# MDS TD 220
## 217–222 MHz Data Transceiver

Start-Up Guide


***Firmware Release 1.x.x***

MDS 05-4818A01, Rev. 02
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DRAFT

GE MDS
industrial wireless networks

## 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 9 dBi antenna (in m): | 2.53 |

Above data based on a 30-watt 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 basic installation and operating instructions for the GE MDS TD 220 Series wireless transceiver.

The TD 220 operates in two bands and power levels:

- 25-Watts in the 220-222 MHz range
- 2-Watts in the 217-220 MHz range

The radio is a GMSK unit intended for bridging ITCS messages over the air between locomotives and wayside devices. The data interface is Ethernet, with UDP-encapsulated ITCS message payload.


**Figure 1. TD 220 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.

Each second is divided into 8 133-byte time slots. The first of the 8 timeslots each second is always reserved for bases to transmit beacon information to the mobiles in the area. Following the beacon are 4 (or 5) time slots that are always reserved for mobiles to transmit. At the end of each second, are 3 (or 2) time slots that can be used by bases or mobiles. These slots are used with the following priority: the previous base, the current base, and then mobiles. In other words, during second 1 in the table below, base A actually has priority over the last three slots. If A does not use them, B can use them. If B does not use them, mobiles can. Bases reserve these time slots with flags in the beacon. This scheme maximizes the potential for utilizing all slots.

| Second 0 | Second 1 | Second 2 | |
|---|---|---|---|
| A | B | C | <- Beacon slots always used by a specific base |
| M | M | M | <- Slots available for CW-based mobile transmissions |
| M | M | M | <- Slots available for CW-based mobile transmissions |
| M | M | M | <- Slots available for CW-based mobile transmissions |
| M | M | M | <- Slots available for CW-based mobile transmissions |
| C or A or M | A or B or M | B or C or M | <- Slots that can be used by one of two bases |
| C or A or M | A or B or M | B or C or M | <- Slots that can be used by one of two bases |
| C or A or M | A or B or M | B or C or M | <- Slots that can be used by one of two bases |

# DATA INTERFACES

## DB-25

Figure 10 shows the pin arrangement for the DB-25 DATA INTERFACE connector. Table 1 lists the pin functions and shows input/output data for the connector.

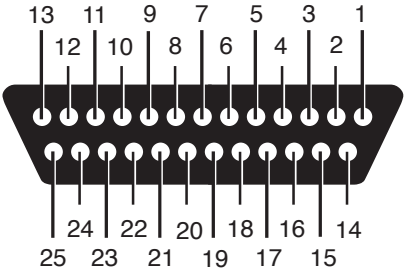



**Figure 2. DB-25 Pin Arrangement**
*(As viewed from outside the radio)*

**Table 1. Data Interface Pinouts**

| Pin No. | Signal Name and Description | Input/ Output |
|---|---|---|
| 1 | **COM3_DCD**—Reserved. | Input |
| 2 | **COM2_TXD**—Descriptive text to be supplied. | Input |
| 3 | **COM2_RXD**—Descriptive text to be supplied. | Output |
| 4 | **COM2_RTS**—Descriptive text to be supplied. | Input |

**Table 1. Data Interface Pinouts**

| | | |
|---|---|---|
| 5 | **COM2_CTS**—Descriptive text to be supplied. | Output |
| 6 | **COM3_TXD**—Reserved. | Output |
| 7 | **Ground**—Descriptive text to be supplied. | -- |
| 8 | **COM2_DCD**—Descriptive text to be supplied. | Output |
| 9 | **COM3_CTS**—Reserved. | Input |
| 10 | **COM3_RTS**—Reserved. | Output |
| 11 | **COM3_DTR**—Reserved. | Output |
| 12 | **COM3_RXD**—Reserved. | Input |
| 13 | **Ground**—Descriptive text to be supplied. | -- |
| 14 | **ETH_TX_H**—Descriptive text to be supplied. | Output |
| 15 | **ETH_TX_L**—Descriptive text to be supplied. | Output |
| 16 | **ETH_RX_H**—Descriptive text to be supplied. | Input |
| 17 | **ETH_RX_L**—Descriptive text to be supplied. | Input |
| 18 | **EXT_Key**—Reserved. | Output |
| 19 | **EXT_DET**—Reserved. | Input |
| 20 | **COM2_DTR**—Descriptive text to be supplied. | Input |
| 21 | **ALARM_OUT**—Reserved. | Output |
| 22 | **GPS_PPS_L**<br>For TTL PPS, leave this pin open. | Input |
| 23 | **GPS_PPS_H**<br>For TTL PPS, use this input. | Input |
| 24 | **COM1_RXD**—Descriptive text to be supplied. | Input |
| 25 | **COM1_TXD**—Descriptive text to be supplied. | Output |

## USB

The radio provides a USB Port conforming to version 1.1 of the USB standard. This port is provided for future features such as ITCS logging to text files on a memory stick. Consult GE MDS for information on this feature. The pinout for this connector is given in the table below.

**Table 2. USB Connector Pinouts**

| Pin | Signal Name | Description |
|---|---|---|
| 1 | PC_USB_+5V | +5 VDC |
| 2 | USBD- | USB Data Minus |
| 3 | USBD+ | USB Data Plus |
| 4 | GROUND | Chassis Ground |

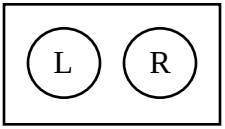
## Power

The power connector is a screw-secured 2-pin connector.

**Table 3. Power Connector Pinouts**

| Pin | Signal Name | Input/Output | Description |
|---|---|---|---|
| 1 (Left) | PWR | Input | 13.8 Vdc input, 7A maximum |
| 2 (Right) | GROUND | Input | Power return |

The pin orientation (as looking into the connector) is shown below.




The following table shows how much current is required for receiving or transmitting vs. input voltage and RF power output.

**Table 4. Current/Voltage Requirements vs. RF Output**

| Voltage (Vdc) | RF Output (W) | Current Required (A) |
|---|---|---|
| **12** | **0 (RX)** | **TBSL** |
| **12** | **2** | **TBSL** |
| **12** | **10** | **TBSL** |
| **12** | **25** | **TBSL** |

**Table 4. Current/Voltage Requirements vs. RF Output**

| Voltage (Vdc) | RF Output (W) | Current Required (A) |
|---|---|---|
| 13.8 | 0 (RX) | TBSL |
| 13.8 | 2 | TBSL |
| 13.8 | 10 | TBSL |
| 13.8 | 25 | TBSL |

### Antenna Connector

The Antenna Connector is a Type-N female connector with 50-Ohm characteristic impedance.

## Common Setup Tasks

### Key the Transmitter for Test Purposes

1. Log in to the radio on its COM1 console using a serial terminal emulator program.
2. Go to the Radio Configuration menu.
3. Select the frequency for the test transmission.
4. Select the RF Output Power to use. Note that power levels greater than 2 Watts will timeout after a 5-second period by default. Ensure ventilation with supplemental forced airflow if longer durations are desired.
5. Select the Force TX Key menu option.
6. When finished, deselect the Force TX Key menu option.

### Prepare the Network Interface for a Radio

Each radio is assigned an IP Address, a Netmask, and a Gateway IP Address. The IP Address and Netmask should be chosen carefully. The radio will network directly with other equipment with IP Addresses that are on a common Subnet. IP Addresses that begin with the same numerical IP address bits where the Netmask is one will be on the same Subnet. For example, if the IP Address is 10.4.100.1 and the Netmask is 255.255.0.0, the radio will attempt direct Ethernet

communication with any node whose IP Address begins with 10.4. If a message is bound for a node outside of the 10.4 network, it will be sent to the Gateway IP address instead so that it can be placed from the radio's subnet onto another subnet.

1. Log in to the radio on its COM1 console using a serial terminal emulator program.
2. Go to the IP Configuration menu.
3. Set the IP address of the radio, plus the Netmask and Gateway.
4. Go to the Maintenance/Tools Menu and select the Ping Utility.
5. Enter the IP address of a known node on the network.
6. Execute the Ping and observe the results. If the network interface is working properly, Ping responses should be received.

## Set Up a Base Unit

1. If not already done, complete steps from 3.2 above.
2. Log in to the radio.
3. Go to the System Configuration menu.
4. Set the unit to Base mode and reboot if necessary.
5. Set the base type (A, B, or C).
6. Set the window size. Mobiles will transmit in a randomly selected available slot among 2^(Window Size) slots. For small networks, this can be 1. For larger networks, use a Window Size that provides double or quadruple the number of mobiles expected under one base at a time.
7. Set the IP Port on which the base will receive UDP messages from wayside devices.
8. Set up an ITCS Translation Table. For test purposes, this may be as simple as setting up one known address with a mask of all “If’s”.
9. Verify Ethernet Link using the Ping utility in the Maintenance/Tools Menu.
10. Begin sending UDP data.
11. Verify the TX LED illuminates and the radio begins transmitting over the air.

## 3.4 Set Up a Mobile Unit

1. If not already done, complete steps from 3.2 above.
2. Log in to the radio.
3. Go to the System Configuration menu.
4. Set the unit to Mobile mode and reboot if necessary.
5. Set the IP Port to which the mobile will send messages received over the air.
6. Set the IP Port on which the mobile will accept incoming messages for transmission over the air.
7. Verify Ethernet Link using the Ping utility in the Maintenance/Tools Menu.
8. Ensure at least one base is present in the neighborhood of this radio so that it can detect beacons and synchronize timing.
9. Begin sending UDP data from a polling program.
10. Verify the TX LED illuminates and the radio begins transmitting over the air.

## 3.5 Perform Test Polling

1. Set up the Base and Mobile as above.
2. Connect as shown in the following diagram. Note: this is for bench testing only, i.e. not for sensitivity testing. Sensitivity testing requires complete RF isolation or mixed operation to prevent the leakage path from being the dominant RF path between units. For bench testing, use attenuation so that the signal level at every unit that is participating is around -70 to -50 dBm.

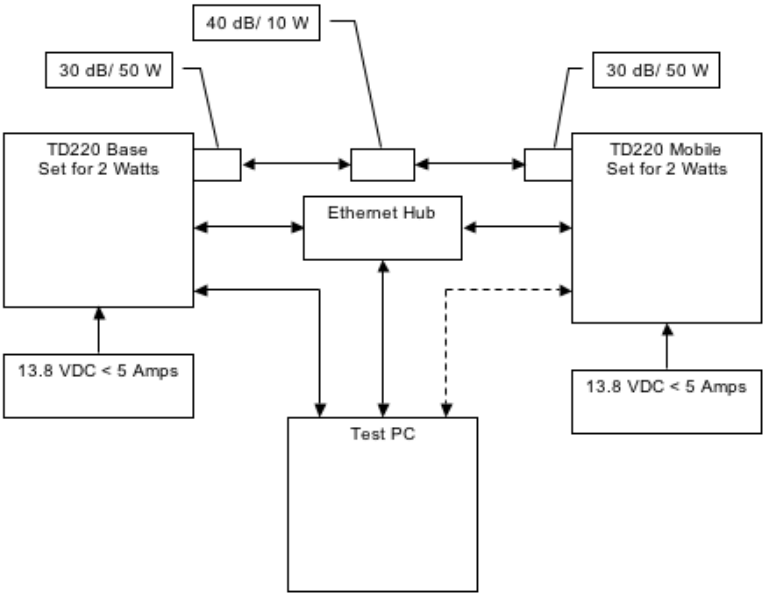



**Figure 3. Test Setup**

3. Configure the Base as follows in the radio software:

```
                        System Configuration Menu
-------------------------------------------------------------------------------

   A| Unit Type                  Base

   B| Base Unit Zone             A

   C| Window Size                2

   D| TTCS UDP Receive Port      50000

   E| Timing Signal Timeout      60 Seconds

   F| TTCS Translation Table

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

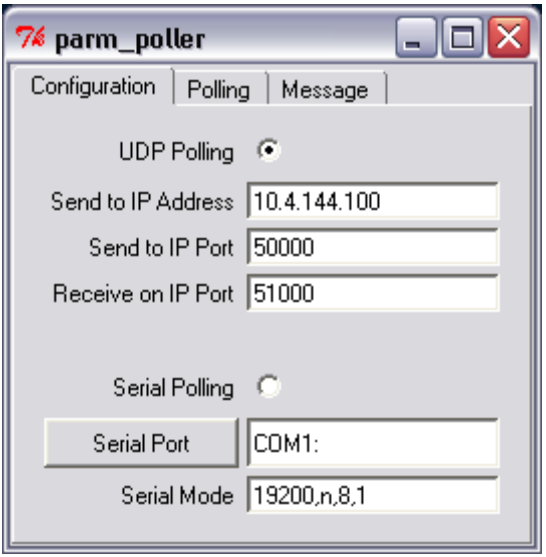
```
                      TTCS Translation Table Menu
-------------------------------------------------------------------------------
          Peer Addr  Addr Mask    Peer IP Addr  Peer Port  RSST Opt
-------------------------------------------------------------------------------
          A| 12345678 FFFFFFFF    10.4.147.170   53000       NO
          B| New Entry

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

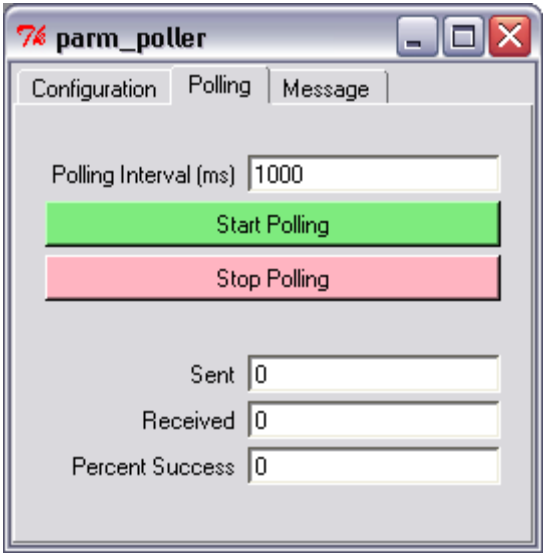
```
                        Radio Configuration Menu
-------------------------------------------------------------------------------

   A| Base Transmit Frequency   221.900000 MHz

   B| Mobile Transmit Frequency 221.900000 MHz

   C| Transmit Slots            4

   D| Output Power              2 W

   E| Force To Key              Normal

   F| TX Key Timeout            5 sec

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

4. Reboot the Base
5. Obtain the Parametric Poller (parm_poller.exe) from GE MDS. This utility saves its settings to **parm_poller.ini** in the current directory, so make one directory for the base and a different directory for the mobile.
6. In the base directory, create the parm_poller data configuration file (**parm_poller.parms**) as shown below.

```
set ::parms {
 { 0 "Dest"   32 "11223344"     "RW" }
 { 1 "Src"    32 "aabbccdd"     "RW" }
 { 2 "Flags"  8  "00"           "RW" }
 { 3 "Length" l1 "00"           "RO" }
 { 4 "Seq No" sn "00"           "RW" }
 { 5 "Data"   nt "Hello, World" "RW" }
```

7. Set up the base parm_poller as shown below, where **10.4.144.100** is replaced with the IP address of your base.



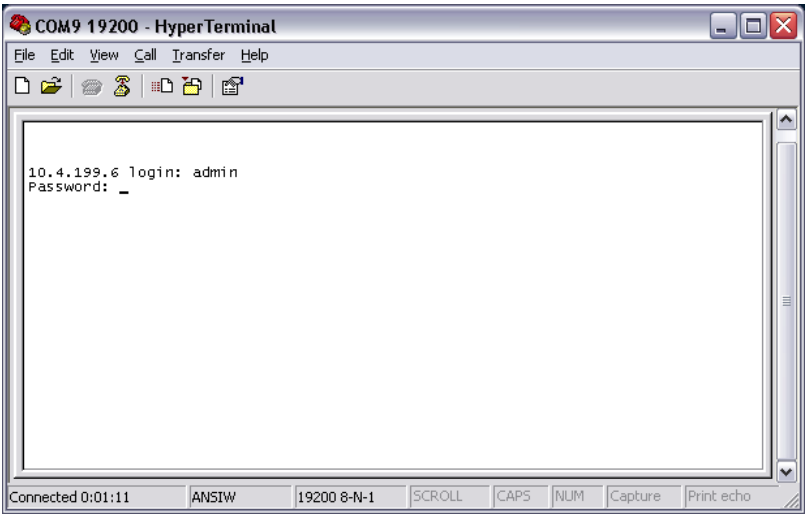


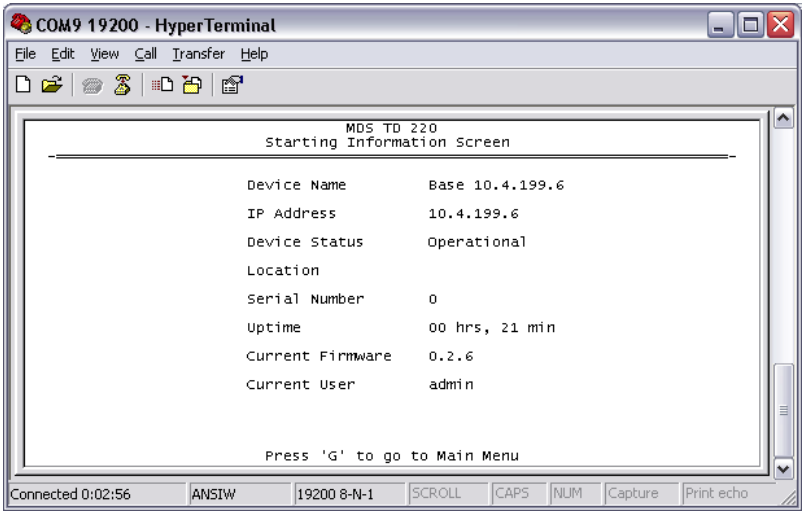

8. Configure the Mobile as follows:
9. Reboot the Mobile unit.
10. Copy the base unit's **parm_poller.parms** file to the mobile directory.
11. Set up the mobile **parm_poller** as shown below.
12. Click Start Polling on both units and observe the message counts and sequence number increment.
13. If additional visibility is desired, obtain **itcslog.exe** from GE MDS. This utility captures messages from the logging output of the TD220 radios and displays statistics about them. The IP Port Number is the port number configured on the radio for ITCS logging.

## Description of Menu Interface

Login with user name **admin**, password **admin**.

When logged in, the Starting Information Screen is displayed.

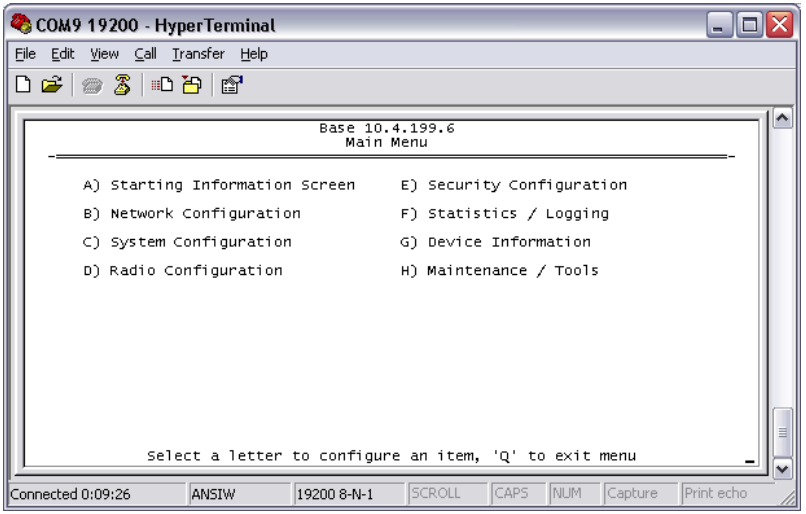


## Table 5. Starting Information Screen Items

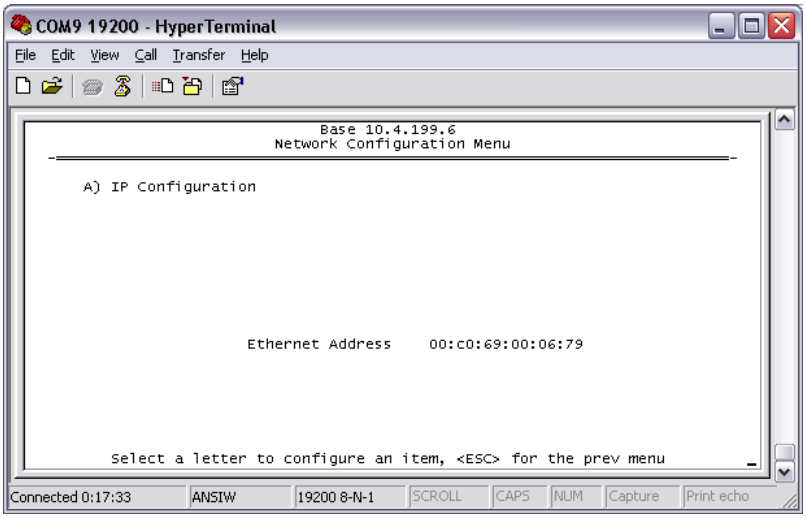
| Parameter | R/W | Description |
|---|---|---|
| Device Name | R* | User-configured name for this radio. Set this from the Device Names menu. |
| IP Address | R* | IP Address for this radio. Set this from the IP Networking menu. |
| Device Status | R | “Initializing” during startup and/or internal RF deck reprogramming, “Operational” when functioning, “Alarmed” when error condition(s) exist. |
| Location | R* | User-configured location for this radio. Set this from the Device Names menu. |
| Serial Number | R | The manufacturer's serial number for this radio. Set only in the factory. |
| Uptime | R | Elapsed time since the radio was started. |
| Current Firmware | R* | The version number of the currently operating firmware. Reprogram firmware from the Reprogramming Menu. |
| Current User | R | Login level |

R* - This parameter is writable from another menu.



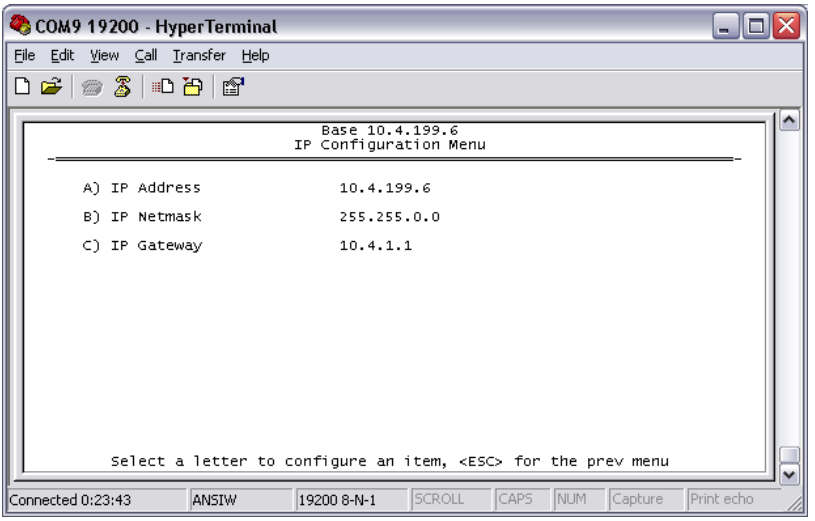
## Table 6. Main Menu Items

| Parameter | R/W | Description |
|---|---|---|
| A) Starting Information Screen | | Returns to the opening menu |
| B) Network Configuration | | Set the radio's IP Address, Netmask, and Gateway |
| C) System Configuration | | Set the radio's Mode (Base/Mobile) and other application-specific operating parameters including the Base's ITCS translation table. |
| D) Radio Configuration | | Set the radio's Frequencies, Base transmit slot allocation (3/4), RF Power Output, and access the Force TX Key function. |
| E) Security Configuration | | Set up how the radio may be accessed |
| F) Statistics / Logging | | Obtain historical and current statistics about the radio's payload performance, and access ITCS Logging configuration. |
| G) Device Information | | Set up the radio's Date, Time, Console Baud Rate and Names. Review the radio's Model, Serial Number, and Uptime. |
| H) Maintenance / Tools | | Access the radio's Firmware Reprogramming, Configuration Script, and Ping Utility menus. |




## Table 7. Network Configuration Menu Items

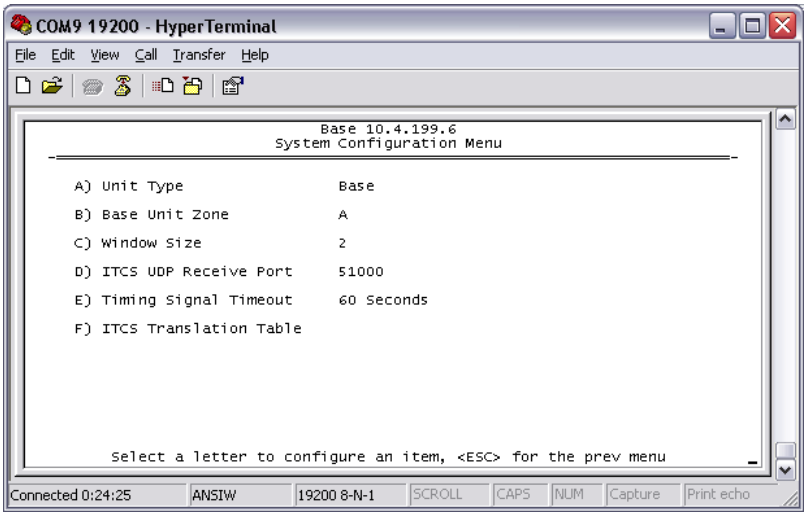
| Parameter | R/W | Description |
|---|---|---|
| A) IP Configuration | | Access the IP Configuration menu to set the IP Address, Netmask, and Gateway IP Address. |
| Ethernet Address | R | Displays the hardware MAC address for the Ethernet port. |




## Table 8. IP Configuration Menu Items

| Parameter | R/W | Description |
|---|---|---|
| IP Address | R/W | The IP address that this radio will use for its Ethernet interface. |
| IP Netmask | R/W | The subnet mask for the network this radio is part of. |
| C) IP Gateway | R/W | The IP address of the gateway that will pass traffic from the radio's subnet to nodes on other networks. |

Note: The IP Address and IP Gateway must be on the same subnet or a Network Interface error will occur.

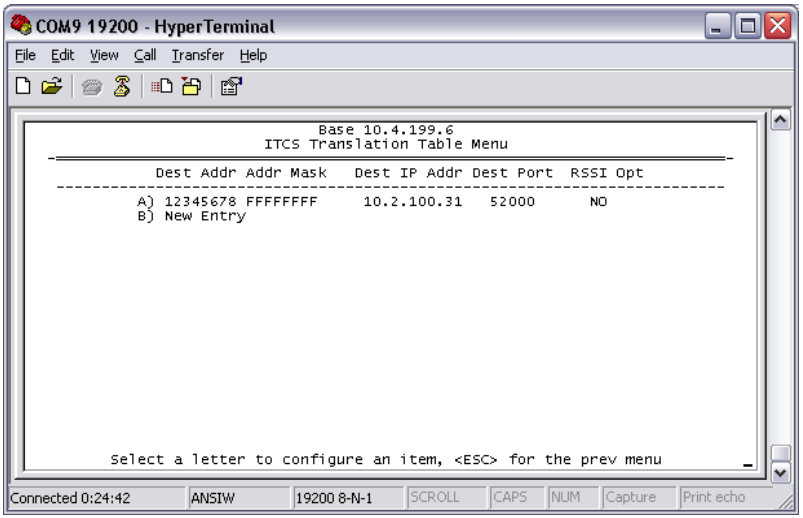



## Table 9. System Configuration Menu Items

| Parameter | R/W | Description |
|---|---|---|
| A) Unit Type | R/W | Bases send beacons out once per epoch and coordinate downstream messages. Mobiles listen to bases to identify free slots, and then select random slots in which to place their upstream messages. |
| B) Base Unit Zone | R/W | Bases are one of three types, A, B, and C. Each base coordinates slots in the epoch assigned to that base and transmits downstream. Base types repeat along lines of track (A, B, C, A, B, …) |

## Table 9. System Configuration Menu Items

| Parameter | R/W | Description |
|---|---|---|
| C) Window Size | R/W | When a mobile is ready to transmit, it chooses at random from 2^(Window Size) slots to minimize collisions with other units. |
| D) ITCS UDP Receive Port | R/W | Wayside devices send UDP messages to this IP port on the radio's network interface for transmission over the air. |
| E) Timing Signal Timeout | R/W | If the GPS Pulse Per Second input is missing for this duration, the radio asserts an alarm. |
| F) ITCS Translation Table | -- | Access the ITCS Translation Table to add or delete routing entries. |



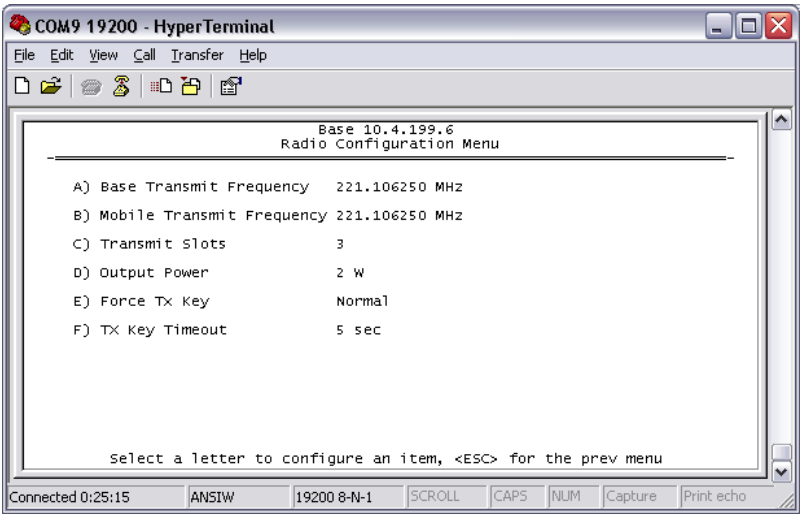
## Table 10. ITCS Translation Table Menu Items

| Parameter | R/W | Description |
|---|---|---|
| A) ITCS Translation Table Entry | R/W | Each entry in this table contains a 32-bit Destination ITCS Address, a 32-bit ITCS Address Mask, an IP Address and port, and the RSSI Option. Any incoming ITCS message is bitwise anded with the mask. If the result matches the Destination ITCS Address, the message is sent to the IP Address and Port given. If the RSSI Option is "yes", the over the air Received Signal Strength Indication is prepended to the data message in the UDP transmission. |

The following chart shows how RSSI Data (shaded portion) is prepended to standard ITCS Data within the UDP packet.

## Table 11. RSSI Data in Relation to ITCS Data

| Non-ITCS Header | | | Data | | ITCS L2 Header | | Data |
|---|---|---|---|---|---|---|---|
| Address | ID | Length | RSSI Type | RSSI Data | Destination ITCS Address | Source ITCS Address | |
| 4 Bytes | 1 Byte | 1 Byte | 1 Byte | 1 Byte | 4 Bytes | 4 Bytes | N Bytes |
| Always 0 | 0 for RSSI | 2 | 0 | Signed value from –120 to –30 dBm | | | |

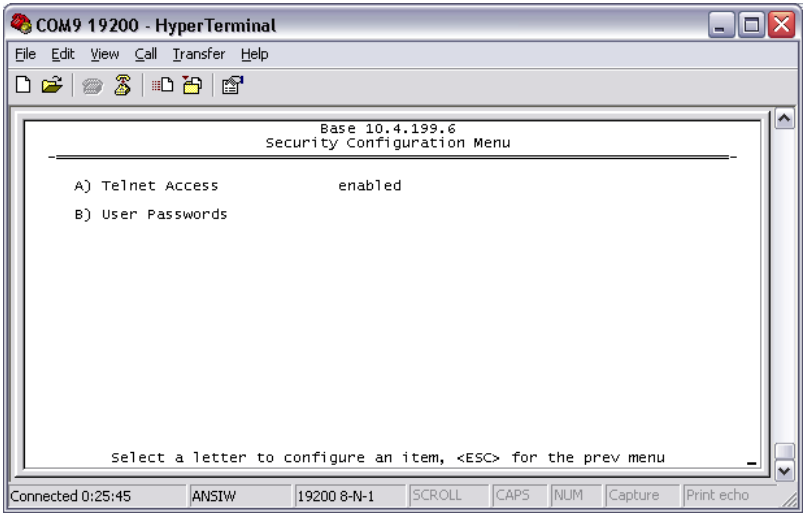



## Table 12. Radio Configuration Menu Items

| Parameter | R/W | Description |
|---|---|---|
| A) Base Transmit Frequency | R/W | The frequency in the 217.44625 to 221.95625 MHz range that the Base Units use for over the air transmissions. |
| B) Mobile Transmit Frequency | R/W | The frequency in the 217.44625 to 221.95625 MHz range that the Mobile Units use for over the air transmissions. |

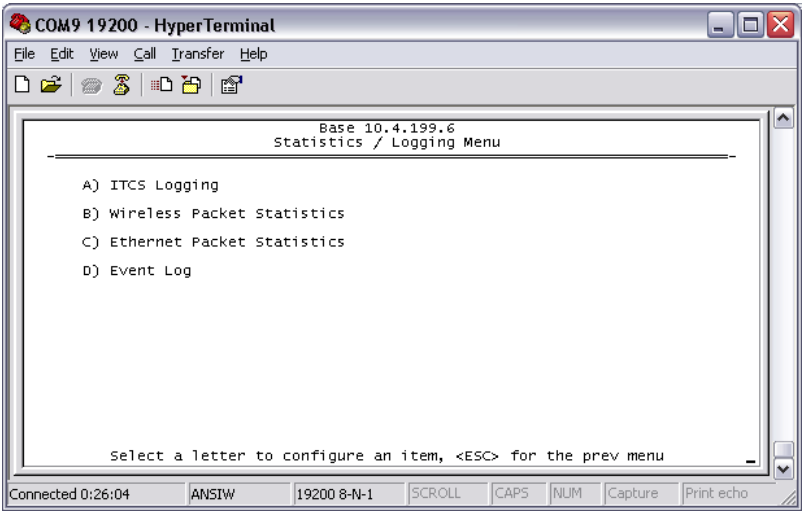
## Table 12. Radio Configuration Menu Items

| Parameter | R/W | Description |
|---|---|---|
| C) Base Transmit Slots | R/W | The number of slots within each 8-slot second that are reserved for base transmissions if needed. NOTE: This parameter must match on all bases and mobiles in the network. |
| D) Output Power | R/W | The RF Output Power from 2 to 25 Watts with which the radio transmits. |
| E) Force TX Key | R/W | “Normal” to allow the radio to operate in data mode, “Forced” to key the transmitter for test purposes. |
| F) TX Key Timeout | R/W | If TX Key is Forced, the radio will automatically De-Key after this timeout. |



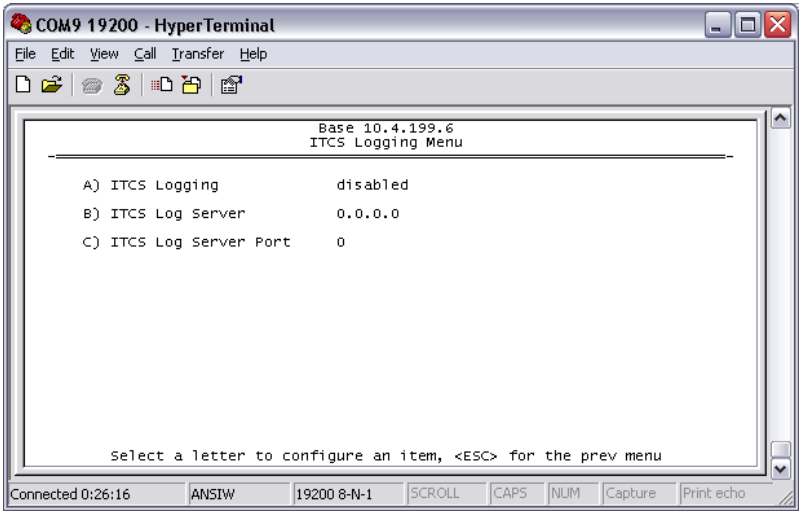
## Table 13. Security Configuration Menu Items

| Parameter | R/W | Description |
|---|---|---|
| A) Telnet Access | R/W | If “enabled”, the radio allows users to Telnet to the radio via Ethernet. If “disabled”, users must manage the radio via SNMP or the serial console. |
| B) User Passwords | | Allows modification of the admin password. |



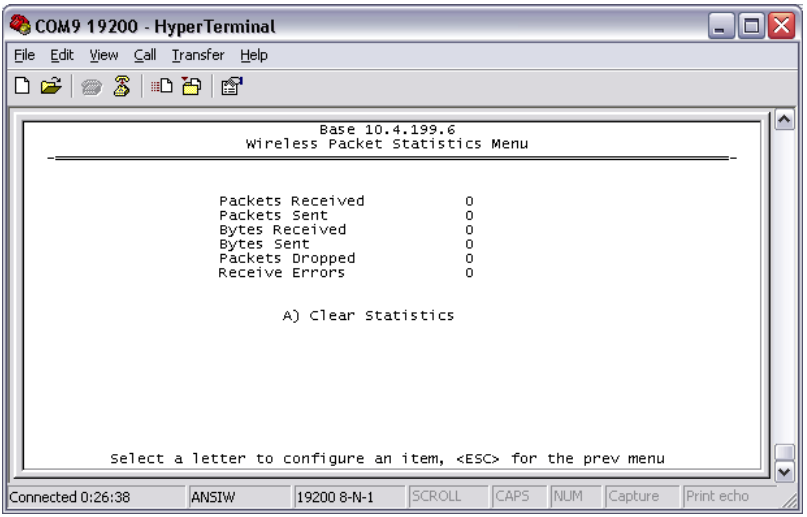
## Table 14. xxxxx

| Parameter | R/W | Description |
|---|---|---|
| A) ITCS Logging | | Access the ITCS Logging configuration menu. |
| B) Wireless Packet Statistics | | Access the Wireless Packet Statistics menu where you can view the number of messages passed over the air. |
| C) Ethernet Packet Statistics | | Access the Ethernet Packet Statistics menu where you can view the number of messages passed via Ethernet. |
| D) Event Log | | Access the Event Log menu where you can view the radio's log of system events and alarms. |



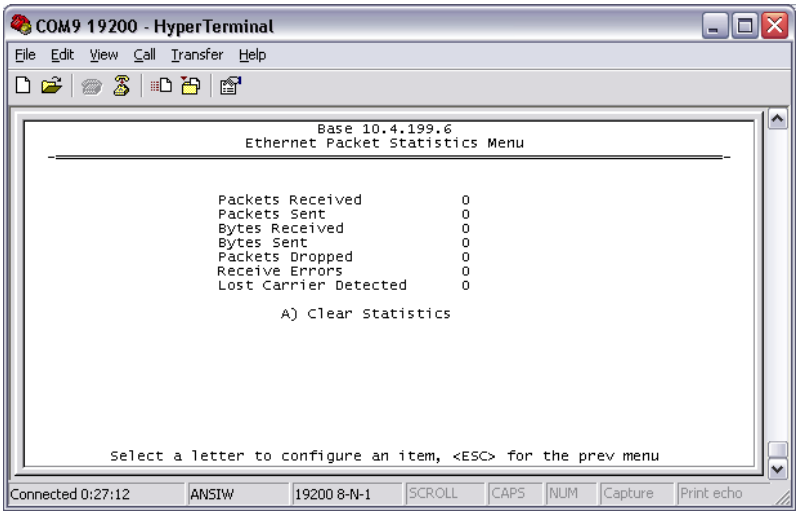
## Table 15. xxxxx

| Parameter | R/W | Description |
|---|---|---|
| A) ITCS Logging | R/W | If “enabled”, send UDP messages to a logging host. |
| B) ITCS Log Server | R/W | The IP address to send UDP messages for logging ITCS traffic. |
| C) ITCS Log Server Port | R/W | The IP port number to send UDP messages for logging ITCS traffic. |



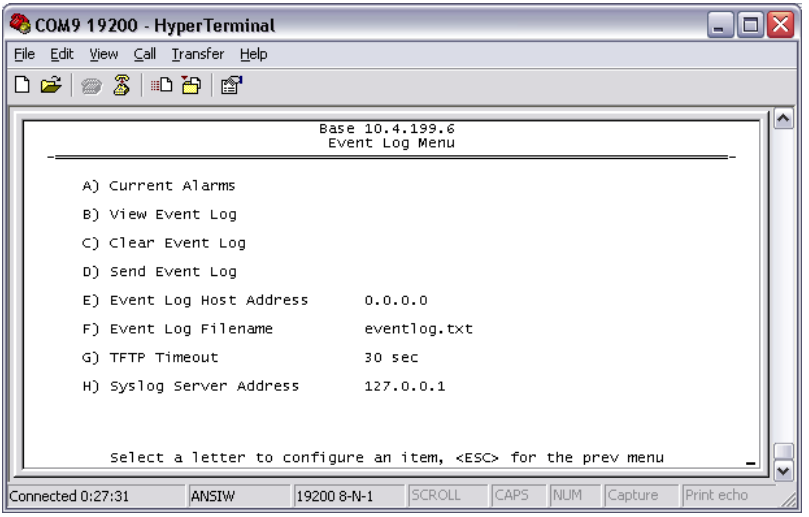
## Table 16. xxxxx

| Parameter | R/W | Description |
|---|---|---|
| Packets Received | R | The number of packets received over the air. |
| Packet Sent | R | The number of packets transmitted over the air. |
| Bytes Received | R | The number of Bytes for all packets received over the air. |
| Bytes Sent | R | The number of Bytes for all packets transmitted over the air. |
| Receive Errors | R | The number of messages received over the air that did not decode properly. |
| A) Clear Statistics | R/W | Reset all results to zero. |



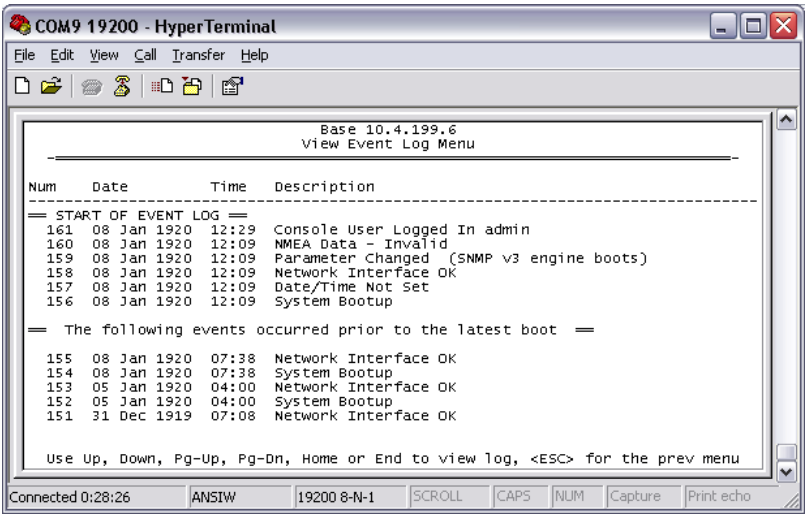
## Table 17. xxxxx

| Parameter | R/W | Description |
|---|---|---|
| Packets Received | R | The number of packets received over Ethernet. |
| Packet Sent | R | The number of packets transmitted over Ethernet. |
| Bytes Received | R | The number of Bytes for all packets received over Ethernet. |
| Bytes Sent | R | The number of Bytes for all packets transmitted over the air. |
| Receive Errors | R | The number of messages received over the air that did not decode properly. |
| A) Clear Statistics | R/W | Reset all results to zero. |

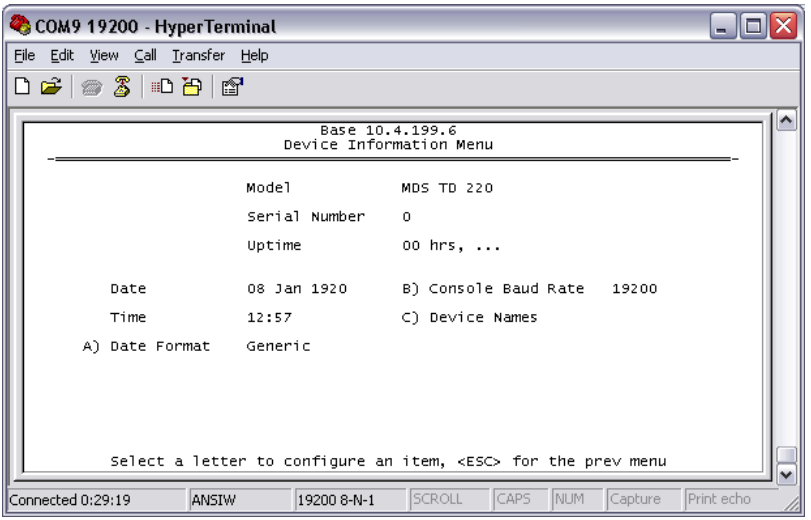


## Table 18. xxxxx

| Parameter | R/W | Description |
|---|---|---|
| A) Current Alarms | | Display a list of the alarms currently active within the radio. |
| B) View Event Log | | Scroll through the historical list of radio events and alarms. |
| C) Clear Event Log | | Erase all history of radio events and alarms. |
| D) Send Event Log | | Begin a TFTP transfer of the historical list of all radio events to the IP Address given by “Event Log Host Address”. |
| E) Event Log Host Address | R/W | The IP Address of the server that will accept TFTP transfer of the Event Log. |
| F) Event Log Filename | R/W | The file name on the server for the event log. |
| G) TFTP Timeout | R/W | If the radio cannot reach the TFTP server, it waits this long before giving up at each step in the process. |
| H) Syslog Server Address | R/W | As events and alarms occur in real time, send them via the standard SYSLOG protocol (RFC 3164) to the server at this IP Address. |




This screen displays the event number, date and time, and event or alarm for each occurrence.



## Table 19. xxxxx

| Parameter | R/W | Description |
|---|---|---|
| Model | R | The Model Type of the radio. |
| Serial Number | R | The factory-assigned unique radio Serial Number. |
| Uptime | R | The number of elapsed hours, minutes, and seconds since the radio last rebooted. |
| Date | R | The Date from the GPS receiver. |
| Time | R | The Time from the GPS receiver. |
| A) Date Format | R/W | Change how the date and time are displayed. |
| B) Console Baud Rate | R/W | The serial port rate the console will communicate at. |
| C) Device Names | | Access the Device Names menu where you can modify the user-programmable name strings for this radio. |

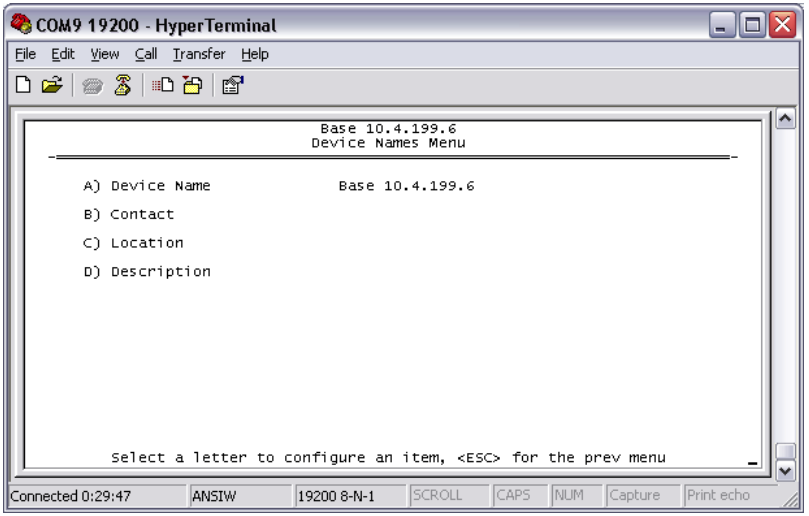
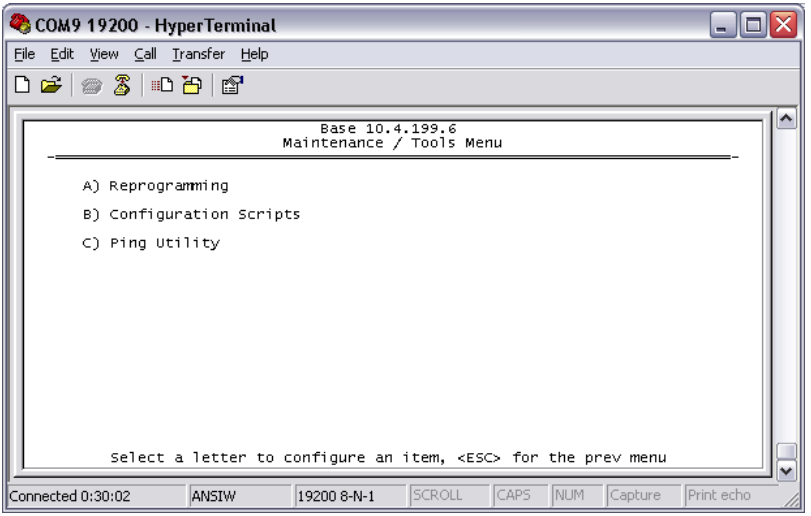


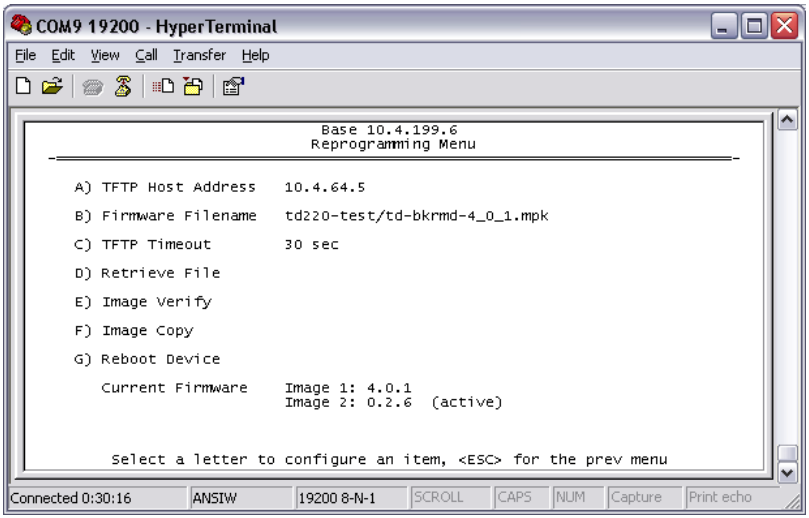
**Table 20. xxxxx**

| Parameter | R/W | Description |
|---|---|---|
| A) Device Name | R/W | Free-form field where you can enter a nickname for this radio. |
| B) Contact | R/W | Free-form field where you can indicate who to contact in case the radio needs service. |
| C) Location | R/W | Free-form field where you can describe the site at which the radio is installed. |
| D) Description | R/W | Free-form field where you can enter details describing this radio. |



## Table 21. xxxxx

| Parameter | R/W | Description |
|---|---|---|
| A) Reprogramming | | Access the Reprogramming menu where you can upgrade the radio's firmware. |
| B) Configuration Scripts | | Access the Configuration Scripts menu where you can save and restore the radio's configuration to and from a text file via a TFTP server. |
| C) Ping Utility | | Access the Ping Utility menu where you can confirm Ethernet communications with one or more hosts. |



## Table 22. xxxxx

| Parameter | R/W | Description |
|---|---|---|
| A) TFTP Host Address | R/W | The IP address of the TFTP server from which you will download a new firmware image. |
| B) Firmware Filename | R/W | The file name for the firmware image. This file must exist on the server. |
| C) TFTP Timeout | R/W | If the radio cannot reach the TFTP server, it waits this long before giving up at each step in the process. |
| D) Retrieve File | | Command the radio to request the firmware image from the TFTP server. |
| E) Image Verify | | Command the radio to perform a check of the firmware image in memory. |
| F) Image Copy | | Command the radio to copy the active firmware image to the inactive position. |
| G) Reboot Device | | Command the radio to restart using one of the firmware images |
| Current Firmware | | Shows the version number of both firmware images, plus which one is currently executing. |

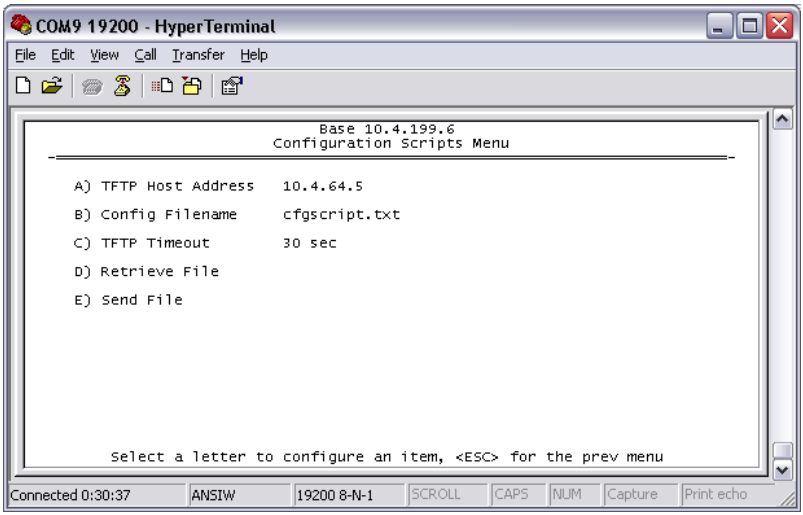



**Table 23. xxxxx**

| Parameter | R/W | Description |
|---|---|---|
| A) TFTP Host Address | R/W | The IP address of the TFTP server to or from which you will upload or download a configuration script. |
| B) Config Filename | R/W | The filename to or from which you will save or restore the radio's configuration. |
| C) TFTP Timeout | R/W | If the radio cannot reach the TFTP server, it waits this long before giving up at each step in the process. |
| D) Retrieve File | | Command the radio to get the file from the TFTP server. |
| E) Send File | | Command the radio to send the file to the TFTP server. |

Configuration scripts are used to store and duplicate radio settings. To use this facility, send the configuration file from a radio to the TFTP server. It can then be archived or edited and retrieved from the same or different radios. For more information, contact GE MDS.

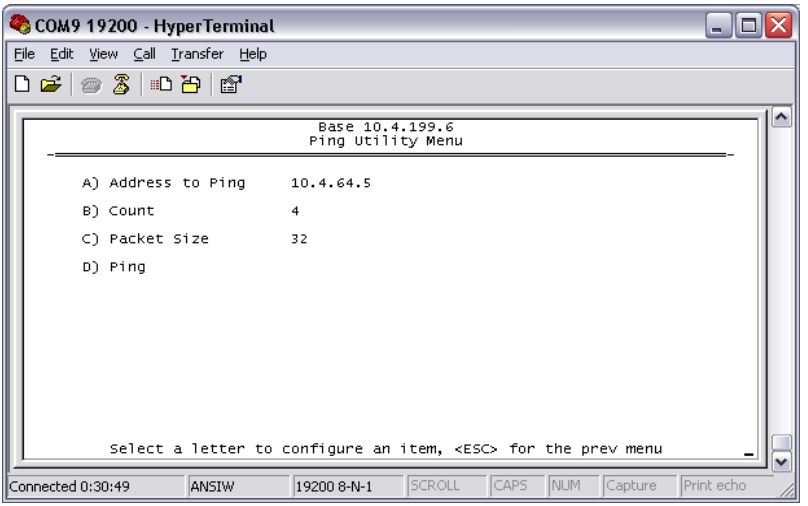



**Table 24. xxxxx**

| Parameter | R/W | Description |
|---|---|---|
| A) Address to Ping | R/W | The IP address of the network host to which you will send test messages. |
| B) Count | R/W | The number of test messages you will send. |
| C) Packet Size | R/W | The number of Bytes each test message will contain. |
| D) Ping | | Command the radio to begin the ping test. |

# Troubleshooting

Here are some tips to help resolve issues when operating the TD220.

SymptomPossible Cause

Radio shows messages are received via Ethernet, but it will not transmit over the air.Radio is alarmed.

XXXXXXXXXXOriginal Follows...Under RevisionXXXXXXXXX

## Front Panel Connectors

Figure 4 and Figure 5 show the interface connectors and indicators on the transceiver's front an d rear panels. These items are referenced in the installation steps given later in this guide.

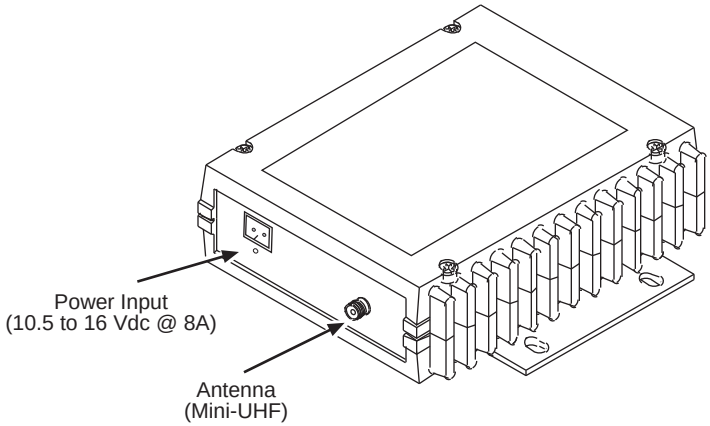



**Figure 4. Antenna & DC Power Connectors**

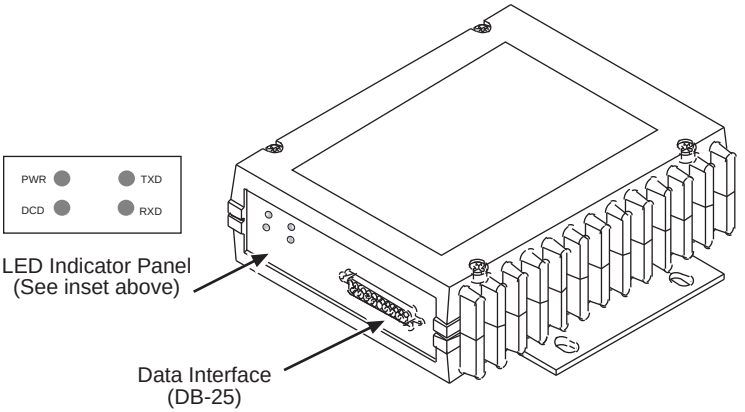



**Figure 5. Data Interface Connector & LED Status Panel**

# INSTALLATION

There are three main requirements for installing the transceiver:

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

Figure 6 shows a typical station arrangement. This is followed by step-by-step procedures for installing the transceiver and making front and rear panel connections.

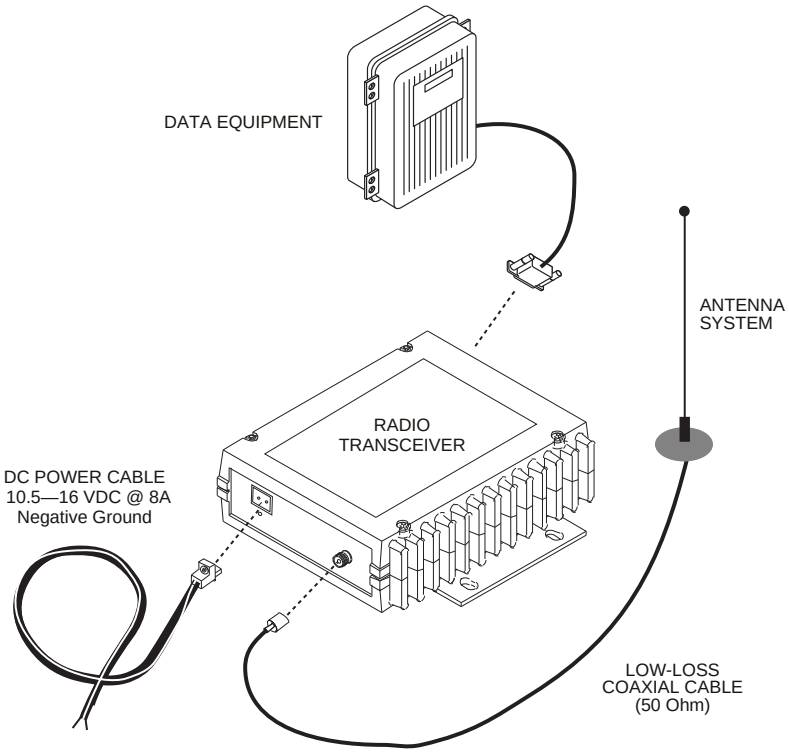



**Figure 6. Typical Station Arrangement**

## Installation Steps

Below are the basic steps for installing the transceiver. Refer to Figure 6 as necessary to make the cable connections.

1. **Mount the transceiver to a stable surface** using the brackets supplied with the radio. Begin by attaching the radio's mounting brackets 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 7 shows the mounting bracket dimensions.

**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.

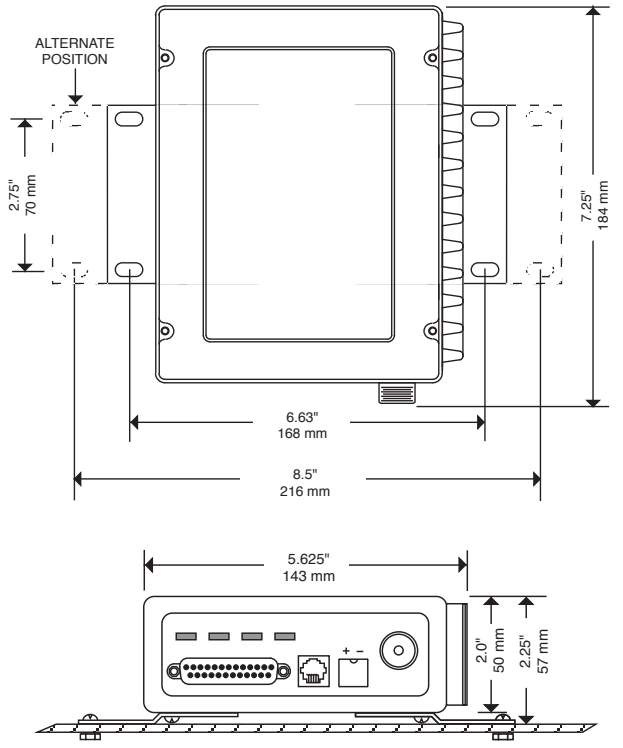



**Figure 7. Transceiver Mounting Bracket Dimensions**

**CAUTION**
**POSSIBLE EQUIPMENT DAMAGE**

Using screws longer than 1/4 inch (6 mm) to attach the brackets 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 SPECIFICATIONS on Page 47 for pin wiring details.

   *Note: The radio's DIAGNOSTICS port is used for reprogramming the radio's firmware.*

4. **Connect primary power to the transceiver.** Power applied must be within 10.5–16 Vdc and capable of continuously providing at least 8 Amperes. A power connector with is provided with each unit (see Figure 6).

**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.

5. **Set the radio's configuration.** The transceiver is designed for quick installation with a minimum of software configuration required.

   a. Connect a PC to the transceiver's DATA INTERFACE connector as shown in Figure 8. If desired, a cable may be built using the information shown on Page 47 of this guide.

   b. Launch a terminal communications program, such as HyperTerminal (included with most Windows™ systems). Press the ENTER key a few times (at half-second intervals) to receive the ready ">" prompt on the screen.

**NOTE:** To prevent unintended keying of the transmitter during management activities, set **PTTSIG** to **OFF**, or do not connect to Pin 6 of the COM1 port.

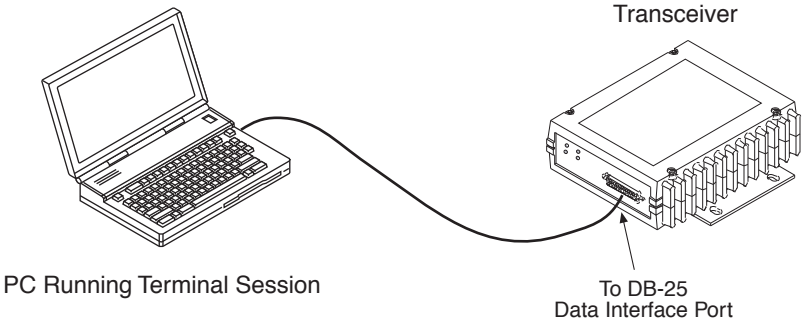



**Figure 8. PC Configuration Setup**

c. Set the transmit frequency by entering **TX xxx.xxxx**, where **xxx.xxxx** is the frequency in MHz. Press **ENTER**. The response **PROGRAMMED OK** indicates successful entry.

d. Set the receive frequency by entering **RX xxx.xxxx**, where **xxx.xxxx** is the frequency in MHz. Press **ENTER**. The response **PROGRAMMED OK** indicates successful entry.

e. Set the radio's modem type if necessary, using the **MODEM xxxx** command, where **xxxx** is the modem selection (typically **4800** or **9600**). The default setting is **9600**. Set the radio's serial data interface rate (typically **BAUD 9600 8N1**).

This completes the initial setup and configuration of the radio.

# SOFTWARE COMMAND SUMMARY

Table 25 lists software commands commonly used during initial installation and setup of the transceiver.

**Table 25. Command Summary**

| Command Name | Function |
|---|---|
| **BAUD [xxxx xxx]** | Sets radio's serial data interface rate/format. Default setting is BAUD 9600 8N1. |
| **DKEY** | Dekey the radio (transmitter OFF). This is generally a radio test command. |
| **KEY** | Key the radio (transmitter ON). This is generally a radio test command. |
| **MODEM [xxxx]** | Set the modem characteristics of the radio. |
| **PWR [37–45]** | Set or display the transmit power setting. |
| **PTTSIG [ON, OFF]** | Set/display push-to-talk configuration. |
| **RSSI** | Display the Received Signal Strength Indication. |
| **RX [xxx.xxxx]** | Set or display receiver frequency. |
| **SER** | Display the radio serial number. |
| **SNR** | Signal-to-Noise Ratio (in dB). |
| **SPECTRUM [xxx.xx]** | Display internal spectrum analyzer, where **xxx.xx** characters denote center frequency in MHz. The command **spectrum** may be entered alone to view current operating channel. |
| **SREV** | Display the Software Revision Level. |
| **STAT** | Display radio status and alarms. |
| **TEMP** | Display the internal temperature of the radio in degrees C. |
| **TX [xxx.xxxx]** | Set or display the transmit frequency. |

## Detailed Command Usage

*(This section currently under revision)*

**chan [chan # [rxfreq # [txfreq # [pwr # [bw # ] ] ] ] ]**

**chan - channel # {all,0-8]**

**rxfreq - receiver frequency**

**txfreq - transmitter frequency**

**pwr - power in watts (2, 5, 20, 25, 30)**

**bw - bandwidth (12.5, 25)**

Examples:

**>chan**

**Channel 1 RX 452.92500 MHz TX 452.92500 MHz PWR 30 Watts BW 25.000 KHz**

**>chan all**

**Selected LCT Channel is 0**

**Channel 0 RX 450.00000 MHz TX 453.00000 MHz PWR 5 Watts BW 25.000 KHz**

**Channel 1 RX 452.92500 MHz TX 452.92500 MHz PWR 30 Watts BW 25.000 KHz**

**Channel 2 RX 452.95000 MHz TX 452.95000 MHz PWR 30 Watts BW 25.000 KHz**

**Channel 3 RX 457.92500 MHz TX 457.92500 MHz PWR 30 Watts BW 25.000 KHz**

**Channel 4 RX 457.95000 MHz TX 457.95000 MHz PWR 30 Watts BW 25.000 KHz**

**Channel 5 RX 452.92500 MHz TX 452.92500 MHz PWR 30 Watts BW 25.000 KHz**

**Channel 6 RX 452.95000 MHz TX 452.95000 MHz PWR 30 Watts BW 25.000 KHz**

**Channel 7 RX 457.92500 MHz TX 457.92500 MHz PWR 30 Watts BW 25.000 KHz**

**Channel 8 RX 457.95000 MHz TX 457.95000 MHz PWR 30 Watts BW 25.000 KHz**

**>chan 8 rxfreq 453**

**rxfreq 453**

**Channel 8 RX 453.00000 MHz TX 457.95000 MHz PWR 30 Watts BW 25.000 KHz**

**>chan 8 pwr 20**

**pwr 20**

**Channel 8 RX 453.00000 MHz TX 457.95000 MHz PWR 20 Watts BW 25.000 KHz**

**>chan 8 bw 12.5**

**bw 12.5**

**Channel 8 RX 453.00000 MHz TX 457.95000 MHz PWR 20 Watts BW 12.500 KHz**

**>mode test**

**>selchan help**

**Usage:**

**selchan [0-8]**

**>selchan 8**

**Channel Number 8**

**>chan**

**Channel 8 RX 453.00000 MHz TX 457.95000 MHz PWR 20 Watts BW 12.500 KHz**

**>key**

**TRANSMITTER ENABLED**

**>dkey**

**TRANSMITTER DISABLED**

**>mode normal**

# 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 9) are an important troubleshooting aid and should be checked whenever a problem is suspected. Table 26 describes the function of each status LED on the front panel of the radio.

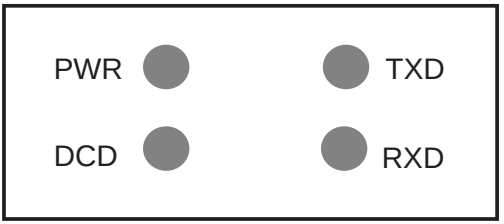



**Figure 9. LED Indicators**

**Table 26. LED Status Indicators**

| LED Name | Description |
|---|---|
| **PWR** | • Continuous—Power applied, no problems detected.<br>• Rapid flash (5 times-per-second)—Alarm indication. |
| **TXD** | Data being transmitted over the air. |
| **RXD** | Data being received over the air. |
| **DCD** | When lit, indicates that a communication link is established with the other station(s). |

## 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 27 (Page 45) for a definition of the event codes.

## Checking for Alarms—*STAT command*

To check for alarms, connect a terminal to the radio's DIAGNOSTICS port. See SPECIFICATIONS on Page 47 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.

If more than one alarm exists, the word **MORE** appears on the screen. To view additional alarms, press **ENTER**.

## 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 27 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 27. 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. |
| 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. |

**Table 27. Event Codes *(Cont'd)***

| Event Code | Event Class | Description |
|---|---|---|
| 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 10) 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 10, 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.

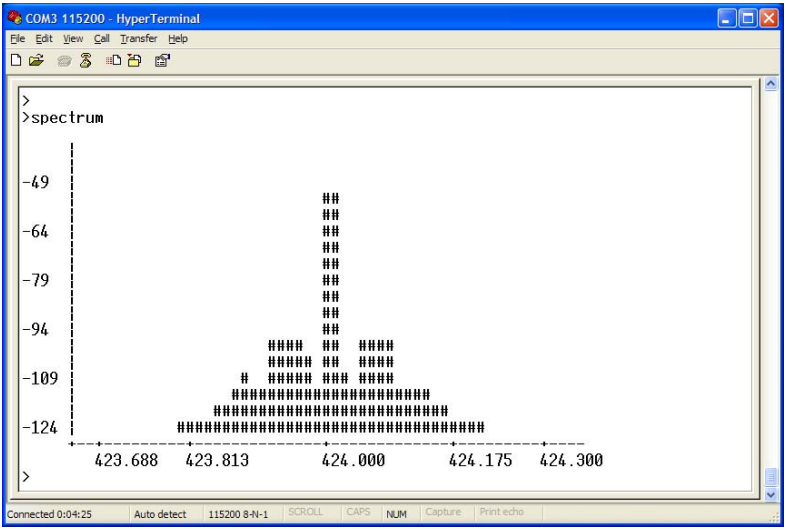



**Figure 10. Internal Spectrum Analyzer Display**

# SPECIFICATIONS

## GENERAL

| | |
|---|---|
| Frequency Ranges*: | 217-220 MHz<br>220-222 MHz |

## RECEIVER

| | |
|---|---|
| Maximum Usable Sensitivity: | –110 dBm at $1x10^{-6}$ BER (Preliminary) |
| Bandwidth: | 12.5 kHz |

## TRANSMITTER

| | |
|---|---|
| RF Carrier Power: | 2 Watts (217-220 MHz)<br>25 Watts (220-222 MHz) |
| Duty Cycle: | 25% |
| Output Impedance: | 50 Ω |
| Channel Spacing: | 6.25, 12.5 kHz |
| FCC Emission Designators: | |
| 12.5 kHz B/W: | 11K0F1D |

## :DATA CHARACTERISTICS

| | |
|---|---|
| Payload Signaling Type: | EIA/RS-485 |
| Connector Type: | DB-25 Female |
| Payload Data Rates: | 300–115200 bps, asynchronous |
| Payload Data Latency: | 10 ms maximum |

## DIAGNOSTICS INTERFACE

| | |
|---|---|
| Signaling Standard: | RS-232 |

## PRIMARY POWER

| | |
|---|---|
| Voltage: | 13.8 Vdc Nominal (10.5 to 16 Vdc)<br>Negative-Ground Systems Only |
| TX Supply Current: | 8 Amperes (Typical) @ 30 Watts Output |
| RX Supply Current: | *Operational*—125 mA, Nominal |
| Fuse: | 8-Ampere, internal |

## ENVIRONMENTAL

| | |
|---|---|
| Humidity: | 95% at 40 degrees C (104°F),<br>non-condensing |
| Temperature Range: | –40 to 70 degrees C (–40°F to +158°F) |
| Weight: | 1.0 kilograms |

GE MDS

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