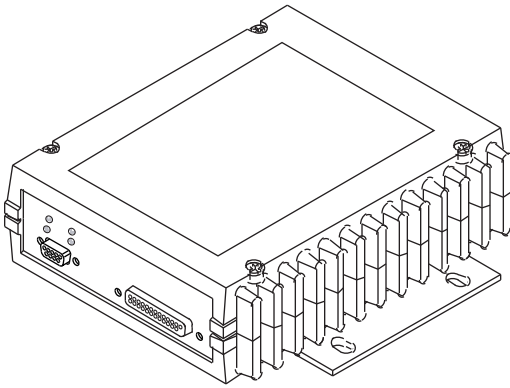


MDS LCT 450

Tri-Mode Data Transceiver



Supporting Phase 1 Units

MDS 05-4819A01, Rev. 08
MAY 2010



Digital Energy
MDS

OPERATIONAL & SAFETY NOTICES

RF Exposure



Concentrated energy from a directional antenna may pose a health hazard to humans. Do not allow people to come closer to the antenna than the distances listed in the table below when the transmitter is operating. More information on RF exposure can be found online at the following website:
www.fcc.gov/oet/info/documents/bulletins.

Antenna Gain vs. Recommended Safety Distance

Device complies with Power Density requirements at 20 cm separation:	No
Required separation distance for 5 dBi antenna (in meters):	1.6
Required separation distance for 10 dBi antenna (in meters):	2.8
Required separation distance for 16.5 dBi antenna (in meters):	6.0

Above data based on a 30-watt RF output level with a 100% duty cycle.

FCC Part 15 Notice

The transceiver is approved under Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation. Any unauthorized modification or changes to this device without the express approval of Microwave Data Systems may void the user's authority to operate this device. Furthermore, this device is intended to be used only when installed in accordance with the instructions outlined in this manual. Failure to comply with these instructions may void the user's authority to operate this device.

INTRODUCTION

This guide presents installation and operating instructions for the MDS LCT 450 Series wireless transceiver.

The transceiver ([Figure 1](#)) is designed to operate in Railroad Distributed Power applications. It is software-configurable to provide flexible operation in a variety of applications using one hardware platform. It employs microprocessor control and Digital Signal Processing (DSP) technology to provide robust communications even under adverse conditions.

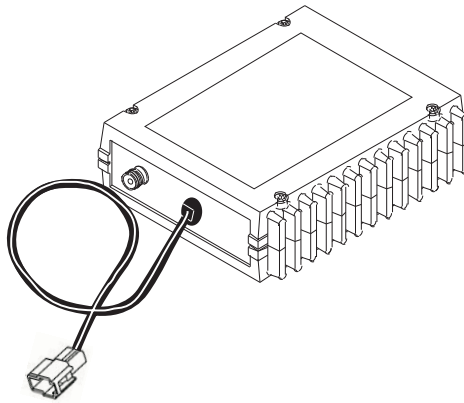


Figure 1. Data Transceiver

NOTE: Some features may not be available on all units, based on the options purchased and the applicable regulatory constraints for the region in which the radio will operate.

Front Panel Connectors

[Figure 2](#) and [Figure 3](#) show the interface connectors and indicators on the transceiver's front and rear panels. These items are referenced in the installation steps given later in this guide.

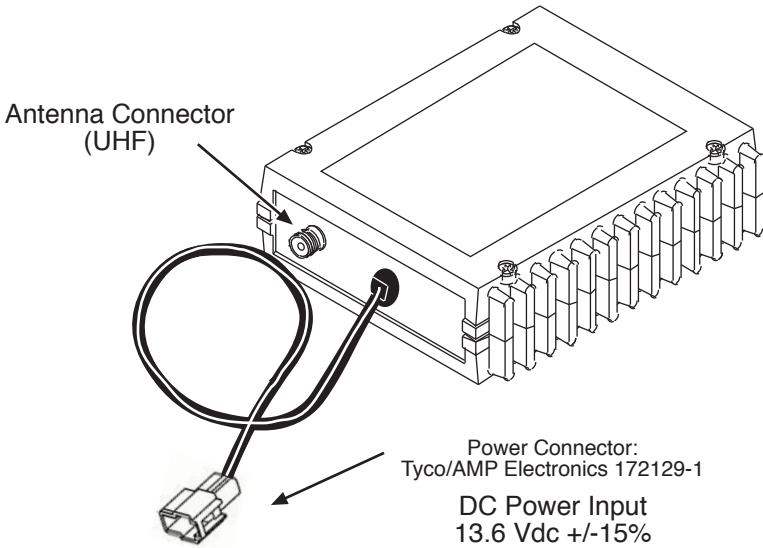


Figure 2. Antenna & DC Power Connectors

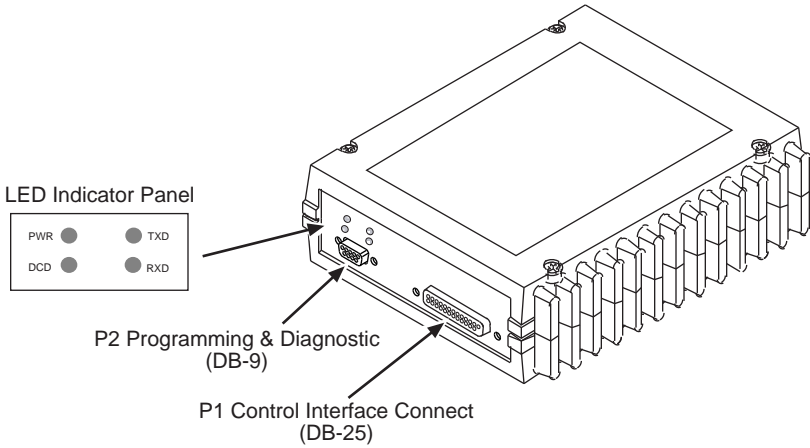


Figure 3. Data Interface Connectors & LED Status Panel

INSTALLATION

There are three main requirements for installing the transceiver as follows:

- Adequate and stable primary power
- An efficient and properly installed antenna system
- Correct data connections between the transceiver and the data equipment.

Figure 4 shows a typical station arrangement. This is followed by step-by-step procedures for installing the transceiver and making front and rear panel connections.

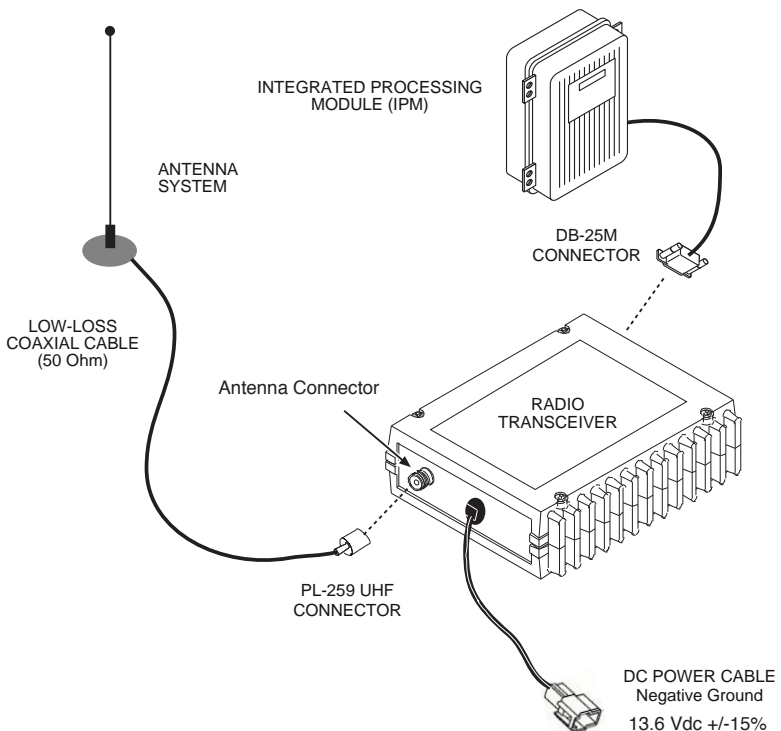


Figure 4. Typical Station Arrangement

Installation Steps

Below are the basic steps for installing the transceiver. Refer to [Figure 4](#) as necessary when making cable connections.

1. **Mount the transceiver to a stable surface** using the U-shaped bracket provided. Begin by attaching the radio's mounting bracket to the bottom of the transceiver case (if not already attached) using the four 6-32 x 1/4 inch (6 mm) screws supplied. [Figure 5](#) shows the transceiver mounting dimensions with bracket attached.

NOTE: To prevent moisture from entering the radio, do not mount the case with the cable connectors pointing up. Also, dress all cables to prevent moisture from running along the cables and into the radio.

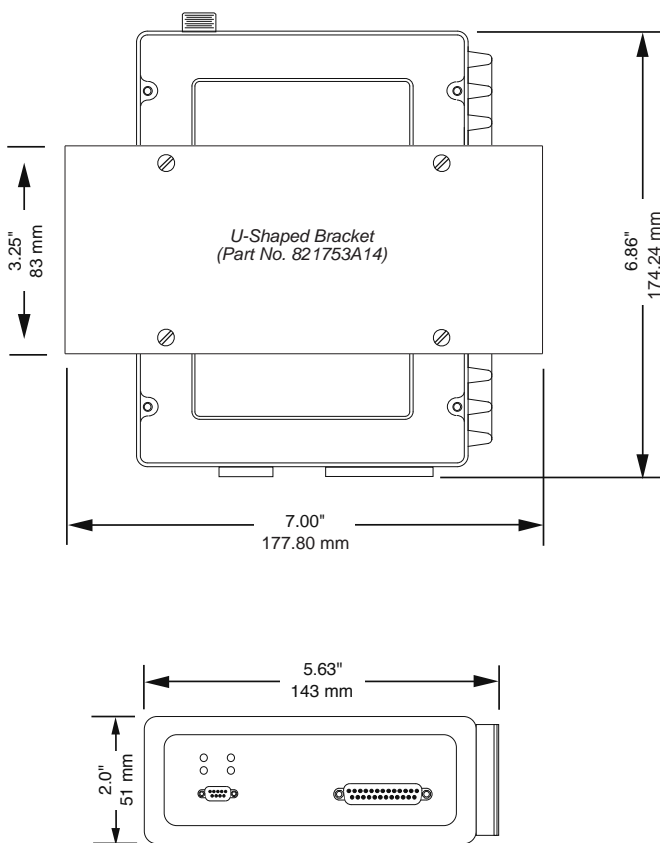


Figure 5. Transceiver Mounting Bracket Dimensions

CAUTION
POSSIBLE
EQUIPMENT
DAMAGE

Using screws longer than 1/4 inch (6 mm) to attach the bracket to the radio may damage the internal PC board. Use only the supplied screws.

2. **Install the antenna and feedline** for the station. The antenna used with the transceiver must be designed to operate in the radio's frequency band, and be mounted in a location that provides a clear path to the other associated station(s). Use low loss coaxial feedline and keep the cable as short as possible.
3. **Connect the data equipment** to the DATA INTERFACE connector. Check **P1 CONTROL INTERFACE** on **Page 24** for pin wiring details.

NOTE: The radio's P2 port is used for entering configuration commands and reprogramming the radio's firmware.

4. **Connect primary power to the transceiver.** Power applied must be 13.6 Vdc (+/- 15%) and capable of providing at least 8 Amperes of continuous current. A power connector with is provided with each unit (see **Figure 4**).

CAUTION
POSSIBLE
EQUIPMENT
DAMAGE

The transceiver is designed for use with negative-ground systems only. The power supply should be equipped with overload protection (NEC Class 2 rating), to protect against a short circuit between its output terminals and the radio's power connector.

This completes the installation of the transceiver.

SOFTWARE COMMANDS

Table 1 lists software commands commonly used during configuration of the transceiver. In many cases, no changes or settings will be required, as the radio is typically supplied ready for operation from the factory. These commands are provided in the event future changes are needed, or to facilitate troubleshooting of the unit.

These commands require a PC to be connected to the transceiver as explained in the following steps:

1. Connect a PC to the transceiver's P2 connector as shown in **Figure 6**. If desired, a connecting cable may be assembled using the information shown on **Page 26**.

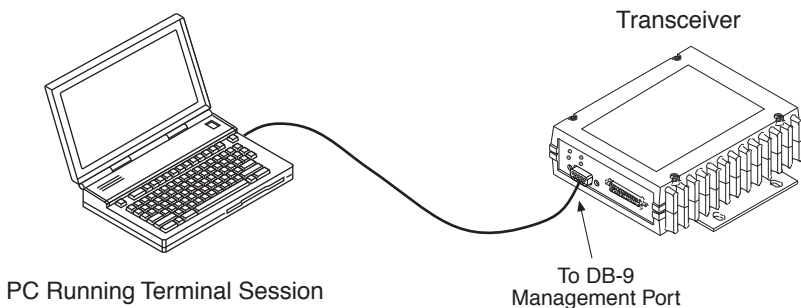


Figure 6. PC Configuration Setup

2. Launch a terminal communications program, such as HyperTerminal (included with most Windows™ systems). Data parameters are 8 data bits, no parity, and 1 stop bit (8N1). Data rate is determined by autobaud, but 1115200 bps is the preferred speed.
3. Press the **ENTER** key a few times (at half-second intervals) to obtain the ready “>” prompt on the screen. Commands may now be entered from the keyboard.

Table 1. Command Summary

Command Name	Function
ALARM	Alarm Summary
AMASK	Alarm Mask
AUDIO	Audio Monitor/Orderwire Status
BOOT	Reboot Radio
CHAN	Channel commands (RX/TX frequency, RF power, bandwidth)
CKEY	Key TX Continuously (Digital Only)
DATAKEY	Key on Data Activity
DUMP	Read Current Unit Profile
EMP	Modem TX Audio Pre-Emphasis
FSET	Receive or Transmit frequency mini/max value

Table 1. Command Summary (Cont'd)

Command Name	Function
HELP	User Help
HREV	Display Hardware Revision
INIT	Initialize EEPROM Defaults
MODE	Radio Mode
MODEL	Model Number Information
MTYPE	Modem Family Type
OPT, OPTION, OPTIONS	Display Authorized Options
OWM	Owner's Message
OWN	Owner's Name
PROG	Program
PWRL, PWRM, PWRH, PWRRXH	Power Lo (5W), Medium (20W), Hi (25), Extra-High (30W)
PTT	Push-to-Talk Delay
REF	Reference Frequency
RSSI	Received Signal Strength Indicator
RXTOT	Loss of RX Data Alarm Time
SER	Radio's Serial Number
SHOW	Show Power Settings
SPECTRUM	Internal Spectrum Analyzer
SQUELCH	Squelch Operation
SREV	Software/Firmware Revision Level
STAT	Alarm Status
TEMP	Internal Temperature
TOT	TX Timeout-Timer
VERSION	Firmware Version

DETAILED USER COMMANDS

The commands in this section may be used in two ways. First, you can type only the command name to view the currently programmed data. Secondly, you can set or change the existing data by typing the command, followed by a space, and then the desired entry. In the list below, allowable programming variables, if any, are shown in brackets following the command name.

ALARM

Alarm Summary

The **ALARM** command displays a summary of the radio's current operating condition. An eight-digit code will be presented which can be decoded as described in “Major Alarms vs. Minor Alarms”.

AMASK [0000 0000-FFFF FFFF]

Alarm Mask

The **AMASK** command displays or sets which events cause an alarm output signal to be active. Normally, the mask is **FFFF FFFF**, meaning that any of the 32 possible events will activate the alarm output signal. Entering the **AMASK** command alone displays the current setting of alarm events in hexadecimal format. Entering the **AMASK** command followed by an eight-digit hexadecimal number reprograms the specified events to trigger an alarm. The eight-digit hexadecimal number used as the command parameter specifies 0 to 32 events that can trigger the external alarm output. The hex value for the mask corresponds to the hex value for the **STAT** command. Each bit that is a '1' identifies an alarm condition that can trigger the external output. For more information on configuring the alarm response, contact GE MDS.

ASENSE [HI/LO]

Alarm Sense

The **ASENSE** command sets or displays the sense of the alarm output at Pin 6 of the COM2 port. Entering the **ASENSE** command alone shows whether the alarm output is active high or low. Entering the **ASENSE** command followed by **HI** or **LO** resets the alarm output to active high or low.

AUDIO [ON/OFF]

Audio Monitor/Orderwire Status

Used to set or display Audio Monitor/Orderwire functionality (on or off)

BOOT [1, 2, OTHER]

Reboot Radio

Used to reboot to selected image or current image if no image specified.

CHAN [0-8, ALL]

[RXFREQ xxx.xxxx] (MHz)

[TXFREQ xxx.xxxx] (MHz)

[PWR [5, 20, 25, 30] (Watts)

[BW [12.5, 25] (kHz)

Channel Mods...

If only the first argument is given, then it displays the channel(s) parameters. If a third (or greater) argument is given, then that channel will have its parameters changed.

CKEY [ON/OFF] - *Digital Only*

Key TX Continuously

The **CKEY** command enables or disables the continuously keyed function of the radio. When **CKEY** is set to **ON**, the radio is continuously keyed and the Timeout Timer is disabled.

CTS [0-255]

Clear-to-Send Time

The **CTS** (clear-to-send) command selects or displays the timer value associated with the CTS line response. The command parameter ranges from **0** to **255** milliseconds.

For DCE operation, the timer specifies how long to wait after the RTS line goes high, before the radio asserts CTS and the DTE can transmit the data. A CTS value of zero keys the radio and asserts the CTS line immediately after the RTS line goes high.

For CTS Key operation (see **DEVICE** command), the timer specifies how long to wait after asserting the CTS, before sending data out the DATA INTERFACE port. A timer value of zero means that data will be sent out the data port without imposing a key-up delay. (Other delays may be present based on selected radio operating parameters.)

CTSHOLD [0-60000]

Clear-to-Send Hold Time

Used in **DEVICE CTS KEY** mode, this command sets the amount of time in milliseconds that CTS remains present after transmission of the last character out the RXD pin of the DATA port. This “hold time” can be used to prevent squelch tail data corruption when communicating with other radios.

The **CTSHOLD** setting can range from **0** to **60000** ms (i.e., 60 seconds). The default value is **0**, which means that CTS will drop immediately after the last character is transmitted. If the command is entered when the radio is in **DEVICE DCE** mode, the response **CTSHOLD N/A** is displayed.

DATAKEY [ON/OFF]

Key on Data Activity

The **DATAKEY** command enables or disables the ability of the radio to key the transmitter as data is received at the DATA INTERFACE connector. Asserting RTS keys the radio regardless of this command setting.

If **DATAKEY** is set to **ON**, the radio will key when a full data-character is received at the transceiver's DATA INTERFACE connector. If **DATAKEY** is set to **OFF**, the radio needs to be keyed by asserting RTS.

DEVICE [DCE, CTS KEY]

Data Device Mode

The **DEVICE** command controls or displays the device behavior of the radio. The command parameter is either **DCE** or **CTS KEY**.

In DCE mode (the default setting), CTS will go high following RTS, subject to the CTS programmable delay time. If the **DATAKEY** command is set to **ON**, keying can be stimulated by the input of characters at the data port. Hardware flow control is implemented by signaling the CTS line if data arrives faster than it can be buffered and transmitted.

In **CTS KEY** mode, the radio is assumed to be controlling another radio. It will still key based on the RTS line, but the CTS line is used as a key-line control for the other radio. CTS is asserted immediately following the receipt of RF data, but data will not be sent out the DATA INTERFACE port until after the CTS programmable delay time has expired. (This gives the other radio time to key.)

DUMP

Read Current Unit Profile

This command causes all of the programmed settings to be displayed.

EMP [ON/OFF]

Modem TX Audio Pre-Emphasis

This command displays or sets the TX pre-emphasis and RX De-Emphasis when the radio is operating with the analog mode and the radio's modem is turned off (**MODEM NONE**). It should be set to match the other radios in the system. The use of pre and de-emphasis can help reduce the detrimental influence of high frequency audio noise.

FSET

Receive or transmit frequency min/max value

HELP

User Help

Show available commands.

HREV

Display hardware revision

INIT

Initialize EEPROM Defaults

The INIT command is used to re-initialize the radio's operating parameters to the factory defaults. This may be helpful when trying to resolve configuration problems that may have resulted from the entry of one or more improper command settings. If you are unsure of which command setting may have caused the problem, this command allows you to get back to a known working state. The following changes to the radio are made when **INIT** is entered:

- **CTS** is set to **0**
- **DATAKEY** is set to **ON**
- **DEVICE** is set to **DCE**
- **PTT** is set to **0**
- **SCD** is set to **0**
- **TOT** is set to **30** seconds and set to **ON**
- **PWR** is set to **+37 dBm** (5 watts)

All other commands remain as previously set.

MODE [NORMAL, TEST]

Radio Mode

This command puts the radio into a **TEST** or **NORMAL** mode. In the test mode, it disables the radio from looking at the hardware channel select lines and automatically selects Channel 0.

MODEL, MODEL1, MODEL2

Model Number Information

MTYPE [SD | X710_AE | X710_B | LOOPBACK]

Modem Family Type

OPT, OPTION, OPTIONS

Display Authorized Options

OWM [XXX...]

Owner's Message

This is a command to display or program an owner's message. To program the owner's message, type **OWM** then the message, followed by an ENTER keypress.

To display the owner's message, type **OWM**, followed by an ENTER keypress. The owner's message appears on the display.

OWN [XXX...]

Owner's Name

This is a command to display or program an owner's name. To program the owner's name, type **OWN** then the name, followed by ENTER.

To display the owner's name, type **OWN** then ENTER. The owner's name appears on the display.

PROG

Program

The **PROG** command used for serial reprogramming - spoof entry into the bootloader.

PROGRAM

Program

The **PROGRAM** command spoofing MDS x710 bootloader program command to start serial reprogramming. Erases and programs inactive image via serial port with xon/xoff flow control. Returns when complete. If successful active image is switched. Only valid after program or prog command at **LOADER>** prompt. Used for serial reprogramming.

PWRL [0-30], PWRM [0-30], PWRH [0-30], PWRXH [0-30]

Sets Power Level

This command sets the power level value for this name. This name is used for the power calibration command (CPWR). PWRL defaults to 5 watts, PWRM defaults to 20, PWRH is 25 and PWRXH is 30 watts.

PTT [0-255]

Push-to-Talk Delay

This command sets or displays the key-up delay in milliseconds. This timer specifies how long to wait after the radio receives a key signal, before actually keying the radio.

REF [xxxxx]

Reference Frequency

RSSI

Received Signal Strength Indicator

This command continuously displays the radio's Received Signal Strength Indication (RSSI) in dBm units, until you press the Enter key. Incoming signal strengths from -50 dBm to -120 dBm can be read.

NOTE: The RSSI samples the incoming signal for one to two seconds before providing an average reading to the connected PC.

RTU [ON/OFF/0-80] Digital Only

RTU Emulator

This command enables or disables the radio's internal RTU simulator, which runs with proprietary factory polling programs such as **poll.exe** and **rsim.exe**. The internal RTU simulator is available whenever a radio has diagnostics enabled. This command also sets the RTU address that the radio will respond to.

The internal RTU can be used for testing system payload data or pseudo bit error rate testing. It can be helpful in isolating a problem to either the external RTU or the radio.

RXTOT [NONE, 1-255]

Loss of RX Data Alarm Time

The **RXTOT** command selects or displays the receive time-out timer value in minutes. This timer triggers an alarm (Event 12) if data is not detected within the specified time.

Entering the **RXTOT** command without a parameter displays the timer value in minutes. Entering the **RXTOT** command with a parameter ranging from **0** to **255** resets the timer in minutes. Entering the **RXTOT** command with the parameter **NONE** disables the timer.

SCD [0-255]

Soft-Carrier Dekey

This command displays or changes the soft-carrier dekey delay in milliseconds.

This timer specifies how long to wait after the removal of the keying signal before actually releasing the transmitter. A value of **0** milliseconds will unkey the transmitter immediately after the removal of the keying signal.

SER

Radio's Serial Number

This command displays the radio's serial number as recorded at the factory.

SHOW [DC, PORT, PWR]

Show Power Settings

The **SHOW** command displays different types of information based on the command variables. The different parameters are:

- **DC**-Display DC input/output voltages
- **PWR**-Display RF power output

SPECTRUM [xxx.xx]

Internal Spectrum Analyzer

Activates the built-in spectrum analyzer tool (see [Figure 8](#)) that can be displayed on a connected PC. This tool is helpful in diagnosing interference problems on or near your channel frequency.

Access the spectrum analyzer by entering `spectrum` at the command prompt. A display appears showing detected signals on your current channel.

Optionally, you can specify a frequency at the command prompt to view the surrounding spectrum of that frequency. To do this, enter `spectrum xxx.xx`, where `xxx.xx` is the frequency in MHz.

A typical spectrum analyzer display is shown in **Figure 8**. The display creates a received signal strength indication (RSSI) vs. frequency plot for the frequency and surrounding signals. By analyzing the display, you can determine the presence of other signals near the transceiver's operating frequency. This information can be helpful in troubleshooting interference problems.

SQUELCH [AUTO, BYPASSED]

Squelch Operation

Set or display analog squelch bypass.

SREV

Software/Firmware Revision Level

This command displays the software revision level of the transceiver firmware.

STAT

Alarm Status

This command displays the current alarm status of the transceiver.

If no alarms exist, the message **NO ALARMS PRESENT** appears.

If an alarm does exist, a two-digit code (**00-31**) is displayed and the alarm is identified as “Major” or “Minor.” A brief description of the alarm code is also given.

TEMP

Internal Temperature

This command displays the internal temperature of the transceiver in degrees Celsius.

TOT [1-255, ON, OFF]

TX Timeout-Timer

This command sets or displays the transmitter Time-out Timer value (1-255 seconds), as well as the timer status (**ON** or **OFF**). If the timer is on, and the radio remains keyed for a longer duration than the **TOT** value, the transmitter is automatically unkeyed.

When this happens, the radio must be commanded back to an unkeyed state before a new keying command is accepted. The default timer value is **30** seconds.

VERSION

Firmware Version

Displays package version information for each firmware image.

RADIO TESTS & TEST MODE COMMANDS

The following are checks and settings that can be performed by a technician to ensure optimal performance of the radio. For most tests, it will be necessary to connect a PC to the radio as described in [SOFTWARE COMMANDS on Page 5](#).

Antenna System SWR Check

SWR is 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 ($\approx 2:1$ SWR). A high SWR may result in decreased performance, and should be corrected.

The transceiver's **TXD/RXD** LEDs will light when the SWR is too high. Actual SWR can be measured by connecting a reflected power meter, such as a Bird Model 43™ directional wattmeter with the proper element installed, between the transceiver and the antenna system. Use the **KEY/DEKEY** commands described below to control the transmitter during these tests. Test transmissions should be kept as brief as possible.

If the results are normal, record them for comparison during future routine preventative maintenance. Abnormal readings indicate a possible trouble with the antenna or the transmission line that will need to be corrected. Look for cable damage, poor connections, or improper positioning of the antenna (such as having the antenna whip too close to a metal surface).

Over-Temperature Check

If the transmitter is approaching an out-of-tolerance temperature condition, an error code is issued (see [Table 3](#)) and the PWR lamp will flash. Further operation may be inhibited. Over-temperature conditions should be investigated and resolved before further use of the radio.

To read the actual internal temperature of the radio (in degrees Celsius), the **TEMP** command may be issued from a PC. Excessive temperatures may be caused by inadequate ventilation of the transceiver case, or operating the unit beyond its rated duty cycle (see “[SPECIFICATIONS](#)” on [Page 26](#)).

Test Mode Commands

The following commands may be used by a technician to test the radio or to make advanced setting changes during installation and maintenance activities.

BW [xxxxx]

Channel Bandwidth

This command displays the current bandwidth or sets the modem bandwidth for channel 0. This command also sets the appropriate deviation for this bandwidth.

CHAN [0-8, ALL]

[RXFREQ xxx.xxxx] (MHz)

[TXFREQ xxx.xxxx] (MHz)

[PWR [5, 20, 25, 30]] (Watts)

[BW [12.5, 25]] (kHz)

Channel Mods...

If only the first argument is given, then it displays the channel(s) parameters. If a third (or greater) argument is given, then that channel will have its parameters changed.

DKEY

Unkey Transmitter

This command deactivates the transmitter after it has been keyed with the **KEY** command.

KEY

TX Key

This command activates the transmitter. See also the **DKEY** command.

MODEM [xxxx]

Analog/Digital Modem Selection

This command selects the radio's modem characteristics. For digital operation enter **MODEM xxxx**, where **xxxx** equals the modem selection of the radio (**9600** or **19200**). For analog operation with an external modem, enter **NONE** for this parameter.

When the **MODEM** command is set to **NONE**, the analog TX Input and RX Audio outputs of the DATA INTERFACE will be used to interface with the connected external modem, and digital operation is disabled. These levels must be set to complement the audio signal level requirements of the external modem. See “RXLEVEL [-20 to 0]” and “TXLEVEL [-20 to 0, AUTO]” for details on setting these levels.

PWR [Watts]

NOTE: This function may not be available in all units, depending on certification requirements for a particular country.

TX RF Power Output Level

This command displays the current power level in watts or sets the desired RF forward output power setting for channel 0 of the radio. The **PWR** command parameter is specified in watts and its settings are **5, 20, 25, 30**. The default setting is **5** watts. To read the actual (measured) power output of the radio, use the **SHOW PWR** command.

RX [xxx.xxxx]

Receive Frequency

This command displays the current receive frequency or selects the radio's receive frequency (in MHz) for channel 0. The frequency step size is 6.25 kHz.

If the radio's frequency has not been programmed at the factory, a default frequency will be programmed in the radio near the center of the frequency band.

SELCHAN [0-8]

Select Channel

This command causes the radio to go to another channel when the radio is in **MODETEST**. It causes the radio to select appropriate RX and TX frequencies, power level and bandwidth for that channel.

TX [xxx.xxxx]

TX Frequency

This command displays the radio's transmit frequency in MHz or changes channel 0's transmit frequency. The frequency step size is 6.25 kHz.

If the frequency has not been programmed at the factory, a default frequency will be programmed in the radio near the center of the frequency band.

TROUBLESHOOTING

For proper operation, all radios in the network must meet these basic requirements:

- Adequate and stable primary power
- Secure connections (RF, data and power)
- A clear transmission path between stations
- An efficient antenna system providing adequate received signal strength.
- Proper programming of the transceiver's operating parameters
- The correct interface between the transceiver and the connected data equipment (correct cable wiring, proper data format, timing, etc.)

LED Indicators

The LED status indicators (Figure 7) are an important troubleshooting aid and should be checked whenever a problem is suspected. Table 2 describes the function of each status LED on the front panel of the radio.

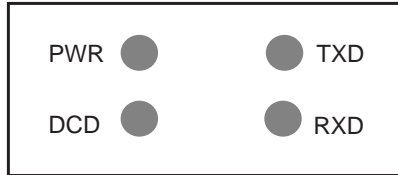


Figure 7. LED Indicators

Table 2. LED Status Indicators

LED Name	Description
PWR	<ul style="list-style-type: none"> • Continuous—Power applied, no problems detected. • Rapid flash (5 times-per-second)—Alarm indication.
TXD	Unit is transmitting.
RXD	Unit ready to receive data (not transmitting).
DCD	Message is being received.

Additional LED indications—for trouble conditions:

TXD/RXD lit: High Standing Wave Ratio (SWR). Check antenna system.

PWR lamp flashing: Over temperature (Observe duty cycle, ensure adequate ventilation)

Event Codes

When an alarm condition exists, the transceiver creates a code that can be read on a connected terminal. These codes can be helpful in resolving many system difficulties. Refer to Table 3 (Page 22) for a definition of the event codes.

Checking for Alarms—*STAT* command

To check for alarms, connect a terminal to the radio's P2 Programming & Diagnostic port. See **P2 PROGRAMMING & DIAGNOSTIC INTERFACE** on Page 26 for pinout information.

Enter **STAT** on the connected terminal. If no alarms exist, the message **NO ALARMS PRESENT** appears on the display.

If an alarm does exist, a two-digit alarm code (00–31) is displayed and the event is identified as a Major or Minor Alarm. A brief description of the alarm is also given.

Major Alarms vs. Minor Alarms

Major Alarms—report serious conditions that generally indicate a hardware failure, or other abnormal condition that will prevent (or seriously hamper) further operation of the transceiver. Major alarms generally indicate the need for factory repair. Contact your factory representative for assistance.

Minor Alarms—report conditions that, under most circumstances will not prevent transceiver operation. This includes out-of-tolerance conditions, baud rate mismatches, etc. The cause of these alarms should be investigated and corrected to prevent system failure.

Event Code Definitions

Table 3 contains a listing of event codes that may be reported by the transceiver. The codes shown are a subset of a larger pool of codes used for various GE MDS products. *For this reason, the table does not show a sequential listing of all code numbers.* Only the codes applicable to this product are shown.

Table 3. Event Codes

Event Code	Event Class	Description
01	Major	Improper software detected for this radio model.
04	Major	The RF synthesizer is reporting an out-of-lock condition.
08	Major	The system is reporting that it has not been calibrated. Factory calibration is required for proper radio operation.

Table 3. Event Codes (Cont'd)

Event Code	Event Class	Description
12	Major	Receiver time-out. No data received within the specified receiver time-out time.
13	Minor	A Transmitter timeout was detected. The radio stayed keyed longer than the duration specified by the TOT command.
17	Minor	A data parity fault has been detected on the PAYLOAD port. This usually indicates a parity setting mismatch between the radio and the customer equipment.
18	Minor	A data framing error has been detected on the PAYLOAD port. This may indicate a baud rate mismatch between the radio and the customer equipment.
26	Minor	The DC input voltage is out-of-tolerance. If the voltage is too far out of tolerance, operation may fail.
31	Minor	The transceiver's internal temperature is approaching an out-of-tolerance condition. If the temperature drifts outside of the recommended operating range, system operation may fail.

Internal Spectrum Analyzer

The radio contains a built-in spectrum analyzer tool (Figure 8) that can be displayed on a connected PC. The tool is helpful in diagnosing interference problems on or near your channel frequency.

Access the spectrum analyzer by entering **spectrum** at the command prompt. A display appears showing detected signals on your *current channel*.

Optionally, you can specify a frequency at the command prompt to view the surrounding spectrum of that frequency. To do this, enter **spectrum xxx.xx**, where **xxx.xx** is the frequency in MHz.

As shown in Figure 8, the display creates a received signal strength indication (RSSI) vs. frequency plot for the frequency and surrounding signals. By analyzing the display, you can determine the presence of other signals near the transceiver's operating frequency. This information can be helpful in troubleshooting interference problems.

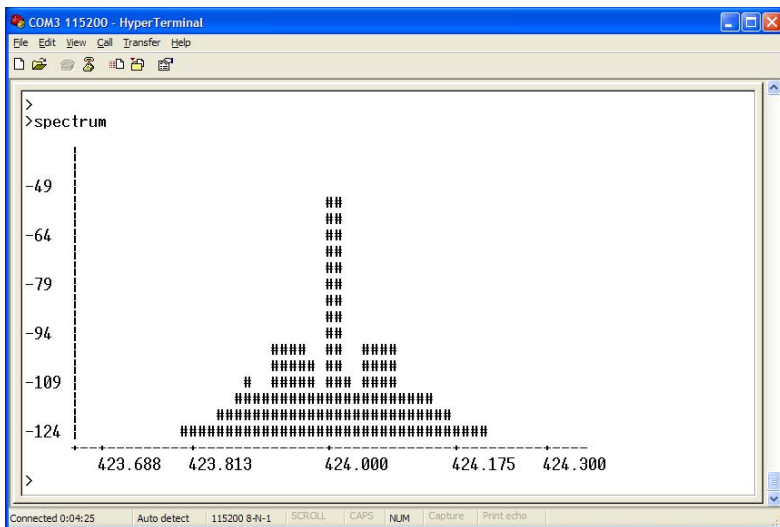


Figure 8. Internal Spectrum Analyzer Display

P1 CONTROL INTERFACE

Table 4 lists the pin functions on the P1 Control Interface connector.

Table 4. P1 Control Interface Pin Descriptions (DB-25)

Pin No.	Description
1	No connection (NC)
2	Audio Isolated Ground
3	No connection (NC)
4	Detected Audio
5	Channel Select 3 (see Note 1).
6	RXD+ (RS-485/422 digital). Output from radio.
7	PTT Keying signal (see Note 2)
8	RXD- (RS-485/422 digital) Output from radio.
9	No connection (NC)
10	No connection (NC)

Table 4. P1 Control Interface Pin Descriptions

11	Audio Isolated Ground
12	No connection (NC)
13	No connection (NC)
14	Channel Select 2 (See Note 1)
15	No connection (NC)
16	RS-485/422 Isolated Ground
17	TX Audio input to radio
18	Channel Select Isolated Ground
19	Channel Select 0 (Note 1)
20	No connection (NC)
21	PTT Isolated Ground
22	No connection (NC)
23	Channel Select 1 (Note 1)
24	TXD+ (RS-485/422 digital) . Input to radio.
25	TXD- (RS-485/422 digital) Input to radio.

Note 1:

Channel select decoding as follows: High = no connection; Low = Gnd. See table below for radio channel selections.

Note 2:

Provide low impedance path to ground to key transmitter.

Table 5. Channel Selection Table

Channel 3	Channel 2	Channel 1	Channel 0	Selected
High (future use)	High	High	High	1
High (future use)	High	High	Low	2
High (future use)	High	Low	High	3
High (future use)	High	Low	Low	4
High (future use)	Low	High	High	5
High (future use)	Low	High	Low	6
High (future use)	Low	Low	High	7
High (future use)	Low	Low	Low	8

P2 PROGRAMMING & DIAGNOSTIC INTERFACE

Table 4 lists the pin functions on the DB-9 DIAGNOSTIC INTERFACE connector.

Table 6. Diagnostic Interface Pin Descriptions (DB-9)

Pin No.	Description
1	No connection (NC)
2	RX Data
3	TX Data
4	No connection (NC)
5	Signal Ground
6	No connection (NC)
7	No connection (NC)
8	No connection (NC)
9	No connection (NC)

SPECIFICATIONS

GENERAL

Frequency Range*: 450–512 MHz

Number of Channels: 8

RECEIVER

Maximum Usable Sensitivity: 0.35 uV for 12 dB SINAD

Bandwidth: 12.5 kHz

Maximum Applied Signal: +28 dBm

TRANSMITTER

RF Carrier Power: 5 Watts to 30 Watts

Duty Cycle: 25%

Output Impedance: 50 Ω

Channel Spacing: 12.5, 25 kHz

FCC Emission Designators:

6.25 kHz B/W: 4K00F1D, 4K00F2D, 4K00F3D

12.5 kHz B/W:	9K30F1D, 9K30F2D, 9K30F3D
25.0 kHz B/W:	16K5F1D, 16K5F2D, 16K5F3D

DATA CHARACTERISTICS (P1 Control Interface Connect)

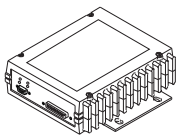
Payload Signaling Type:	CCITT V.23
Connector Types:	DB-25 Female
Payload Data Rate:	1200 bps

DATA CHARACTERISTICS (P2 Programming & Diagnostic Port)

Connector Type:	DB-9F
Signaling Standard:	RS-232

PRIMARY POWER

Voltage:	13.6 Vdc (+/- 15%) Negative-Ground Systems Only
TX Supply Current:	8 Amperes (Typical) @ 30 Watts Output
RX Supply Current:	<i>Operational</i> —125 mA, Nominal
Power Connection:	5-inch "pigtail" (14 AWG) with Tyco/AMP connector (Part No. 172129-1)
Fuse:	8-Ampere, internal





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