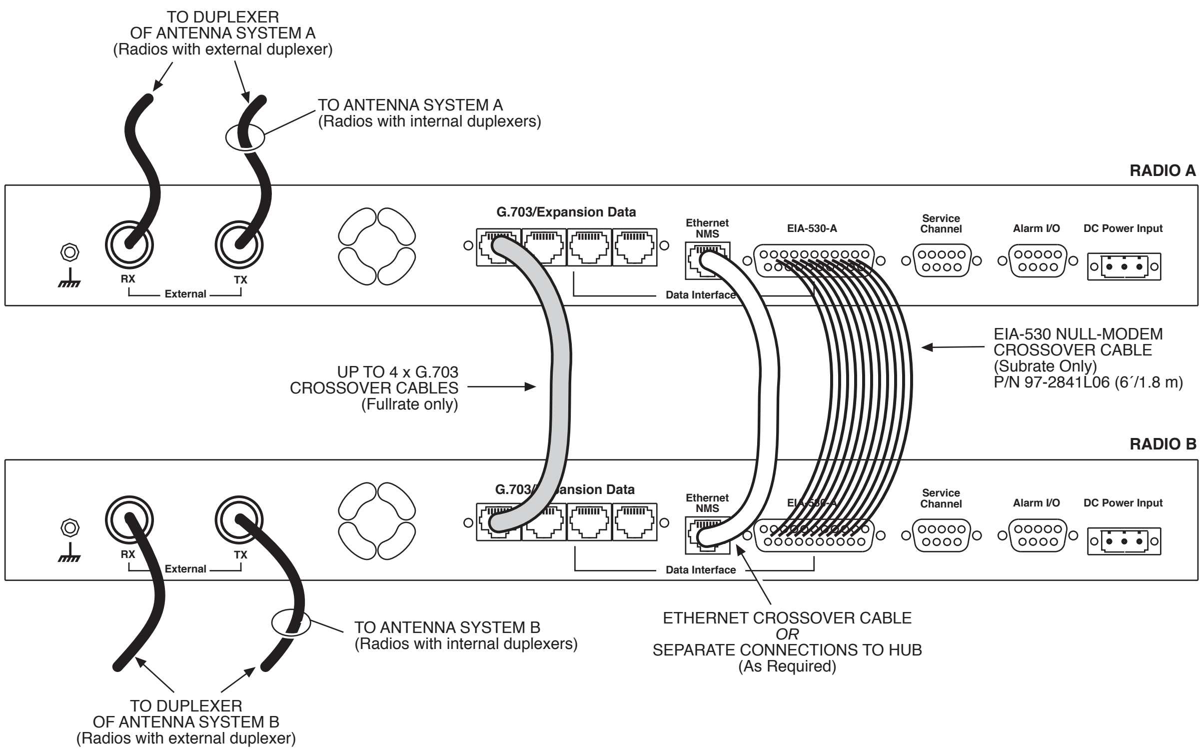


Figure 10. Inter-unit Cabling—Repeater Configuration

Protected Configuration

The Service Channel connections on the LEDR radio chassis in a protected configuration should *not* be used. The SERVICE CHANNEL connector of the Protected Switch Chassis (PSC) provides a connection to the two radio units. For further information on protected configurations See "PROTECTED CONFIGURATION" on Page 108.

Alarm I/O

This is a 9-pin connector that has both inputs and outputs.

Output Contacts

The ALARMS Port is outfitted with four optically-isolated relays that are controlled by the LEDR radio's CPU. The contacts (Pins 6, 7, 8, & 9) are normally open and can handle a non-inductive load of ±60 Volts Peak (AC/DC) at a maximum current of 1 Ampere. These are suitable for the control of an external device or indicator when a radio event occurs.

An alarm output could be used, for example, to activate a sounding device when the radio link goes down, or when the battery for the real-time clock is low. Another example is to use the alarm outputs to drive the inputs of an external monitoring system. (See the list of radio events for more options.) These outputs are not suitable for data interface without the use of an external "debouncing" circuit.

Input Connections

In addition, four external alarm input lines (Pins 1, 2, 3 and 4) are provided. Normally, the input is either left open or shorted to ground, to indicate an alarm condition.

Each alarm input is diode-clamped to +3.3 Vdc or chassis ground, and can tolerate inputs from -4 to +6 Vdc without drawing excessive current. If left open, each input is pulled up. To indicate an alarm condition, short the input pin to the ground provided on the alarm connector (Pin 5). The maximum DC loop resistance is 2 KΩ. These alarm input lines can tolerate circuit "bounce" common with mechanical relays.

NOTE: The normal (unalarmed) state of the contacts (open or closed) or input alarm state (high or low) can be selected by a software subcommand. See "alarm" on Page 52 for details.

Alarm Events

The events that cause alarm output signals can be configured in the radio software. See "evmap" on Page 60 for information on programming which events trigger an alarm.

See Figure 35 on Page 137 for Alarm I/O pinout information.

DC Power Input (Primary Power)

The DC POWER INPUT connector is a three-pin keyed connector used to connect an external DC power source. A label next to the power connector indicates the nominal voltage of the radio. Table 9 lists the actual operating voltage ranges.

The connector matches with a power plug (GE MDS Part No. 73-1194A22) which contains binding posts for attaching the positive and negative power leads. The polarity of the power connections does not matter; the positive and negative leads may be connected to either the left or right binding posts as shown in Figure 8 on Page 14 and Figure 9 on Page 15. The center conductor is *not* connected in the LEDR chassis and should be left unwired.

Table 9. Primary Power Input Options

Nominal Voltage	Operating Range
24 Vdc	19.2 to 28.8 Vdc
48 Vdc	38.4 to 57.6 Vdc

CAUTION
POSSIBLE EQUIPMENT DAMAGE

Before connecting primary power to the radio, verify that the source provides a voltage within the proper operating range. Improper voltages may damage the equipment. Permissible voltage limits are shown in Table 9.

Protected Configuration Connections

There are several connections between the LEDR radio chassis and the Protected Switch Chassis. They include the primary data interface, RF, Ethernet, orderwire and Service Channel. Details on cabling and other items relating to the protected (redundant) configuration appear in "PROTECTED CONFIGURATION" on Page 108.

2.7 Bandwidths, Data Rates and Modulation Types

The hardware in the LEDR chassis is configured at the factory for a specific bandwidth. However, the modulation type and data rate can be changed *as long as the bandwidth is sufficient to support the modulation type and data rate*. (If you need to change your radio’s bandwidth, refer to "INCREASE BANDWIDTH BY CHANGING TRANSMITTER AND RECEIVER FILTERS" on Page 125 for details.)

Use of the **modem** command (Page 74) and configuration (**[argument]**) code automatically sets the combination of data rate, bandwidth and modulation type if the radio is capable of supporting it.

Table 10 shows the combinations of radio bandwidth, data rates and modulation types that are available for subrate radios at the time of publication. Table 11 shows the combinations available for fullrate radios.

Table 10. Subrate Bandwidth vs. Modem Selection Code

Radio Bandwidth	Configuration Code	Data Rate(s)	Modulation
25 kHz	B1	64 kbps	16-QAM
	C1	64 kbps	32-QAM
50 kHz	A1	64 kbps	QPSK
	B2	128 kbps	16-QAM
100 kHz	A1	64 kbps	QPSK
	A2	128 kbps	QPSK
	B3	256 kbps	16-QAM
200 kHz	A1	64 kbps	QPSK
	A2	128 kbps	QPSK
	B3	256 kbps	16-QAM
	B4	384 kbps	16-QAM
	B5	512 kbps	16-QAM
	C6	768 kbps	32-QAM

Table 11. Fullrate Bandwidth vs. Modem Selection Code

Radio Bandwidth	Configuration Code	Data Rate(s)	Modulation
500 kHz	C7	E1	32-QAM
1000 kHz	B7	E1	16-QAM
	C7	E1	32-QAM
	C8	2E1	32-QAM
2000 kHz	A7	E1	QPSK
	B7	E1	16-QAM
	B8	2E1	16-QAM
	C8	2E1	32-QAM
	C10	4E1	32-QAM

2.8 Transmit Clock Selection (Subrate Radios Only)

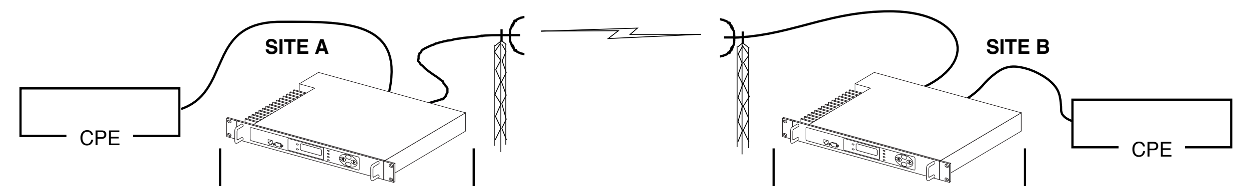
For a subrate radio, transmit clock arrangement must be set by the user. Clocking arrangements for fullrate radios is automatically handled by the LEDR radios.

It is essential that there be only *one* master clock in a subrate radio network. The master clock can originate from the radio or from the Customer Premises Equipment (CPE).

LEDR radios are capable of several different clocking modes. Refer to Figure 11 and Figure 21 on Page 114 for typical system clocking arrangements.

Refer to the `Clock Mode` screen description on Page 34 for setting the radio transmit clocking from the front panel. Refer to the **clkmode** description on Page 57 for setting the radio transmit clocking mode from the front panel CONSOLE Port.

NOTE: When customer premises equipment (CPE) is operated in looped clock mode, it is recommended that the radio *not* be set to line clock mode. To do so may cause the transmitting radio's PLL (phase-locked loop) to be pulled out-of-lock, especially when operating at 4E1 data rates.



Customer Premises Equipment (CPE)	LEDR Radio Clock Source	Over-the-Air RF Path	LEDR Radio Clock Source	Customer Premises Equipment (CPE)
Internal Clock	External Clock	←→	Looped Clock	External Clock
External Clock	Internal Clock	←→	Looped Clock	External Clock

Figure 11. EIA-530 Clocking Arrangements for Protected (1+1) LEDR Radio Operation

3.0 INITIAL STARTUP AND CONFIGURATION

3.1 Introduction

The radio is commonly configured to parameters provided by the customer at the time the order was placed. Even so, there are some parameters that must be reviewed and set during installation. The following steps summarize the initial set-up of a LEDR radio link. If this is your first installation of a LEDR radio system, it is recommended the equipment be set up on a test bench.

3.2 STEP 1—Power up the LEDR Radios

There is no primary power switch; simply connecting primary power to the unit will start the radio operating. After a short self-test, a "default screen" similar to the following appears on the radio's LCD display:

```
  LEDR Link
RSSI: -60 dBm
```

NOTE: The LEDR radio is normally keyed continuously, and the radio will transmit whenever power is applied. Ensure there is a suitable load on the antenna connector before connecting power.

3.3 STEP 2—Establish Communications with the Radio

There are four different methods available to set radio parameters and query the radio. They are:

- **Front Panel—**The front panel is intended to serve as a convenient user interface for local radio management. Most, but not all, parameters and functions are accessible from the front panel. (See "Front Panel LCD Menu Descriptions" on Page 31.)
- **NMS (Network Management System)**—The NMS is used via a terminal connected to the front panel CONSOLE Port. It may be used to configure and query every manageable radio parameter on a given network using the out-of-band Service Channel. The built-in menu system may be used on the local radio (login command) or through any remote radio in the network using the rlogin command.
- **Telnet—**A standard network application protocol which provides an NMS-type interface to configure and query most radio parameters.
- **SNMP Network Management System—**The SNMP agent interface is optimized to fulfill the fault configuration, performance, and user access requirements of the LEDR radio system. A separate manual, GE MDS P/N 05-3532A01, explains SNMP in more detail.

3.4 STEP 3—Make Initial Login to Radio

When the radio is first powered up, it defaults to a read-only condition. That is, the radio parameters may be viewed, but cannot be changed. To enable changes to radio settings, a valid user name and password must be entered.

A factory-programmed username and password is provided to enable a System Administrator to operate a newly installed radio. This administrator account is called “SUPER”. Two other accounts, “ENGR” and “FACT” are reserved for use by factory personnel.

When the radio is shipped from the factory, an administrative (user) account is provided which is referred to as the “SUPER” account. The SUPER account is pre-programmed with a temporary password of “SUPER” in all uppercase letters.

NOTE: Usernames and passwords are case sensitive. Do not use punctuation mark characters. A maximum of eight characters are allowed for the password.

It is highly recommended that the password for **SUPER** be changed as soon as possible to maintain system security. The password can be changed through the front panel keypad or a computer connected to the front panel CONSOLE or Ethernet ports using Telnet or SNMP commands.

Navigation Key Method

To log in from the front panel using the temporary credentials, follow these steps:

1. Go to the Login screen and press the front panel ENTER key. The Username screen appears with **SUPER** displayed.

2. Press the ENTER key again to access the Password screen. Use the arrow keys to scroll through the list of characters and individually select the letters spelling out the word **SUPER**. Press ENTER after each character selection. (For more information on character selection using the navigation keys, See “INITIAL STARTUP AND CONFIGURATION” on Page 22.)

3. When all of the characters have been entered, press ENTER again. The screen briefly displays **Login Success** and returns to the Login entry screen.

You may now access any of the screens shown in Figure 12 with SUPER-level (Administrator) privileges.

The user account will automatically close after 10 minutes of inactivity.

CONSOLE Method

To login using a terminal connected to the front panel CONSOLE Port, follow the steps below. The default connection parameters are 9600 bps, 8 bits, no parity, 1 stop bit (9600/8/N/1).

1. Connect a terminal data port or a PC’s serial port to the radio’s front panel CONSOLE Port.

2. Open an ANSI terminal program, such as HyperTerminal™ in the Windows O/S. Press ENTER. The **LEDR>** prompt should appear on the terminal’s display.

3. Enter **login SUPER**. The **Password >** prompt will appear.

4. Enter the password **SUPER**. The following response appears: **login: SUPER logged in.**

You may now access any of the NMS commands listed in Table 14 on Page 47 with Administrator level privileges (the highest allowable user level).

3.5 STEP 4—Change the SUPER Password

Follow these steps to change the factory-programmed password.

1. Login as **SUPER** using the NMS method described above.

2. Enter the command **passwd**. At the next prompt, enter a new password with a maximum of eight characters. (See "passwd" on Page 76.)

NOTE: Passwords cannot be changed using the front panel navigation buttons. A console terminal must be used.

---

3. Re-enter your new password (for verification purposes). If the entry is correct, the radio responds with **user: Command Complete**.

4. Set up user accounts as required beyond the factory default of SUPER.

   Create accounts, set permission levels, or delete accounts as desired using the **user** command. See Page 90 for complete description of **user** command.

NOTE: It is recommended that users log out when finished using the front panel navigation keys or console terminal. This can be done using the Logout screen on the radio, or the **logout** command from a console terminal as appropriate. *If there is no key or terminal activity for 10 minutes, the radio automatically logs out and reverts to read-only status.*

3.6 STEP 5—Review Essential Operating Parameters

Review and set the following parameters to allow data throughput and interconnection with the network. These are radio operating frequencies, data interface clocking, and data framing. Table 11 outlines these based on each model group and configuration.

Table 11. Essential Parameters for Standalone & Protected

Model Group	Data Interface	Parameter	Setting
Subrate	EIA-530	RF TX/RX Frequency	Factory configured for customer frequencies.
		Clocking	Use **clkmode** command (Page 57) to match interface equipment.
		Framing	Does not apply.
	FT1/FE1	RF TX/RX Frequency	Factory configured for customer frequencies.
		Clocking	Automatically set to match connected equipment.
		Framing	Set as appropriate using **fstruct** command (Page 61).
		Time Slot	Set as appropriate using **timeslot** command (Page 88).
		Line Code	Set as appropriate using **linecode** command (Page 68).
Fullrate	E1	RF TX/RX Frequency	Factory configured for customer frequencies.
		Clocking	No settings are necessary. Radio automatically detects clock and sets mode.
		Framing	• Radio set to unframed (default). • Make changes as appropriate using **fstruct** command (Page 61) to match interface equipment.
		Line Code	Set as appropriate using **linecode** command (Page 68).

3.7 STEP 6—Set TCP/IP Settings to Enable SNMP and/or Telnet Management (if required)

- The unit IP address is factory configured with a unique address based on the last three digits of the radio's serial number.
- Use **ip** command (Page 66) to change the IP address, set netmask, gateway and IP Port as necessary.
- In a protected radio, change the **rdnt** settings (Page 77) to match the user-assigned IP addresses.

3.8 STEP 7—Set User Configurable Fields

Change only if required.

Many items are user-configurable. These include, but are not limited to the following. See the NMS command description in the manual for more detail:

- Set user information fields using **info** command (Page 64)
- Set alarms and alarm mappings using the **alarm** command (Page 52)
- Set event mappings using the **evmap** command (Page 60)
- Set alarm thresholds using the **threshold** command (Page 87)
- Set the SNMP community using the **snmpcomm** command (Page 84)

3.9 STEP 8—Verify Radio Performance

The data performance and NMS should be verified. Use the **loopback** command (Page 71) to verify data throughput.

3.10 STEP 9—Install the Link

Aim the antennas for maximum RSSI using the continuously updated **rssi** command (Page 83), from either the front panel screen, or using the **trend** command (Page 90) via a connected terminal.

3.11 STEP 10—Verify the Link Performance

Connect and verify the proper operation of external equipment connected to the LEDR radio link.

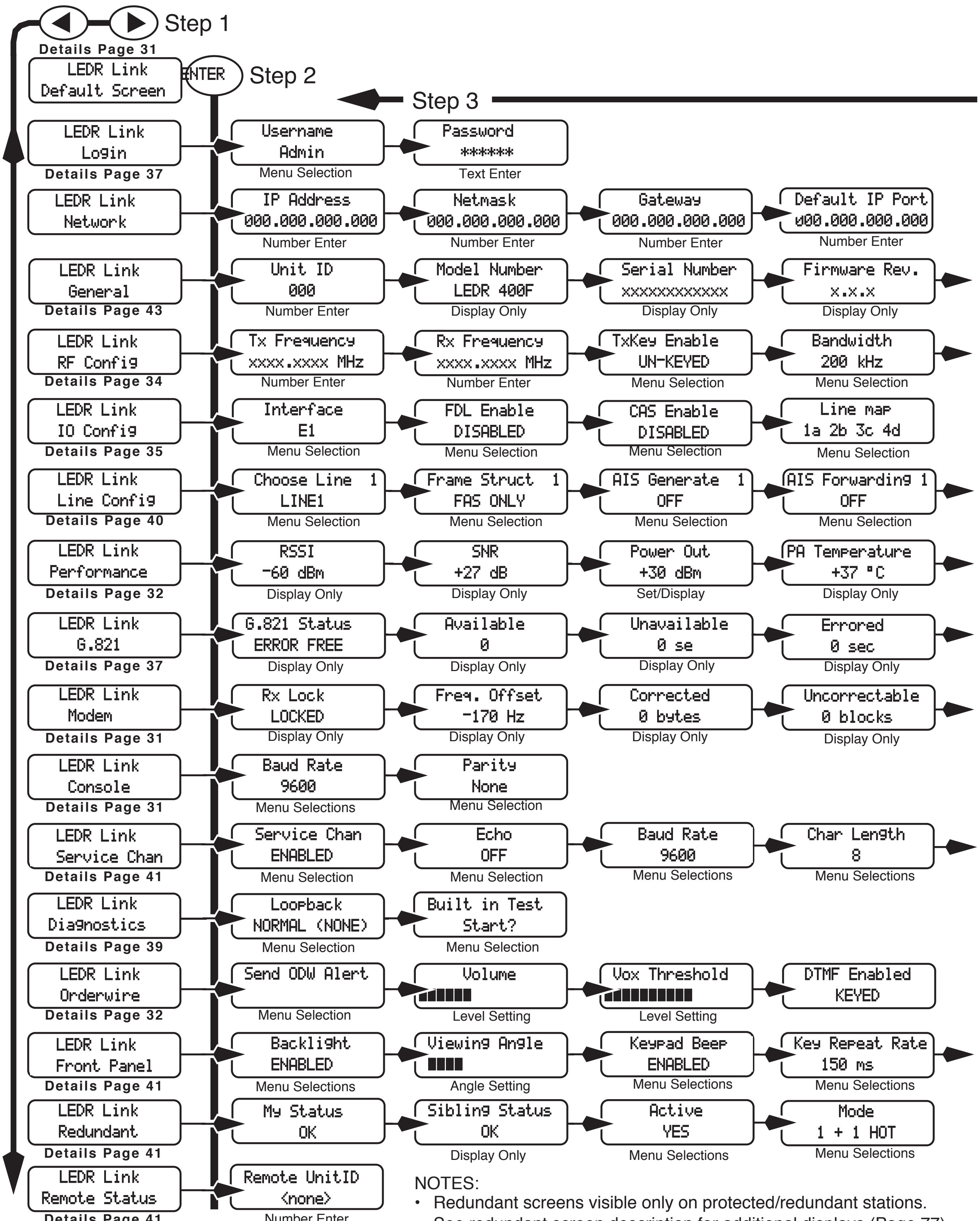
4.0 CONFIGURATION AND CONTROL VIA THE FRONT PANEL

Figure 12 shown on the following pages is a pictorial view of the front panel menu tree. Detailed explanations of the screens are follow in Section 4.1, Front Panel LCD Menu Descriptions.

Some options or displays are dependent on the unit's current user-configuration and service. Accessibility to some configuration screens and parameters is dependent on the user signing into the LEDR radio from the front panel, or through a terminal. If you are not logged in, or your interactive session has timed out (>10 minutes), you will see a display of "ACCESS DENIED". This display will also appear if the user-level you signed in with does not have privileges to perform the requested change.

There are three levels of user access to the LEDR radio: SUPER (Supervisory/Administrative), ENGR (Engineering), and FACT (Factory). The SUPER user is provided for end-user configurationally of the LEDR radio. See “STEP 3—Make Initial Login to Radio” on Page 23 for further information on using and changing the user password.

When you request a change to a parameter via the front panel, an icon ( ) will appear in the bottom right-hand corner of the screen indicating you are in a data-entry mode.



NOTES:
- Redundant screens visible only on protected/redundant stations.
- See redundant screen description for additional displays (Page 77).

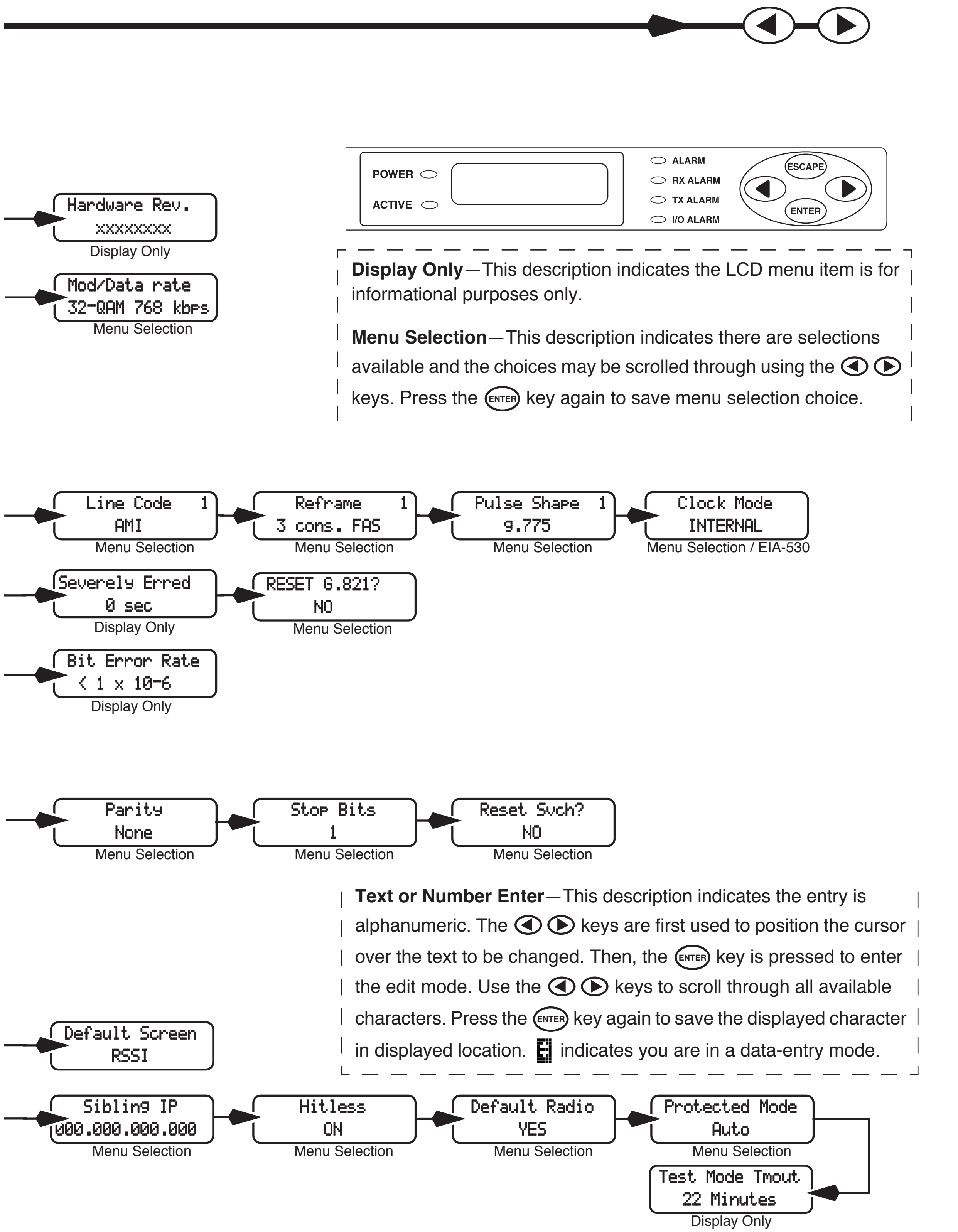


Figure 12. Front Panel LCD Menu Navigation

4.1 Front Panel LCD Menu Descriptions

NOTE: These menu selections are listed in alphabetical order.

Console (Front Panel Terminal Port)

LEDR Link
Console

This menu to review and set the parameters for the CONSOLE Port's serial interface. The pinout information of the front panel DB-9 port can be found in Figure 30 on Page 135.

Baud Rate
9600

This menu allows you to set or view the current data rate setting for the CONSOLE Port serial interface.

NOTE: The console port's interface speed setting is stored in the radio's memory. During a radio reboot, if your terminal's baud rate is not set to 9600 baud, random characters will appear on terminal screen until the boot process is completed.

For the NMS command-line equivalent, See "con" on Page 57.

Parity
None

This menu allows you to set or view the current parity setting for the CONSOLE Port serial interface. Refer to Figure 30 on Page 135 for pinout information for this Port. Typically, this will be set to **NONE**.

For the NMS command-line equivalent, See "con" on Page 57.

Default Screen

LEDR Link
Default Screen

This menu allows you to view the default screen that appears on the LCD display. If desired, the default screen may be changed (See " Default Screen" on Page 32).

Diagnostics

Loopback
NORMAL (NONE)

This menu is used to start the loopback mode for testing purposes. Remote loopback port selection is relative to the *local port*. The radio link will translate any line mapping to select the correct physical remote port to loop back, based on the selected local port.

When conducting RF loopback testing, see Page 71 (**loopback** NMS command) for additional information.

For the NMS command-line equivalent, See "loopback" on Page 71.

```
Built in Test
   Start?
```

This menu is used to start the loopback mode to check radio functions. When conducting RF loopback testing, see Page 71 (**loopback**) for important information.

For the NMS command-line equivalent, See “test” on Page 87.

Front Panel

```
  Backlight
     ON
```

This screen provides control of the front panel LCD backlighting. The LCD illumination may need to be enabled to view the LCD depending on ambient lighting conditions.

```
Viewing Angle
██
```

This screen allows you to adjust the viewing angle (top to bottom) of the LCD screen. The angle may need to be adjusted to compensate for the radio mounting position and ambient lighting conditions. Use the ◀ ▶ keys to adjust the screen. Pressing ENTER saves the adjusted value as the default setting.

```
 Keypad Beep
   ENABLED
```

This screen allows the keypad beeper to be disabled or enabled. The beeper provides a short “chirp” whenever a front panel key is pressed.

```
Key Repeat Wait
  150 ms
```

This screen allows you to set the time delay that occurs before a key will start repeating its function when held down.

```
Default Screen
     RSSI
```

This screen allows you to set the default screen that appears when the radio is first turned on, or is left idle for more than 10 minutes. The RSSI screen is commonly chosen, but any screen may be selected as a default.

G.821

```
  LEDR Link
    G.821
```

This menu provides information on the radio link’s G.821 performance.

NOTE: When viewing the submenu screens of the G.821 menu, a letter or number will appear in the upper right-hand corner of the display to indicate the function whose performance is currently being displayed.

D = Demodulator
1 = E1 I/O Line 1
2 = E1 I/O Line 2
3 = E1 I/O Line 3
4 = E1 I/O Line 4

For the NMS command-line equivalent, See “g821” on Page 62.

```
G.821 Status
Error Free
```

This display shows summary information regarding the bit-error-rate (BER) status of the radio.

```
Available
0 sec
```

This screen shows the available seconds of the radio link. The G.821 standard defines Available Seconds as the period of time following a period of 10 consecutive seconds, each of which has a BER of less than $1x10^{-3}$.

```
Unavailable
0 sec
```

This screen shows the unavailable seconds of the radio link. The G.821 standard defines Unavailable Seconds as the period of time following a period of 10 consecutive seconds, each of which has a BER of higher than $1x10^{-3}$. This report will include any time the modem is unlocked.

```
Errored
0 sec
```

This screen shows the erred seconds of the radio link. The G.821 standard defines “Errored Seconds” as a one second period in which one or more bits are in error.

```
Severe Errored
0 sec
```

This screen shows the severely-erred seconds of the radio link. The G.821 standard defines Severely Errored Seconds as a one second period that has a BER higher than $1x10^{-3}$.

```
Reset G.821?
NO
```

This screen allows the user to reset the G.821 performance monitoring screens.

```
G.821
DEMOD
```

This screen provides for the selection of what G.821 statistics are displayed. If you press the enter key on this screen you can choose from “DEMOD” (the default) to get over-the-air (RF) statistics or you can choose to monitor each of the E1 lines instead (IO1 to IO4).

General

```
Unit ID
000
```

This menu allows the Unit ID of the radio to be displayed or changed. The Unit ID allows an individual radio to be signaled for Orderwire use.

For the NMS command-line equivalent, See “unitid” on Page 90.

```
Model Number
LEDR 1400S
```

This menu displays the radio model number. The user cannot change the radio type.

For the NMS command-line equivalent, See “model” on Page 74.

```
Serial Number
xxxxxxxxxxxx
```

This menu displays the radio serial number and matches the serial number on the chassis sticker. The user cannot change the radio's serial number.

For the NMS command-line equivalent, See "sernum" on Page 84.

```
Firmware Rev.
x.x.x
```

This menu displays the firmware revision level of the internal radio software.

For the NMS command-line equivalent, See "ver" on Page 91.

```
Hardware Rev.
X
```

This menu displays the hardware revision level of the main PC board in the radio.

For the NMS command-line equivalent, See "ver" on Page 91.

I/O Configuration

```
Clock Mode
INTERNAL
```

This screen is used to set or display the data clocking method. For synchronization purposes, several different clocking schemes can be used. See Table 10 on Page 21 for the combinations of radio bandwidth, data rates and modulation types available for subrate radios. Table 11 on Page 21 contains the same information for fullrate radios.

For the NMS command-line equivalent, See "date" on Page 58.

NOTE: For subrate models: LEDR 400S/900S/1400S
Earlier versions of the software may display the Clock Mode as **NORMAL** instead of **INTERNAL**.

```
Interface
E1
```

This screen is used to set or display the payload data interface. The available selections are E1, T1 and EIA530, depending on hardware configuration of the LEDR radio.

For the NMS command-line equivalent, See "interface" on Page 64.

```
FDL Enable
DISABLED
```

Enable support for Facility Data Link (FDL) messaging on fullrate LEDR units with T1 interfaces. The available selections are `Enabled` and `Disabled`.

For the NMS command-line equivalent, See "fstruct" on Page 61.

CAS Enable
DISABLED

This screen is used to set or display the Channel Associated Signaling (CAS) status. The available selections are Enabled and Disabled.

This screen will only be functional in radios factory-equipped to support CAS and with an E1 interface. Consult with the factory if you require this service.

For the NMS command-line equivalent, See "fstruct" on Page 61.

Line map
1a 2b 3c 4d

This screen is used to set or display the current line mapping span configuration. The entry consists of from 1 to 4 alpha-numeric characters specifying line interface to span mapping. Valid numbers are 1–4. Valid span characters are a–d.

Example: Entering 1a 2b 3c 4d asserts the following:

maps line 1 to span a
maps line 2 to span b
maps line 3 to span c
maps line 4 to span d

For the NMS command-line equivalent, See "linemap" on Page 69.

Line Configuration

Choose Line 1
LINE1

This screen is used to choose or display the line (1-4) that is selected. This selection will be active for all of the screens that follow in the Line Configuration menu and will be displayed in the upper right hand corner of each screen.

For the NMS command-line equivalent, See "linename" on Page 70.

Frame Struct 1
FAS ONLY

This screen is used to set or display the span(s) frame structure. The allowable selections are shown in Table 12.

Table 12. Frame Structure—Allowable Selections

T1 Operation	E1 Operation
0 – FT only (Default)	0 – FAS Only (Default)
1 – ESF	1 – FAS + BSLIP
2 – ESF + PRM	2 – FAS + CRC
3 – SF	3 – FAS + CRC + BSLIP
4 – SF + JYEL	4 – FAS + CAS

Table 12. Frame Structure—Allowable Selections

T1 Operation	E1 Operation
5 – ESF + CRC	5 – FAS + CAS + BSLIP
6 – ESF + CRC + PRM	6 – FAS + CRC + CAS
7 – Unframed (none)	7 – FAS +CRC + CAS +BSLIP
	8 – Unframed (none)

For the NMS command-line equivalent, See “fstruct” on Page 61.

```
AIS Generate 1
     OFF
```

This screen is used to set or display the Alarm Indication Signal (AIS) status. It may be set to ON or OFF. When generation is enabled, fault conditions within the link or at the line interface will cause the appropriate AIS signaling to occur. AIS is not generated when “Hitless Switching” is enabled. (See “Redundant (Hardware)” on Page 41)

For the NMS command-line equivalent, See “ais” on Page 50.

```
AIS Forwarding 1
     OFF
```

This screen is used to set or display the Alarm Indication Signal (AIS) forwarding status. It may be set to ON or OFF. When forwarding is enabled, AIS/RAI (remote alarm indication) signaling at the line interfaces will be detected and passed to the other end of the radio link.

For the NMS command-line equivalent, See “ais” on Page 50.

```
  Line Code    1
     AMI
```

This screen is used to set or display the linecode used by the radio. The available selections are AMI or HDB3.

For the NMS command-line equivalent, See “linecode” on Page 68.

```
   Reframe     1
 3 cons. FAS
```

This screen is used to set or display the reframe criteria of the LEDR radio. The setting is based on the number of errors encountered. The available selections for T1 and E1 operation are listed in Table 13 below.

Table 13. Reframe Criteria Selections

T1 Operation	E1 Operation
2 out of 4 Fbit errors (Default)	3 consecutive FAS errors (Default)
2 out of 5 Fbit errors	915 CRC errors
2 out of 6 Fbit errors	

For the NMS command-line equivalent, See “reframe” on Page 79.

`Pulse Shape 1`
`g.775`

This command is used to select or display the pulse shape used with the data interface cable. The available selections for T1 and E1 operation are: **g.775** (default) and **i.431** .

For the NMS command-line equivalent, See “line” on Page 67.

Login

`LEDR LINK`
`Login`

The login menus allows you to log in to the radio’s operating system and gain access to configuration and diagnostics functions permitted for your assigned access level.

`Username`
`Admin`

The username menu is where you specify the user name assigned by the user access administrator.

For the NMS command-line equivalent, See “login” on Page 71.

`Password`
`******`

The password screen is where you specify the password associated with your user name to gain access to the login account. A maximum of eight characters is allowed and is case sensitive.

For the NMS command-line equivalent, See “passwd” on Page 76.

Logout

`LEDR Link`
`Logout`

The logout menu allows you to terminate your session with the LEDR radio. When this screen is displayed, press (ENTER) to finish your session.

Modem

`Rx Lock`
`LOCKED`

This menu indicates whether the receiver demodulator has detected a signal, acquired the carrier, and data rate, as well as achieved a Forward-Error Correction (FEC) lock.

`Freq. Offset`
`-170 Hz`

This screen shows the frequency offset of the LEDR radio as measured in Hertz.

```
Corrected
0 bytes
```

This menu shows how many bytes have been corrected by the radio's FEC capability.

```
Uncorrectable
0 blocks
```

This menu shows how many frames (blocks) could *not* be corrected by the radio's FEC capability.

```
Bit Error Rate
< 1 x 10-6
```

This menu shows the current bit error rate (BER) of the LEDR radio.

Network

```
IP Address
000.000.000.000
```

This menu allows changes to the radio's IP address. The IP address is used for network connectivity. The IP address also allows new radio software to be downloaded over-the-air.

For the NMS command-line equivalent, See "ip" on Page 66.

```
Netmask
000.000.000.000
```

This menu allows the subnet mask to be viewed and changed. The subnet mask specifies which bits of the host IP address can be re-used for increased network addressing efficiency.

Example: Consider an IP address in a Class C network, such as 150.215.017.009. The Class C network means that the right-most group of numbers (009) identifies a particular host on this network. The other three groups of numbers (150.215.017) represent the network address.

Subnetting allows the further division of the host part of the address (right-most group of numbers) into two or more subnets. A subnet mask of 255.255.255.127 allows half of the host portion of the IP address to be reused to define sub-networks.

For the NMS command-line equivalent, See "ip" on Page 66.

```
Gateway
000.000.000.000
```

This menu allows the Gateway IP address to be viewed or set. The Gateway IP address is the address of the radio that connects the radio network to an IP network.

For the NMS command-line equivalent, See "ip" on Page 66.

```
Default IP Port
Ethernet
```

This menu allows selection of the Default IP port for networking connections to the LEDR radio. The **Ethernet** selection is used for cable connection to a Local Area Network (LAN) or repeater via the radio's rear panel ETHERNET connector.

The **AIR** selection is commonly used for over-the air (RF) networking between radios, but may also be used with a back-to-back cable connection between two radios via the radio's rear panel ETHERNET NMS connector. This type of communication uses the SNAP protocol and requires the use of an ethernet crossover cable.

For the NMS command-line equivalent, See "ip" on Page 66.

UDP Checksum
OFF

Control of UDP checksum function. This control will only be functional when the default IP port is set to Ethernet. The available selections are ON and OFF.

For the NMS command-line equivalent,See "ip" on Page 66.

Orderwire

Send ODW Alert

This menu allows you to "ring" the Orderwire at a specified radio site. Refer to "USING ORDERWIRE" on Page 103 for instructions on using the Orderwire.

For the NMS command-line equivalent, See "alert" on Page 53.

Volume
███

This screen is used to set or display the Orderwire volume. Use the ◀ ▶ keys to adjust the volume level. Pressing ENTER saves the adjusted value as the default setting.

For the NMS command-line equivalent, See "volume" on Page 92.

Vox Threshold
██

This screen is used to set or display the Orderwire vox threshold (activation level). Use the ◀ ▶ keys to adjust the vox threshold. Pressing ENTER saves the adjusted value as the default setting.

For the NMS command-line equivalent, See "vox" on Page 92.

DTMF Enable
ON

With DTMF (a.k.a. Touch Tone™) turned on, this unit will be able to be "called" by service personnel using telephone handsets equipped with a DTMF keypad connected to the orderwire jack of an associated LEDR radio. A DTMF decoder will monitor the orderwire for DTMF signalling tones and "ring" the associated LEDR through the handset connected to the other radio. See "USING ORDERWIRE" on Page 103 for further details.

The available selections are ON and OFF.

For the NMS command-line equivalent, See "dtmf" on Page 59

Performance

The Performance menu items provide diagnostics information regarding the radio. The following diagnostic parameters are available on a continuous, updating basis:

- **RSSI—**Received Signal Strength Indicator
- **SNR—**Signal/Noise Ratio (not valid if there is an RX Alarm)
- **POUT—**Power Output
- **PA Temperature—**Power amplifier temperature

RSSI
-60 dBm

The RSSI display indicates the strength of the radio signal being received by the radio. The measurement is in dBm. Therefore, an RSSI of –80 dBm is stronger than a –100 dBm signal.

For the NMS command-line equivalent, See "rssi" on Page 83.

SNR
+27 dB

The SNR display indicates the relationship of the amount of intelligence versus noise on the radio signal. The higher the SNR, the better the quality of the radio signal.

For the NMS command-line equivalent, See "snr" on Page 85.

Power Out
+30 dBm

The Power Output display indicates the transmitter power output in dBm. (+30 dBm is equal to 1.0 watt; +20 dBm is 100 mW.)

The power output level can be set from this display by pressing the ENTER key, and through use of the arrow keys, increase or decrease the power level. When the desired value is displayed, press the ENTER key to save the setting.

For the NMS command-line equivalent, See "rfout" on Page 80.

PA Temperature
+37 °C

The PA Temperature display indicates the internal temperature (degrees Celsius) at the warmest point on the radio's printed circuit board (near the power amplifier section).

For the NMS command-line equivalent, See "temp" on Page 86.

NOTE: It is normal for the PA temperature to be 30 to 40° C (86 to 104° F) above the ambient room temperature.

Redundant (Hardware)

My Status
OK

This screen is used to display the status of the LEDR radio hardware currently online. "`OK`" is displayed when no problems are detected.

For the NMS command-line equivalent, See "rdnt" on Page 77.

Sibling Status
OK

This screen is used to display the status of the second, "sibling", radio of the pair in a redundant/protected configuration—the one not currently online. "`OK`" is displayed when no problems are detected.

NOTE: Proper operation of a hardware redundant station is dependent on each radio having firmware of the same revision level. If you are unsure, use the **ver**(sion) command to determine the firmware version at each radio before proceeding to make any changes.

For the NMS command-line equivalent, See "rdnt" on Page 77.

Active
YES

This screen is used to set or display whether the currently selected radio is the active/online unit.

For the NMS command-line equivalent, See "rdnt" on Page 77.

Mode
1 + 1 HOT

This screen displays whether or not the unit is operating as part of a hardware-redundant system. A display of "`1 + 1 HOT`" indicates this unit is part of an active hardware-redundant configuration. "`Standalone`" indicates the unit is currently serving as an independent radio, even if it is connected to a Protected Switch Chassis.

For the NMS command-line equivalent, See "rdnt" on Page 77.

`Sibling IP`
`000.000.000.000`

This screen is used to set or display the sibling radio's Internet Protocol (IP) address. Program the sibling's IP address into each LEDR radio connected to the Protected Switch Chassis. (See note below.)

NOTE: The associated radio IP address is used by the redundant radio to share information between the units. This address is necessary for proper operation in a redundant operation with the Protected Switch Chassis. The presence of the sibling radio's IP address *will not* affect IP routing and forwarding, SNMP, or Telnet communications directed to each LEDR chassis.

See "Protected Operation" on Page 109 and "Protected/Redundant-Specific Parameters" on Page 113 for further information.

For the NMS command-line equivalent, See "rdnt" on Page 77.

`Hitless`
`ON`

This screen sets or displays whether the radio is set to perform "hitless" (error-free) switchover to the sibling radio in the event of an alarm condition. AIS is not generated when "Hitless Switching is enabled (`ON`).

For the NMS command-line equivalent, See "rdnt" on Page 77.

`Default Radio`
`Yes`

This screen displays whether or not this radio is serves as the "A" radio in a hardware-redundant configuration. The "A" radio is determined by which one is connected to the top connector of the Protected Switch Chassis rear panel. A display of "`No`" indicates this radio is serving as the "B" radio in the system. (See Figure 9 on Page 15.)

For the NMS command-line equivalent, See "rdnt" on Page 77.

`Protected Mode`
`AUTO`

This screen is used to set or display the radio's hardware redundancy mode. The available selections are: **A ONLY** ("A" radio will be online), **B ONLY** ("B" radio will be online) or **AUTO** configuration.

NOTE: In the **AUTO** mode, the data stream will be protected by the redundant sibling LEDR radio hardware connected to the Protected Switch Chassis.

In the **AUTO** mode, the “A” radio hardware will always be active unless it has failed and the “B” radio hardware is OK.

In the **A-ONLY** and **B-ONLY modes** data protection by the redundant radio hardware is disabled.

For the NMS command-line equivalent, See “rdnt” on Page 77.

`Test Mode Timeout`
`5 Minutes`

How long the transmitter power-measurement command (**rdnt pmmode**) will stay in the A-only or B-only configuration before reverting back to AUTO. Displays only the time programmed; does not display balance of time period.

For the NMS command-line equivalent, See “pmmode” on Page 77.

Remote Status

`LEDR Link`
`Remote Status`

Enter this menu to set or display the unit identification for the remote radio.

`Remote UnitID`
`<none>`

This screen is used to display or set the radio’s unit identification number used for Orderwire signaling and by the NMS (Network Management System). (See “USING ORDERWIRE” on Page 103.) The factory default is the last three numbers of the unit serial number. (Range: 1-999)

RF Configuration

`Tx Frequency`

This menu is used to set or view the transmit (TX) frequency of the radio.

For the NMS command-line equivalent, See “freq” on Page 61.

`Rx Frequency`

This menu is used to set or view the receive (RX) frequency of the radio.

For the NMS command-line equivalent, See “freq” on Page 61.

Tx Key Enable

This menu is used to enable (key) or disable (dekey) the transmitter or to verify that the radio is keyed and the transmitter is active. The radio is normally keyed and transmitting whenever power is applied.

For the NMS command-line equivalent, See “txkey” on Page 90.

Bandwidth

This menu displays the bandwidth setting of the radio. The bandwidth is set at the factory and cannot be changed by the user. Refer to Table 10 on Page 21 for allowable combinations of bandwidth, data rates, and modulation types.

Mod / Data rate
32-QAM 768 kbps

This menu displays the modulation type and the aggregate link data rate. The available modulation types are QPSK, 16 QAM, and 32 QAM. The data rate can be changed, but is dependent on the modulation type. See “Bandwidths, Data Rates and Modulation Types” on Page 20.

For the NMS command-line equivalent, See “modem” on Page 74.

Service Channel

LEDR Link
Service Chan

This menu is used configure the operating parameters of the service channel frequently used.

For the NMS command-line equivalent, See “svch” on Page 86.

Service Chan
ENABLED

Enable or disable the service channel services. Options are: ENABLED (ON) and DISABLED (OFF).

For the NMS command-line equivalent, See “svch” on Page 86.

Echo
OFF

Enable or disable echoing data received by this unit to the remote data communication equipment. Options are: ON and OFF.

For the NMS command-line equivalent, See “svch” on Page 86.

Baud Rate
9600

Display or set the service channel data baud rate. Options are: 300,1200, 2400, 4800, and 9600 bps.

For the NMS command-line equivalent, See “svch” on Page 86.

`Char Length 8`

Display or set the character length for communications over the service channel. Range: 5 to 8.

For the NMS command-line equivalent, See “svch” on Page 86.

`Parity None`

Display or set the parity value for communications over the service channel. Options: None, even or odd.

For the NMS command-line equivalent, See “svch” on Page 86.

`Stop Bits 1`

Display or set the number of parity bits for data communications over the service channel. Options: 1 or 2.

For the NMS command-line equivalent, See “svch” on Page 86.

`Reset Svch NO`

Provides for setting and storing the service channel to the new arrangement. Options: NO or YES. This screen will only be functional when changes have been initiated in other screens of the Service Channel.

For the NMS command-line equivalent, See “svch” on Page 86.

For further information, See “USING THE SERVICE CHANNEL” on Page 106.

5.0 CONFIGURATION AND CONTROL VIA THE CONSOLE PORT

5.1 Introduction

The CONSOLE Port on the front panel provides full access to configuration and diagnostics information. It is the most common way to access the LEDR radio for its initial configuration. The CONSOLE Port is an EIA-232 connection that provides ASCII text communications to a connected terminal.

Most of the commands listed on the following pages are available through other communication channels as well. These include Ethernet, IP, Telnet and the rear panel Service Channel.

Refer to "I/O Connector Pinout Information" on Page 135 for connector wiring details.

NOTE: It is important to use a terminal or terminal-emulator that supports 80 characters-per-line and 25 lines-per-screen. The display will be distorted if terminals with different line characteristics are used.

5.2 Initial Connection to the CONSOLE Port

NOTE: The default connection parameters for console operation are 9600 bps, 8 bits, no parity, 1 stop bit (96008N1). The console port is configured as DCE.

1. Connect a terminal to the front panel DB-9 connector labeled .

2. Open an ANSI terminal application on the terminal. (If using the Windows operating system, a HyperTerminal session can be started by selecting **Programs>Accessories>HyperTerminal**.)

3. Press ENTER a few times. When communications are established with the radio, a **LEDR>** text prompt appears on the terminal screen.

4. Type **login <your username>** (or **rlogin <your username>** for remote access) and press ENTER . At the **password>** prompt, type your password (Eight characters maximum; case sensitive).

5. You now have access to the command line interface. It can be used to configure and query the radio parameters and setup information. The available commands can be listed on the display by typing **help** at the **LEDR>** prompt, then ENTER .

5.3 NMS Commands

Once you are successfully logged in, the Network Management System (NMS) commands shown in Table 14 are available at the command line prompt (**LEDR>**). Note that some commands are model and/or feature specific. See Table 15 on Page 50 for an explanation of feature-specific icons.

Command Entry Hints—*Recalling Commands*

Recalling the most recent command

To recall the most recent command issued from the terminal, enter two exclamation points (**!!**) followed by ENTER . The command will reappear at the **LEDR>** prompt. Press ENTER again to invoke the command, or edit the string as necessary.

Recalling the most recent command beginning with xyz...

To recall the most recent command beginning with *xyz* (where *xyz* is a string of up to 16 characters), enter an exclamation point (**!**) followed by a few characters of the command. For example, if the **threshold** command was recently used, entering **!thresh** followed by **ENTER** would make the **threshold** command reappear at the **LEDR>** prompt. Press **ENTER** again to invoke the command, or edit the string as necessary.

These "recall" techniques are especially useful for commands containing a long string of characters, such as IP addresses or other configuration data.

Command Summary

Table 14 contains a summary of terminal commands, along with references to pages where more detailed information can be found.

Table 14. NMS Commands

Command	Description Summary	Details
? or **help**	Displays the available NMS commands. May also be entered after any other command to obtain context sensitive help.	Page 50
ais	Echoes/enables/disables Alarm Indication Signal (AIS) generation and Remote Alarm Indication (RAI) detection, AIS and RAI Signal (RAIS) forwarding on given span(s).	Page 50
alarm	Provides control of alarm outputs and displays state of alarm inputs.	Page 52
alert	Sends an alert sound to the specified radio	Page 53
arp	Set/display ARP Setting of Ethernet Port	Page 53
ber	Bit-Error Rate report for the RF link.	Page 54
bert	Bit-Error Rate test of data interface	Page 54
boot	Displays the active image (firmware) or reboots the radio with a specified firmware image	Page 56
buzzer	Briefly sounds the radio's piezo buzzer to test its operation	Page 56
clkmode	Set/display data clocking mode	Page 57
coffset	Displays modem carrier frequency offset in Hz	Page 57
con	Set/display CONSOLE Port communications parameters	Page 57
config	Used to get or send a radio configuration file	Page 58
date	Set/display current date	Page 58
dtmf	Turns dual-tone, multi-function signaling feature on or off	Page 59
eia530	Set/display EIA-530 RTS or DTR control lines	Page 59
ethernet	Displays Ethernet address	Page 59
events	Event log commands	Page 59
evmap	Set/display alarm port and alarm LED settings	Page 60
fec	Display corrected and Uncorrectable FEC errors	Page 60

Table 14. NMS Commands *(Continued)*

Command	Description Summary	Details
freq	Set/display operating frequencies	Page 61
fset	Display absolute frequency limits	Page 61
fstruct	Set/display current span(s) frame structure	Page 61
g821	Show/Reset G.821 information	Page 62
group	Set/display network group	Page 63
help or **?**	Displays the available NMS commands. May also be entered after any other command to obtain context sensitive help.	Page 50
icopy	Firmware image copy	Page 63
idlepat	Set/display timeslot idle pattern	Page 64
info	Set/display radio/owner information	Page 64
interface	Set/display the payload data interface	Page 64
interleave	Set/display interleave depth	Page 65
ip	Set/display the radio's IP configuration	Page 66
iverify	Firmware image verify	Page 66
lcd	Tests radio's front panel LCD display	Page 67
led	Tests radio's front panel LEDs	Page 67
line	Set/display pulse shape settings	Page 67
linecode	Set/display the linecode used by span(s)	Page 68
linerr	Show/enable/clear line errors	Page 70
linemap	Set/display current linemapping configuration	Page 69
linename	Set/display names for line interfaces	Page 70
log	View, sort, clear, send event log information	Page 70
login	Console user level access	Page 71
logout	Console user exit	Page 71
loopback	Set/display loopback modes	Page 71
model	Display radio model number	Page 74
modem	Set/display radio modulation type and data rate	Page 74
network	Display radios in the network	Page 75
passwd	Sets new user password (8 characters max.)	Page 76
ping	Test link to IP address on network	Page 76
pll	Displays Phase Lock Loop status	Page 76
pmmode	Enables/disables modem modulator power measurement mode (on/off)	Page 77
rdnt	Set/display redundant operating configuration	Page 77
reframe	Set/display the reframe criteria	Page 79
reprogram	Reprograms radio software	Page 79
rfocal	Set/display RF power output calibration sequence	Page 80
rfout	Displays transmit power	Page 80
rlogin	Log in to remote radio	Page 81

Table 14. NMS Commands *(Continued)*

Command	Description Summary	Details
route	Add/delete/modify IP routing table entries	Page 81
rssi	Displays received signal strength	Page 83
rssical	Set/display RSSI calibration table	Page 83
rxlock	Displays current modem lock status	Page 84
sabytes	Echo/set sa bytes in E1 multi-frame	Page 84
sernum	Displays radio serial number	Page 84
snmpcomm	Set/display SNMP community names	Page 84
snr	Display signal to noise ratio	Page 85
spur	Set/display spur frequencies for the radio network	Page 85
status	Display performance and configuration data	Page 85
svch	Set/display Service Channel configuration	Page 86
telnetd	Display or kill (terminates) Telnet session(s)	Page 86
temp	Display PA temperature	Page 86
test	Runs self-test of LEDR hardware	Page 87
threshold	Set/display performance degradation threshold(s)	Page 87
time	Set/display system time	Page 88
timeslot	Select which timeslots to transmit for a span(s). Default action is to enable.	Page 88
trapfilter	Set/display which events cause SNMP traps	Page 89
trapmgr	Set/display the trap manager IP address	Page 89
trend	Display continuously updated readings of: RSSI, radio temperature, RF output, signal-to-noise ratio, and FEC errors (corrected and uncorrectable).	Page 90
txkey	Key or unkey radio	Page 90
unitid	Display the three-digit unit identification	Page 90
uptime	Display how long the radio has been operating	Page 90
user	Administration tool for adding, modifying or deleting user accounts	Page 90
ver	Display software version	Page 91
volume	Set/display orderwire handset volume	Page 92
vox	Set/display orderwire VOX threshold	Page 92
who	Display the currently logged in radio users/accounts	Page 92

Detailed Descriptions—Console Commands

The following commands are available through the CONSOLE port. These commands all require the Enter or Return key be pressed after the command.

The following conventions are used to help describe the usage of the commands.

Square brackets **[ ]** contain subcommands that may or may not be needed as part of the desired command. If there is more than one possible subcommand a vertical line **|** separates the commands within the square brackets. A subcommand is an optional extension of the command and changes the basic command.

Angle brackets **< >** contain arguments. The arguments are values needed to carry out the command such as a frequency value or option.

Some commands are limited to use in certain radio models or configurations. These include subrate and fullrate. One or more of the symbols as listed in Table 15 will identify these commands.

Table 15. Feature-Specific Icons

Symbol	Interface/Group
530	EIA-530
FT1	Fractional-T1/G.703
FE1	Fractional-E1/G.703
E1	E1/G.703

? or **help**

User help

Usage: **?** or **help**

This command returns a list of currently available commands. In addition, entering a question mark (**?**) as a subcommand after a command returns usage information regarding the command.

Command Example:

rssi ?

Returns:

Usage: RSSI [subcommand] [arguments]

Set/Display Interpolated Rssi Parameters

Subcommand:

offset [<dB>|clear] - Display/Clear current offset in dB

Usage: **command <argument>**

ais FT1 E1 FE1

Alarm Indication Signal

Usage: **ais [linelist] [-g <on|off>] [-f <on|off>]**

This command enables or disables alarm signal generation [**-g**] and forwarding [**-f**] on specified E1/T1 interface lines. When generation is enabled, fault conditions within the link or at the line interface will cause the appropriate AIS/RAI signaling to occur. When forwarding is enabled, AIS/RAI signaling at the line interfaces will be detected and passed to the other end of the link.

Command Example:

ais -f on -g on

Returns:

AIS on RAI on

NOTE: For protected/redundant configurations and full-rate radios, disable the alarm generation through the use of the **ais -g off** command.

Background on AIS command:
In fractional operation, the radio extracts the required timeslots and data at the input to a link, and reconstructs the full frame at the output end. The **AIS -g (generation)>** command, when enabled, allows the radio to override the frame reconstruction process in order to generate a proper all-ones alarm signal. For example, modem loss of synchronization will cause all-ones to be transmitted from the active G.703 ports. When **AIS -g** is disabled, the output will consist of a framed signal with all-ones in the active timeslots. In Fractional operation, AIS generation also creates a yellow alarm/RAI back to the defective source when a problem is found at the input. In FE1 mode, when **AIS -g** is enabled, loss of Multi-Framing Alignment Sequence (MFAS) at the line receiver will generate a Multi-frame Yellow Alarm (MYEL) or Multi-frame Remote Alarm Indication (MRAI) at the line transmitter.

AIS <-f (forwarding)> is the act of detecting a condition at the input and causing an appropriate response at the other end. For example, with forwarding enabled, an all-ones signal applied at one end causes all-ones to be output at the other. A Remote Alarm Indication (RAI) applied will likewise appear at the opposite end. Disabling the forwarding function limits the presentation of alarm signaling to the active timeslots at the remote end. It is recommended that the **ais -f on** or **ais --g on** command be used for Fractional operation, to enable alarm generation and forwarding.

In full-rate modes, the radio will always output AIS when the unit is unlocked—received radio signal is lost. When the modem is locked, and the input is removed from one end, you will get all-zeros at the other end unless AIS generation is enabled. Yellow alarms/RAI are not generated in the full-rate LEDR radio models; however AIS and RAI forwarding are available. It may be desirable to have alarms generated (**ais -g on)** in full rate models, depending on the user's requirements as outlined in the next paragraph.

Since the generation and forwarding operations require use of the Service Channel, the AIS/RAI response times are on the order of a few seconds. Generation and forwarding can be very helpful in correcting problems with the network when they arise. However, in systems where the response time is critical, these modes should be disabled: In fractional mode, enter **ais -f off -g off**. In full-rate mode, enter **ais -g off**.

alarm

Alarm I/O

Usage: **alarm [in|out] [1-4|all] [subcommand] [arguments]**

This command is used to control the four (4) external alarm contacts and display the state of the four (4) external alarm inputs.

Outputs (Relays)—Alarm outputs may be directly driven to a state, or be mapped to, internal events via the **evmap** command (Page 60). When mapped to events, the active level may reprogrammed to be either active-open or active-closed. Active means that an event is mapped to an external alarm output that is currently active. (See “Alarm I/O” on Page 18 for electrical parameters and typical examples of alarm usage.)

Inputs—Alarm inputs are used to generate events in the event log and also generate SNMP traps if so programmed by the **events** filter command. They may be directly read via the **alarm** command, as well. They may also have their active level set to be either active high or low. (**alarm active high**; **alarm active low**)

Naming—Finally, both inputs and outputs may be named by users to allow for easy identification. For example, “Fire Alarm” could be used as the name for Alarm Input 1. Traps are sent with this name so that users may more easily identify the source of the alarm.

Subcommands:

active [open|closed]—Set alarm input/outputs active state.

set [open|closed] —Latch alarm outputs to one state to ignore events which are assigned to them.

name [name_string]—Create a user defined “name” for each alarm. No spaces, 16 characters maximum; not compatible with “**all**”.

Command Example #1:

alarm in all

Returns:

```
alarm:                                 Active  Current
alarm:   Type   #        Name          Level   Reading
alarm:  ======  =  ================    ======  =======
alarm:   Input  1  AlarmInput1         closed   open
alarm:   Input  2  AlarmInput2         closed   open
alarm:   Input  3  AlarmInput3         closed   open
alarm:   Input  4  AlarmInput4         closed   open
```

Command Example #2:

alarm out 2 set closed

Returns:

```
alarm:                                 Active  Current
alarm:   Type   #        Name          Level   Reading
alarm:  ======  =  ================    ======  =======
alarm:  Output  2  AlarmOutput2        closed  closed
```

Command Example #3:

alarm in 3

Returns:

```
alarm:                                 Active  Current
alarm:   Type   #        Name          Level   Reading
alarm:  ======  =  ================    ======  =======
alarm:  Input   3  AlarmInput3         closed  open
```

alert

Alert another LEDR Radio in the Network

Usage: **alert <3 digit unit ID>|all**

This command is used to sound the alert buzzer on another radio. This function allows you to signal a radio and alert someone that the Orderwire handset should be picked up.

The three-digit number following the command indicates the unit ID of the radio that will be signaled. Radios available for signaling can be determined by issuing the **network** command. See "USING ORDER-WIRE" on Page 103 for more information.

arp

Address Resolution Protocol (ARP) Setting of Ethernet Port

Usage: **arp [-a | -s [ip address] | -d [ip address]**

-a View the ARP table

-s Add the IP address to the ARP table. The radio will proxy ARP for any addresses that are added

-d delete the IP address from the ARP table

This command displays the contents of the radio's ARP table, which is a listing of IP addresses of which the radio is aware. It can also be configured to "spoof," or proxy, for other (non-LEDR) devices that are managed using the radio's out-of-band Service Channel and directly connected at some point to a radio's Ethernet port, or to a common hub with a LEDR radio. In other words, the radio network can be configured for seamless integration of other IP-manageable devices by responding to ARP requests and/forwarding IP traffic directed to those devices.

See the **route** command on Page 81 for information on other necessary configuration steps to allow for IP connectivity to LEDR radios and associated devices using the radio's network-management channel.

ber

Bit-Error Rate of the RF Link

Usage: **ber**

This command displays pre-FEC and post-FEC Bit-Error Rate (BER) between the LEDR radios in the first link.

NOTE: The BER measurement limit is 10E-8. For more reliable information on the link-error rate, use the **g821 demod** command (Page 62).

---

bert

Bit-Error-Rate Test of Data Interface

FT1 E1 FE1

Usage: **bert [linelist] [-e [pattern] | -d | -i [error] | -lp | -le | stats]**

bert is used for diagnostic purposes by causing the selected line of the FT1/E1 interface port lines to output a user-selectable pseudo-random bit sequence, either framed or unframed. This command also allows the user to measure the bit error rate, number of errors, etc. This command tests all T1/E1 timeslots without regard to the timeslot command's configuration.

linelist—List of local line interfaces. Can be single line number or linename (see **linename** command), comma-separated list of line numbers or linenames, a range of line numbers (for example: 1-4), or if **linelist** is not given, all lines will be tested.

NOTE: The hyphen is part of the argument string and must be included for the command to function.

Subcommands:

Control—

-e Enable bert generation/monitoring for line(s)

Can be immediately followed by the test pattern index value (See **-lp** below). If none is included in the command, the last-used pattern will be implemented.

-d Disable bert generation/monitoring for line(s)

-i Inject error. Index specifying type of error to inject. If no error is specified, last error selected is used.

Reference—

-lp List available pseudo-random bit patterns
(See Table 16 on Page 55 for options.)

-le List available errors to inject
(See Table 17 on Page 55 for options.)

stats Display bert statistics

Table 16. Pseudo-Random Bit Patterns

Index	Description	Data Inversion
0	Unframed 2^11 *(Factory Default)*	No
1	Unframed 2^15	Yes
2	Unframed 2^20	No
3	Unframed 2^23	Yes
4	Unframed 2^11 with 7 zero limit	No
5	Unframed 2^15 with 7 zero limit	No
6	Unframed 2^20 with 14 zero limit (QRSS/QRS/QRTS)	No
7	Unframed 2^23 with 14 zero limit (non-standard)	No
8	Framed 2^11	No
9	Framed 2^15	Yes
10	Framed 2^20	No
11	Framed 2^23	Yes
12	Framed 2^11 with 7 zero limit	No
13	Framed 2^15 with 7 zero limit	No
14	Framed 2^20 with 14 zero limit (QRSS/QRS/QRTS)	No
15	Framed 2^23 with 14 zero limit (non-standard)	No

Table 17. Errors to Inject

Index	Description
1	CAS multiframe (MAS) pattern error (E1 only)
2	Fs (T1) or MFAS (E1)
3	PRBS error
4	Change of frame alignment, 1 bit minus
5	Change of frame alignment, E1, 1 bit plus
6	CRC6 for T1, CRC4 for E1
7	Frame bit error...Ft, FPS, or FAS bit error depending on current framer mode
8	Linecode violation

Background information on **bert** command:

The bit error-rate test command, **bert**, is used to evaluate the link between the LEDR data interface and the customer premises equipment (CPE). When used, the LEDR radio will send a test pattern out of the LEDR FT1/E1 Data Interface lines towards the CPE while simultaneously attempting to receive the same pattern back from the CPE. For example, you can loopback the CPE's external data device's I/O, then issue a **bert** command to the LEDR radio to check the integrity of the wire connection. The test pattern can be user-selectable. (See bert command Options above for further information.)

NOTE: The **bert** command will not test or evaluate the integrity of the LEDR radio link. (See "BENCH TESTING OF RADIOS" on Page 127 for further information.)

NOTE: When operating FT1 or FE1 interfaces, this command tests all T1/E1 timeslots without regard to the timeslot command's configuration.

boot

Boot from Active/Archive Software

Usage: **boot [<1|2|-s|-o>]**

This command is used to view or change the radio's active software image. If **boot** is entered alone, the currently active firmware image (1 or 2) is displayed. A selection of 1 or 2 after the command (e.g., **boot 2**) initiates a reboot from that image. (A message appears to confirm that you wish to reboot the radio firmware.) Upon reboot, the radio and all radio functions are restarted in a manner similar to turning the radio power off and then on again. The radio is taken out of service until it re-initializes, and the link loses synchronization until the reboot process completes and the demodulators at both ends reacquire the radio signals.

A choice of software images allows booting an alternate version of radio software. The ability to have two radio-resident software images allows radio software reprogramming over-the-air and the ability to restore operation to the original software if required.

Subcommands:

1 Boot from Image 1

2 Boot from Image 2

-s Boot from the active (same) image

-o Boot from the inactive (other) image

buzzer

Buzzer

Usage: **buzzer**

This command briefly sounds the radio's piezo buzzer for testing. It should be used only from the CONSOLE Port.

Example Response:

buzzer: Starting test
buzzer: Test complete

clkmode

Clock Mode (Subrate Radios Only)

530

Usage: **clkmode [< internal | exttx | looped | extdce >]**

This command displays or sets the source of the radio's transmit clock. For synchronization purposes, several different clocking schemes can be used. See Table 10 on Page 21 for the combinations of radio bandwidth, data rates and modulation types that are available for subrate radios. Table 11 on Page 21 shows the combinations available for full rate radios.

Subcommands:

- **internal**—Internal oscillator sources TC; RC derived from far end of radio link (default).
- **exttx**—ETC accepted from external equipment on EIA-530 interface; RC derived from far end of radio link.
- **looped**—Recovered RF (RX) clock; TC is synchronized to RC; RC is derived from far end of radio link. Note: Do not use looped clocks at both ends of any radio link.
- **extdce**—ETC and ERC are accepted as inputs on the EIA-530 interface.

NOTE: Early versions of the software may display the Clock Mode as **NORMAL** instead of **INTERNAL**. It is recommended that you upgrade to the latest firmware to correct this problem and to benefit form other improvements.

coffset

Carrier Offset of Radio Modem

Usage: **coffset**

This command displays the Modem Carrier Frequency Offset.

con

Console Port Configuration on LEDR Front Panel

Usage: **con (baud [300|1200|2400|4800|9600|19200|38400|115200]) (parity [none|even|odd])**

This command sets or displays the CONSOLE Port's operating parameters. The CONSOLE Port data rate is set or displayed using the **baud** subcommand. The parity is set or displayed using the **parity** subcommand.

The default setting is 9600 bps, no parity, 8 data bits and 1 stop bit.

NOTE: Firmware version 5.2.4 and later will remember the CONSOLE Port baud rate setting through a power cycle. When the radio is rebooted, you may see random characters on the terminal until the boot cycle is completed.

config

Configuration

Usage: **config [get | send | getall] [filename | console] [hostIP]**

This command is used to get or send a radio configuration file.

The radio stores its configuration data in a file that you can download using the **config send** command. The output can be directed to a file or to the NMS window, either in a Telnet session or a serial NMS session. The **config send** command allows sending the configuration file over the Ethernet management channel and storing it on a PC running a TFTP server.

Subcommands:

send—Upload entire radio configuration file to host (includes all radio-specific data)

get—Download radio configuration file from host (DOES NOT download radio-specific data)

getall—Download entire radio configuration file from host (including all radio-specific data)

Radio-specific data includes IP address, network settings, frequencies, target power thresholds, calibration data, and IP routing table.

Command Example: **config send config.txt 192.168.1.14**

This sends the configuration file to a TFTP server running on host 192.168.1.14 and stores it as a file called config.txt.

date

Calendar Date

Usage: **date [MM/DD/YYYY]**

This command sets or displays the date and time of the radio's internal real-time clock. The real time clock operates from an internal lithium battery so it is running even if the radio has no DC power connected. The date format may also be set or displayed from this screen for one of three formats: U.S., European, or generic.

Subcommands: **date format [<1-3>]**

Date Format 1: mm/dd/yyyy (All numbers)

Date Format 2: dd/mm/yyyy (All numbers)

Date Format 3: dd-MON-yyyy (English abbreviation of month)

Example Response: **date: 07-JUN-1999 08:11:30**

dtmf

Dual-Tone Multi-Function Orderwire Signalling

Usage: **dtmf [on|off]**

This command is used to turn the orderwire DTMF signaling decoder on or off. See “USING ORDERWIRE” on Page 103 for further details.

eia530

530

EIA-530 Selection

Usage: **eia530 [rts <on|off>] [dtr <on|off>]**

This command is used to set or display the status of the EIA-530 control lines (RTS and DTR).

ethernet

Ethernet Port’s Hardware Address

Usage: **ethernet**

This command displays the fixed hardware address of the radio’s Ethernet port. This address is globally unique; it is assigned at the factory and cannot be changed.

events

Events

Usage: **events [subcommand] [event#] [<arguments>]**

Subcommands:

- **pending**—View currently pending events
- **filter [event#] [<count>]**—Set number of occurrences/log entry
- **filter io[1 | 2 | 3 | 4 | x] [<count>]**—Filter I/O line(s); **iox** = all
- **init [savemap]**—Re-initialize the event processing,
  - **savemap**—Option to preserve event map
- **desc [<event #>]**—Display event description

This command allows viewing the pending events (**pending**), suppressing the notification of particular events (**filter**), initializing events processing (**init**) and display of event descriptions (**desc**). To turn off logging (notification in the event log) for a particular event, the filter count value should be set to zero.

Events 135-138 are **remote alarm in [1-4]**, respectively, which reflects the event state of the **alarm in [1-4]** of the remote-located radio at the other end of the RF link.

Example Response:

```
events {events}: -DEMOD_ACQUISITION (Event #27)
events: Event#0 Filter count=1
events {init}: The event log has been re-initialized
events {desc}: Event#40 Description-
IO2_DIG_REM_LPBACK
```

evmap

Event Mapping (for Alarm Output and LEDs)

Usage: **evmap [subcommand] [event #] [arguments]**

This command sets or displays which radio system events cause alarm indications on the front panel LEDs or the rear panel ALARM I/O connector. The user can rename the alarm events, but they cannot be deleted, nor can new ones be created.

The subcommands specify which output will be asserted (**led** or **aout**) upon occurrence of an **event #**. Multiple outputs can be specified with spaces between them. The **dump** option allows determining the current event mapping for all of the events or, optionally, a specified numeric range of events.

Events 135-138 are **remote alarm in [1-4]**, respectively, which reflects the event state of the **alarm in [1-4]** of the remote-located radio at the other end of the RF link. Use the event filter counter to enable each particular event. Use **evmap** and map to alarm output contact when necessary.

Subcommands are listed below:

led [ioalarm|txalarm|rxalarm|alarm|none]
Maps front panel LED(s) to an event.

aout [none | 1 | 2 | 3 | 4]
Maps an alarm output(s) to an event.

dump [<range>]
Display the LED and alarm output mappings for all events. (Optional Range: “x-y”)

send [filename] [hostIP]
Send event map file to host

get [filename] [hostIP]
Get event map file from host

See Figure 5 for reference to the Front Panel LEDs. Refer to "Alarm—Rear Panel" on Page 137 for the pinouts of the ALARM I/O connector and "Disabling the Front Panel Alarm LED for Unused E1 Option Ports" on Page 93 for further information.

fec

Forward Error Correction Statistics

Usage: **[fec <clear>]**

This command displays corrected bytes and uncorrectable FEC block errors.

Example Response: **fec: 1812992 Correctable Bytes**
fec: 2 Uncorrectable Blocks

freq

Frequency of TX & RX Channel

Usage: freq **[tx | rx] [<freq>]**
or
freq [<tx freq>] [<rx freq>]
Add a period (.) at the end of frequency input to signify MHz unit.

This command sets or displays the transmit and receive frequency.

Example Response: **freq {TxFreq}: 942175000 Hz**
freq {RxFreq}: 944175000 Hz

fset

Frequency Limits Setting

Usage: **fset [<min freq>] [<max freq>]**

This command sets the absolute frequency limits of the transmitter and receiver.

Example Response: **fset {Tx MinFreq}: 1350000000 Hz**
fset {Tx MaxFreq}: 1535000000 Hz
fset {Rx MinFreq}: 1350000000 Hz
fset {Rx MaxFreq}: 1535000000 Hz

fstruct

Frame Structure

FT1
E1
FE1

Usage: **fstruct [linelist] [mode <0-7|none>]**

This command is used to set or display the span(s) frame structure. The **[linelist]** variable represents a list of line interfaces. This entry can be either a single line number or line name (see **linename** command), a comma-separated list of line numbers or line names, a range of line numbers (i.e., 1-4), or if **linelist** is not given *all* lines.

In general, this parameter should be configured to match the frame structure used by the customer premises equipment. The **fstruct** command also controls the generation of performance report messages in ESF modes. In E1 radios, an unframed mode is available by issuing the command **fstruct mode 8**.

In Fractional-E1 mode timeslot 0 is always sent, and for fstruct modes 4 through 7, timeslot 16 must be added to the payload list for proper operation.

Table 18 shows a list of line mode values for T1 interfaces and Table 19 for E1 interfaces.

Table 18. T1 Frame's Line Mode Values

Value	Mode
0	FT only (default)
1	ESF
2	ESF + PRM
3	SF
4	SF + JYEL
5	ESF + CRC
6	ESF + CRC +PRM

Table 19. E1 Frame's Line Mode Values

Value	Mode
0	FAS only (default)
1	FAS + BSLIP
2	FAS + CRC
3	FAS + CRC + BSLIP
4	FAS + CAS
5	FAS + CAS + BSLIP
6	FAS + CRC + CAS
7	FAS + CRC + CAS + BSLIP
8	Raw, unframed, transparent mode.*

** Mode 8 is forbidden in fractional modes.*

g821

G.821 Information

FT1
E1
FE1

Usage: **demod io1 | io2 | io3 | io4 | all [clr]**

This command is used to show or reset the radio's G.821 information.

The LEDR family of radios support the ITU G.821 recommendation for display of four categories of statistical availability information: available seconds, errored seconds, severely-errored seconds, and unavailable seconds.

Example Response:

```
Demodulator: ERROR FREE
Savail: 1036
Sunavail: 0
ES: 0
SES: 0
```

NOTE 1: The G.821 statistics are not reset when the modem locks.

NOTE 2: Modem unlocked time will be added to the unavailable seconds.

group

Group Number in LEDR System

Usage: **Group [< 0 - 99 >]**

This command sets or displays the network group in which the radio is operating.

Example Response:**group: 1**

In a typical system, all the radios would operate in the same group, allowing the flow of network-management and orderwire activity between radios and from one radio link to any other in the system. At a repeater site, all radios must be set to the same "group number" (and not group zero) for this flow of information to take place. Setting group numbers differently in repeater systems isolates links from each other from a network-management perspective, allowing segmenting networks and controlling the flow of network-management information. Across a radio link, groups can differ from each other; only radios physically connected by Ethernet cables to each other or to the same hub must have the same group number to intercommunicate.

Setting a radio's group to zero prohibits *all* network management traffic from flowing to and from that radio's Ethernet port.

help or **?**

User help

Usage: **help** or **?**

This command can be used alone, to list all available commands, or with a specific command, to provide syntax assistance. Entering **help** before or after a command will display the usage and possible subcommands of the command.

icopy

Image Copy

Usage: **icopy [< app | dsp | fpga | scripts >]**

This command is used to copy the active software image to the inactive software image.

Each radio stores two independent firmware files that control the radio's operation. The radio uses one of the files as the active software, which is running. The other software file is inactive and is not running. The ability to have two firmware images allows firmware reprogramming to be done over-the-air and provides the ability to restore operation to the original software if required. The **icopy** command allows copying all, or a selected subset, of the regions of the active image to the inactive image area. This is typically used to update the inactive image after loading new firmware and rebooting the radio from the new image.

To view or change the active firmware image See “boot” on Page 56.

idlepat

Idle Pattern

FT1 E1 FE1

Usage: **idlepat [<linelist>] [slots <slotlist>] <pattern>**

This command is used to set or display the bit-pattern used in the idle timeslots. Some equipment requires a particular pattern. To set the bits to all ones, use the command **idlepat ff**. To set the bits to a zero followed by seven ones, use the command **idlepat 7f**. This command does not apply to subrate models.

Argument Definitions:

linelist—Represents a list of line interfaces. It can consist of a single line number or linename, a comma separated list of line numbers or line names, a range of line numbers (i.e., 1–4) or, if linelist is not given, all lines. See Table 18 on Page 61 for a list of line numbers.

slotlist—A list of timeslots consisting of a single slot number, comma separated list of slot numbers, or a range of slot numbers (i.e., 2-8).

pattern—A 2 hex digit value (default value is 17).

info

Information as Selected by User

Usage: **info [<owner|description|contact|name|location>] [<string>]**
info clear [<owner|description|contact|name|location>]

This command is used to program information into (or clear it from) radio memory that is particular to the radio site or installation. The information is intended for identification and memorandum needs.

Five text fields are provided. The owner’s name string is limited to 10 characters. The description, contact, location, and name text fields are limited to 254 characters. Any standard, printable ASCII characters are allowed. The description field is programmed at the factory and is not user-definable.

To display the owner’s name text field enter **info owner**. To display the contact information enter **info contact**. To display the name information enter **info name**. To display the location information enter **info location**.To display all the parameters enter **info**.

To change the info text, enter text after **info owner** or other info field name.

interface

530 FT1 E1 FE1

Interface for User Data

Usage: **interface [e1 -O | t1 -O | 530 -O]**

This command is used to select or display the payload data interface. All units can be configured to use the EIA-530 port, or the T1/E1 port if the optional interface card has been installed. If an optional data interface board is installed, the user may select between the T1 or E1 interface modes. The system will recommend a reboot and provide a prompt to do so. This command must be properly set, or no communication will be possible.

Command Example:

interface

Example Response:

interface {Line}: e1

NOTE: 1E1 through 4E1 data rates are not supported when using the EIA-530 interface. The maximum EIA-530 data rate is 768 kbps.

Be sure to place a space after the abbreviation for the type of interface and the hyphen and the “O” character (not a zero). As an example, **interface e1 -O**. The is necessary only for LEDR radios with an optional interface PCB installed.

interleave

Interleave Depth

Usage: **interleave [1 - 12]**

This command is used to set or display the interleave depth. The depth range is 1–12 with settable values of 1, 2, 3, 4, 6 and 12. Default setting for Subrate is 2, Default setting for Fullrate is 12. The interleave setting must match at both ends of a radio link, or the link cannot synchronize regardless of any other radio settings or signal strength. Larger interleave settings cause longer link latency; in latency-sensitive applications, interleave value should be reduced to as small a value as is possible while maintaining good link performance (See the **g821 demod** command described earlier in this section).

Example Response:

interleave: 1

Background:

In digital communications, interference often occurs in the form of short noise bursts. These bursts normally corrupt a series of consecutive bits.

Interleaving is a digital algorithm that allows Forward Error Correction (FEC) to better handle bursts of noise. Interleaving reorders the data so that the symbols that would normally be neighbors in a given block are spread among multiple blocks. FEC works on a block of data of a specific size and can properly correct errors as long as the number of errors is small enough. With interleaving, the number of errors that occur within a single block is reduced, thereby allowing the FEC to more effectively correct burst errors.

The value of the interleaver function should not be changed unless there are latency limitations for the radio link. If low latency is required, then the interleave can be changed, but the ability to correct for the influence of burst-noise on the BER will be reduced.

ip

Internet Protocol Settings

Usage: **ip [subcommand] [<argument>]**

Subcommands:

address [x.x.x.x]

netmask [x.x.x.x]

gateway [x.x.x.x]

port [ETH|AIR]

udpcksm [on|off]

This command sets or displays the Internet Protocol (IP) settings for the LEDR radio. The subcommands allow you to set the IP **address**, IP **netmask**, IP **gateway**, or **IP port**. The port setting determines whether IP communication to and from a particular radio occurs over the radio link or via a PC (or other networked device, such as a router) directly connected to the radio's ETHERNET port. See "Network" on Page 38 for additional information.

Example Response: **IP Address: 10.2.142.143**
IP Netmask: 255.255.0.0
IP Gateway: 0.0.0.0
IP Port: ETH
IP udpcksm: ON

iverify

Image Integrity Verification

Usage: **iverify [image < 1 | 2 >] [< app | dsp | fpga | scripts | option >]**

This command is used to determine the data integrity of the two firmware image files that reside in the radio as a whole or the several sub-sections: application (app), digital signal processing (dsp), field-programmable gate array (**fpga**), scripts (**scripts**), and support for the E1/T1 interface option (**options**), if it is installed.

Verifying subsections of the firmware can be used as a troubleshooting tool. The GE MDS firmware loader utility (Flash Utility) can be used to reload the firmware, or any subsection, provided your computer is connected to the radio chassis through the front panel CONSOLE Port.

See "CONSOLE" on Page 14 for details on using the using the port.

See “icopy” on Page 63 for instruction on loading firmware from the firmware image file within the radio.

Example Response: **iverify: Image has been verified**

lcd — Liquid Crystal Display (LCD) Test

Usage: **lcd [<on|off|restore>]**

This command starts a two-part test of the radio’s front panel LCD. When **lcd** is first entered, the display should appear with all blocks black. When the **RETURN** key is pressed, the screen should change to completely blank.

led — Light Emitting Diode Test (Front Panel LEDs)

Usage: **led [< alarm | rxalarm | txalarm | ioalarm | all | restore >] [< on | off >]**

This command is used to test the front panel LEDs. If no argument is given, all front panel LEDs (except POWER) should flash in sequence. Press Control-C to end the test. (See “Disabling the Front Panel Alarm LED for Unused E1 Option Ports” on Page 93 for further information.)

Command Example:

led alarm on

Returns:

led: Alarm LED ON

line — Line Compensation (T1 or E1 Interface Cables)

FT1 E1 FE1

This command is used to set or display the internal pulse template selection used by the LEDR interface to compensate for signal distortion created by various lengths and types of interface cables.

The **[linelist]** variable represents a list of line interfaces. It can consist of a single line number or line name, a comma-separated list of line numbers or line names, a range of line numbers (i.e., 1–4), or if linelist is not given all lines will be displayed. See Table 18 on Page 61 for a list of line numbers.

FT1

Usage For T1: **line [linelist] [cable length<0–4>] [spec]**

T1 interfaces require setting of a minimum of two variables: ITU cable specification and cable length. Table 20 shows the specification options and Table 21 lists values used for various lengths of standard 100 Ω twisted pair cables.

Table 20. ITU Cable Specifications—Subcommand [spec]

Specification
g.775 (Default)
i.431

Table 21. Cable Length Values—Subcommand [cable length]

Value	Line Length (Meters)	Line Length (Feet)
0	0.3 to 40 (default)	1 to 133 feet (default)
1	40 to 81	133 to 266
2	81 to 122	266 to 399
3	122 to 163	399 to 533
4	163 to 200	533 to 655

E1
FE1

Usage For E1: **line [linelist] [spec]**

The only cable specification needed for E1 is the ITU cable type. Table 22 lists the specification values for two standard 120 Ω ITU-T G.703 cables

Table 22. E1 Cable Specifications—Subcommand [spec]

Specification
g.775 (Default)
i.431

Command Example:

LEDR> line

Returns:

```
line {LINE1} {cable}: ITU-T G.703 120 Ω Twisted Pair
        {spec}: i.431
line {LINE2} {cable}: ITU-T G.703 120 Ω Twisted Pair
        {spec}: g.775
line {LINE3} {cable}: ITU-T G.703 120 Ω Twisted Pair
        {spec}: g.775
line {LINE4} {cable}: ITU-T G.703 120 Ω Twisted Pair
        {spec}: g.775
```

linecode

Line Code

FT1
E1
FE1

Usage: **linecode [linelist] [B8ZS | AMI | HDB3]**

This command sets or displays the radio’s linecode (T1: B8ZS or AMI; E1: HDB3 or AMI).

The **[linelist]** variable represents a list of line interfaces. It can consist of a single line number or line name, a comma-separated list of line numbers or line names, a range of line numbers (i.e., 1–4), or if linelist is not given all lines will be displayed. See Table 18 on Page 61 for a list of line numbers.

The most typical Fractional-T1 selection is to choose B8ZS for all ports by entering **linecode b8zs** and E1 interfaces choose HDB3 for all ports by entering **linecode hdb3**.

Example Response: **linecode: HDB3**

linemap FT1 E1 FE1

Line Mapping

Usage: **linemap [maplist]**

This command is used to set or display the current span mapping configuration for E1 and T1 configurations. The **maplist** variable consists of from 1 to 4 alpha-numeric characters specifying line interface to span mapping. Valid numbers are 1–4. Valid span characters are a–d.

Example: Entering **linemap 1d 2b 3a 4c** causes the following:

maps line 1 to span d
maps line 2 to span b
maps line 3 to span a
maps line 4 to span c

NOTE: FE1/FT1 always use Span A.

Figure 13 shows the example pictorially. There are no restrictions of which lines are mapped to which data channel spans.

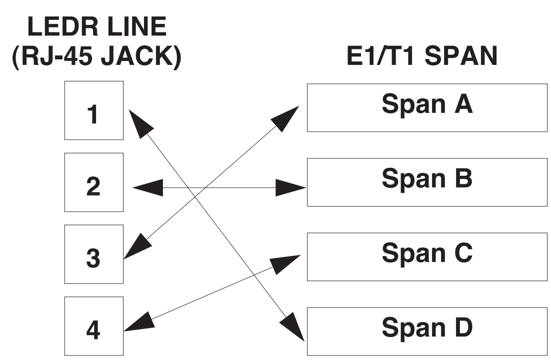


Figure 13. Example of Linemapping

NOTE: The cluster of four RJ-45 jacks on the rear of the radio is coded from left to right as 1, 2, 3 and 4 as viewed from the outside of the chassis.

linename FT1 E1 FE1

Line Name

Usage: **linename <linelist> <namelist>**

This command is used to set or display meaningful names of up to 16 characters to the four possible line interfaces.The **[linelist]** variable represents a list of line interfaces. It can consist of a single line number or line name, a comma separated list of line numbers or line names, a range of line numbers (i.e., 1–4) or, if linelist is not given, *all* lines. See Table 18 on Page 61 for a list of line numbers.

The namelist variable consists of a list of names. It can consist of a single name or a comma/whitespace-separated list of names. Names can be up to 16 characters long.

linerr FT1 E1 FE1

Line Errors

Usage: **linerr [linelist] [on | off]**

This command measures and displays the line performance between the radio and customer equipment. Entering the command **linerr on** will initialize the line error measurement feature. The **[linelist]** variable represents a list of line interfaces. It can consist of a single line number or line name, a comma-separated list of line numbers or line names, a range of line numbers (i.e., 1–4), or if linelist is not given all lines will be displayed. See Table 18 on Page 61 for a list of line numbers.

log

Log of Events

Usage: **log [subcommand] [<argument>]**

Subcommands:

view [critical|major|minor|inform]
clear
send [filename] [hostIP]

This command is used to display and manage the event log file. Without a subcommand, the complete log file will be displayed one page at a time. If you are interested in less than the full report, use one of the following subcommands:

view—Sets or displays the types of events to be displayed.

clear—Resets the event log and purges all events from memory.

send—Uploads the event log information to an IP address using TFTP protocol in a way similar to the **config** command. (See config command on Page 58.)

NOTE: When setting up a link for the first time, after powering up the unit, you may want to clear the event log. After logging in as **SUPER**, enter the command **log clear**.

login — Log into the radio's CONSOLE port

Usage: **login [username]**

This command allows access to configuration and diagnostics information as allowed by the radio system administrator. You can shorten the login sequence by following the **login** command with the user/account name (**username)**.

Example:

LEDR> login

Returns:

Username>

Type: **fieldserv** (or appropriate user name)

Returns:

Password>

Type: (password)

NOTE: User names and passwords must not exceed eight characters and are case sensitive. Do not use punctuation marks.

See **user** command on Page 90 for more information on user access levels.

NOTE: Only one user can be logged in through the CONSOLE Port at a time. Any new login will close the previous user/account. Other users can login simultaneously through the ETHERNET Port or front panel.

logout — Logout of the LEDR radio

Usage: **logout**

This command is used to log out a user.

loopback — Loopback Functions

The **loopback** command is used to set or display the loopback mode that can be used for diagnostic purposes and interrupts payload data during the loopback period. Entering **loopback** without any parameters displays the current loopback mode.

Entering **loopback** without any parameters displays the current loopback mode.

NOTE: RF Loopback

Testing using RF loopback can be a valuable diagnostic tool, but it should not be considered an exhaustive test of the transceiver. Performance and results of this test will vary from one LEDR radio chassis to the next.

In some configurations, there can be insufficient signal strength for RF loopback testing. Also, internal RF circuitry interaction under this test arrangement can generate an erroneously high BER.

Good performance results (low BER) indicates the radio is operating properly, however, poor results should not be regarded as indicating any internal problems, unless the unit under test has previously demonstrated excellent BER results.

On all LEDR radios, except the LEDR 1400 Series, the transmit and receive frequencies must be within the same sub-band for RF loopback to function.

530

Loopback for EIA-530

loopback [none | rf | local | remote | <timeout>]

Subcommands:

none—Disables all loopback operation. This is the mode for normal point-to-point operation.

rf—Enables an RF loopback mode. This mode allows testing of the local radio transceiver's transmit and receive chain. The receiver is rechanneled to the transmitter frequency. (See the preceding note in this section.)

local—Enables a local digital loopback mode. With this test, incoming bits on the EIA-530 interface are sent back out the radio's DATA connector before the modem module. This can be used to verify proper interconnection between the radio and the connected equipment. None of the radio's RF circuitry is involved in this test.

remote—Instructs the LEDR radio at the other end of the link to "echo" all of the data it receives only through the EIA-530 port. This is an effective way of testing the entire communications system, including the transmission path over the air. (In the event of a communications failure with the remote radio, the message "Remote Error" is displayed, and no loopback mode is selected.)

Variable:

timeout—The **timeout** variable may be set between 0 minutes (never time out) and 60 minutes.

FT1

Loopback for Fractional-T1
(With FT1/E1 option installed)

Usage:

loopback [none | rf | remote | iol <linelist> | ior <linelist>] <timeout>]

Subcommands:

none—Disables all loopback operation. This is the mode for normal point-to-point operation.

rf—Enables an RF loopback mode. This mode allows testing of the local radio transceiver's transmit and receive chain. The receiver is temporarily rechanneled to the transmitter frequency. (See the preceding note in this section.)

iol—The **iol** subcommand, for "I/O local," refers to the *local* line loopback.

ior—An abbreviation for "I/O remote", refers to the *remote* line loopback. Remote loopback port selection is relative to the local port. The radio link will translate any line mapping to select the correct physical remote port to loop back, based on the selected local port.

Variables:

linelist—Represents a list of local line interfaces. It can consist of a single line number or line name, a comma-separated list of line numbers or line names, a range of line numbers (i.e., 1–4), or if linelist is not given *all* lines. See Table 18 on Page 61 for a list of line numbers.

timeout—The **timeout** variable may be set between 0 minutes (never time out) and 60 minutes.

E1

FE1

Loopback for E1
(With FT1/E1 option installed)

Usage: **loopback [rf | iol <linelist> | ior <linelist>| inb | outb] [on | off] [-u <code>] [-d <code>]**

Subcommands:

rf—Enables an RF loopback mode. This mode allows testing of the local radio transceiver's transmit and receive chain. The receiver is temporarily rechanneled to the transmitter frequency. (See the preceding note in this section.)

iol—The **iol** subcommand, for "I/O local," refers to the *local* line loopback.

ior—An abbreviation for "I/O remote", refers to the *remote* line loopback. Remote loopback port selection is relative to the local port. The radio link will translate any line mapping to select the correct physical remote port to loop back, based on the selected local port.

inb—Refers to the *inband* loopback configuration.

outb—Refers to the *outband* Extended Super Frame (ESF) loop-back configuration.

Variables:

linelist—Represents a list of local line interfaces. It can consist of a single line number or line name, a comma-separated list of line numbers or line names, a range of line numbers (i.e., 1–4) or, if linelist is not given, *all* lines. See Table 18 on Page 61 for a list of line numbers.

on | off—To turn the loopback feature on or off.

-u <code>—Allows setting of the inband|outband loopback *upcode*.

The inband code consists of 1-7 bits, binary format.

Example: 00001

-d <code>—The subcommand allows setting of the inband|outband loopback *downcode*.

The outband code consists of 6 bits within the 16 bit ESF data link codeword.

Example: 000111
within 16 bit codeword: 0<000111>0 11111111

model

Radio Model Number

Usage: **model**

This command displays the radio model number. This information is programmed at the factory and cannot be changed.

modem

Modem

Usage: **modem [matrix id] [+cas]**

This command sets or displays the radio modem modulation type and data rate. Table 23 shows the alphanumeric codes that can be entered for fullrate radios and Table 24 for codes for subrate radios. Note that the E1 selections are only valid on fullrate radios.

Table 23. Modem Command Arguments for E1 (Fullrate) Radios[1]

	DATA RATES			
Modulation Type	**1xE1**	**2xE1**	**3xE1**	**4xE1**
QPSK	A7	—	—	—
16 QAM	B7	B8	—	—
32 QAM	C7	C8	C9	C10

1. The available selections depend on the radio's factory programmed bandwidth. See Table 10 on Page 21 for the allowable combinations of bandwidth, data rates and modulation types.

Table 24. Modem Command Arguments for EIA-530 & FT1 (Subrate) Radios[1]

	DATA RATES					
Modulation Type	**64 kbps**	**128 kbps**	**256 kbps**	**384 kbps**	**512 kbps**	**768 kbps**
QPSK	A1	A2	A3	—	—	—
16 QAM	B1	B2	B3	B4	B5	B6
32 QAM	—	—	—	—	—	C6

1. The available selections depend on the radio's factory programmed bandwidth. See Table 10 on Page 21 for the allowable combinations of bandwidth, data rates and modulation types.

Command Examples:
To set 32 QAM with 1xE1, enter **modem C7**
To set 16 QAM/384 kbps, enter **modem B4**

Special-Order Argument

NOTE: The **cas** command functions only in radios equipped with either the FT1 or FE1 Interface and user firmware of revision 3.0 or higher.

FT1
FE1

cas—Set or display the Channel Associated Signaling (CAS) status for Fractional-T1 or Fractional-E1 operation. The available selections are **modem +cas** (on) and **modem -cas** (off). This command provides for FT1 Robbed-Bit Signaling bits to pass over the link. In the FE1 case, this command, in conjunction with the **fstruct** command, ensures the proper handling of the timeslot 16 signaling bid.

network

Network (IP)

Usage: **network**

This command displays the radios that can be reached via the Service Channel for Orderwire and Element Management System (EMS) diagnostics.

Example Response:

Network Address	Netmask	RF Hops	Ethernet Hops	Received on Port	Owner
10.2.142.148	255.255.0.0	0	0	LPBK	Tech Serv 1
10.2.200.196	255.255.0.0	1	0	AIR	Tech Serv 2

passwd

Password

Usage: **passwd**

This command is used to change the password for the user currently logged in. A maximum of 8 characters is allowed, and it is case sensitive.

ping

Ping IP Address (Send ICMP Echo Request)

Usage: **ping [ip address] [reps]**

This command is used to verify the accessibility of any IP address on the network to determine availability and measure network response time. This command requires proper IP Routing and IP connectivity.

ipaddress—IP address to which you will send the request

reps - Number of requests-to-send (default = 1, maximum = 1000)

Example:

```
LEDR> ping 10.2.233.12 5
```

Example Response:

```
PING 10.2.233.12: 56 data bytes
64 bytes from 10.2.233.12: seq=1, ttl=255, rtt=49ms
64 bytes from 10.2.233.12: seq=2, ttl=255, rtt=6ms
64 bytes from 10.2.233.12: seq=3, ttl=255, rtt=9ms
64 bytes from 10.2.233.12: seq=4, ttl=255, rtt=33ms
64 bytes from 10.2.233.12: seq=5, ttl=255, rtt=12ms
```

pll

Phase-Locked Loop

Displays current TX & RX frequencies, and TX/RX PLL status.

Example Response:

```
pll:

Tx Freq = 438075000 Hz, Rx Freq = 428075000
Tx PLL Status: Locked
Rx PLL Status: Locked
```

pmmode

Power Measurement Mode

Usage: **pmmode <on|off>**

This command is used to generate an unmodulated carrier on the transmitter frequency for the purpose of measuring RF output power or frequency stability using a spectrum analyzer. The remaining time in this mode is displayed on the LEDR front panel in the Redundant menu's last screen ("Test Mode Tmout", See "Redundant (Hardware)" on Page 41).

Example Response:

pmmode: off

NOTE: Enabling the power measurement mode (**pmmode on**) will take the local link down (out-of-service).

---

rdnt

Redundant (Protected Operation)

The **rdnt** command is used to manage operation of redundant equipment in a protected LEDR radio and display operating status.

NOTE: Proper operation of a hardware redundant station is dependent on each radio having firmware of the same revision level. If you are unsure, use the **ver**(sion) command to determine the firmware version at each radio before proceeding to make any changes.

Usage: **rdnt [subcommand] [arguments]**

Subcommands:	**active**	
	default	**[on|off]**
	hitless	
	ip	**[sibling IP address]**
	status	
	temp	**[overtemp switching threshold]**
	nsd	**[on|off] - enable/disable protected**
	pmode	**[a|b|auto] [minutes|force]**
	mode	**[0|1]** **0 — Standalone** **1 — 1+1 Hot Standby**

The following subcommands are divided into two groups: read only and read and set.

Read Only:

active—Shows whether the currently selected transmitter is active or inactive.

default [on|off]—Displays whether the radio is the default radio in a protected configuration.

status—Protected status of this radio and the sibling radio.

Read & Set:

hitless—Sets or displays the hitless (error-free) switching status of the receivers. It can be enabled or disabled using the **hitless on|off** command. In the data-protected operation, either receiver (regardless of which transmitter is active) can provide data to the user data port(s) in hitless mode. In non-hitless mode, only the receiver in the active radio provides received data. Radios operated in a space-diversity configuration must be configured to use hitless switching. AIS is not generated when "Hitless Switching is enabled (ON).

ip [sibling IP address]—Used to set or display the IP address to be kept in the memory of this unit of the associated (sibling) radio in the redundant pair of transceivers. In other words, the **rdnt ip** setting of the top radio in a protected pair must be set to the bottom radio's IP address for proper switching and network-management functionality.

NOTE: The associated radio IP address is used by the redundant radio to share information between the units. This address is necessary for proper operation in a redundant operation with the Protected Switch Chassis. The presence of the sibling radio's IP address *will not* affect IP routing and forwarding, SNMP, or Telnet communications directed to each LEDR chassis.

---

status—Shows the state of both radios. Two status lines are displayed; **This Radio** and **Other Radio**.

temp—Set or display an over-temperature threshold (final amplifier temperature in degrees Celsius), at which temperature switchover to the other radio occurs.

nsd [on/off]—Enable (on) or disable (off) network self-discovery (NSD) between the units connected to a Protected Switch Chassis (PSC).

mode [on/off]—Identifies the connected unit as an independent, standalone, unit, or part of a hardware-protected station consisting of two LEDR transceivers and a Protected Switch Chassis.

pmode [a|b|auto] [minutes|force]—Set the operating mode for a hardware-redundant LEDR radio station (two LEDR transceivers and a PSC). Selecting "A" or "B" will force that unit online and disable data protection through automatic switching of LEDR transmitter and receiver units. "AUTO" will enable data protection through the use of the redundant LEDR transceiver hardware.

You can use the second argument to force (**force**) the selected protected mode immediately, or operate in the new mode for a specific number of minutes (**minutes**) before reverting to the automatic (**auto**) mode.

NOTE: When using **AUTO** configuration, ensure that both radios are upgraded to firmware 5.2.2 before using the protected mode test mode feature ("**rdnt pmode**")

Example Response for **rdnt** command:

```
LEDR> RDNT
rdnt {status}:  This Radio  = OK
rdnt {status}:  Other Radio = OK
rdnt {active}:  active
rdnt {mode}:    1+1 Hot Standby
rdnt {ip}:      10.4.142.84
rdnt {hitless}: on
rdnt {default}: yes
rdnt {temp}:    100
rdnt {nsd}:     off
rdnt {pmode}:   Auto Switch
```

reframe

Reframe Criteria for User Interface Ports

FT1 E1 FE1

Usage: **reframe [linelist] [2of4 | 2of5 | 2of6 | CFAS | CRC]**

This command is used to set or display the reframe criteria. The **[linelist]** variable represents a list of line interfaces. It can consist of a single line number or linename, a comma separated list of line numbers or line names, a range of line numbers (i.e., 1–4), or if linelist is not given *all* lines. See Table 18 on Page 61 for a list of line numbers.

For Fractional-T1:

2of4 – 2 out of 4 Fbit errors (default)
2of5 – 2 out of 5 Fbit errors
2of6 – 2 out of 6 Fbit errors

For E1:

CFAS – Consecutive FAS errors (default)
CRC – 915 CRC (rx framer only)

reprogram

Load Radio Firmware Into LEDR Radio

Usage: **reprogram [subcommand] [<argument>]**

Subcommands:

network [filename] [hostIP]

status

This write command loads the radio application software (firmware) into the LEDR chassis from an external resource using Trivial File Transfer Protocol (TFTP). A TFTP server must be running on the network and properly configured to serve the necessary file(s). See "OPTION 3: Uploading Firmware from a Remote Server via Ethernet" on Page 102 for further details.

rfocal

Transmitter RF Output Calibration Table

Usage: **rfocal <freq region#> <cal-point#>**

This command starts the **RFOUT** Calibration Sequence and should only be used when directed by factory personnel.

CAUTION: This command is used to recalibrate the internal transmitter power output metering circuitry and may affect the accuracy of the power output level measurement.

Contact the Technical Services Department at GE MDS for further instructions before using this command. Ask for technical publication, *Retuning Procedure for LEDR II Radios*, P/N 05-3633A01.

Recalibration may be necessary if the radio's transmitting frequency has been significantly changed. For the LEDR 400 and 900 radios, this is generally a change of more than two radio channels. In addition, it is very important to verify the power calibration is correct on the new frequency by measurement with a calibrated external wattmeter before using this command.

The radio frequencies of the LEDR 1400 radio can be changed without impacting the accuracy of the power metering circuit's calibration.

Example Entry: **rfocal**

Example Response:

```
Region 0
Index 0, Rfout = 18 dbm, Gain = 17
Index 1, Rfout = 20 dbm, Gain = 28
Index 2, Rfout = 22 dbm, Gain = 47
Index 3, Rfout = 25 dbm, Gain = 79
Index 4, Rfout = 27 dbm, Gain = 110
Index 5, Rfout = 30 dbm, Gain = 170
Index 6, Rfout = 32 dbm, Gain = 210
```

rfout

RF Output Level Measurement

Usage: **rfout**

This command displays the transmitter RF power output in dBm. See "Watts-dBm-Volts Conversion" on Page 138.

rlogin

Remote Login

Usage: **[<toUnitID>] [<UserName>]**

The **rlogin** command is used to login to a remotely located radio via the CONSOLE Port. It can be used to log into any radio that appears in the **network** command display.

route

Routing Tables for IP

Usage: **route [command [destination] [mask netmask] [gateway] [port]]**

The **route** command is used to add, delete or modify the IP routing table entries. Other radios in the network are automatically added to the routing table using the radio's "Network Self-Discovery." Routing IP traffic to other devices via the radio's management channel can be performed by adding routes to the radio's routing table.

Once the IP configuration is set using the **ip** command (Page 66), several routing entries will appear in the routing table. The first of these routes is the default route which has a destination address of 0.0.0.0. This route is used when a more appropriate route is not available. Thus it becomes the "catch-all" route. The second route that will appear is the default network route. This route has a destination address calculated by "anding" the IP address and subnet mask together. The Next Hop address of this entry will be the default gateway configured using the **ip** command and the Interface will be the default port. This route is used to tell the radio how to reach its base network.

The third route that is added has a destination address of 127.0.0.1. This is known as the loopback route and is used when the radio sends a packet to its own IP address.

Primary Commands:

print —Show the current IP routing table

add [address] mask [netmask] [gw] [port]—Add/Change a route

gw is a gateway IP address

port is specified as either "ETH" or "AIR"

delete [address] mask [netmask] [gw]—Delete a route

gw is a gateway IP address

stored—Display all user-added stored routes

flush—Deletes all stored routes

destination—Specifies the host to send command

Command Arguments:

mask—Where the **mask** keyword is present, the next parameter is interpreted as the netmask parameter.

netmask—Specifies a sub-net mask value to be associated with this route entry.

gateway—Specifies gateway IP address

port—Specifies IP port, either “ETH” or “AIR”

Example 1 Entry:

LEDR> route add 10.2.150.1 mask 255.255.255.255 10.2.150.101 air

Example 1 Response:

route: Route added

Example 2 Entry:

LEDR> route stored

Example 2 Response:

Destination	Net Mask	Next Hop	Interface
10.2.150.1	255.255.255.255	10.2.150.101	AIR
10.2.140.0	255.255.255.0	10.2.227.51	ETH

Example 3 Entry:

LEDR> route print

Example 3 Response:

Destination	Net Mask	Next Hop	Interface
0.0.0.0	0.0.0.0	0.0.0.0	ETH
10.2.140.0	255.255.255.0	10.2.227.51	ETH
10.2.150.1	255.255.255.255	10.2.150.101	AIR
127.0.0.1	255.255.255.255	10.2.227.5	LPBK

Background on this command:

The LEDR Series of radios can be configured to pass IP management traffic across the radio’s raw service channel. A process called “network self-discovery” automatically configures IP routes between all radios in a network (provided that the **group** command has been correctly configured throughout the system. (See “group” on Page 63). Also, see the arp command on Page 53.

IP management traffic routing allows configuring and monitoring devices other than LEDR radios using the same management channel, providing clean integration of SNMP, Telnet, TFTP, and other IP management methods via one channel that doesn’t use any of the customer payload bandwidth of the radio network.

Routes must be added to the radios at two points in the system to support routing IP traffic to and from the connected devices: 1. At the gateway end (where the management station is located), and 2. At the destination end. Routes are added to the radios using the same convention as used in the MS Windows, Windows NT, and DOS operating environments. The exceptions here are that a mask and port must be specified, as well as the target and gateway IP addresses. At both ends, the command used is exactly the same (see command Example 1, above). In the command example given above, the route is being added at the gateway end. The difference is that at the gateway end, the port is **air**, and at the destination end, the port is **eth**. Routes do not need to be added at points between the gateway and destination, because the radio network handles the routing between radios via network self-discovery. However, in each radio, the IP gateway must be specified as the IP address of the radio at the network-management gateway in the system.

NOTE: Gateway Settings in Connected Devices

In the connected IP-manageable device, use the local radio's IP address as the default IP gateway for the device.

NOTE: Routing in Protected Systems

Each route added to a LEDR radio of a protected pair must be added to its sibling in the pair, as the information is stored separately in each unit.

The LEDR radios in a protected pair serve as a proxy for its sibling, so the routing functionality is unchanged and either radio in a protected pair can be specified as the gateway for a connected device.

However, *if a protected LEDR radio is removed for servicing*, all the routing information must be programmed in the remaining radio for proper IP management functionality.

rssi

Received Signal Strength Indicator

Usage: **rssi**

This command displays the received signal strength. The measurement is in dBm. Therefore, an RSSI of –80 dBm is stronger than a –100 dBm signal. There may be a time delay between moving the antenna and updating of the RSSI display. Be sure to allow adequate time between antenna movements and observations.

rssical

RSSI Calibration

Usage: **rssical <freq region#> <cal-point#>**

This command starts the RSSI Calibration Sequence. See rfocal command on Page 80 for conditions.

CAUTION: This command should never be used unless calibrated test equipment has shown the radio to have inaccurate RSSI calibration.

Contact the Technical Services Group at GE MDS for further instructions before using this command.

Example entry: **rssical**

Example Response:

Region 0
Index 0, RSSI = –110 dbm, Gain = –104
Index 1, RSSI = –90 dbm, Gain = –40
Index 2, RSSI = –75 dbm, Gain = +1
Index 3, RSSI = –60 dbm, Gain = +28
Index 4, RSSI = –45 dbm, Gain = +61
Index 5, RSSI = –30 dbm, Gain = +97

rxlock

Receiver Locked Onto Remote Radio

Usage: **rxlock**

This command displays the current modem synchronization status.

Example Response:: **rxlock: Modem is locked**

sabytes

SA Bytes in E1 Multi-Framing

E1

Usage: **sabytes [linelist] [bytes <bytelist>]**

This command is used to set or display SA bytes in E1 multiframing. The **[linelist]** variable represents a list of line interfaces. It can consist of a single line number or line name, a comma-separated list of line numbers or line names, a range of line numbers (i.e., 1–4), or if linelist is not given *all* lines. See Table 18 on Page 61 for a list of line numbers.

The **bytelist** variable consists 5 hex bytes (i.e., 3c) representing SA[4-8]. To keep a bytes present value when modifying higher bytes (i.e., modifying SA[7] only) use a * character in the respective byte position. Example: **sabytes 1 bytes *,*,*,3c** changes only SA[7] for line 1 to 3c.

sernum

Serial Number of Radio

Usage: **sernum**

This command displays the serial number of the radio. The number displayed with this command matches the serial number printed on the serial number sticker on the radio chassis.

snmpcomm

SNMP Community Names

Usage: **[<read|write|trap>][<string>]**

This command is used to set or display SNMP community names. Community names are passwords that are required to match at the SNMP management station and each radio or other SNMP agent. You can add security to the radio system's network management by choosing non-default community names (listed in the example) and setting the community names in your management software to match.

Example Response:

snmpcomm {read}: public
snmpcomm {write}: private
snmpcomm {trap}: public

snr

Signal-to-Noise Ratio of Incoming RF Signal

Usage: **snr**

This command displays the signal-to-noise ratio (SNR) of the received signal in dB. The SNR is an indication of the quality of the received signal. The higher this number, the higher the quality of the received signal. SNR readings are invalid when the receiver is unlocked. See rxlock command for details.

spur

Spur Frequencies

Usage: **spur [<Frequency>|clear|default] [<frequencyToClear>]**

This command is only operative for LEDR 1400 Series radios. It is used to set or display the spur frequencies for the radio network. Add a decimal point "." to the end of a frequency input to signify MHz unit.

status

Status

Usage: **status**

This command is used to display key performance and configuration data.

Example Response:

status {Tx Freq}:438075000
status {Rx Freq}:428075000
status {Bandwidth}:100 kHz
status {Data Rate}: 256 kbps
status {Interleave}: 1
status {Clock Mode}:internal
status {RSSI}:–78 dBm
status {SNR}:28 dB
status {Rx Lock}:Locked
status {Tx RF Out}:30 dBm
status {TxKey}: Keyed
status {Temp}:37 Degrees C
status {IP Address}: 192.168.11.49
status {IP Netmask}: 255.255.0.0
status {IP Gateway}: 0.0.0.0

svch — Service Channel Settings

Usage: **svch [subcommand] [<argument>]**

Subcommands:

on—Enable the service channel

off—Disable the service channel

reset—Re-initialize the service channel

echo [on|off]
trans parent [on|off]
baud [300|1200|2400|4800|9600
char [5 – 8]
parity [none|even|odd]
stop [1 – 2]

Defaults:

Service Channel Port = On
Echo [**echo**] = Off
Transparency [**transparent**] = On
Baud Rate [**baud**] = 9600
Character Bits [**char**] = 8
Parity [**parity**]= None
Stop Bits [**stop**] = 1

This command sets or displays the Service Channel settings. For further information, See “USING THE SERVICE CHANNEL” on Page 106.

telnetd — Telnet Display or Terminate Session

Usage: **telnetd [kill session]**

This command is used to display or kill (terminate) the current Telnet session(s).

Entry Example: **telnetd**

Response:

Session	Username	Rem. Addr.	Connected
tns0	SUPER	10.2.129.22	01/03/2003 @ 13:57:17

Use **telnetd kill session** to terminate the current session.

temp — Temperature of PA Device

This command displays the radio’s power amplifier (PA) temperature.

Example Response:**: temp: 35 Degrees C (PA Temperature)**

test

Self-Test of Radio Hardware

Usage: **test [<0–n>|<testname>]**

This command starts a self-test function of the radio. There are several separate tests that can be run individually by specifying the test number after the command.

CAUTION
POSSIBLE EQUIPMENT DAMAGE

CAUTION: Do not perform a transmitter PLL test while the radio is keyed, or the radio's receiver may be damaged.

NOTE: Performing a receiver or transmitter PLL test during normal link operation will take the link down for the duration of the test and the re-synchronization interval.

The internal self tests are listed in Table 25.

Table 25. Internal Self-Tests

Function Evaluated	Number	Name
Flash Memory	0	flash
DRAM Memory	1	dram
Configuration	2	config
Battery	3	batt
Radio A- to-D Circuits	4	atod
Transmitter Phase Locked Loop	5	txpll
Receiver Phase Locked Loop	6	rxpll
Real-Time Clock	7	rtc
FPGA Logic	8	fpga
DSP	9	dsp
CODEC	10	codec

threshold

Threshold of Performance Degradation

Usage: **threshold [<level>]**

This command sets or displays the performance degradation threshold(s) of the LEDR radio, at which time events are logged and SNMP traps are generated. Setting these thresholds to zero or a negative number will disable event logging and trap generation for those parameters.

Example Response:: **threshold {rssi}: 0**
threshold {snr}: 0
threshold {coffset}: 0
threshold {temp}: 110
threshold {15mines}: 900
threshold {15minses}: 900
threshold {24hres}: 86400
threshold {24hrses}: 86400

rssi—dBm level below which an RSSI alarm is generated.

snr—Value below which a signal-to-noise level alarm is generated.

coffset—Maximum tolerable RF carrier frequency difference between the local LEDR unit's transmit frequency and the incoming RF signal from the other LEDR radio.

temp—Power amplifier temperature above which an alarm condition is generated.

15mines—Number of errored seconds within the last 15 minutes.

15minses—Number of severely errored seconds within the last 15 minutes.

24hres—Number of errored seconds within the last 24 hours.

24hrses—Number of severely errored seconds within the last 24 hours.

time

Time of Internal Clock

Usage: **time [HH:MM[:SS]**

This command displays or sets the time of the radio's internal real-time clock. The radio's real time clock operates from an internal lithium battery so it is running even if the radio has no DC power connected.

The real time clock is fully compliant with Year 2000 standards.

timeslot

Time Slot Assignment

FT1

FE1

Select which timeslots to transmit. This command has two uses; in Usage 1, the timeslots can be set or displayed. In Usage 2, all pending timeslots are committed/made active.

The timeslots may be different at each end of the link. They will be monotonically mapped; that is, Slot 1 is mapped to Slot 13, Slot 2 is mapped to Slot 14, etc. To select timeslots 1 through 12, enter the command **timeslot 1-12**.

Usage 1: **timeslot [-d] [slotlist]**

Usage 2: **timeslot -c**

Variables:

–d Disable timeslot(s)
–c Commit pending timeslots

Modifications to the timeslot list are kept pending until *all available* slots have been assigned. The user can choose to commit slots when the last available slot is added to the pending list, or by using the **-c** option. (See Usage 2.)

The default action is to enable given timeslots. If no arguments are entered, the currently active timeslots and pending timeslots are displayed.

If rearrangement of timeslots is desired, some simple rules must be followed when CAS framing is used. Refer to the chart below for this discussion, where “TS” = “Timeslot”:

TS00	TS01 – TS15	TS16	TS17 – TS31
1	M	1	N

If the timeslots are rearranged such that M is to the “left” of timeslot 16, and N to the “right,” then the timeslot numbers at the other end of the link must agree (M and N). They may be repositioned *within* their part of the E1 frame (to the left or right of TS16) but may not be moved to the other side.

The **slotlist** variable is a list of timeslots and can be a single slot number, comma separated list of slot numbers, or a range of slot numbers (i.e., 2-8). Timeslots can be entered in any order and are automatically configured. Extra slots will be ignored. *Unassigned timeslots in the pending list are signified by* **MA** *(must assign).*

NOTE: Enough slots for the full data capacity of the modem setting must be specified or the link will not synchronize.

NOTE: FT1 timeslots are 1–24. E1 timeslots are 0–31.

NOTE: In FE1 mode timeslot 0 is always selected. When frame structures are selected that contain CAS (**fstruct 4-7**) timeslot 16 must be selected.

trapfilter

Trap Filtering for SNMP

Usage: **trapfilter [<critical|major|minor|inform>]**

This command sets or displays which events cause SNMP traps. Filtering traps is done by category. Traps that are filtered are allowed to pass through the network-management system. (See "trapmgr" on Page 89 and "snmpcomm" on Page 84 for additional information.)

trapmgr

Trap Manager IP Addresses

Usage: **trapmgr [<1-5>] [<IP address>]**

This command sets or displays the trap manager IP addresses. These are the IP addresses of up to five network-management stations on which SNMP manager software is operating, and to which notifications of SNMP events (traps) are to be sent. The IP mask used for sending traps is that set by the **ip** command. (See “ip” on Page 66.)

Example Response:: **trapmgr: 1 = 10.2.129.22**
trapmgr: 2 = 0.0.0.0
trapmgr: 3 = 0.0.0.0
trapmgr: 4 = 0.0.0.0
trapmgr: 5 = 10.2.129.1

trend

Trend of RF Performance Indicators

Usage: **trend [<rssi|temp|rfout|snr|fec|ifec|time|all>] [<display time (msec)>]**

This command is used to display continuously updated readings of: RSSI, radio temperature, RF output, signal-to-noise ratio, and FEC errors (corrected and uncorrectable). The display can be stopped by pressing Control-C on the terminal.

If the **trend** command is used by itself or with **all** (**trend all**), all associated parameters will be reported. More than one argument can be used to display several selected items in the desired order.

NOTE: This command is not available from a Telnet session.

---

txkey

Radio Transmitter Keying Status

Usage: **txkey [on|off]**

This command sets or displays the radio transmitter status. ON indicates the radio transmitter is keyed and transmitting. **OFF** indicates the transmitter is not keyed.

unitid

Unit Identification Number for Orderwire and NMS

Usage: **unitid [<ID>]**

This command sets or displays the radio's unit identification number. This number is used for Orderwire signaling and by the NMS (Network Management System). (See "USING ORDERWIRE" on Page 103.) The factory default is the last three numbers of the unit serial number. (1-999)

uptime

Up Time

Usage: **uptime**

This command displays how long the radio has been powered-on.

user

User Account Information

Usage: **user [subcommand] [<argument>]**

Subcommands: **add <user> <pass> <perm>**
del <user>
perm <user> <perm>
pass

This command provides administrator access for setting new user accounts and permission levels.

NOTE: The password (**pass**) and user names are case sensitive and may not exceed eight characters. Two quotation mark characters ("") may be used as a "blank" password. If quotation marks are used, the shift key or cap lock keys must be depressed.

User permission (**perm**) may be set to: read (**r**), write (**w**), network (**n**) or administrator (**a**). The privileges granted by each level are as follows:

- Read (**r**) is the lowest level of user access and allows radio information to be viewed only. Changes to radio settings are not allowed.
- Write (**w**) allows most, but not all radio settings to be changed.
- Network (**n**) allows everything permitted by lower levels, and also allows changes to the radio's IP configuration.
- Administrator (**a**) allows everything permitted in lower levels, and also allows changes to be made to user accounts (add, delete, modify). It is normally used by a System Administrator or other person responsible for the radio system.

Example entry: **user add fieldserv secret w**

The above example shows the command string for adding a new user (fieldserv), with "write" permission and a password of **secret**.

Example Response: **user: Command Complete**

NOTE: If you are logging in for the *first time* since the radio was shipped from the factory, refer to Page 23 for important login information.

ver

Version of Firmware/Hardware

Usage: **ver [frw|hdw|ext]**

This command displays radio version information for firmware (**frw**), hardware (**hdw**) and Extended Version Information (**ext**).

Example 1: **LEDR> ver frw**

Response 1: **ver: LEDR Part #06-3451A01**
ver: 2.4.3 (Version of firmware P/N above)

Example 2: **LEDR> ver hdw**

Response 2: **ver: {Hardware version}: A**

Example 3: **LEDR> ver ext**

Response 3:

```
ver: Part #06-3451A01
ver: 2.4.3
ver:
ver: Image 1
ver: Region    Expected   Upgrade
ver: Firmware 2.4.3
ver: DSP       1.1.0
ver: FPGA      Ver1.22
ver: Scripts   Ver1.44                  ver: Option    Ver1.56
ver:
ver: Image 2 (Active)
ver: Region    Expected   Upgrade
ver: Firmware 2.4.3
ver: DSP       1.1.0
ver: FPGA      Ver1.22
ver: Scripts   Ver1.44
ver: Option    Ver1.56
ver {Active code}: compiled Aug 15 2000 08:47:46
```

Note: Blank lines following “Ver:” are spaces used as vertical separations between data groups.

volume

Volume of Orderwire Earpiece

Usage: **volume [<level (0–255)>]**

This command sets or displays the orderwire handset volume.

Example Response:: **volume: 100**

vox

Voice-Operated Transmit

Usage: **vox threshold <1–100>**

The **vox** command sets or displays the level/threshold at which the orderwire microphone will key the transmitter.

NOTE: When the orderwire microphone is spoken into, the audio will be heard by all LEDR radios in the network which currently have a handset plugged into the front panel handset jack. Only one station can transmit at a time; the circuit is half-duplex.

Example Response:: **vox: 5**

who

Who is Logged In to NMS

Identifies who is currently logged onto the Network Management Ports.

Usage: **who**

This command displays users currently logged in to the radio operating system.

5.4 Disabling the Front Panel Alarm LED for Unused E1 Option Ports

To disable the ALARM LED on the front panel for a particular E1 port, use the commands found in Table 26 below according to the E1 port number. When alarm events are pending, the alarm condition for the unused E1 ports remains until a valid input signal (as defined by G.703) is applied.

You must log into the LEDR radio as a user with “Administrator” privileges to execute these commands. If you are using a terminal program connected to the radio, send one command sequence at a time to the radio with a 5 ms delay between each line.

Table 26. Commands to Disable E1 Port Alarms

Disable the LED for IO1	Disable the LED for IO2
Evmap led 74 none	Evmap led 87 none
Evmap led 75 none	Evmap led 88 none
Evmap led 76 none	Evmap led 89 none
Evmap led 77 none	Evmap led 90 none
Evmap led 78 none	Evmap led 91 none
Evmap led 79 none	Evmap led 92 none
Evmap led 80 none	Evmap led 93 none
Evmap led 81 none	Evmap led 94 none
Evmap led 82 none	Evmap led 95 none
Evmap led 83 none	Evmap led 96 none
Evmap led 84 none	Evmap led 97 none
Evmap led 85 none	Evmap led 98 none
Evmap led 86 none	Evmap led 99 none
Disable the LED for IO3	**Disable the LED for IO4**
Evmap led 100 none	Evmap led 113 none
Evmap led 101 none	Evmap led 114 none
Evmap led 102 none	Evmap led 115 none
Evmap led 103 none	Evmap led 116 none
Evmap led 104 none	Evmap led 117 none
Evmap led 105 none	Evmap led 118 none
Evmap led 106 none	Evmap led 119 none
Evmap led 107 none	Evmap led 120 none
Evmap led 108 none	Evmap led 121 none
Evmap led 109 none	Evmap led 122 none
Evmap led 110 none	Evmap led 123 none
Evmap led 111 none	Evmap led 124 none
Evmap led 112 none	Evmap led 125 none

To restore the factory default settings to all of the E1 ports, issue the commands shown in Table 27.

Table 27. Restore Factory Defaults to Alarm Ports

Evmap led 74 ioalarm	Evmap led 100 ioalarm
Evmap led 75 ioalarm	Evmap led 101 ioalarm
Evmap led 76 ioalarm	Evmap led 102 ioalarm
Evmap led 77 ioalarm	Evmap led 103 ioalarm
Evmap led 78 ioalarm	Evmap led 104 ioalarm
Evmap led 79 ioalarm	Evmap led 105 ioalarm
Evmap led 80 ioalarm	Evmap led 106 ioalarm
Evmap led 81 ioalarm	Evmap led 107 ioalarm
Evmap led 82 ioalarm	Evmap led 108 ioalarm
Evmap led 83 ioalarm	Evmap led 109 ioalarm
Evmap led 84 ioalarm	Evmap led 110 ioalarm
Evmap led 85 ioalarm	Evmap led 111 ioalarm
Evmap led 86 ioalarm	Evmap led 112 ioalarm
Evmap led 87 ioalarm	Evmap led 113 ioalarm
Evmap led 88 ioalarm	Evmap led 114 ioalarm
Evmap led 89 ioalarm	Evmap led 115 ioalarm
Evmap led 90 ioalarm	Evmap led 116 ioalarm
Evmap led 91 ioalarm	Evmap led 117 ioalarm
Evmap led 92 ioalarm	Evmap led 118 ioalarm
Evmap led 93 ioalarm	Evmap led 119 ioalarm
Evmap led 94 ioalarm	Evmap led 120 ioalarm
Evmap led 95 ioalarm	Evmap led 121 ioalarm
Evmap led 96 ioalarm	Evmap led 122 ioalarm
Evmap led 97 ioalarm	Evmap led 123 ioalarm
Evmap led 98 ioalarm	Evmap led 124 ioalarm
Evmap led 99 ioalarm	Evmap led 125 ioalarm

6.0 STANDARDIZING RADIO CONFIGURATIONS

6.1 Introduction

Setting up and configuring a network of point-to-point systems can be a lengthy task. To make the task easier and more predictable, the parameters of one LEDR radio can be used as a template for other radios in your system. You need only address the parameters that are site or unit-specific, such as an IP addresses.

The **config** command allows the user to upload/download the radio's configuration data from/to a PC. There are two classifications of configuration data—radio-specific data and standard data.

Radio-Specific data is:

- Frequencies
- Target Power
- Thresholds
- Calibration Data
- IP Address
- IP Routing Table
- Network Settings

Standard radio data are the configuration parameters that are common in *all* LEDR radios.

Both types of data can be uploaded and downloaded between the radio and a PC. It is up to the user to decide whether to download *both* types or just the standard (core) data. Once the data is on a PC, the file can be edited off-line, for example, the configuration data, if desired. The customized configuration file can then be downloaded to other LEDR radios in your system from your PC.

NOTE: Before proceeding to standardize a group of LEDR radios, make sure they are equipped with the same firmware version. It is also advisable to upgrade all LEDR radios with the latest firmware to be assured of the greatest flexibility and reliability.

If you are unsure, use the **ver**(sion) command to determine the firmware version at each radio before proceeding to make any changes.

NOTE: For Event Map Users

It is possible to erase the radio's event map by upgrading the firmware. If you do not use the default event map (evmap) follow the procedure below:

1. Before beginning the reprogram, save your event map using the "evmap send" command. (See "evmap" on Page 60)

2. After reprogramming the radio and booting into the new firmware, clear the event map by using the "events init" command (see "events" on Page 59). It is also recommended that the log file be cleared with a "log clear" command. (See "log" on Page 70)

3. After clearing the event map, Step 2 above, reload the desired map previously saved in Step 1 by using the "evmap get" command. (See "evmap" on Page 60)

6.2 Setup by TFTP

To use this function the user will need:

- A PC with a TFTP server running.
- The IP address of the PC running the TFTP server.

Finding IP Addresses

To determine the IP address of a Windows NT/2000/XP computer, select **Run** from the **Start** menu, and enter **cmd**. At the **cmd** prompt, type **ipconfig**. (For Windows 95/98 platforms, select **Run** from the **Start** menu and enter **winipcfg**.) The IP address of the *radio* can be determined using the radio's **ip** command.

Downloading Procedure

To download the configuration data from the LEDR radio to a file (**filename.txt**) on the user's PC, enter the following command:

LEDR> config send [filename.txt] [1.2.3.4 <IP Address>]

The file, **filename.txt,** will be written to in the default path set in the TFTP server. The numeric string, "**1.2.3.4**", is the IP address of the PC destined to receive the file.

Uploading Procedure

To upload into a LEDR radio only the *standard* configuration data from a file on the PC (filename.txt) to the radio enter the following command:

LEDR> config get [filename.txt] [1.2.3.4 <IP Address>]

To download *both* the standard and radio-specific configuration data from a file on the PC (**filename.txt**) to the radio enter the following command:

LEDR> config getall [filename.txt] [1.2.3.4 <IP Address>]

Ideally, the process of updating a system would go like this:

1. Upload the current configuration data from each radio to a specific file on your PC.

   At Radio 1 CONSOLE Port enter: **config send radio_1.txt 1.2.3.4**
   At Radio 2 CONSOLE Port enter: **config send radio_2.txt 1.2.3.4** (etc.)

2. Upgrade the software on each radio.

3. Boot from the new software.

4. Download the saved configuration data from Step 1 back into each radio using the **getall** subcommand so that you will get both the standard and radio-specific parameters.

At radio 1 CONSOLE Port enter: **config getall radio_1.txt 1.2.3.4**

At radio 2 CONSOLE Port enter: **config getall radio_2.txt 1.2.3.4** (etc.)

6.3 Setup Through the DB-9 CONSOLE Port

You have the option of sending the configuration data to the CONSOLE Port instead of sending it to a file on a PC. Then the terminal program can be set to log the data as it is created by the radio. The advantage of this option is that you do not need to use the TFTP server, routing, etc. on the PC.

During the upload, the LEDR software will prompt you to begin/end recording at the terminal program. You will also be prompted on how to end a download.

When the **config get** downloading option is chosen (standard data only), the software will filter out all the radio-specific parameters as they come through.

To upload the data to the CONSOLE Port:

LEDR> config send console

To download only the standard data via the CONSOLE Port:

LEDR> config get console

To download standard and radio-specific data: **LEDR> config getall console**

7.0 UPGRADING LEDR FIRMWARE

7.1 Introduction

The LEDR radio's firmware can be upgraded with new software releases that may be issued from time-to-time by GE MDS. To support firmware upgrades while the radio is in use, the LEDR radio contains two complete copies of its firmware. Once the inactive version is replaced, the radio can be rebooted using the code in the new firmware. However, if an error occurs during the download, the radio can easily recover because it always has a complete copy of firmware available.

NOTE: Any time new firmware is loaded into a radio, it must be *power cycled*. Merely rebooting a radio will not guarantee proper operation with the new firmware, you must use the **boot** command as described in the following sections to operate with the new firmware.

Firmware reprogramming can be done using one of three methods:

1. Locally through the front panel CONSOLE Port.

2. Locally using TFTP and Telnet through the ETHERNET Port.

3. Remotely over a network connection using TFTP and Telnet to the ETHERNET Port.

The procedures that follow use one or both of two utilities found in GE MDS' *LEDR Utilities* package. These utilities will facilitate local and remote transferring of firmware files to and from the LEDR radio. These applications are available from the factory on disk (P/N 03-3631A01) or on the FTP section of the factory website at **www.GEmds.com**. *LEDR Software Release Notes* are also available with the files, and should be reviewed prior to installation.

The following sections will explain how to program new firmware into the radio using each of the three connection options. They assume the LEDR Utilities are installed on each computer system named in the procedure.

NOTE: The ETHERNET, SERVICE CHANNEL and CONSOLE Ports share a common data channel when loading firmware over-the-air. Transferring the radio firmware image file (≈ 1 Mb), may take up to 30 minutes if there is other activity on any of the other ports.

Regardless of your connection to the LEDR radio, loading data/firmware into the radio's SRAM is much slower than loading software onto a PC hard drive or RAM.

7.2 OPTION 1: Uploading Firmware via the CONSOLE Port

This method of upgrading the firmware is well suited to field service personnel that carry a laptop PC to field installation. Any computer running the Windows operating system is suitable. Figure 14 shows the basic arrangement.

Setup

Connect a PC to the radio's front panel CONSOLE Port using a 9-pin RS-232 cable. (See Figure 30 on Page 135 for cable wiring details.) The CONSOLE Port supports RS-232 at 9600 bps to 115200 bps.

Download Procedure

1. Start the GE MDS *Flash Utility* application.

2. From the **View>Options** menu, select the appropriate COM Port and baud rate. Ensure that **autobaud** is enabled (Look in the lower right-hand corner of the *Flash Utility* window).

3. From the **View** menu, select **console**. This will bring up a NMS window to the LEDR radio. At the **LEDR>** prompt, enter a login name and password and then close the session.

4. Using the **File|Open** dialog, select the directory where the new firmware is located. In the file window, highlight the correct (**.mpk**) file and then press the green **start** arrow.

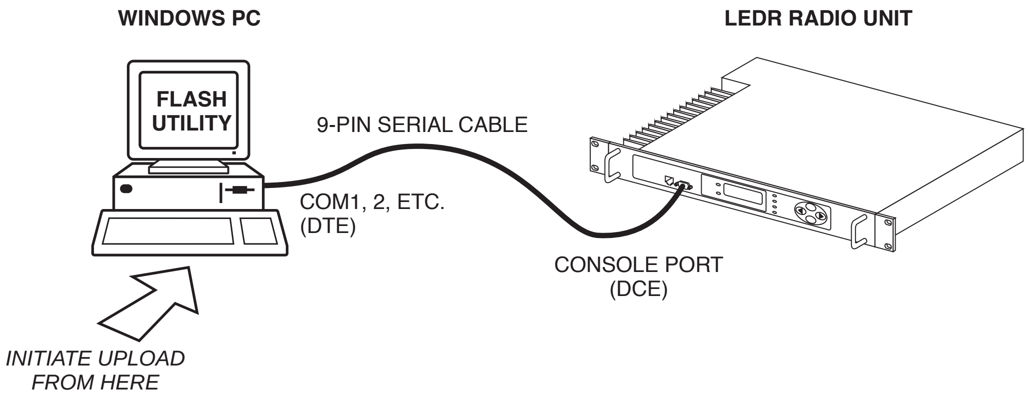


Figure 14. Direct connection through the LEDR CONSOLE Port

Verification and Reboot

1. To verify the correct operation of the new firmware, open the NMS again by pressing **Alt + L**. Enter **boot** to determine which image is currently active. This command will respond as follows:

   boot: Image 1 is Active or, **boot: Image 2 is Active**

2. The new firmware is downloaded into the *inactive* image. Therefore, if the radio responded **Image 1 is Active**, enter “image verify” command, **iverify 2**, otherwise, enter **iverify 1**. The radio will respond indicating whether or not the image has been verified as being a valid file, it will not determine if the contents are complementary to the other firmware image. If the image does not verify, try downloading the firmware again into the radio.

NOTE: The following paragraph describes rebooting the radio. This action will disrupt the communications link.

3. Once the image has been verified, the radio must be rebooted using the new firmware. This is done by entering the command **boot 1** or **boot 2**, where the **1** or **2** corresponds with the image number used with the **iverify** command above.

4. Once the radio has rebooted and Flash Utility screen displays the **LEDR>** prompt, the firmware can be downloaded or copied into the other image. Often, copying the firmware from one image to the other can be faster than performing a second download. To copy the firmware over to the other image, simply enter **icopy**. The radio will prompt you for confirmation (**y/n**) and then begin copying.

7.3 OPTION 2: Uploading Firmware Locally by Telnet via Ethernet

This method can be used in the field or in a workshop by using a Windows computer equipped with an Ethernet interface. Figure 14 shows the basic arrangement.

NOTE: You must know the IP address of the LEDR Radio and the PC that you are going to connect together. (Both units must have the same Subnet, Netmask and Gateway addresses, or at least have routes to one another.) This is essential for a direct Ethernet connection.

To find the IP address of your Windows computer, refer to "Finding IP Addresses" on Page 96. The IP address of the *radio* can be determined using the radio's **ip** command.

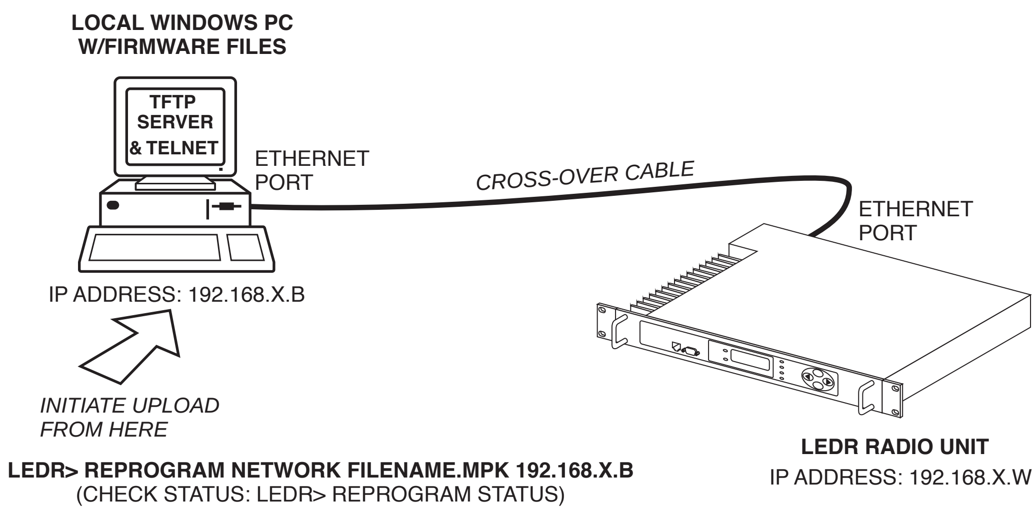


Figure 15. Direct connection through the LEDR ETHERNET Port

Setup

1. Connect the PC's Ethernet interface to the radio's ETHERNET Port  using a Category 5 Ethernet cross-over cable.

2. Copy the LEDR firmware image file (**ledr.mpk)** into a known directory on your PC. For example, **c:\windows\LEDR\Firmware V2.5**. This directory path will be used later by the TFTP server.

Download Procedure

1. Launch the *TFTP Server* on a PC connected to the LEDR radio's ETHERNET Port through a cross-connect cable.

2. Point the *TFTP server* to the directory from which you desire to upload the new firmware. In the SNMP TFTP server, you should execute the **set root** command and point to the known directory where **ledr.mpk** has been copied.

3. Launch your Telnet application and login to the radio which you desire to load (reprogram) the firmware image file.

4. Determine the active (firmware) image from which you are currently executing by typing **boot**. The new firmware will downloaded into the *inactive* image.

5. Execute the command **reprogram network ledr.mpk [IP address]**. In the command, in place of **[IP address]**, you should actually type the IP address of the TFTP server. For example, **reprogram network ledr.mpk 192.168.1.2**

6. If desired, the status of the transfer during reprogramming may be displayed by typing **reprogram status.**

7. The *TFTP Server* and radio will notify you when the programming is complete.

Verification and Reboot

1. To verify the integrity of the new firmware enter **boot** to determine which image is currently active. This command will respond as follows:

   boot: Image 1 is Active or, **boot: Image 2 is Active**

   If the radio responded to the **boot** command with **Image 1 is Active**, enter the "image verify" command, **iverify 2**, otherwise, enter **iverify 1**. The radio will respond indicating whether or not the image has been verified as being a valid file, it will not determine if the contents are complementary to the other firmware image. If the image does not verify, try downloading the firmware again into the radio.

NOTE: The following paragraph describes rebooting the radio. This action will disrupt the communications link.

---

2. Once the image has been verified, the radio must be rebooted using the new firmware. This is done by entering the command **boot 1** or **boot 2**, where the **1** or **2** corresponds with the image number used with the **iverify** command above.

3. Once the radio has rebooted and Flash Utility screen displays the **LEDR>** prompt, the firmware can be downloaded or copied into the other image. Often, copying the firmware from one image to the other can be faster than performing a second download. To copy the firmware over to the other image, simply enter **icopy**. The radio will prompt you for confirmation (**y/n**) and then begin copying.

7.4 OPTION 3: Uploading Firmware from a Remote Server via Ethernet

Setup

Connect the LEDR radio's ETHERNET connector to network which has a PC connected with the desired LEDR firmware on its hard drive. The "network" can be a local area network, a wide-area network or any IP network that can connect the two units.

The computer hosting the firmware image, must be running a TFTP server software. If not, install, launch and configure the *TFTP Server* software found on the *LEDR Utilities* disk. The setup configuration is shown in Figure 16.

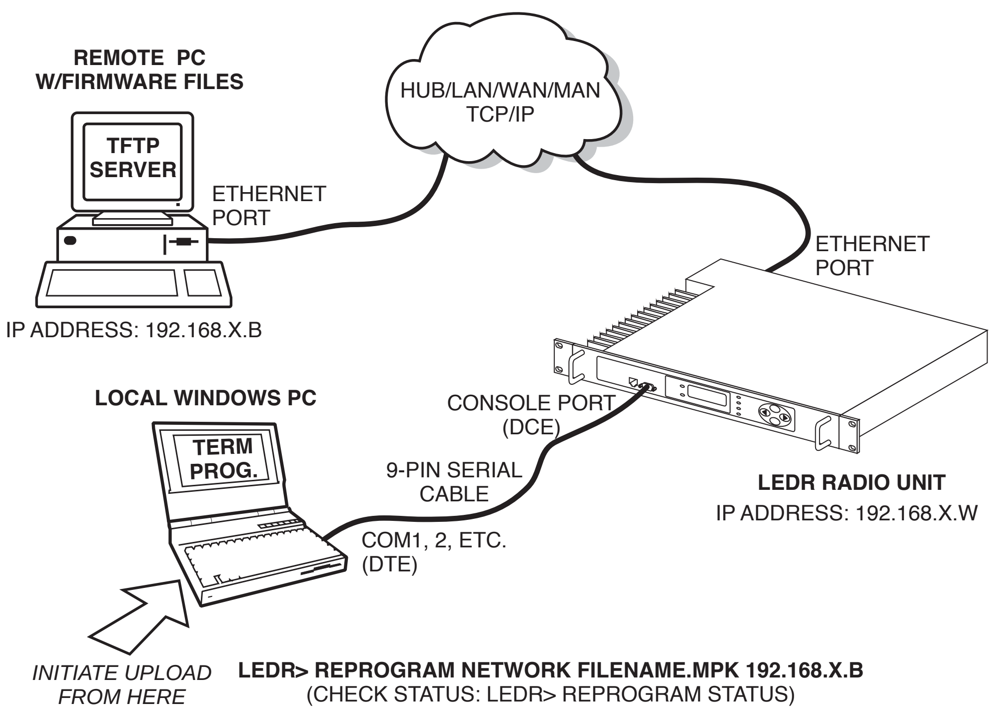


Figure 16. Uploading firmware from a remote server via Ethernet

Download Procedure

1. Start a terminal program, such as HyperTerminal, on the local PC.
2. Log into the LEDR radio using the **login** command.
3. Use the **ip** command to ensure that the radio has a valid IP address.
4. Use the **ping** command from the local PC to ensure that the PC and the radio have valid routes to pass information between them.
5. At the radio's **LEDR>** prompt, start the download by entering **reprogram network [filename] [source PC's IP Address]**. The download can be monitored from the radio by entering **reprogram status**. When the download is complete the radio will sound two short beeps and the response from **reprogram status** will indicate that the download has finished.

SNMP Option

The TFTP download process can also be initiated using an SNMP manager. The **FirmwareIFwProgTable** object provides a means for specifying the TFTP server IP address and the filename for the firmware.

Verification and Reboot

When the download is complete, verify the firmware image and reboot the radio as described under Verification and Reboot in Paragraph See "Verification and Reboot" on Page 99 for the procedure.

8.0 USING ORDERWIRE

8.1 Introduction

A handset may be plugged into the front panel of the LEDR radio to allow voice communications between radio sites (see Figure 17). This can be especially useful during setup and maintenance activities. All radios on the network can hear what is said by any individual speaking into a handset. No other radio may transmit on the orderwire until the current speaker is finished. Depending on the number of hops, the link data rates, and Interleave setting, there may be a noticeable latency from one end of the network to the other.

The Orderwire supports the transmission of DTMF-type signaling by detecting tones at the source, and regenerating them at the receiving end, however, there are no other DTMF-supported functions in the LEDR radios.

With DTMF turned on ("dtmf" on Page 59), a “ring” will be heard in the earpiece of the orderwire handset plugged into the LEDR chassis and the unit’s internal annunciator will sound. The Unit ID serves as the “phone number”. The “ring” signal will be the DTMF tones representing each of the characters of the Unit ID. Signally can only be done to LEDR units on the same link and with DTMF turned on.

Normal payload data is *not* affected by orderwire use. The orderwire uses voice-compression technology that introduces a slight, but noticeable, delay in orderwire audio.

The orderwire will not interrupt the normal data flow through the LEDR data communication channel, however, it will reduce the throughput efficiency of any data communications on the Service Channel during periods of voice transmission.

A handset kit is available from GE MDS (P/N 02-1207A01), which provides basic communication services but does not contain a built-in DTMF (tone) keypad.

8.2 Setup

Program the **vox** and **volume** setting for each radio. The volume setting is user preference. The **vox** setting requires some forethought. The higher the **vox** setting, the louder the user must speak to get the voice decoder to recognize the speech. This will, however, prevent noise from entering the “line.” A low **vox** level will recognize speech better but may transmit more noise with the speech. The user should experiment with the **vox** setting to determine the best level for the speaker and the noise environment.

8.3 Operation

1. Plug the handset into the front panel jack labeled [handset icon]. (Figure 29 on Page 135 provides pinout details for this connector.)

2. Press [◁] or [▷] at the menu’s top level until `Orderwire` appears on the LCD display. Press [ENTER] to move to the lower levels of the menu.

3. To call a specific radio station, enter the Unit ID number for the station to be called. (At this point, an alert signal (“ring”) will be sent to earpiece of the handset connected to the “called” station.

4. Simply speak into the handset to initiate transmission. The transmitter will be dekeyed when you stop speaking. The VOX level must be properly set for this function to work. (See “vox” on Page 92.)

5. Alternatively, a DTMF-style handset can be used to “dial” the required radio station.

6. Remember, regardless of the number of users, only one may speak at a time.

NOTE: The LEDR radio has a built-in DTMF decoder in the orderwire circuitry. If a standard DTMF telephone test set is plugged into the orderwire, the user can dial in the three digit unit address on the handset to “ring” the earpiece of the handset of the associated LEDR unit and the unit’s internal annunciator.The LEDR chassis will not provide power to ring a standard bell or electronic ringer.

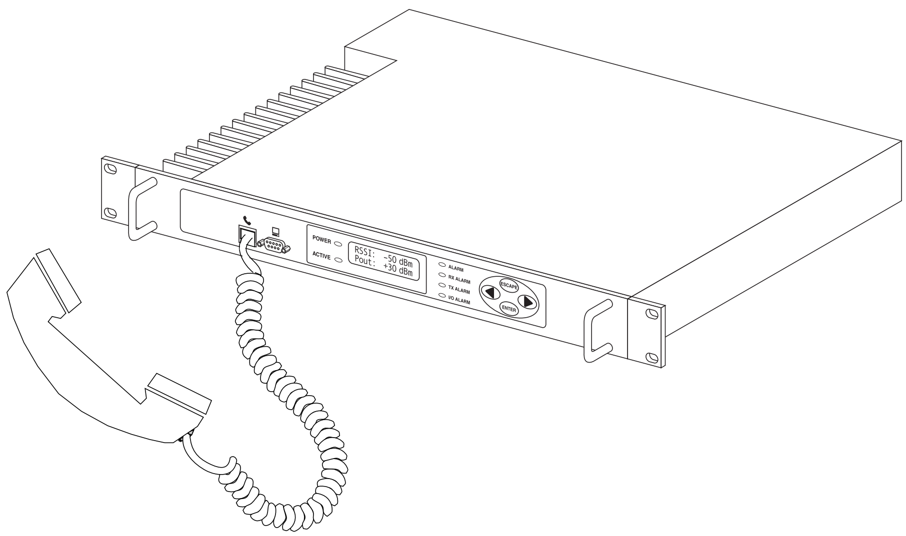


Figure 17. Orderwire Connection with 12-1307A03 Handset

8.4 Related NMS Commands

The orderwire can be configured by the NMS commands or through the front panel. The earpiece volume is more easily set by the front panel controls as the level is dependent on personal preference.

vox – Voice level (relative) at which speech will be detected by the software (See “vox” on Page 92)

volume – Sets/displays the handset volume (See “volume” on Page 92)

alert – Sends an orderwire alert to a specific radio or to all the radios on the network (See “alert” on Page 53)

9.0 USING THE SERVICE CHANNEL

9.1 Concept

The Service Channel sends and receives ASCII-based information at 9600 bps in a half-duplex broadcast mode throughout the network. This means that any data coming through the Service Channel Port of a radio will be broadcast to the Service Channel of each radio in the network. There can be only one radio transmitting Service Channel data over the network at a time and the data will always be sent to every radio on the network. *No other radio will be allowed to transmit until the current sender is finished.*

If a radio does receive data in the Service Channel Port while another radio is the active-sender, the data coming in the port will be queued and sent when the active sender is finished. Depending on the number of hops, link data rate, and Interleave setting, there may be a noticeable latency from one end of the network to the other.

NOTE: When the LEDR radio is part of a hardware-redundant configuration with a Protected Switch Chassis and operating in the "1 + 1 HOT" mode, the outgoing service channel data is provided simultaneously to both rear panel Service Channel DB-9 connectors.

9.2 Setup

The user can configure all the Service Channel parameters for a specific radio. The port may be enabled or disabled. In the disabled state (**svch port off**), any data that comes in the Service Channel port will be discarded and any Service Channel data that comes into the radio from another radio in the network will be passed along to the rest of the network but not sent out the Service Channel Port. When the Service Channel Port (**svch port on**) is enabled, it will behave based on the other settings.

The most important setting is the **echo** parameter. Echo is used with a terminal emulator on a PC and the program does not display on the screen character keyed in by the user.

When you set up a system, you must be careful to avoid an infinite loop. If echo is enabled, then every character that enters the Service Channel port will be echoed back out the port. When echo is disabled then data that comes in the Service Channel port is not sent back out the port. Trouble may arise if the device that is connected to the Service Channel also echoes the data it sends. In that case, the device will send characters into the Service Channel Port, the radio will echo the characters back to the device, the device will consider the echoed data to be input which it will in turn echo back to the radio, etcetera, until an overflow condition occurs.

You must also set the communication parameters (baud rate, stop bits, char length, and parity) via the **svch** subcommands so that the settings match those at the device connected to the Service Channel Port.

Lastly, the user can re-initialize the Service Channel port via the **svch reset** command. This may be helpful in the case where an infinite loop overflow condition has locked the port.

9.3 Usage

The Service Channel supports ASCII data transfer over the network in broadcast fashion. As a result, devices connected to the Service Channel Ports of different radios will appear to have a transparent half-duplex connection between them.

NOTE: Service channel activity can cause data loss or repeats in systems using packet-size-dependent protocols. For optimum reliability turn “Transparency” on in the service channel settings. (See "svch" on Page 86 and "Service Channel" on Page 44 for details.)

9.4 NMS Commands

This command is used to set/display Service Channel parameters.

Usage: **svch [subcommand] [<argument>]**

Subcommands:

onEnable the service channel
offDisable the service channel
resetRe-initialize the service channel
echo[on|off]
transparent[on|off]
baud[300|1200|2400|4800|9600
char[5 – 8]
parity[none|even|odd]
stop[1 – 2]

Defaults:
Service Channel Port = On
Echo [**echo**] = Off
Transparency [**transparent**] = On
Baud Rate [**baud**] = 9600
Character Bits [**char**] = 8
Parity [**parity**]= None
Stop Bits [**stop**] = 1

For further information on “transparency”, See “Usage” on Page 107.

10.0 PROTECTED CONFIGURATION

10.1 Introduction

The LEDR radio can be supplied in a protected (also called redundant or “1+1”) configuration (Figure 18). The protected version is designed to perform automatic switchover to a second LEDR radio in the event of a failure in the online unit.

Protected operation is important for many mission-critical or revenue producing links. By configuring two identical LEDR radios in parallel and including a switch and interface box containing the RF switching circuits and customer interfaces, it is possible to protect against failure in an associated LEDR radio. A “failure” can be from either a hardware malfunction, or temporary external environmental effects, such as multipath fading or nearby lightning strikes.

A protected station consists of two standard LEDR Series radios and a Protected Switch Chassis (Figure 18). Ordinarily, the three chassis are mounted together in a “stacked” arrangement, one above the other, with one rack unit of space in between.

The top unit is referred to as the system’s “Unit A”, and the lower one as “Unit B”. Each unit is considered to be the “sibling” of the other. The sibling of Unit A is Unit B, and the sibling of Unit B is Unit A. This distinction is used in the **rdnt** command found on Page 77 under the subheading “*Read & Write Commands*.”

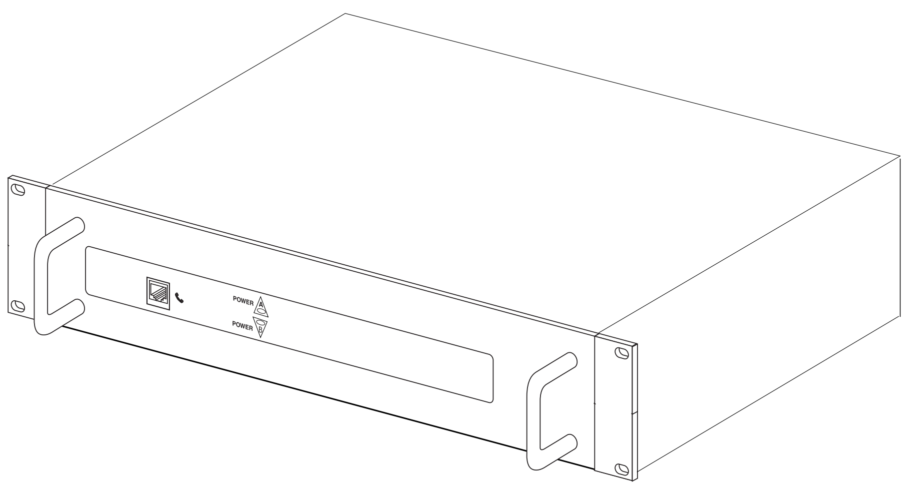


Figure 18. Protected Switch Chassis (PSC)

The front panel of the Protected Switch Chassis (PSC) has only two LEDs and an RJ-11 jack for an orderwire handset. The LEDs indicate by light and an arrow outline which LEDR chassis is active. It is assumed the two LEDR chassis will be mounted above and below the PSC with Unit A on top and Unit B on the bottom.

10.2 Protected Operation

During normal operation, one LEDR radio unit and associated data interfaces is selected and the RF and interface switches within the PSC are set to service that radio unit. (The illuminated POWER LED indicator on the front panel of the Protected Switch Chassis points to the currently active/online unit.) A switch in the PSC allows a single antenna connected to the PSC's ANTENNA port to serve both LEDR radios. A splitter in the PSC allows both radio receivers to simultaneously receive the incoming RF signal for processing.

The Protected Switch Chassis is a gateway for data coming and going between each of the LEDR radio units and the common data circuits connected to the PSC. The PSC monitors various RF and data signal paths for predefined fault-determining parameters. If signal conditions are not normal, the PSC's microprocessor controller will issue an alarm and move the standby LEDR radio to the active mode.

Fault-determining parameters can be programmed from the Network Management System (NMS) software. Examples of these parameters are:

- Low RF output power
- High transmitter temperature
- Synthesizer out-of-lock
- Problem with the option board or framers
- CPU failure wherein the CPU watchdog causes a reset

Transmitter Failure

Any failure on the "active" transmitter path will create a fault condition which will place the currently active transmitter on standby and switch the "standby" transmitter to "active." The newly active transmit path will remain in use until a manual changeover returns the configuration to the original transmitter path. This allows the link to remain fully operational until the user has replaced the faulty transmitter circuitry.

Receiver Failure

Both receivers are fed via an RF splitter from the antenna port. Each RF path is buffered and monitored for receive signal integrity for uncorrectable bit-errors. If the "active" receive circuitry fails, uncorrectable bit-errors will be detected. The modem receive switch will first determine that the "standby" receive path is operational (no uncorrectable bit errors) and will switch accordingly.

10.3 PSC Rear Panel Connectors

The following are descriptions of the rear panel connections of the Protected Switch Chassis. The PSC's rear chassis is shown in Figure 19.

Figure 18 presents an inter-unit cabling diagram for protected configurations.

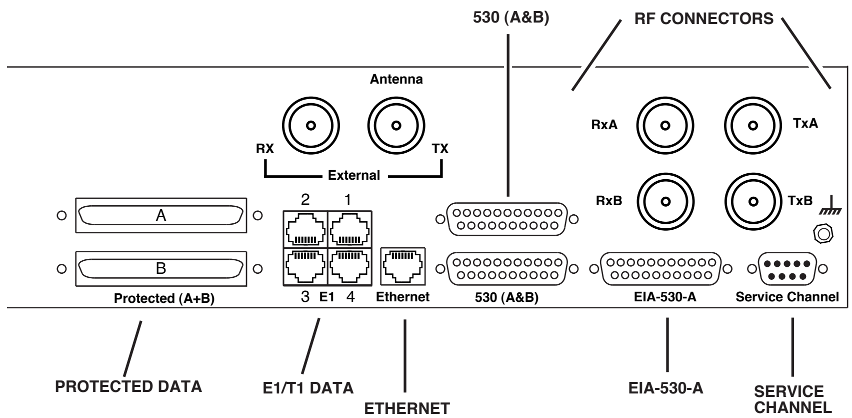


Figure 19. Protected Switch Chassis—Rear Panel

RxA

The RXA (Receive—Radio A) connector is a N-type coaxial connector. It connects to the RX port on the rear panel of Radio A via a short coaxial cable.

RxB

Same as RXA, but for Radio B.

Antenna

The ANTENNA connector is a N-type coaxial connector. It serves as the connection point for the station antenna.

TxA

The TXA (transmit, radio A) connector is a N-type coaxial connector. It connects to the TX port on the rear panel of Radio A via a short coaxial cable.

TxB

Same as TXA, but for Radio B.

Protected (Data)

This pair of connectors accepts data signals from each of the LEDR radios. The top connector is for Radio A, and the bottom connector is for Radio B. For pinout information, consult the factory. Replacement cables are available from GE MDS (P/N 03-3837A02).

E1

This is a block of four RJ-45 modular connectors for connection to a multiplexer or other customer-supplied E1 equipment. For detailed pin information, Figure 33 on Page 136.

These connectors are not operational on “S” Series (Subrate) radios.

Ethernet

The ETHERNET connector provides access to the embedded SNMP agent and other elements of the TCP/IP network management system. The connector is a standard 10 Base-T connection with an RJ-45 modular connector. For detailed pin information, see Figure 31 on Page 135.

NOTE: Avoid permanently connecting the LEDR chassis to a Ethernet network with a high volume of traffic not related to the LEDR network. The LEDR modem can become overloaded and cause slowdowns in payload throughput or an undesired reboot.

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530 (A&B)

This pair of DB-25 connectors accepts EIA-530 data signals from each of the LEDR radios. The top connector is for Radio A, and the bottom connector is for Radio B. For pinout information, see Figure 33 on Page 136.

EIA-530-A

This DB-25 connector provides a connection point for customer-supplied EIA-530 data equipment.

NOTE: The EIA-530-A port is not operational in fullrate models.

Service Channel

In a protected configuration, this DB-9 connector becomes the Service Channel connection for *both* LEDR radios. (In the protected radio configuration, the Service Channel connectors on the radios are non-functional.) For detailed pin information, See “Service Channel—Rear Panel” on Page 137.

10.4 Inter-Unit Cabling for Protected Stations

The required cabling between the two radios and the Protected Switch Chassis is dependent on the data interface, unit type (subrate versus full-rate), and transmit and receive antenna configuration.

The cabling for a pair of standard radios with internal duplexers is shown in Figure 20.

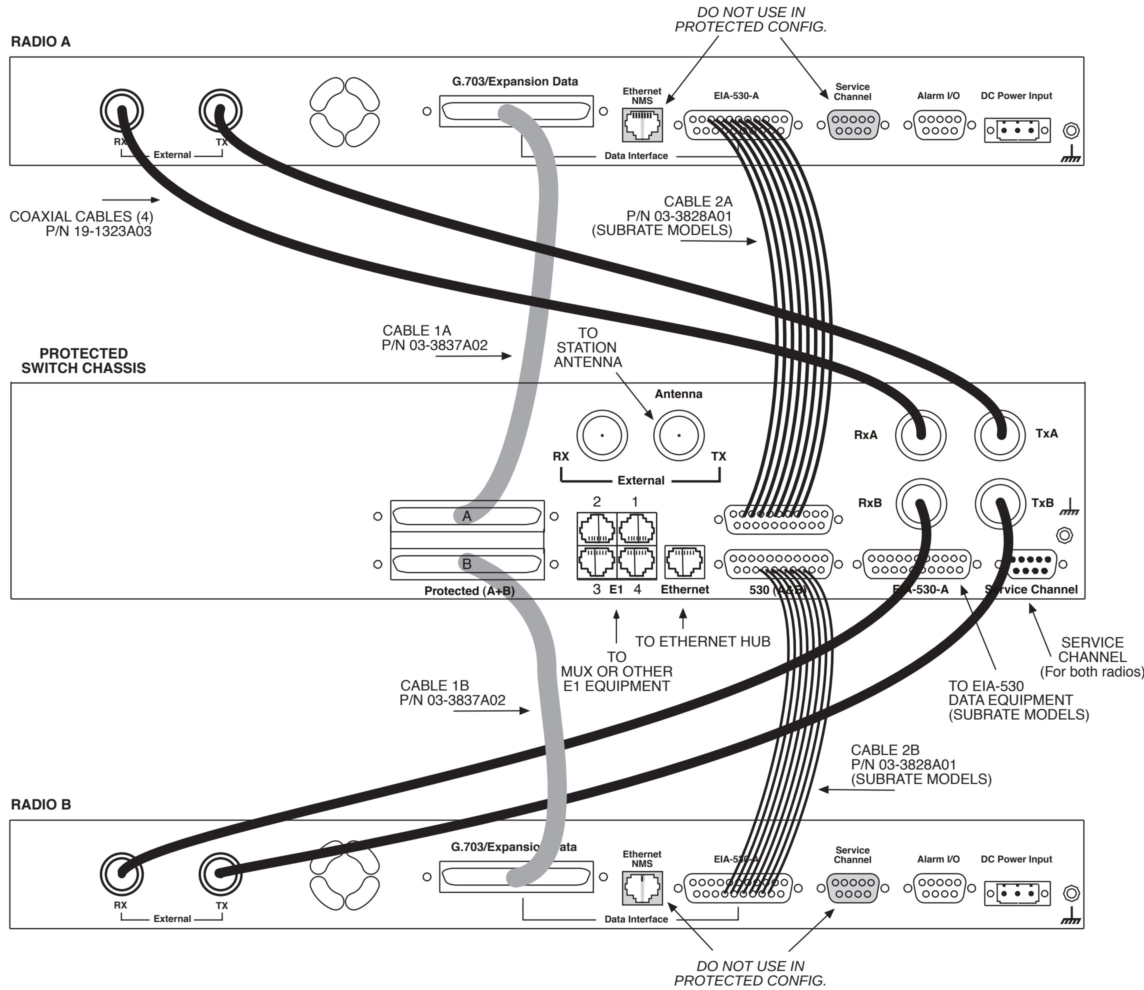


Figure 20. Inter-unit Cabling—Protected Version with Internal Duplexers

10.5 Configuration Commands for a Protected System

NOTE: In a protected link configuration, ensure that the E1/T1 interface settings are identical for both radios at a each end of the link.

Once the inter-chassis cabling is in place and the units are powered up, several parameters are required to place the LEDR radio into proper operation as a member of a protected system.

The tasks involved are reviewing and setting up of the following parameters:

- Radio Operation
  - General
  - Protected/Redundant-Specific

- Data Interface
  - Subrate—Fractional-T1
  - Fullrate—E1/T1

Protected/Redundant-Specific Parameters

There are several parameters that must be set to enable proper operation of a protected station. These are all covered under the **rdnt** command found on Page 77.

Sample Protected/Redundant Configuration Session

The following is a example of a session used to configure a LEDR radio to serve in a redundant/protected system. This sequence will need to be repeated for each radio in the protected pair.

1. Configure the redundant/protected mode to hot-standby:

```
LEDR> rdnt mode 1
rdnt {mode}: 1+1 Hot Standby
LEDR>
```

2. Configure the IP address of each radio:

```
LEDR> ip address 192.168.1.1
ip {netmask}: (255.255.0.0)
ip {gateway}: (0.0.0.0)
ip {port}:    (ETH)
ip {address}: 192.168.1.1
ip {netmask}: 255.255.0.0
ip {gateway}: 0.0.0.0
ip {port}:    ETH
ip: A reboot is strongly recommended. Do you wish to reboot? (y/n) >y
LEDR>
```

3. Configure the sibling IP address of each radio:

```
LEDR> rdnt ip 192.168.1.2
redundant {ip}: 192.168.1.2
LEDR>
```

4. Configure the hitless switching. (Note that the default is on.):

```
LEDR> rdnt hitless on
rdnt {hitless}: on
LEDR>
```

5. Configure the temperature (°C) threshold:

```
LEDR> rdnt temp 100
rdnt {temp}: 100
LEDR>
```

Transmit Clock Selection (Subrate Models Only)

The transmit clock selection must be addressed for every radio in a subrate radio system installation. The single most important consideration is that there be only *one* master clock in a subrate radio network. The master clock can originate from the radio or from the Customer Premises Equipment (CPE).

The radio is capable of several different clocking modes. Refer to Figure 21 on Page 114 for typical system clocking methods.

Refer to the `Clock Mode` screen description on Page 34 for setting the radio transmit clocking from the front panel. Refer to the **clkmode** description on Page 58 for setting the radio transmit clocking mode from the CONSOLE Port.

NOTE: When customer premises equipment (CPE) is operated in looped clock mode, it is recommended that the radio *not* be set to line clock mode. To do so may cause the transmitting radio's PLL to be pulled out-of-lock, especially when operating at 4E1 data rates.

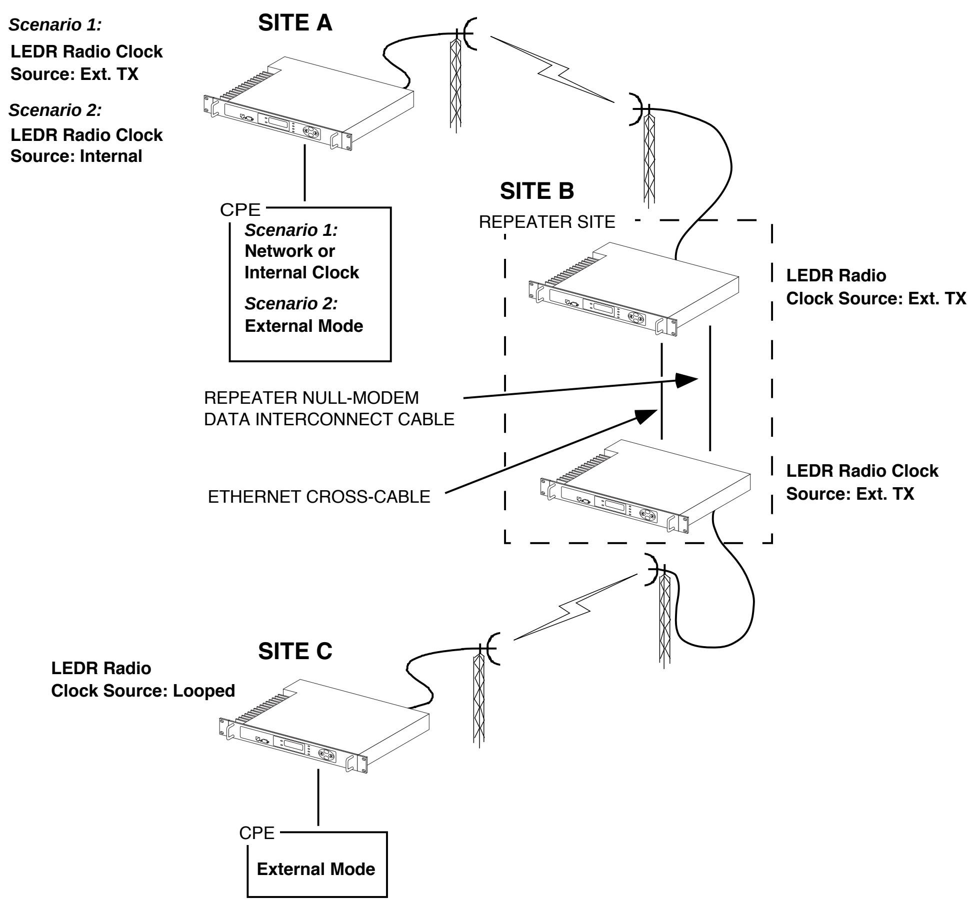


Figure 21. Typical Repeater Clocking Arrangement
(no multiplexer at repeater site)

11.0 SPACE DIVERSITY OPERATION

11.1 Introduction

Space diversity operation is an effective mechanism of increasing a radio link's resilience to transmission impairments such as multipath fading or frequency selective fading. In difficult transmission environments such as over highly reflective and moving water paths, or in arid environments where atmospheric ducting occurs, space diversity is the most effective way of maintaining a continuous radio link.

In a space diversity link, two radio receivers are operated in parallel, from two separate antennas mounted several wavelengths apart vertically on the antenna tower. The separation of antennas is such that when one antenna experiences fading due to multi-path interference, the other antenna, being several wavelengths away, is not likely to experience the same fade. Thus, one receive path may experience uncorrectable errors, while the other path will be error free. Similar to the protected operation, the receive modem switch will determine which buffered data path is operating with the highest integrity, and select that path without inducing any additional bit-errors into the link.

Space diversity is especially effective in changeable multi-path environments such as over tidal water paths. Since water is highly reflective, there will be continual "constructive" and "destructive" interference at each single antenna over the course of the day as the water rises and falls and the reflected water path interferes with the line-of-sight path. By correct vertical positioning of the antennas, these effects can be negated, allowing one antenna to see a good signal while the other is experiencing fading, and the modem switching accordingly to allow the link to operate error-free.

The space diversity LEDR radio is available only in a hot standby configuration.

11.2 User Interface & Control

Data-protected operation is provided by redundant radio hardware. The hardware is configured using the Redundant screen (Page 77) on either radio front panel, or with the **rdnt** command from a NMS terminal (see Page 77).

11.3 Transmit Clock Selection

There is no difference between a space diversity system and protected/redundant radio arrangements with respect to transmit clock selection. Fullrate radios require no user intervention for clocking. Users of subrate systems should set the radio clocks as described for subrate systems. See "Transmit Clock Selection" on Page 115 for further information.

11.4 Inter-Unit Cabling for Space Diversity Stations

The RF cabling for space diversity stations depends on the location of the duplexers. The block diagram in Figure 22 shows the RF connections in a typical system with two external duplexers.

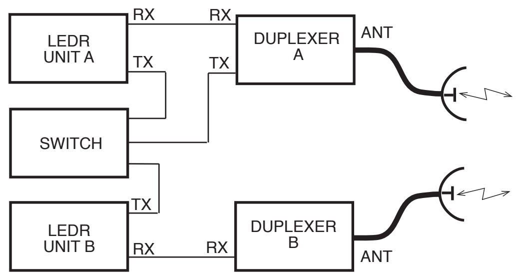


Figure 22. Block Diagram of a Space Diversity Station with External Duplexers

The inter-unit cabling for a space diversity system with external duplexers is shown in Figure 23.

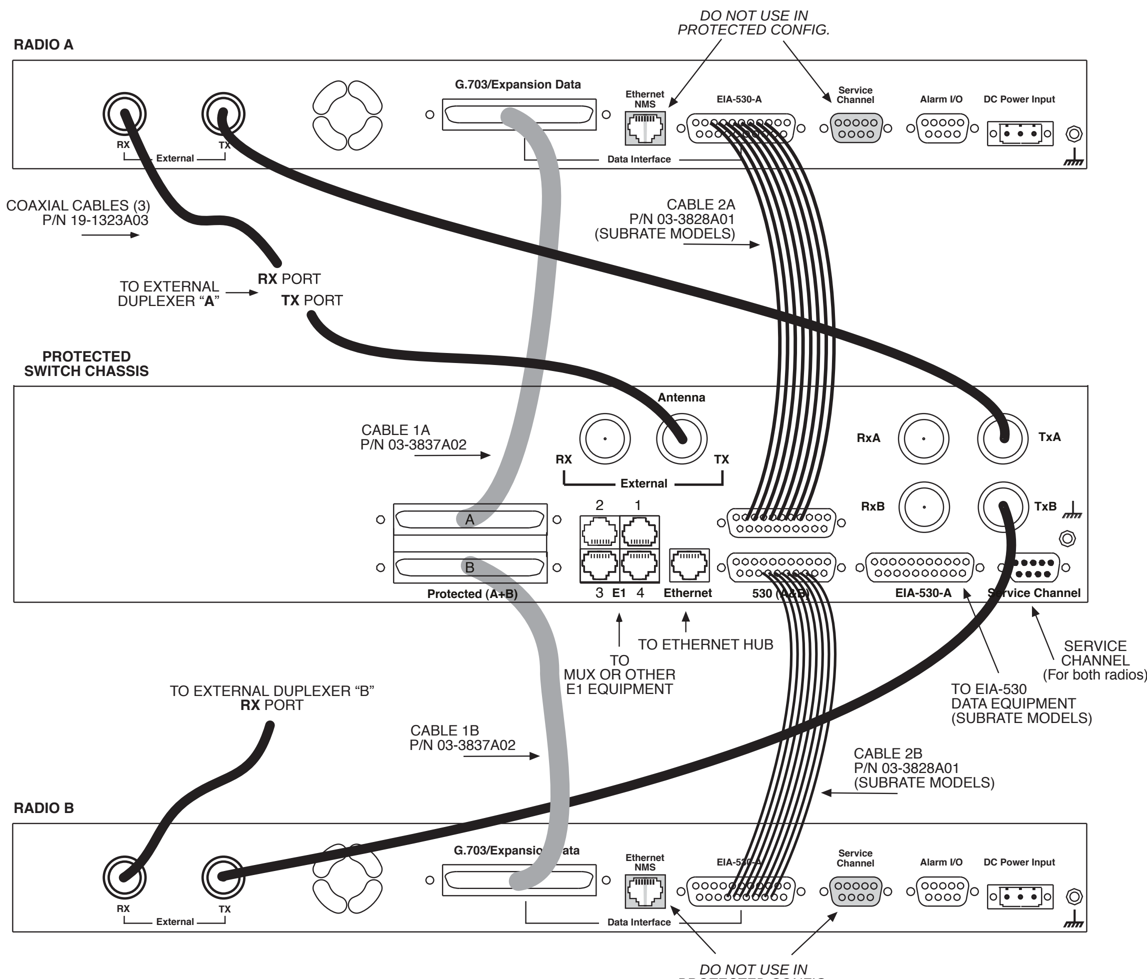


Figure 23. Inter-unit Cabling— Space Diversity with External Duplexers

The inter-unit cabling for a space diversity system with internal duplexers is shown in Figure 24.

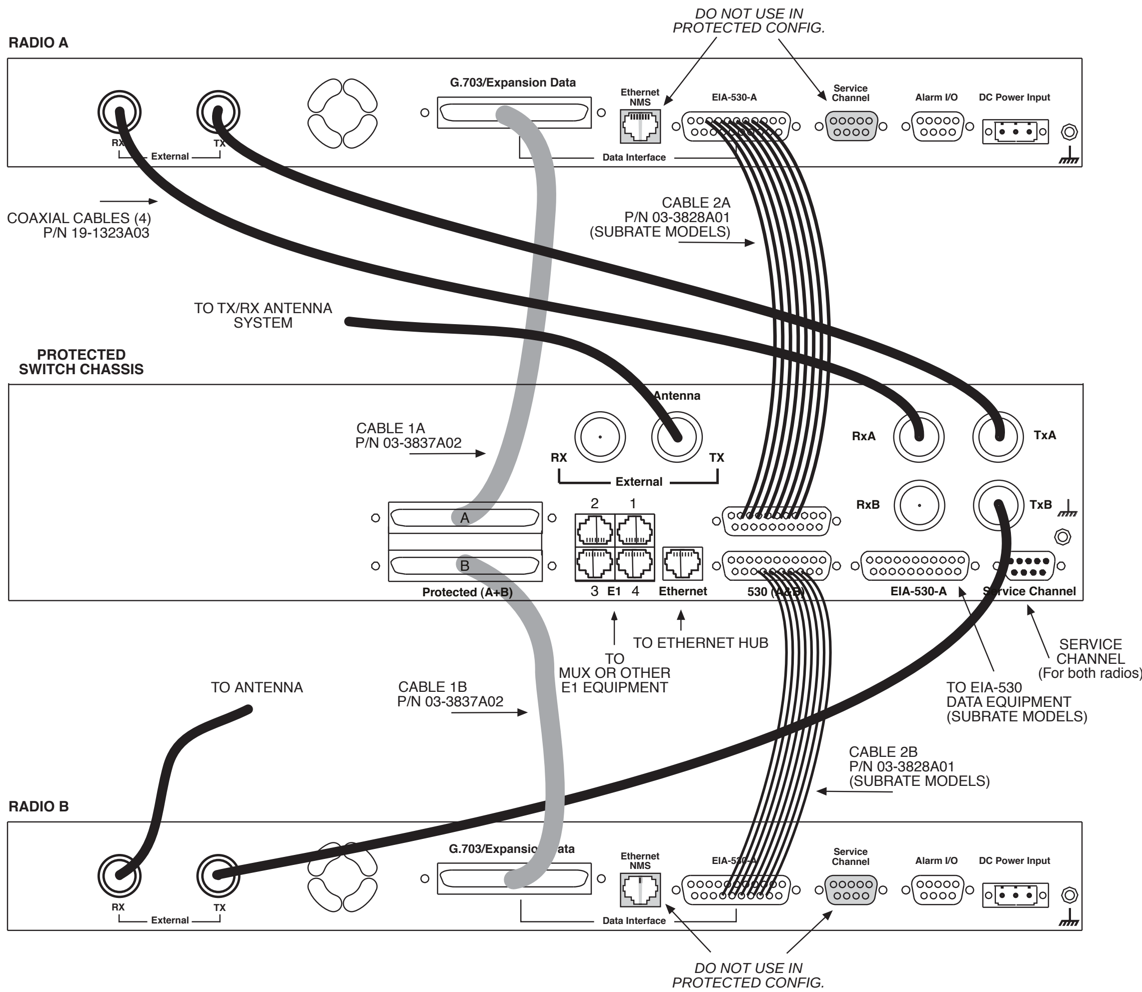


Figure 24. Inter-unit Cabling—
Space Diversity with Internal Duplexers

CAUTION
POSSIBLE EQUIPMENT DAMAGE

Duplexer alignment is a sophisticated procedure and a duplexer can be easily damaged if not handled carefully. It is highly-recommended duplexers needing re-alignment be returned to GE MDS, or the original duplexer manufacturer, for alignment. In some cases, it may be more economical to replace the unit than to have it re-aligned.

12.0 SPARE PARTS, UNITS AND ACCESSORIES

12.1 Spares

Spare assemblies and units used for repair of LEDR radios are listed in Table 28. Field servicing, or replacement of PC boards and assemblies, should only be performed by qualified service personnel.

When ordering parts from the factory, always give the *complete* model number of the radio as found on the serial number label on the chassis. Contact information can be found at the back of this guide.

Table 28. Field Replaceable Units for LEDR Radios

Item	Model	GE MDS Part Number
Transceiver's SRAM Power Back-up Battery	All Models	27-3109A01
Protected Switch Chassis (Complete unit)	All Models	Consult factory
Duplexer, if equipped. (Conventional and bandpass types available)	All Models	Frequency dependent; Consult factory.
FT1 Data Interface PCB	LEDR 700S LEDR 900S	03-3846A01
E1/FE1 Data Interface PCB	LEDR 400F LEDR 400S LEDR 900F LEDR 900S LEDR 1400F LEDR 1400S	03-3846A02
Subrate Data Interface PCB	LEDR PSC	03-2824A01
Fullrate Data Interface PCB	LEDR PSC	03-3539A01

12.2 Accessories

Table 28 lists LEDR accessories that may be ordered from the factory. Refer to the back of this manual for contact information.

Table 29. Accessory Items for LEDR Radios

Item	Description	GE MDS Part Number
V.35 Interface Cable	6 ft. (1.8 m) cable adapter used to convert subrate LEDR radio EIA-530 data interface to V.35 male data interface.	03-2174A01
G.703 Balun	Miniature G.703 balun used to convert a fullrate LEDR radio's 120 Ω balanced data interface to two 75 Ω BNC coaxial data interfaces. One balun required per E1 port.	01-3494A01
EIA-530 Null-MODEM Crossover Cable	6 ft. (1.8 m) cable adapter to connect subrate interfaces in a repeater configuration.	97-2841L06
SNMPc™ Network Management Manager	SNMP Management Software to access the LEDR embedded SNMP agent, allowing management of the LEDR radio network and any interconnected SNMP enabled peripherals. For Windows 95 O/S	03-3530A01
SNMPc™ Network Management Manager	SNMP Management Software to access the LEDR embedded SNMP agent, allowing management of the LEDR radio network and any interconnected SNMP enabled peripherals. For Windows 98 or NT O/S.	03-3530A02
Orderwire Handset (LEDR)	Voice handset and cord with RJ-11 modular plug.	12-1307A03
Orderwire Handset Kit	Voice handset with cord (RJ-11 modular plug), hanger and mounting bracket.	02-1207A01
AC Power Adapter	External AC power supply provides 24 Vdc to LEDR radio. Input: 110 Vac to 240 Vac, 50 to 60 Hz	03-3862A01
DC Power Plug	3-pin keyed connector with binding posts.	73-1194A22

13.0 FRACTIONAL-T1 INTERFACE CARD (03-3846A01)

FRACTIONAL-E1 INTERFACE CARD (03-3846A02)

13.1 Introduction

The Fractional-T1 (FT1) and Fractional-E1 (FE1) Interface cards are optional assemblies which provide additional connectivity within a LEDR network for all subrate (S) models. The installation of the FT1/FE1 Interface card inside the radio allows the standard EIA-530 customer data interface to be bypassed and the radio data lines to be connected *directly* to a G.703 T1 or E1 interface. (See Figure 14 on Page 99 for rear panel view.)

With the optional FT1/FE1 Interface, users are able to place a LEDR link from a network service access point to a remote site, where an installation supports multiple communications devices. Direct interface to customer equipment, such as channel banks, is possible without the use of expensive protocol converters.

13.2 Fractional-T1/E1 Performance

The FT1 and FE1 Interface allows the LEDR radio to be connected directly with a G.703 T1 or E1 interface. The line rate of the interface operates at the T1 rate of 1.544 Mbps, or E1 rate of 2.048 Mbps. Twelve user selectable DS0 timeslots are transmitted over the air in either case. The FT1 interface is G.703 at 100 Ω line impedance. The FE1 interface is G.703 at 120 Ω line impedance. Physical connection is via an RJ-45 jack on the rear panel.

13.3 Configurable Parameters

The following performance specifications of the T1 fractional interface are adjustable by the user. All of these parameters are manageable locally, or over the air via SNMP network management. (Refer to the SNMP Handbook, P/N 05-3532A01 for more information.)

Timeslots and Framing

Twelve DS0 timeslots are permitted. In FT1, the timeslot selection is arbitrary. In FE1, timeslot 0 is always sent and the remaining timeslots are arbitrary with the exception of timeslot 16. (Timeslot 16 must be sent when any CAS frame structures are selected.) The selection of timeslots can be different at each end of the link, provided their *number* is equal. The timeslots may not be reordered.

Alarm signals RAI and AIS are generated as appropriate. The user may optionally have these signals forwarded over the RF link.

The frame formats available for **Fractional-T1** operation are as follows:

- FT only
- ESF without CRC checking and generation
- SF (D4)
- SF with JYEL indication
- ESF with CRC checking and generation

The frame formats available for **Fractional-E1** operation are as follows:

- FAS only
- FAS with BSLIP
- FAS with CRC
- FAS with CRC and BSLIP
- FAS and CAS
- FAS with CAS and BSLIP
- FAS with CAS and CRC
- FAS with CAS
- CRC and BSLIP.

The re-framing criteria may be adjusted to the following settings: 2 out of 4 Fbit errors, 2 out of 5 Fbit errors, 2 out of 6 Fbit errors. For FE1, the reframing criteria is selectable between consecutive FAS errors or CRC errors.

Line Codes

The following standard T1 line codes are supported: B8ZS, AMI, and per-channel B7ZS.

The following standard E1 line codes are supported: HDB3 and AMI.

Diagnostics

The T1 line at each end of the link may be tested using a variety of bit patterns. In normal operation, statistics are stored for any errors occurring at the line interface, such as framing errors, bipolar violations, and CRC errors.

Data may be looped back at the local port, through the T1 option only, and at the remote unit. Further, the unit will respond to in-band (SF) and data link (ESF) loopback codes at the local port.

When in ESF framing mode, the option can automatically generate performance report messages.

The following alarms may be monitored & logged. They may also be associated with a user-selectable indication (alarm contact or front panel LED): Remote Loopback, Lost Frame, Lost Signal, Lost Analog Signal, AIS, RAI (RYEL), MultiFrame RAI, Severely Errored Frame, Frame Re-Align, MultiFrame AIS, Far End Block Error, Line Code Error, CRC Errors and Frame Bit Error.

Clocking

The clock source is configurable for network, loopback, and internal timing, with secondary selections available should the primary source become faulty. Refer to the discussion of the **clkmode** command (Page 57) for more information

13.4 Field Installation of the FT1 Interface Board

An “S” Series LEDR radio can be fitted with a Fractional-T1 (FT1) or Fractional-E1 (FE1) Interface Board (Figure 25). The addition of an FT1/FE1 board enables the radio to operate with a G.703 interface at speeds up to 768 kbps.

To add the FT1/FE1 Interface Board to an existing LEDR radio transceiver, follow these steps:

1. Remove the top cover of the radio (4 Phillips screws).

2. Identify the installation area for the Interface Board (See Figure 26). Remove the three Phillips screws on the main PC board which correspond to the mounting holes on the Interface Board.

3. Install the threaded standoff spacers (furnished with the option board) onto the main PC board in the holes formerly occupied by the screws. (Note: Washers must *not* be used between the standoff spacers and either of the PC boards.)

4. Locate connectors J912 and J913 (See Figure 26). These connectors mate with the plugs on the bottom of the Interface board.

5. Carefully set the optional board into place, making sure to align the mounting holes with the threaded standoffs on the main PCB. (The Interface Board’s rear panel connector should align with the rectangular cutout at the radio’s rear panel, and the rear edge of the option board should be parallel to the main PC board.)

6. Look under the right edge of the Interface board to ensure that J912 is aligned with the mating connector on the option board. With the board properly aligned, push down firmly in the area directly above J913 and then over J912 at the edge. A distinct “locking” action will be felt as the connectors engage.

7. Install the Phillips mounting screws with lockwashers on the top of the FT1 board.

CAUTION
POSSIBLE EQUIPMENT DAMAGE

The Interface board must be properly seated onto the LEDR radio's motherboard before powering up the radio chassis. Failure to properly install the board could result in permanent damage to the motherboard and the optional PCB.

8. Re-install the radio's top cover. This completes the Interface Board installation.

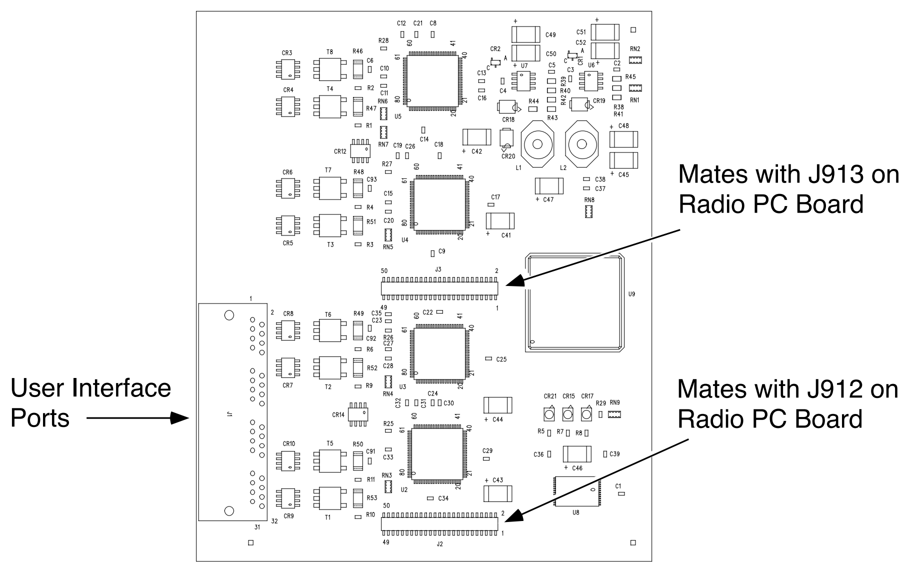


Figure 25. FT1/FE1 Interface Board—Optional Assembly (Part No. 03-3846Axx)

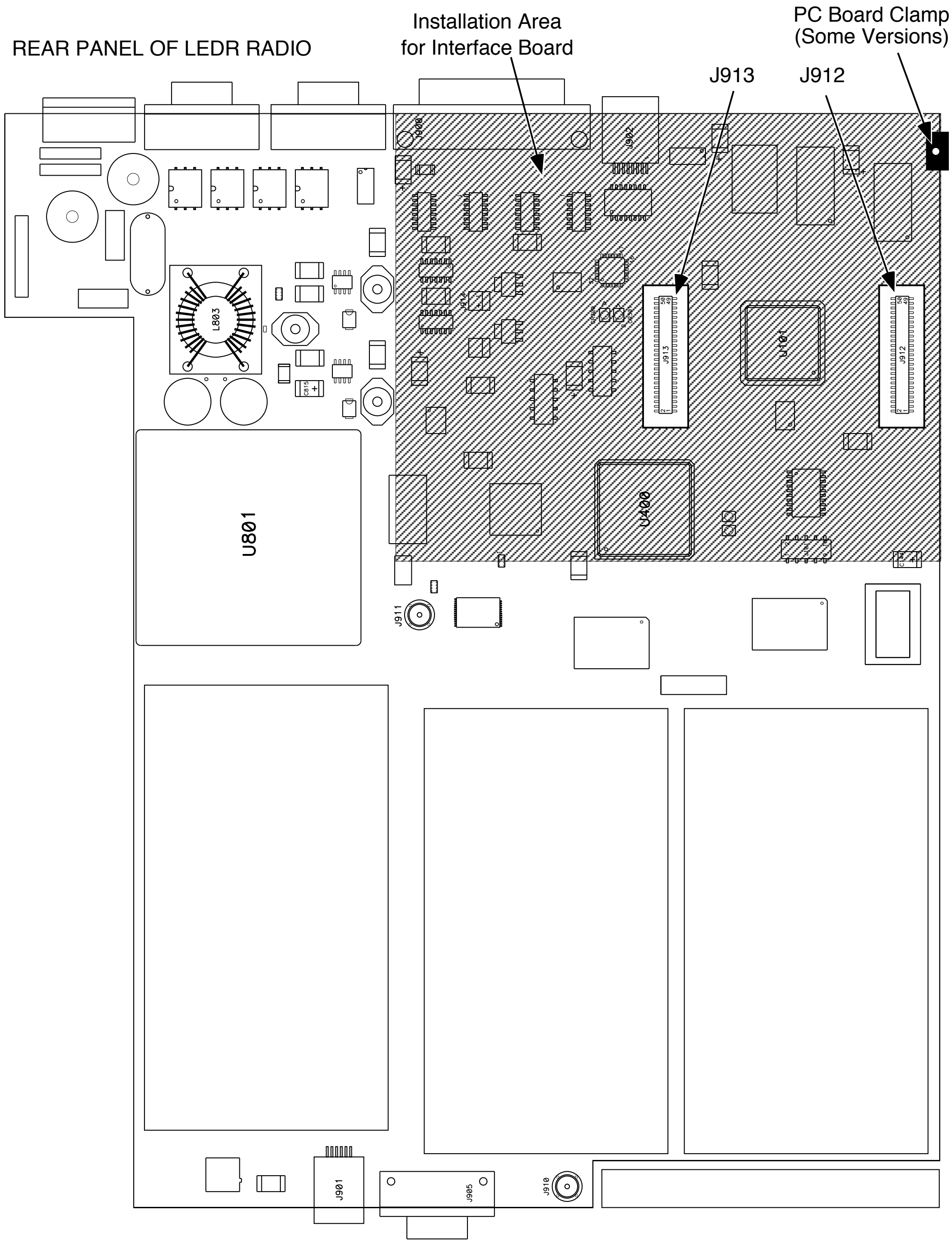


Figure 26. View of Radio PC Board
Showing Installation Details for FT1/FE1 Interface Board

14.0 INCREASE BANDWIDTH BY CHANGING TRANSMITTER AND RECEIVER FILTERS

14.1 Introduction

It is possible for qualified service personnel to upgrade LEDR Series radios in the field to increase the radios RF bandwidth. Listed in Table 30 are five upgrade kits. Each kit consists of three RF filters; one is used in the transmitter section and two are used in the receiver section. In addition, there is a unique software key that will allow the data circuitry to handle the higher data bandwidth. This key is based on the radio's serial number and can only be used with that radio.

Each kit consists of a set of 3 filters (transmitter 1; receiver 2), software activation key and instructions for converting radio's occupied bandwidth. The radio serial number must be provided to the factory for issue of authorization key.

Table 30. Hardware Upgrade Kits for Increased RF Bandwidth

For Subrate Radios	For Fullrate Radio
25 kHz to 50 kHz	500 kHz to 1.0 MHz
25 kHz to 100 kHz	500 kHz to 2.0 MHz
25 kHz to 200 kHz	1.0 MHz to 2.0 MHz
50 kHz to 100 kHz	
50 kHz to 200 kHz	
100 kHz to 200 kHz	

To realize the full benefit of the increased RF bandwidth, it may be necessary to upgrade the radio's data interface. Table 1 on Page 1 provides a simplified listing of radio bandwidth and compatible data interfaces.

14.2 Filter Removal and Replacement

These instructions describe the removal and replacement of filter modules inside a LEDR Transceiver, as well as the software commands necessary to authorize the new bandwidth.

CAUTION: This upgrade involves the removal of small, delicate parts. It must be performed by experienced personnel only, using proper tools and equipment to preserve the factory warranty. Precautions must be taken to prevent damage to components due to static discharge and other risks.

---

1. Remove the radio from service and disconnect all cabling from the rear panel.

2. Remove the top cover of the radio (four Phillips head screws).

3. Remove the Transmitter and Receiver section's RF shields (Figure 27). It will be necessary to unplug the ribbon cables that cross over the shields—record their locations as you remove them.

4. Locate and remove Filter FL700 from the transmitter section. In its place, install the replacement filter furnished with the upgrade kit. Ensure that the new filter is installed in the same orientation as the original unit.

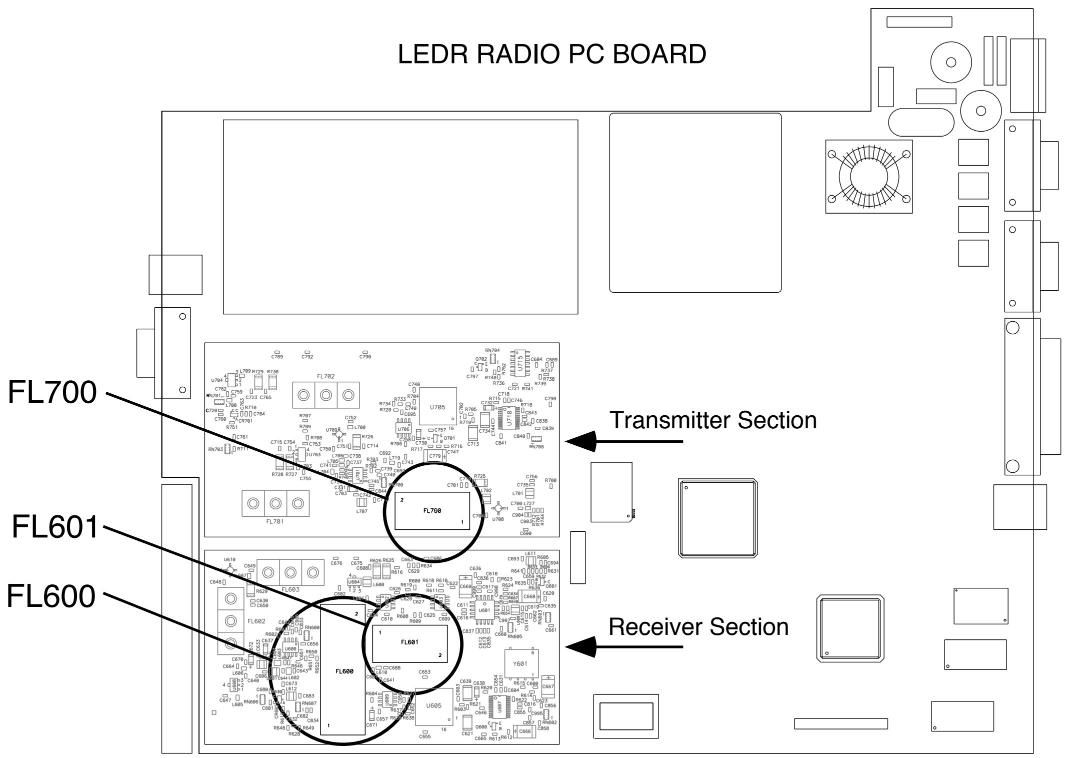


Figure 27. Location of Bandwidth Filters FL600, FL601 and FL700

5. Locate and remove Filters FL600 and FL601 from the Receiver module. In their place, install the replacement filters furnished with the upgrade kit. Ensure that the new filters are installed in the same orientation as the original units.

6. This completes the required hardware changes. Fasten the top cover and re-connect all cables to the rear panel.

7. Power up the radio and proceed to "Software Commands" below.

14.3 Software Commands

To activate the new filter bandwidth, it is necessary to enter an authorization key provided by the factory. This key is based upon the radio serial number and will authorize the new bandwidth of the radio. Contact the factory if you do not already have an authorization number.

1. Initiate a NMS terminal session with the LEDR radio. (Refer to Page 23 for login details.)

2. At the **LEDR>** prompt, type: **auth add <authorization number>**, where **<authorization number>** is the number provided to you by the factory. Press **ENTER**.

3. This completes the required software changes. If desired, the **auth show** command may be entered to display all of the current options for the LEDR radio.

4. Check for alarms on the front panel LED display. If no alarms are present, the basic functionality of the radio can be confirmed. If an alarm is present, double check all cable connections and radio settings.

15.0 BENCH TESTING OF RADIOS

In some cases, it may be necessary to test the operation of the equipment in a bench setting. Figure 28 shows a simple arrangement for bench testing using RF attenuators between the two units under test.

For weak signal tests (weaker than –80 dBm), a three-meter physical separation between Radio 1 and Radio 2 may be required to prevent unintentional coupling between the radios.

On protected radio configurations, a weak received signal will cause the radio transceivers to switch.

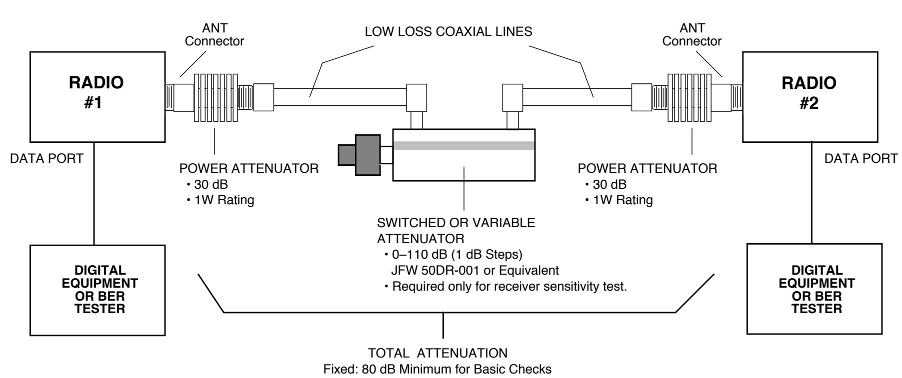


Figure 28. Back-to-Back Link Test

You can perform an over-the-air BER test on the bench or in the field. In this case, attach a separate piece of BER test equipment and feed it into one or more of the T1/E1 ports. At the other end of the link, you use another BER test box, or attach a loopback plug to the CPE data I/O port. This tests the quality of the radio link itself with regard to the user payload data. Such a bench, or over-the-air, test does not use the LEDR **bert** command.

NOTE: It is important to avoid over-driving the receiver as it can be damaged by strong signals. Signals stronger than -20 dBm should be avoided to protect the receiver.

NOTE: User BERT test equipment connected to a LEDR T1 data interface my yield different BERT results than the radio's **ber** command. This is likely when less than the channel's capacity is utilized by the timeslot command configuration.

16.0 TECHNICAL REFERENCE

16.1 Specifications for Subrate Models: LEDR 400S, 900S and 1400S

GENERAL SPECIFICATIONS	
Frequency Range	LEDR 400S: 330-512 MHz LEDR 900S: 800-960 MHz LEDR 1400S: 1350-1535 MHz
RF Occupied Bandwidth	25, 50, 100, 200 kHz
User Data Rates	64 kbps, 128 kbps, 256 kbps, 384 kbps, 512 kbps, 768 kbps
Modulation Type	32 QAM, 16 QAM, QPSK
FEC	Reed Solomon
Temperature Range	–10° to 50° C
Humidity	<95% non-condensing
Voltage Range	±24 Vdc, or ±48 Vdc (±20%)
Power Consumption	< 60 W
Size	4.5cm (1U) x 48cm x 30cm; 1.75" x 19" x 12"n
TRANSMITTER	
Power Output at antenna port	+30 dBm
Output Control Range	10 steps of up to 10 dB
Frequency Stability	1.5 ppm
Spurious Outputs	Exceeds ETSI specifications < -60 dBc
RECEIVER	

Residual BER	$< 1 \times 10^{-10}$
Dynamic Range	> 65 dB
INTERFACES	
Data	EIA-530
Orderwire	DTMF-capable
Data Service Channel	RS-232, 300–9600 bps
Ethernet NMS	10 Base-T
Console Port	RS-232, 9600 bps to 115.2 kbps
Alarms	4 Programmable Outputs 4 Programmable Inputs
Antenna	50 Ohms Impedance
OPTIONS	
• Space Diversity • Hot-standby Protected • Bandwidth Upgrade Kits (consult factory for details) • Bandpass Duplexers • Integrated Multiplexers (see separate specifications sheet)	
NETWORK MANAGEMENT	
Local LED Indicators	Front Panel LED status indicate: Power, Active, General Alarm, Rx Alarm, Tx Alarm, I/O Alarm.
Front Panel LCD	Display & keypad for management of local & remote radio.
Element Management	Full management of LEDR network via command-line interface.
SNMP Management	Full IP-based management of LEDR network and SNMP-enabled peripherals via custom enterprise MIB
HTML Webserver	Full IP-based management of LEDR network and web-enabled peripherals via any Web browser (e.g. Netscape™ or Internet Explorer™)
ACCESSORIES	
• 110/240 Vac, 50/60 Hz Power Supply • LEDR Orderwire Handset • G.703 120 Ohms to 75 Ohms balun	
AGENCY APPROVALS	
LEDR 400S	Transmission: FCC Part 90, IC RSS-119 EMC: ETS 300 385, FCC Part 15
LEDR 900S	Transmission: FCC Part 101, IC RSS-119 EMC: FCC Part 15
LEDR 1400S	Transmission: ETS 300 630, MPT 1717, Class 3 Environmental: ETS 300 019, Class 3.2 EMC: ETS 300 385 Safety: CE Mark ETSI: 25 kHz / 16-QAM @ 64 kbps 75 kHz / 16-QAM @128 kbps 200 kHz / 16-QAM @ 768 kbps MPT 1717: 25 kHz/16-QAM @ 64 kbps

LEDR FRACTIONAL T1/E1 INTER FACE CARD		
General Specifications	Line rate	T1 (1.544 Mbps); E1 (2.048 Mbps)
	Channel Size	200 kHz
	Data Rate	768 kbps (12 x 64 kbps)
	Framing	SF, ESF (T1); FAS, CAS, CRC (E1)
	Signaling	RBS (T1); Time Slot 16 CAS (E1)
	Line Codes	AMI, B8ZS, B7ZS (T1); AMI, HDB3 (E1)
	Interface	RJ48C Balanced Interface 100 Ohms (T1), 120 Ohms (E1)
Physical	Size	15.24 cm x 12.7 cm (6 in x 5 in)
	Configuration	Option card, fitted internal to LEDR chassis
	Availability	Fractional T1: LEDR 900S Fractional E1: LEDR 400S, LEDR 900S, LEDR 1400S

SYSTEM PERFORMANCE				
Channel Spacing	**25 kHz**	**50 kHz**	**100 kHz**	**200 kHz**
Capacity (raw data)	72 kbps	152 kbps	360 kbps	800 kbps
	64 kbps	128 kbps	256 kbps	768 kbps
Receiver Sensitivity **10^{-6} BER @ 32QAM**	-101 dBm	-97 dBm	-96 dBm	-91 dBm
	Note: Receiver sensitivity for 10^{-3} BER is typically -3 dB better			
System Gain **10^{-6} BER @ 32QAM**	131 dB	127 dB	126 dB	121 dB

Modulation Type	Threshold Differential	System Gain Differential
QPSK	-4.5 dB	-5.5 dB
16 QAM	1.5 dB	2.5 dB
32 QAM	0 dB	0 dB

16.2 Specifications for Subrate Model: LEDR 700S

GENERAL SPECIFICATIONS	
Frequency Range	746-794 MHz (Guard Bands), 30 MHz split
RF Occupied Bandwidth	25, 50, and 100 kHz
User Data Rates	64 kbps, 128 kbps, 256 kbps, 384 kbps

Permitted Data Throughput	Channel Size / Maximum Data Rate 25 kHz* @ 64 kbps 50 kHz* @ 28 kbps 100 kHz @ 256 kbps * Contact factory for availability.
Modulation Type	32 QAM, 16 QAM
FEC	Reed Solomon
Temperature Range	–5° to 50° C
Humidity	<90% non-condensing
Voltage Range	24 Vdc, or 48 Vdc (±20%)
Power Consumption	< 60 W
Size	4.5cm (1U) x 48cm x 30cm; 1.75" x 19" x 12"n
TRANSMITTER	
Power Output at antenna port	+30 dBm (1 Watt)
Output Control Range	0 dB to –10 dB
Frequency Stability	1.5 ppm
Spurious Outputs	< –60 dBc
RECEIVER	
Sensitivity	**Bandwidth** / **Data Rate** / **BER @ 10^{-6}** 25 kHz* / 64 kbps / –101 dBm 50 kHz* / 128 kbps / –98 dBm 100 kHz / 256 kbps / –95 dBm
Residual BER	$< 1 \times 10^{-10}$
Dynamic Range	> 65 dB
INTERFACES	
Data	EIA-530
Orderwire	DTMF-capable
Data Service Channel	RS-232, 9600 bps
Ethernet NMS	10 Base-T
Console Port	RS-232, 9600 bps to 115.2 kbps
Alarms	4 Programmable Outputs 4 Programmable Inputs
Antenna	50 Ohms Impedance
OPTION	
Bandwidth Upgrade Kits (Consult factory for details)	
ACCESSORIES	
• 110/240 Vac, 50/60 Hz Power Supply	• LEDR Orderwire Handset
NETWORK MANAGEMENT	
Local LED Indicators	Front Panel LED status indicate: Power, Active, General Alarm, Rx Alarm, Tx Alarm, I/O Alarm
Front Panel LCD	Display & keypad for management of local & remote radio
Element Management	Full management of LEDR network via command-line interface

SNMP Management	Full IP-based management of LEDR network and SNMP-enabled peripherals via custom enterprise MIB
HTML Webserver	Full IP-based management of LEDR network and web-enabled peripherals via any Web browser (e.g. Netscape™ or Internet Explorer™)
AGENCY APPROVALS	
LEDR 700S	Transmission: FCC EMC: FCC

16.3 Specifications for Fullrate Models: LEDR 400F, 900F and 1400F

GENERAL SPECIFICATIONS	
Frequency Range	LEDR 400F: 330-512 MHz LEDR 900F: 800-960 MHz (consult factory) LEDR 1400F: 1350-1535 MHz
RF Occupied Bandwidth	500 kHz, 1.0 MHz, 2.0 MHz
User Data Rates	• 2 x E1 (4 Mbps) • 1 x E1 (2 Mbps) • 3 x E1 (6 Mbps) • 4 x E1 (8 Mbps)
Modulation Type	32 QAM, 16 QAM, QPSK
FEC	Reed Solomon
Temperature Range	–10° to 50° C
Humidity	<95% non-condensing
Voltage Range	±24 Vdc, or ±48 Vdc (±20%)
Power Consumption	< 60 W
Size	4.5cm (1U) x 48cm x 30cm; 1.75" x 19" x 12"n
TRANSMITTER	
Power Output at antenna port	+30 dBm
Output Control Range	10 steps of up to 30 dB
Frequency Stability	1.5 ppm
Spurious Outputs	Exceeds ETSI specifications < -60 dBc
RECEIVER	
Residual BER	$< 1 \times 10^{-10}$
Dynamic Range	> 65 dB
INTERFACES	
Data	G.703
Orderwire	DTMF-capable
Data Service Channel	RS-232, 300–9600 bps
Ethernet NMS	10 Base-T
Console Port	RS-232, 9600 bps to 115.2 kbps

Alarms	4 Programmable Outputs 4 Programmable Inputs
Antenna	50 Ohms Impedance

OPTIONS

- Space Diversity
- Hot-standby Protected
- Bandwidth Upgrade Kits (consult factory for details)
- Bandpass Duplexers
- Integrated Multiplexers

NETWORK MANAGEMENT

Local LED Indicators	Front Panel LED status indicate: Power, Active, General Alarm, Rx Alarm, Tx Alarm, I/O Alarm.
Front Panel LCD	Display & keypad for management of local & remote radio.
Element Management	Full management of LEDR network via command-line interface.
SNMP Management	Full IP-based management of LEDR network and SNMP-enabled peripherals via custom enterprise MIB
HTML Webserver	Full IP-based management of LEDR network and web-enabled peripherals via any Web browser (e.g. Netscape™ or Internet Explorer™)

ACCESSORIES

- 110/240 Vac, 50/60 Hz Power Supply
- LEDR Orderwire Handset
- G.703 120 Ohms to 75 Ohms balun

AGENCY APPROVALS

LEDR 400F	Transmission: FCC Part 90, IC RSS-119 EMC: ETS 300 385, FCC Part 15
LEDR 900F	Transmission: FCC Part 101, IC RSS-119 EMC: FCC Part 15
LEDR 1400F	Transmission: ETS 300 630, MPT 1717 Environmental: ETS 300 019, Class 3.2 EMC: ETS 300 385 Safety: CE Mark

SYSTEM PERFORMANCE			
Channel Spacing	**500 kHz**	**1.0 MHz**	**1.75/2.0 MHz**
Capacity	1 x E1	2 x E1	4 X E1
Receiver Sensitivity 10^{-6} BER @ 16 QAM	-89 dBm	-86 dBm	-83 dBm
Note: Receiver sensitivity for 10^{-3} BER is typically -3 dB better			
System Gain 10^{-6} BER @ 32 QAM	119 dBm	116 dBm	113 dBm

Modulation Type	Threshold Differential	System Gain Differential
QPSK	-4.5 dB	-5.5 dB
16 QAM	-1.5 dB	-2.5 dB
32 QAM	0 dB	0 dB

16.4 Specifications—Configuration

PROTECTED CONFIGURATION	
Configuration	2 x LEDR radios, connected via protected switch chassis
Total Size	2 x 1 RU high + 1 x 2 RU high
Transmit Switching	< 250 ms
Transmit Branching Loss	2 dB
Receive Branching Loss	5 dB
Receive Switching	Hitless
Power Consumption	<135W (2 x LEDR + Protected Chassis)

16.5 Optional Equipment

(Consult factory for detailed information)

- Space Diversity
- Hot-standby Protected
- Bandwidth Upgrade Kits

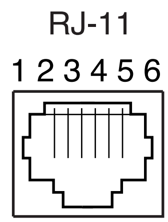
16.6 Accessories

- 120/240 Vac 50/60 Hz Power Supply (24 Vdc Output)
- LEDR Orderwire Handset
- Other items listed in Table 29 on Page 119

NOTE: The factory reserves the right to make changes to this specification without advance notice or obligation to any person.

16.7 I/O Connector Pinout Information

Orderwire—Front Panel



Pin	Signal	Direction
1	+ 12 Vdc	Output
2	Mic Return	—
3	Ear Audio	Output
4	Ear Return	Output
5	Mic Audio	Input
6	Ground	—

Figure 29. Orderwire RJ-11 Connector

CONSOLE Port—Front Panel

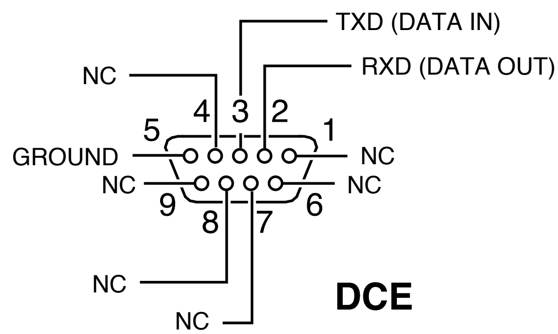
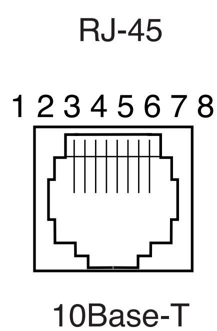


Figure 30. CONSOLE Port DB-9 Female Pinout

Ethernet—Rear Panel

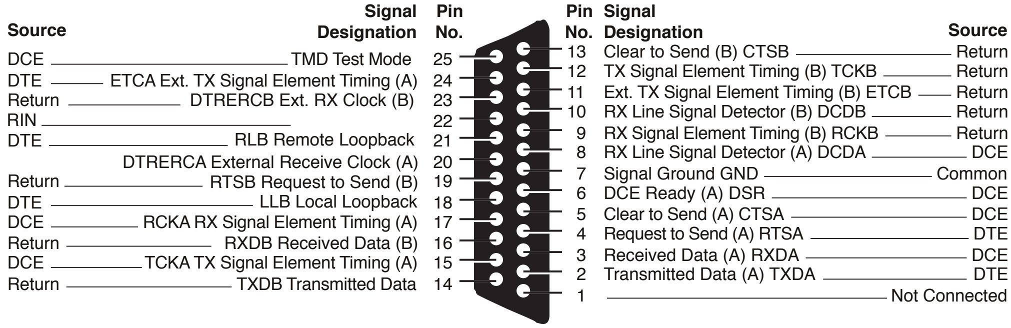


Pin	Signal	Direction
1	Ethernet Transmit High	Output
2	Ethernet Transmit Low	Output
3	Ethernet Receive High	Input
4	No Connection	—
5	No Connection	—
6	Ethernet Receive Low	Input
7	No Connection	—
8	No Connection	—

Figure 31. Ethernet Connector (RJ-45)

EIA-530-A Data—Rear Panel

EIA-530 Interface



NOTE: All signals from perspective of the radio (*i.e.,* TXD goes out of radio, RXD goes into radio); External Clock A/B used with external DCE in Clock Mode menu.

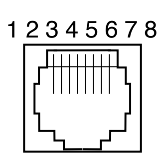
Figure 32. EIA-530 Connector Pinout (DB-25)
(See table below for input/output information)

Table 31. EIA-530 Pin Functions (Showing Inputs and Outputs)

Input Pins	Clkmode Under These Conditions Only...	Output Pins	Clkmode Under These Conditions Only...
2 & 14 TXD	All	RXD = 3 & 16	All
* 4 & 19 = RTS	All	* CTS = 5 & 13	All
24 & 11 = ETC	EXTTX/EXTDCE	* DCD 8 & 10	All
20 & 23 ERC	EXT DCE	RCLK 17 & 9	Internal & looped, EXTTX
		TCLK 15 & 12	Internal
Unbalanced pins on EIA-530 Connector: 6, 7 (Ground), 18, 21, 22, 25			
* These pins are required pairs			

E1 (G.703) Data Connectors (Qty. 4)—Rear Panel

RJ-45



As viewed from outside of radio

Pin	Signal	Direction
1	Differential digital output signal, ring	Output
2	Differential digital output signal, tip	Output
3	Ground (Early models: No Connection)	—
4	Differential digital input signal, ring	Input
5	Differential digital input signal, tip	Input
6	Ground (Early models: No Connection)	—
7	No Connection	—
8	No Connection	—

Figure 33. G.703 Data Connector Pinout (RJ-45)

Service Channel—Rear Panel

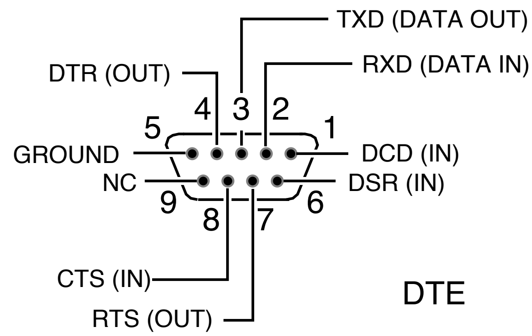


Figure 34. Service Channel Connector Pinout (DB-9 Male)

Alarm—Rear Panel

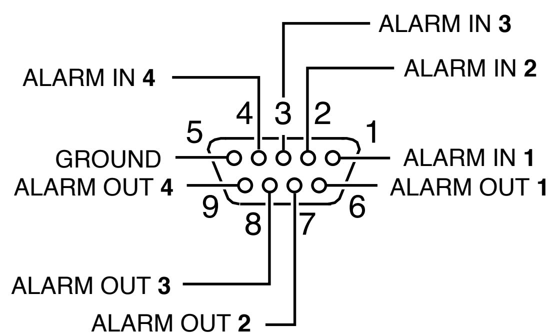


Figure 35. Alarm Connector DB-9 Female Pinout
(See "Alarm I/O" **on Page 18** *for parameters.)*

16.8 Watts-dBm-Volts Conversion

Table 32 is provided as a convenience for determining the equivalent voltage or wattage of an RF power expressed in dBm.

Table 32. dBm-Volts-Watts Conversion Chart

dBm	V	Po
+53	100.0	200W
+50	70.7	100W
+49	64.0	80W
+48	58.0	64W
+47	50.0	50W
+46	44.5	40W
+45	40.0	32W
+44	32.5	25W
+43	32.0	20W
+42	28.0	16W
+41	26.2	12.5W
+40	22.5	10W
+39	20.0	8W
+38	18.0	6.4W
+37	16.0	5W
+36	14.1	4W
+35	12.5	3.2W
+34	11.5	2.5W
+33	10.0	2W
+32	9.0	1.6W
+31	8.0	1.25W
+30	7.10	1.0W
+29	6.40	800mW
+28	5.80	640mW
+27	5.00	500mW
+26	4.45	400mW
+25	4.00	320mW
+24	3.55	250mW
+23	3.20	200mW
+22	2.80	160mW
+21	2.52	125mW
+20	2.25	100mW
+19	2.00	80mW
+18	1.80	64mW
+17	1.60	50mW
+16	1.41	40mW
+15	1.25	32mW
+14	1.15	25mW
+13	1.00	20mW
+12	.90	16mW
+11	.80	12.5mW
+10	.71	10mW
+9	.64	8mW
+8	.58	6.4mW
+7	.500	5mW
+6	.445	4mW
+5	.400	3.2mW
+4	.355	2.5mW
+3	.320	2.0mW
+2	.280	1.6mW
+1	.252	1.25mW

dBm	V	Po
0	.225	1.0mW
-1	.200	.80mW
-2	.180	.64mW
-3	.160	.50mW
-4	.141	.40mW
-5	.125	.32mW
-6	.115	.25mW
-7	.100	.20mW
-8	.090	.16mW
-9	.080	.125mW
-10	.071	.10mW
-11	.064	
-12	.058	
-13	.050	
-14	.045	
-15	.040	
-16	.0355	

dBm	mV	Po
-17	31.5	
-18	28.5	
-19	25.1	
-20	22.5	.01mW
-21	20.0	
-22	17.9	
-23	15.9	
-24	14.1	
-25	12.8	
-26	11.5	
-27	10.0	
-28	8.9	
-29	8.0	
-30	7.1	.001mW
-31	6.25	
-32	5.8	
-33	5.0	
-34	4.5	
-35	4.0	
-36	3.5	
-37	3.2	
-38	2.85	
-39	2.5	
-40	2.25	.1μW
-41	2.0	
-42	1.8	
-43	1.6	
-44	1.4	
-45	1.25	
-46	1.18	
-47	1.00	
-48	0.90	
-49	0.80	
-50	0.71	.01μW
-51	0.64	
-52	0.57	
-53	0.50	
-54	0.45	
-55	0.40	
-56	0.351	
-57	0.32	
-58	0.286	
-59	0.251	
-60	0.225	.001μW
-61	0.200	
-62	0.180	
-63	0.160	
-64	0.141	

dBm	μV	Po
-65	128	
-66	115	
-67	100	
-68	90	
-69	80	
-70	71	.1nW
-71	65	
-72	58	
-73	50	
-74	45	
-75	40	
-76	35	
-77	32	
-78	29	
-79	25	
-80	22.5	.01nW
-81	20.0	
-82	18.0	
-83	16.0	
-84	11.1	
-85	12.9	
-86	11.5	
-87	10.0	
-88	9.0	
-89	8.0	
-90	7.1	.001nW
-91	6.1	
-92	5.75	
-93	5.0	
-94	4.5	
-95	4.0	
-96	3.51	
-97	3.2	
-98	2.9	
-99	2.51	
-100	2.25	.1pW
-101	2.0	
-102	1.8	
-103	1.6	
-104	1.41	
-105	1.27	
-106	1.18	

dBm	nV	Po
-107	1000	
-108	900	
-109	800	
-110	710	.01pW
-111	640	
-112	580	
-113	500	
-114	450	
-115	400	
-116	355	
-117	325	
-118	285	
-119	251	
-120	225	.001pW
-121	200	
-122	180	
-123	160	
-124	141	
-125	128	
-126	117	
-127	100	
-128	90	
-129	80	.1ƒW
-130	71	
-131	61	
-132	58	
-133	50	
-134	45	
-135	40	
-136	35	
-137	33	
-138	29	
-139	25	
-140	23	.01ƒW

17.0 RADIO EVENT CODES

Table 33 lists the event codes that may be encountered during operation of the radio. These codes may be read from a terminal using the **events pending** command. (See Page 59 for a full description of the **events** command.)

NOTE: The event codes listed here are available on radios equipped with the optional FT1 Interface Board. Standard "S" Series radios will display fewer codes.

Table 33. Event Codes

ID	EVENT NAME	DESCRIPTION	DEFAULT LED	SNMP TRAP LEVEL
0	EXT_ALARM_IN1	External Alarm Input #1	ALARM	CRITICAL
1	EXT_ALARM_IN2	External Alarm Input #2	ALARM	CRITICAL
2	EXT_ALARM_IN3	External Alarm Input #3	ALARM	CRITICAL
3	EXT_ALARM_IN4	External Alarm Input #4	ALARM	CRITICAL
4	MODULATOR_EV	Communication failure with modulator	ALARM	CRITICAL
5	DEMODULATOR_EV	Communication failure with demodulator	ALARM	CRITICAL
6	MOD_SELFTEST	Modulator selftest failed	NONE	CRITICAL
7	DEMOD_SELFTEST	Demodulator selftest failed	NONE	INFORM
8	PERM_REGN_CHECKSUM	Permanent region checksum failed	NONE	INFORM
9	APP1_REGN_CHECKSUM	Application #1 checksum failed	NONE	INFORM
10	APP2_REGN_CHECKSUM	Application #2 checksum failed	NONE	INFORM
11	BOOT_REGN_CHECKSUM	Boot loader checksum failed	NONE	INFORM
12	CONF1_REGN_CHECKSUM	Configuration Data region #1 checksum failed	NONE	INFORM
13	CONF2_REGN_CHECKSUM	Configuration Data region #2 checksum failed	NONE	INFORM
14	RTC_TEST	Real-time clock error	NONE	INFORM
15	BBRAM_TEST	NV-RAM test failed	NONE	INFORM
16	BATTERY_LOW	NV-RAM battery is low	ALARM	MAJOR
17	TX_SYNTH_LOCK	Transmit Synthesizer out-of-lock	TXALARM	CRITICAL
18	RX_SYNTH_LOCK	Receive Synthesizer out-of-lock	RXALARM	CRITICAL
19	DIG_POWER_REF	Digital Power Reference is out of specified range	ALARM	CRITICAL
20	TEMPERATURE	Temperature sensor reads over 80 degrees Celsius	ALARM	CRITICAL
21	TX_POWER_LOOP	Transmit Power Loop is out-of-lock	TXALARM	MAJOR

Table 33. Event Codes *(Continued)*

ID	EVENT NAME	DESCRIPTION	DEFAULT LED	SNMP TRAP LEVEL
22	DEMOD_SNR_LOW	Demodulator Signal-to-Noise ratio is unacceptably low	NONE	MINOR
23	DEMOD_AGC_RSSI	Demodulator Automatic Gain Controlled RSSI too low	NONE	MINOR
24	DEMOD_FEC_RECOVER	FEC circuitry has detected and corrected one or more errors	NONE	MINOR
25	DEMOD_FEC_UNRECOVER	FEC circuitry has detected one or more uncorrectable errors	NONE	MINOR
26	DEMOD_MULTIPATH	Excessive multipath distortion detected	NONE	MINOR
27	DEMOD_ACQUISITION	Demodulator lost sync. lock on received signal	RXALARM	CRITICAL
28	TX_TO_REMOTE_RX	Problem with link between the local transmitter & remote Rx	ALARM	CRITICAL
29	redundant_ALARM	Problem with redundant unit	ALARM	CRITICAL
30	WDOG_TIME_OUT	Processor watchdog has expired and reset the processor	ALARM	CRITICAL
31	RX_OFF	Radio is not receiving due to a weak signal or equipment failure	RXALARM	CRITICAL
32	SOFTWARE_TX_OFF	Software command has unkeyed the radio	TXALARM	CRITICAL
33	RTC_NOT_SET	The real time clock is not programmed	NONE	MINOR
34	IO1_DIG_LOC_lOOPBACK	The radio’s 530 or TELCO I/O port is in Digital local loopback mode	NONE	INFORM
35	IO2_DIG_LOC_lOOPBACK	The radio’s 2nd TELCO I/O port is in Digital local loopback mode	NONE	INFORM
36	IO3_DIG_LOC_lOOPBACK	The radio’s 3rd TELCO I/O port is in Digital local loopback mode	NONE	INFORM
37	IO4_DIG_LOC_lOOPBACK	The radio’s 4th TELCO I/O port is in Digital local loopback mode	NONE	INFORM
38	RF_LOCAL_LOOPBACK	The radio is in Local RF loopback test mode	NONE	INFORM
39	IO1_DIG_REM_LOOPBACK	The radio’s 530 or TELCO I/O port is in Digital Remote loopback mode	NONE	INFORM
40	IO2_DIG_REM_LOOPBACK	The radio’s 2nd TELCO I/O port is in Digital Remote loopback mode	NONE	INFORM
41	IO3_DIG_REM_LOOPBACK	The radio’s 3rd TELCO I/O port is in Digital Remote loopback mode	NONE	INFORM
42	IO4_DIG_REM_LOOPBACK	The radio’s 4th TELCO I/O port is in Digital Remote loopback mode	NONE	INFORM

Table 33. Event Codes *(Continued)*

ID	EVENT NAME	DESCRIPTION	DEFAULT LED	SNMP TRAP LEVEL
43	RAW_SERVICE_CHANNEL	The Raw Service Channel data frame is exhibiting error	ALARM	MAJOR
44	ATOD_REFERENCE	A fault is detected with the Analog to Digital converter	ALARM	CRITICAL
45	NEW_CONFIG_REV	A new revision of configuration data structure has been detected	NONE	INFORM
46	FPGA_LOAD	FPGA is not loaded correctly	NONE	INFORM
47	DATE_TIME_CHANGE	The date or time is been modified	NONE	INFORM
48	HARDWARE_TX_OFF	The transmitter key hardware is in an unkeyed state	TXALARM	CRITICAL
49	INACTIVE_ON	Current radio transceiver is in standby mode when in protected radio chassis	ALARM	MAJOR
50	NO_OPTION_UNIT	No Option Card is detected	NONE	INFORM
51	VOCODER_INIT_ERR	The voice processor initialization failed	ALARM	MAJOR
52	VOCODER_ERROR	The voice processor is reporting a problem	ALARM	MAJOR
53	POWER_ON_RESET	This indicates Power On Reset Cycle	NONE	INFORM
54	EXT_HARD_RESET	This indicates last Power-Up Cycle was due to External Hard Reset	NONE	INFORM
55	EXT_SOFT_RESET	This indicates last Power-Up Cycle was due to External Soft Reset	NONE	INFORM
56	INACT_CONFIG_SYNC	Protected 1+1 mode Active to Inactive Configuration data sync. error	ALARM	CRITICAL
57	NEW FIRMWARE LOADED	New firmware has been downloaded from flash memory.	NONE	INFORM
58	CONFIG_CHANGED	The radio transceiver configuration has been modified	NONE	INFORM
59	SELFTEST_COMPLETE	A self test has completed execution	NONE	INFORM
60	PERFORM_DEGRADED	A performance degradation threshold has been exceeded	ALARM	INFORM
61	DUPLICATE_UNIT_ID	Another unit with the same unit ID has been detected	ALARM	INFORM
62	LINK_UNAVAILABLE	The G821 status indicates that the link is unavailable	NONE	INFORM
63	EVENT_LOG_CLEARED	The event log has been cleared	NONE	INFORM
64	Reserved	—	—	—

Table 33. Event Codes *(Continued)*

ID	EVENT NAME	DESCRIPTION	DEFAULT LED	SNMP TRAP LEVEL
65	Reserved	—	—	—
66	USER_REBOOT	The user has rebooted the radio	NONE	INFORM
67	MODEM_LOCAL_LOOPBACK	Modulator data path is locally looped back to Demodulator	NONE	INFORM
68	MODEM_REMOTE_LOOPBACK	Demodulator data path is looped back to modulator for remote radio loopback application	NONE	INFORM
69	OPT_MUX_LOOBACK	Option card multiplexed data path from Line(s) is looped back	NONE	INFORM
70	IO1_REM_LOOPBACK_SERV	Radio is server for remote radio loopback mode with its payload data at Line IO #1 looped back to the commanding local radio	NONE	INFORM
71	IO2_REM_LOOPBACK_SERV	Radio is server for remote radio loopback mode with its payload data at Line IO #2 looped back to the commanding local radio	NONE	INFORM
72	IO3_REM_LOOPBACK_SERV	Radio is server for remote radio loopback mode with its payload data at Line IO #3 looped back to the commanding local radio	NONE	INFORM
73	IO4_REM_LOOPBACK_SERV	Radio is server for remote radio loopback mode with its payload data at Line IO #4 looped back to the commanding local radio	NONE	INFORM
74	IO1_RECVR_LOF	Line IO #1 receiver Loss-of-framing alarm.	I/O ALARM	CRITICAL
75	IO1_RECVR_LOS	Line IO #1 receiver Loss-of-signal alarm	I/O ALARM	CRITICAL
76	IO1_RECVR_ALOS	Line IO #1 receiver Loss-of-analog-signal alarm	I/O ALARM	CRITICAL
77	IO1_RECVR_AIS	Line IO #1 receiver detected AIS alarm	I/O ALARM	CRITICAL
78	IO1_RECVR_RAI	Line IO #1 receiver detected RAI (yellow) alarm	I/O ALARM	CRITICAL
79	IO1_RECVR_MRAI	Line IO #1 receiver detected multi-framed RAI (yellow) alarm	I/O ALARM	CRITICAL
80	IO1_RECVR_SEF	Line IO #1 receiver detected Severely Errored Frames	I/O ALARM	CRITICAL
81	IO1_RECVR_COFA	Line IO #1 receiver detected Change-of-Frame-Alignment alarm	I/O ALARM	CRITICAL
82	IO1_RECVR_MAIS	Line IO #1 receiver detected multi-framed AIS alarm	I/O ALARM	CRITICAL
83	IO1_RECVR_FEBE	Line IO #1 receiver detected E1 Far-End-Block-Errors alarm	I/O ALARM	INFORM

Table 33. Event Codes *(Continued)*

ID	EVENT NAME	DESCRIPTION	DEFAULT LED	SNMP TRAP LEVEL
84	IO1_RECVR_LCV	Line IO #1 receiver detected Line-Code-Violation alarm	I/O ALARM	INFORM
85	IO1_RECVR_CRC	Line IO #1 receiver detected CRC alarm	I/O ALARM	INFORM
86	IO1_RECVR_FBIT	Line IO #1 receiver detected Frame Bit Error	I/O ALARM	INFORM
87	IO2_RECVR_LOF	Line IO #2 receiver Loss-of-framing alarm	I/O ALARM	CRITICAL
88	IO2_RECVR_LOS	Line IO #2 receiver Loss-of-signal alarm	I/O ALARM	CRITICAL
89	IO2_RECVR_ALOS	Line IO #2 receiver Loss-of-analog-signal alarm	I/O ALARM	CRITICAL
90	I02_RECVR_AIS	Line IO #2 receiver detected AIS alarm	I/O ALARM	CRITICAL
91	IO2_RECVR_RAI	Line IO #2 receiver detected RAI (yellow) alarm	I/O ALARM	CRITICAL
92	IO2_RECVR_MRAI	Line IO #2 receiver detected multi-framed RAI (yellow) alarm	I/O ALARM	CRITICAL
93	IO2_RECVR_SEF	Line IO #2 receiver detected Severely Errored Frames	I/O ALARM	CRITICAL
94	IO2RECVR_COFA	Line IO #2 receiver detected Change-of-Frame-Alignment alarm	I/O ALARM	CRITICAL
95	IO2_RECVR_MAIS	Line IO #2 receiver detected multi-framed AIS alarm	I/O ALARM	CRITICAL
96	IO2_RECVR_FEBE	Line IO #2 receiver detected E1 Far-End-Block-Errors alarm	I/O ALARM	INFORM
97	IO2_RECVR_LCV	Line IO #2 receiver detected Line-Code-Violation alarm	I/O ALARM	INFORM
98	IO2_RECVR_CRC	Line IO #2 receiver detected CRC alarm	I/O ALARM	INFORM
99	IO2_RECVR_FBIT	Line IO #2 receiver detected Frame Bit Error	I/O ALARM	CRITICAL
100	IO3_RECVR_LOF	Line IO #3 receiver Loss-of-framing alarm	I/O ALARM	CRITICAL
101	IO3_RECVR_LOS	Line IO #3 receiver Loss-of-signal alarm	I/O ALARM	CRITICAL
102	IO3_RECVR_ALOS	Line IO #3 receiver Loss-of-analog-signal alarm	I/O ALARM	CRITICAL
103	IO3_RECVR_AIS	Line IO #3 receiver detected AIS alarm	I/O ALARM	CRITICAL
104	IO3_RECVR_RAI	Line IO #3 receiver detected RAI (yellow) alarm	I/O ALARM	CRITICAL
105	IO3_RECVR_MRAI	Line IO #3 receiver detected multi-framed RAI (yellow) alarm	I/O ALARM	CRITICAL

Table 33. Event Codes *(Continued)*

ID	EVENT NAME	DESCRIPTION	DEFAULT LED	SNMP TRAP LEVEL
106	IO3_RECVR_SEF	Line IO #3 receiver detected Severely Errored Frames	I/O ALARM	CRITICAL
107	IO3_RECVR_COFA	Line IO #3 receiver detected Change-of-Frame-Alignment alarm	I/O ALARM	CRITICAL
108	IO3_RECVR_MAIS	Line IO #3 receiver detected multi-framed AIS alarm	I/O ALARM	CRITICAL
109	IO3_RECVR_FEBE	Line IO #3 receiver detected E1 Far-End-Block-Errors alarm	I/O ALARM	INFORM
110	IO3_RECVR_LCV	Line IO #3 receiver detected Line-Code-Violation alarm	I/O ALARM	INFORM
111	IO3_RECVR_CRC	Line IO #3 receiver detected CRC alarm	I/O ALARM	INFORM
112	IO3_RECVR_FBIT	Line IO #3 receiver detected Frame Bit Error	I/O ALARM	INFORM
113	IO4_RECVR_LOF	Line IO #4 receiver Loss-of-framing alarm	I/O ALARM	CRITICAL
114	IO4_RE CVR_LOS	Line IO #4 receiver Loss-of-signal alarm	I/O ALARM	CRITICAL
115	IO4_RECVR_ALOS	Line IO #4 receiver Loss-of-analog-signal alarm	I/O ALARM	CRITICAL
116	IO4_RECVR_AIS	Line IO #4 receiver detected AIS alarm	I/O ALARM	CRITICAL
117	IO4_RECVR_RAI	Line IO #4 receiver detected RAI (yellow) alarm	I/O ALARM	CRITICAL
118	IO4_RECVR_MRAI	Line IO #4 receiver detected multi-framed RAI (yellow) alarm	I/O ALARM	CRITICAL
119	IO4_RECVR_SEF	Line IO #4 receiver detected Severely Errored Frames	I/O ALARM	CRITICAL
120	IO4_RECVR_COFA	Line IO #4 receiver detected Change-of-Frame-Alignment alarm	I/O ALARM	CRITICAL
121	IO4_RECVR_MAIS	Line IO #4 receiver detected multi-framed AIS alarm	I/O ALARM	CRITICAL
122	IO4_RECVR_FEBE	Line IO #4 receiver detected E1 Far-End-Block-Errors alarm	I/O ALARM	INFORM
123	IO4_RECVR_LCV	Line IO #4 receiver detected Line-Code-Violation alarm	I/O ALARM	INFORM
124	IO4_RECVR_CRC	Line IO #4 receiver detected CRC alarm	I/O ALARM	INFORM
125	IO4_RECVR_FBIT	Line IO #4 receiver detected Frame Bit Error	I/O ALARM	INFORM
126	DIG_REM_LOOPBACK	For EIA-530, local radio is in remote loopback mode	NONE	INFORM

Table 33. Event Codes *(Continued)*

ID	EVENT NAME	DESCRIPTION	DEFAULT LED	SNMP TRAP LEVEL
127	SERV_REM_LOOPBACK	For EIA-530, local radio (as remote server) is serving remote loopback mode	NONE	INFORM
128	BAD_CLKMODE	Line framers detected bad clock mode configuration	NONE	INFORM
129	REDUNDANT_SWITCH	Switchover has occurred	NONE	INFORM
130	IF_SYNTH_LOCK	Intermediate Frequency (IF) synthesizer out of lock	TXALARM RXALARM	CRITICAL
131	OPT_FPGA_LOAD	Option Card Field Programmable Gate Array loading error	NONE	INFORM
132	USER_RDNT_SWITCH	User-initiated switchover has occurred.	NONE	INFORM
133	USER_LOGIN	User has logged into radio	NONE	INFORM
134	USER_LOGOUT	User has logged out of radio	NONE	INFORM
135	REM_ALARM_IN1	Remote Alarm Indication #1	ALARM	CRITICAL
136	REM_ALARM_IN2	Remote Alarm Indication #2	ALARM	CRITICAL
137	REM_ALARM_IN3	Remote Alarm Indication #3	ALARM	CRITICAL
138	REM_ALARM_IN4	Remote Alarm Indication #4	ALARM	CRITICAL
139	ODW_ALERT	Alert signal from orderwire	NONE	INFORM
140	REDUNDANT_ACTIVE	LEDR station is operating in redundant (protected) mode	NONE	INFORM
141	RX_TX_SPLIT_ERR	Error detected in RX/TX frequency split	RXALARM	CRITICAL
142	IO1_TAIS	RF Receiver AIS for IO #1	I/O ALARM	CRITICAL
143	IO2_TAIS	RF Receiver AIS for IO #2	I/O ALARM	CRITICAL
144	IO3_TAIS	RF Receiver AIS for IO #3	I/O ALARM	CRITICAL
145	IO4_TAIS	RF Receiver AIS for IO #4	I/O ALARM	CRITICAL

18.0 IN CASE OF DIFFICULTY...

GE MDS products are designed for long life and trouble-free operation. However, this equipment, as with all electronic equipment, may have an occasional component failure. The following information will assist you in the event that servicing becomes necessary.

18.1 TECHNICAL ASSISTANCE

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

Phone: 585 241-5510 E-Mail: TechSupport@GEmds.com

FAX: 585 242-8369 Web: www.GEmds.com

18.2 FACTORY SERVICE

Component level repair of this equipment is not recommended in the field. Many components are installed using surface mount technology, which requires specialized training and equipment for proper servicing. For this reason, the equipment should be returned to the factory for any PC board repairs. The factory is best equipped to diagnose, repair and align your radio to its proper operating specifications.

If return of the equipment is necessary, you must obtain a Service Request Order (SRO) number. This number helps expedite the repair so that the equipment can be repaired and returned to you as quickly as possible. Please be sure to include the SRO number on the outside of the shipping box, and on any correspondence relating to the repair. No equipment will be accepted for repair without an SRO number.

SRO numbers are issued online at **www.GEmds.com/support/product/sro/**. Your number will be issued immediately after the required information is entered. Please be sure to have the model number(s), serial number(s), detailed reason for return, "ship to" address, "bill to" address, and contact name, phone number, and fax number available when requesting an SRO number. A purchase order number or pre-payment will be required for any units that are out of warranty, or for product conversion.

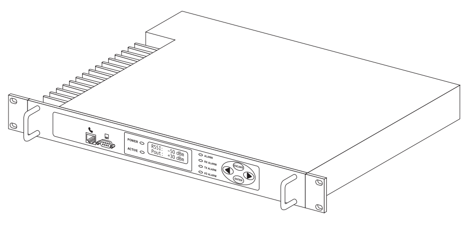
If you prefer, you may contact our Product Services department to obtain an SRO number using one of the following methods:

Phone Number: 585-241-5540
Fax Number: 585-242-8400
E-mail Address: productservices@GEmds.com

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

GE MDS, LLC
Product Services Department
(SRO No. XXXX)
175 Science Parkway
Rochester, NY 14620 USA

When repairs have been completed, the equipment will be returned to you by the same shipping method used to send it to the factory. Please specify if you wish to make different shipping arrangements. To inquire about an in-process repair, you may contact our Product Services Group using the telephone, Fax, or E-mail information given above.



GLOSSARY

AIS—Alarm Indication Signal. Indicates all ones are being sent or received.

AMI—Alternate Mark Inversion. A bipolar format where consecutive marks (ones) have the polarity inverted. Spaces (ones) are represented by zero volts. This technique prevents long sequences of positive or negative voltages.

Analog—Signals with a continuously varying amplitude, such as the human voice.

BERT—Bit-error rate test. The results of a BERT are normally expressed as a ratio (power of 10) of the number of bits received in error compared to the total number received.

BER—Bit-error rate. See also *BERT*.

Bit—Binary digit. The smallest unit of digital data, often represented by a one or a zero. Eight bits usually comprise a byte.

bps—Bits-per-second. A measure of the information transfer rate of digital data across a communication channel.

BSLIP—Bit Slip. Protocol that allows a bit to be added or deleted without causing a reframe sequence. Applies principally to Dutch PTT National applications.

Byte—A digital "word" usually made up of eight bits.

cas—Channel Associated Signalling.

CPE—Customer premise (provided) equipment.

dBi—Decibels of gain relative to an isotropic radiator. (A hypothetical antenna which radiates equally in all directions.) Used to express antenna gain.

dBm—Decibels relative to one milliwatt. An absolute unit used to measure signal power, as in transmitter power output, or received signal strength.

DTR—Data Terminal Ready. A control signal sent from the radio indicating that it is ready to transmit data.

DCE— Data (circuit terminating) Communications Equipment. In data communications terminology, this is the "modem" side of a computer-to-modem connection. The transceiver is a DCE device which is designed to connect to a DTE device.

Decibel (dB)—A measure of the ratio between two signal levels. Frequently used to express the gain or loss of a system.

DSP—Digital Signal Processing. A processing technique that uses software algorithms to filter, shape, or otherwise modify the characteristics of a given signal. In the LEDR radio, DSP is used primarily in modulation and demodulation functions.

E1—An international telephony standard that operates at 2.048 megabits-per-second (Mbps). This transmission speed is commonly used throughout the world except for North America (which uses T1 1.544 Mbps). Framed E1 consists of 30 digitized telephone channels and two 64 Kbps control channels.

EIRP—Effective Isotropic Radiated Power. Commonly used to express the power radiated from a gain antenna. It is equal to the power transmitted (minus feedline loss) plus the antenna gain.

Fade Margin—The maximum tolerable reduction in received signal strength which still provides an acceptable signal quality. This compensates for reduced signal strength due to multipath, slight antenna movement or changing atmospheric losses. Expressed in decibels.

fas—Frame Alignment Sequence.

FEC—Forward Error Correction. Extra data is added to the transmitted signal to allow for detection and correction of some transmission errors.

Frame—A segment of data that adheres to a specific data protocol and contains definite start and end points. It provides a method of synchronizing transmissions.

Fresnel Zone—A point of maximum width or girth of the transmitted radio signal. Obstructions in this region (the "first Fresnel zone") can have a detrimental effect on reception quality. As a general rule, 60 percent of the first Fresnel zone should be free of obstructions in a well designed system. (Additional considerations are also required when planning a microwave path.

G.703—The ITU standard defining the characteristics of digital interfaces (pulse shape, voltage levels, etc.). This applies to high-speed, three-level data being sent over coaxial or twisted pair lines.

G.821—The ITU standard by which data transmission quality is measured. The analysis considers available vs. unavailable time.

Half-Power Beamwidth—The customary way of measuring the width of a directional antenna's radiation pattern. This beamwidth is measured in degrees between the half-power points (the point at which the power is reduced 3 dB with respect to the main beam).

HDB3—High density bipolar order of 3. A line interface standard for E1 transmission that employs coding to eliminate data streams with four or more consecutive zeros.

Hitless Switching Operation—Refers to the practice of switching between receive signal paths without introducing bit errors or timing slips. This feature is required for space or frequency diversity applications.

Hot-Standby—Refers to a state of the inactive (standby) transceiver in a Protected or Redundant configuration. In a Hot Standby configuration, the standby transceiver is actively transmitting.

ITU—International Telecommunications Union.

kbps—Kilobits-per-second.

Linecode—Refers to the data coding format used by the radio for the line interface. (It does not pertain to the radio's modulation coding.) The available linecode selections are HDB3 and AMI.

Mbps—Megabits-per-second.

MIB—Management Information Base. The MIB stores SNMP messages that are directed to the management console. This can include Server events, statistical data and system queries.

Multipath Fading—Signals arriving at the receiver out of phase which have a tendency to cancel each other. It is caused by reflections of the transmitted wave and results in distortion at the receiver or weak received signal strength.

Multiplexer—A signal processing unit that combines multiple streams of data into one for transmission across a single data channel.

NMS—Network Management System. A software application used to configure, diagnose and monitor a communication network. The LEDR radio's SNMP program is an example of an NMS.

Protected Radio—A radio configuration where there are redundant modules that automatically become active in the event of a failure.

Protected Operation—Refers to the practice of providing redundant transmit and receive signal paths through the radio (antenna to customer payload interface) so that no single point of failure in a single radio will interrupt the link. This feature is also referred to as 1+1 Operation and is usually provided by operating the system using Hot Standby.

PSC—Protected Switch Chassis. Chassis holding data and RF control/switch circuitry in a redundant/protected configuration.

QAM—Quadrature Amplitude Modulation. Uses phase shifts and amplitude changes to send high-speed data in a comparatively narrow RF channel. See also *QPSK*.

QPSK—Quadrature Phase Shift Keying. Uses four levels of phase shift to send high-speed data with a higher system gain than QAM modulation. See also *QAM*.

Redundant Switching—Refers to the practice of switching between transmit signal paths when a fault condition occurs on the currently active radio.

rai—Remote Alarm Indication. Sometimes referred to as “yellow” alarm.

RSSI—Received signal strength indication. Expressed in dBm.

SNMP—Simple Network Management Protocol. A common network management system (NMS) protocol used to monitor and control a communications network

SNR—Signal-to-noise ratio. Expressed in decibels (dB).

SWR—Standing Wave Ratio. A parameter related to the ratio between forward transmitter power and the reflected power from the antenna system. As a general guideline, reflected power should not exceed 10% of the forward power (2:1 SWR).

TFTP—Trivial File Transfer Protocol. A standard network protocol used to send and receive files between two devices.

GE MDS

Numerics

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QUICK START GUIDE

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7. Set TCP/IP settings to enable SNMP and/or Telnet Network Management (If required)

- Radio IP addresses are factory configured with a unique address based on the last three digits of the unit's serial number.
- Use **IP** command to change the IP address, set netmask, gateway and IP Port as necessary. In a protected radio, change the **RDNT** settings to match the user-assigned IP addresses.

8. Assign user configurable fields (as required)

Many items are user configurable, to ease customer use. These include, but are not limited to the following. See the **NMS** command description in the manual for more detail:

- Set user information fields using **INFO** command (Page 64).
- Set alarms and alarm mappings using the **ALARM** (Page 52) and **EVMAP** (Page 60) commands.
- Set alarm thresholds using the **THRESHOLD** command (Page 87).
- Set the SNMP community using the **SNMPCOMM** command (Page 84).
- Refer to this manual for other configuration settings.

9. Verify performance of the radio

The data performance and NMS should be verified before field installation. Use the **LOOPBACK** commands (Page 71) to verify data throughput. (See "BENCH TESTING OF RADIOS" on Page 127.)

10. Field-install the equipment

- Refer to the Installation section of this manual for detailed procedures.
- Ensure a path study has been conducted and that the radio path is acceptable.
- When installing antennas, use good quality, low loss coaxial cable. Keep cables as short as possible.
- Preset directional antennas in the direction of desired transmission/reception.
- Aim the station antennas for maximum RSSI, using the continuously-updated **RSSI** command (Page 83) at the front panel, or the **TREND** command (Page 90) available via the NMS.

11. Verify proper in-service operation by observing the LED display

- Refer to "Front Panel" on Page 11 for a description of the status LEDs.

12. Configure the SNMP Manager software

- Refer to the SNMP Handbook (Part No. 05-3532A01). (This manual is published by GE MDS in paper form, or may be downloaded from our web site at **www.GEmds.com**.

End of Quick Start Guide

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