GE MDS TD220MAX Manual
P/N 05-6906A01
Version 11

Table of Contents

1 Important Information

1.1 Antenna Installation Warnings

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 below, ensure the transmitter has been disabled.
2. Depending upon the application and the gain of the antenna, the total composite power could exceed 90 watts EIRP. For fixed/mobile configuration, the distances in the table below must be followed.

Antenna Gain vs. Minimum Safety Distance
(Based upon a 50% Duty Cycle, 0 dB Feedline Loss) Uncontrolled Environment Exposure limits

	Fixed/Mobile Antenna Gain		
	0-6 dBi	6-10 dBi	10-16.5 dBi
Minimum RF Safety Distance	1.78 meters	2.82 meters	5.01 meters

1.2 ESD Notice

To prevent malfunction or damage to this product, which may be caused by Electrostatic Discharge (ESD), the radio should be properly grounded at the time of installation. In addition, the installer or maintainer should follow proper ESD precautions, such as touching a bare metal object to dissipate body charge, prior to touching components or connecting/disconnecting cables.

1.3 FCC Approval Notice

This device is offered as a licensed transmitter per FCC Parts 80, 90 and 95. It is approved for use under the following conditions: Changes or modifications not expressly approved by the party responsible for compliance will void the user's authority to operate the equipment.

1.4 FCC Part 15 Notice

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.

Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device. Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

1.5 FCC Part 80 Notice

For FCC Part 80, the Effective Radiated Power (ERP) must be less than or equal to 4 Watts for mobile use and 20 Watts for fixed use. This can be accomplished by adjusting the output power of the radio and selecting an antenna with appropriate gain. Consult the following table for assistance in setting the output power and selecting an antenna to maintain compliance. The table provides examples, however other combinations can be used.

Radio Power Setting	ERP	Maximum Antenna Gain
2 W	4 W	3 dBd (5.2 dBi)
4 W	4 W	0 dBd (2.2 dBi)
2 W	20 W	10dBd (12.2 dBi)
10 W	20 W	3 dBd (5.2 dBi)
20 W	20 W	0 dBd (2.2 dBi)

1.6 Industry Canada ICES-003 and RSS-119 (Pending)

This Class A digital apparatus complies with Canadian ICES-003 and with RSS-119. Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.

2 Introduction

The GE MDS TD220X is a 25-Watt 220 MHz GMSK data radio intended for bridging messages over the air between locomotives and wayside devices in rail applications or between ship and shore in maritime applications. The data interface is Ethernet and uses the UDP/IP-based Simple Timeslot/Frequency/Power Protocol (STFP), defined elsewhere. STFP is capable of supporting various payload protocols.

A time division channel access method is used by the TD220X for wireless communication. Each second is divided into 8 133-byte time slots. The radio further defines a multi-second epoch to allow the effective number of time slots to be scaled according to system design. Radios must be configured with the same epoch size.

Precise synchronization of timing amongst radios is necessary for operation. Each radio can be configured to use one of three timing sources: GPS, Precision Time Protocol (PTP), and over-the-air (OTA). While system design can be flexible, a base radio installation typically uses either GPS or PTP timing and a mobile radio typically uses OTA to synchronize to the wireless transmissions of a base radio. Radios configured for GPS timing must be connected to an external GPS unit to receive NMEA sentence information and the PPS signal. Radios configured for PTP timing will interact with a PTP Grandmaster Clock over the Ethernet port using IEEE 1588 (PTPv2). Radios configured for OTA timing use messages received wirelessly in the first time slot of each second to maintain timing.

With its time slot definition and variable epoch size, the TD220X provides a generic TDMA implementation that can be used by an external Communication Manager (CM) to support a variety of TDMA schemes. A CM is responsible for making decisions regarding timeslot, frequency, power, and payload organization. The TD220X is responsible for requesting data from a CM for upcoming timeslots, forwarding messages received wirelessly to a CM, and wirelessly transmitting messages received from a CM using the specified timeslot, frequency, and power. All communication between the TD220X and a CM is done using STFP.

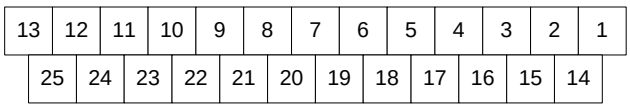
3 Interfaces

3.1 Data Interface (DB-25)

The Data Interface has several ports integrated into one connector: Ethernet, COM1 and COM2 Serial Ports, and GPS signaling. Note that COM3 is connected internally and therefore not available on pins labeled with "COM3."

DB-25 Pin	Signal	Direction WRT MDS Equipment	Notes
1	COM3_DCD	Input	Reserved
2	COM2_TXD	Input	GPS NMEA Data Expected
3	COM2_RXD	Output	
4	COM2_RTS	Input	
5	COM2_CTS	Output	
6	COM3_TXD	Output	Reserved
7	GND	Input/Output	
8	COM2_DCD	Output	Used for aggregated alarm output, negative voltage = no alarm, 0 voltage = radio off, positive voltage = ALARM PRESENT. RS-232 Levels.
9	COM3_CTS	Input	Reserved
10	COM3_RTS	Output	Reserved
11	COM3_DTR	Output	Reserved
12	COM3_RXD	Input	Reserved
13	GND	Input/Output	
14	ETH_TX_H	Output	
15	ETH_TX_L	Output	
16	ETH_RX_H	Input	
17	ETH_RX_L	Input	
18	EXT_KEY	Output	Reserved
19	EXT_DET	Input	Reserved
20	COM2_DTR	Input	
21	ALARM_OUT	Output	Reserved
22	GPS_PPS_L	Input	Not Connected
23	GPS_PPS_H	Input	TTL level 1PPS signal input. 0 to 5 VDC nominal.
24	COM1_RXD	Input	Console
25	COM1_TXD	Output	Console

The DB-25 connector is female, and the orientation of the connector as looking into the front panel of the unit is as shown below.



3.2 USB

The radio provides a USB Port conforming to version 1.1 of the USB standard. This port is provided for features such as logging STFP messages 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.

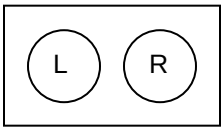
Pin	Signal Name	Description
1	PC_USB_+5V	+5 VDC
2	USBD-	USB Data Minus
3	USBD+	USB Data Plus
4	GROUND	Ground

3.3 Power

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

Pin	Signal Name	Direction with respect to MDS Equipment	Description
1 (L)	PWR	Input	13.8 VDC input, 7 Amps maximum.
2 (R)	GROUND	Input	Power return.

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



Consult the following table to determine how much current is required for receiving or transmitting vs. input voltage and RF power output. Duty cycle is a function of how many time slots of the 8 per second are used for transmission. The STFP protocol used by the communications manager to send data into the radio for transmission over the air specifies what time slot to use for each, so if the communications manager uses all 8 slots, the duty cycle is 100%. If four are used every second, the duty cycle is 50%. If 7 are used every 3 seconds (24 slots), the duty cycle is 29% (roughly 30%). Many other duty cycles are possible depending on the epoch size and number of transmissions within each epoch. If the duty cycle exceeds 29%, the RF output power is limited to 2 Watts. All MPE RF safety calculations are based on the highest ERP levels.

Voltage (V)	RF Power Out (W)	Duty Cycle (%)	Current Required (A)	Thermal Dissipation (W)
12	0 (RX)	0	0.3	TBSL
12	2	100	TBSL	TBSL
12	10	30	TBSL	TBSL
12	25	30	TBSL	TBSL
13.8	0 (RX)	0	0.3	TBSL
13.8	2	100	1.2	14
13.8	10	30	3.2	14
13.8	25	30	5.5	15

3.4 Antenna Connector

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

Common Setup Tasks

Note: For accessing the COM1 console, use a serial terminal emulator program such as HyperTerminal or Putty. The default settings are: baud rate 19200, no parity, 8 data bits, and 1 stop bit. The pins for this port are listed in section 3.1.

4.1 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.

4.2 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.

4.3 Upgrade the Firmware

4.3.1 Introduction

From time-to-time MDS will offer upgrades to the TD220X firmware. Uploading new firmware into the radio does not require that the radio be taken off-line until you want to operate the radio from the new firmware image. You must use the TD220X's embedded Menu System for all firmware activities, including uploading firmware from a TFTP server. The Menu System can be accessed in one of two ways:

- Terminal-Emulator—Use a terminal emulator program on your PC, such as HyperTerminal or Putty, connected directly to the TD220X COM1 port via a serial cable.
- Telnet—Text-based access to the Menu System through a network connection.

Firmware images are provided free-of-charge on the MDS Web site at:
http://supportcentral.ge.com/products/sup_products.asp?prod_id=181796

4.3.2 Installing TD220X Firmware 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.

If you do not know your computer's address on a Windows PC, you can use the RUN function from the Start menu and enter winipcfg or ipcfg to determine your local PC's IP address. The IP address of the radio can be found on the Starting Information Screen. (See Page 24.) A TFTP server can be found on the MDS web site at:
http://supportcentral.ge.com/products/sup_products.asp?prod_id=181796

4.3.3 Upload Procedure

To upload a new firmware file (tdx-krmd-X_Y_Z.mpk) into the TD220X unit use the following procedure:

1. Launch a TFTP server on a PC connected either directly or via a LAN to the Ethernet port (LAN) of the radio. On the Options tab, set the outgoing path to the directory containing the firmware image file.
2. Connect to the radio's Menu System by whichever means is convenient: Telnet via the LAN or Terminal emulator via the COM1 port.
3. Go to the Reprogramming Menu.
   (Starting Menu->Main Menu>Maintenance Menu>Reprogramming Menu)
4. Fill in the information for the:
   - TFTP Host Address – IP Address of the server (host computer) running the TFTP server.
   - Retrieve File – Name of the file (tdx-krmd-X.Y.Z.mpk) to be pulled from the TFTP server holding the firmware file.
5. Pull the firmware file through the TFTP server into the TD220X radio.
   (Note: the uploaded firmware image file replaces the "Inactive Image" file and be automatically verified.)
6. Reboot the TD220X radio.
7. Test the radio for normal operation.
8. End of procedure.

4.4 Set Up a GPS Base Unit

1. If not already done, complete steps from 4.2 above.
2. Connect the RS-232 NMEA serial data output from the GPS receiver to the Base Radio via the radio's COM2 port. Drive serial data into the radio on DB-25 pin 2.
3. Connect the GPS's PPS output to the Base Radio. Drive TTL into the radio on DB-25 pin 23.
4. Log in to the radio.
5. Go to the GPS Configuration menu.
6. Verify that the GPS NMEA Baud Rate and PPS Polarity match the connected GPS.
7. Go to the System Configuration menu.
8. Set the timing source to GPS and reboot if necessary.
9. Set the STFP radio ID. Set to 64 (decimal) to match the configuration in the tests below.
10. Set the IP Port on which the base will receive STFP messages from the Communication Manager.
11. Set the IP Address of the Communication Manager to which timing markers and messages received from mobiles should be sent.
12. Set the epoch size to match the same value configured on the neighboring radios and reboot if necessary.
13. Set the STFP slot delay as necessary. This number, multiplied by 125ms, represents the slot delay allowed from when a timing marker is sent to the Communication Manager to when a data message must be received from the Communication Manager. For most cases the default value of 2 should suffice.

14. Go to the Maintenance/Tools menu.
15. Verify the Ethernet Link using the Ping utility.
16. Begin sending UDP data.
17. Verify the TX LED illuminates and the radio begins transmitting over the air.

4.5 Set Up a PTP Base Unit

1. If not already done, complete steps from 4.2 above.
2. Install and configure a PTP Grandmaster Clock. The clock must be connected to the base through the Ethernet Link. The base also communicates with the Communication Manager using the Ethernet Link; therefore an external switch or router may be required.
3. Log in to the radio.
4. Go to the PTP Configuration menu.
5. Set the IP Port on which the base will receive PTP messages from the Grandmaster Clock.
6. Set the IP Address of the Grandmaster Clock.
7. Set the IP Port of the Grandmaster Clock.
8. Go to the System Configuration menu.
9. Set the timing source to PTP and reboot if necessary.
10. Set the STFP radio ID. Set to 64 (decimal) to match the configuration in the tests below.
11. Set the IP Port on which the base will receive STFP messages from the Communication Manager.
12. Set the IP Address of the Communication Manager to which timing markers and messages received from mobiles should be sent.
13. Set the IP Port of the Communication Manager to which timing markers and messages received from mobiles should be sent.
14. Set the epoch size to match the same value configured on the neighboring radios and reboot if necessary.
15. Set the STFP slot delay as necessary. This number, multiplied by 125ms, represents the slot delay allowed from when a timing marker is sent to the Communication Manager to when a data message must be received from the Communication Manager. For most cases the default value of 2 should suffice.
16. Go to the Maintenance/Tools menu.
17. Verify the Ethernet Link using the Ping utility.
18. Begin sending UDP data.
19. Verify the TX LED illuminates and the radio begins transmitting over the air.

4.6 Set Up an OTA Mobile Unit

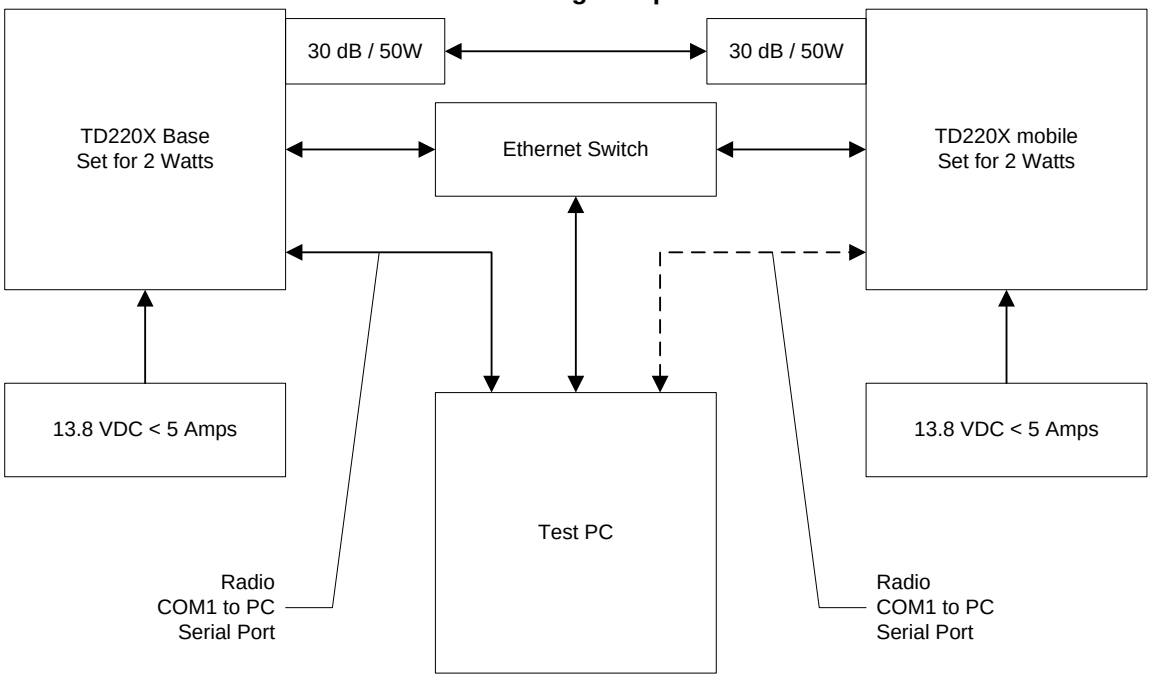
1. If not already done, complete steps from 4.2 above.
2. Log in to the radio.
3. Go to the System Configuration menu.
4. Set the timing source to OTA and reboot if necessary.
5. Set the STFP radio ID to 0 to match the configurations in the tests below.
6. Set the IP Port on which the mobile will receive STFP messages from the Communication Manager.
7. Set the IP Address of the Communication Manager to which timing markers and messages received from bases should be sent.
8. Set the IP Port of the Communication Manager to which timing markers and messages received from bases should be sent.
9. Set the epoch size to match the same value configured on the neighboring radios and reboot if necessary.
10. Set the STFP slot delay as necessary. This number, multiplied by 125ms, represents the slot delay allowed from when a timing marker is sent to the Communication Manager to when a data message must be received from the Communication Manager. For most cases the default value of 2 should suffice.

11. Go to the Maintenance/Tools menu.
12. Verify the Ethernet Link using the Ping utility.
13. Ensure at least one base is present in the neighborhood of this radio so that it can detect beacons and synchronize timing.
14. Begin sending UDP data from a polling program.
15. Verify the TX LED illuminates and the radio begins transmitting over the air.

4.7 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.

Test Polling Setup



3. Configure the Base as follows:

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

   A) Timing Source             GPS

   B) STFP Radio ID             64

   C) STFP Receive Port         53000
   D) STFP Transmit Address     x.x.x.x  (Note: Use IP address of Poller PC)
   E) STFP Transmit Port        50000

   F) STFP Epoch Size           6 sec
   G) STFP Slot Delay           2
   H) STFP Send OTA Beacon      enabled

   I) Timing Signal Timeout     60 Seconds


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

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

   A) Transmit Frequency        219.000000 MHz

   B) Transmit Frequency        219.000000 MHz

   C) Output Power              2 W

   D) Enable External PA        enabled

   E) Max Message Age           60 sec

   F) Force Tx Key              Normal

      TX Key Timeout            5 sec


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

4. Reboot the Base

5. Configure the Mobile as follows:

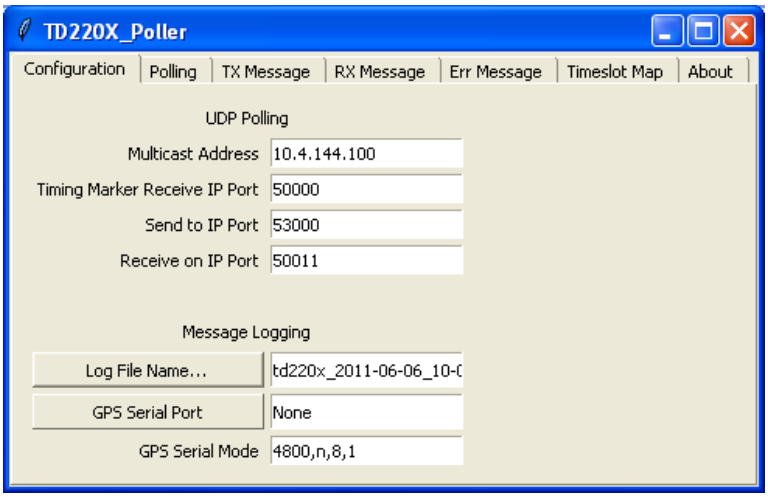
```
                          System Configuration Menu
-=============================================================================-

   A) Timing Source             OTA

   B) STFP Radio ID             0

   C) STFP Receive Port         53000
   D) STFP Transmit Address     x.x.x.x  (Note: Use IP address of Poller PC)
   E) STFP Transmit Port        50011

   F) STFP Epoch Size           6 sec
   G) STFP Slot Delay           2
   H) STFP Send OTA Beacon      disabled

   I) Timing Signal Timeout     60 Seconds


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

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

   A) Transmit Frequency        219.000000 MHz

   B) Transmit Frequency        219.000000 MHz

   C) Output Power              2 W

   D) Enable External PA        enabled

   E) Max Message Age           60 sec

   F) Force Tx Key              Normal

      TX Key Timeout            5 sec


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

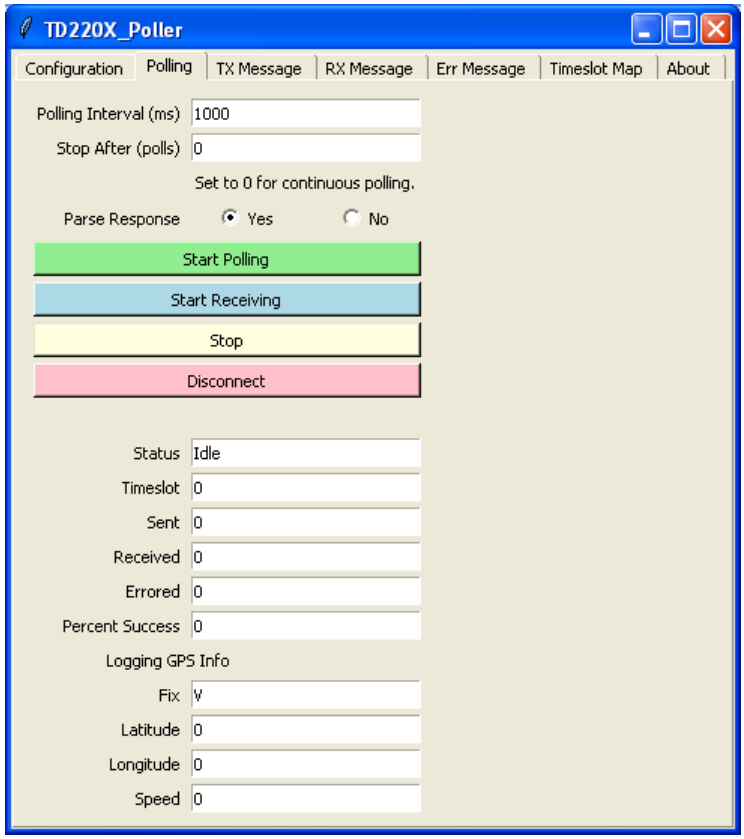
6. Reboot the Mobile
7. Obtain the TD220X Poller (TD220X_Poller.exe) from GE MDS.
8. In the Poller directory, create or modify the TD220X poller data configuration file (TD220X_Poller.parms) as shown below.

```
set ::TXparms {
  { 0 "Type"           8 "00"                   "RW" }
  { 1 "Ver"            8 "09"                   "RW" }
  { 2 "Radio ID"      32 "00000040"             "RW" }
  { 3 "Radio Cfg Tag"  8 "00"                   "RW" }
  { 4 "Timeslot"      ts "07"                   "RW" }
  { 5 "TX Freq MHz"   32 "30323139"             "RW" }
  { 6 "TX Freq kHz"   24 "303030"               "RW" }
  { 7 "TX Freq Hz"    24 "303030"               "RW" }
  { 8 "RX Freq MHz"   32 "30323139"             "RW" }
  { 9 "RX Freq kHz"   24 "303030"               "RW" }
  { 10 "RX Freq Hz"   24 "303030"               "RW" }
  { 11 "TX Power"      8 "02"                   "RW" }
  { 12 "Length"       l4 "00000000"             "RO" }
  { 13 "Seq No"       sn "00"                   "RW" }
  { 14 "Data"         nt
"12345678901234567890123456789012345678901234567890123456789012345678
901234567890123456789012345678901234567890123456789012345"         "RW" }
  { 15 "CRC32"        ck "00000000"             "RO" }
}
set ::RXparms {
  { 0 "Type"           8 "00"                   "RW" }
  { 1 "Ver"            8 "09"                   "RW" }
  { 2 "Radio ID"      32 "00000000"             "RW" }
  { 4 "Timeslot"      ts "07"                   "RW" }
  { 5 "TX Freq MHz"   32 "30323139"             "RW" }
  { 6 "TX Freq kHz"   24 "303030"               "RW" }
  { 7 "TX Freq Hz"    24 "303030"               "RW" }
  { 8 "RX Freq MHz"   32 "30323139"             "RW" }
  { 9 "RX Freq kHz"   24 "303030"               "RW" }
  { 10 "RX Freq Hz"   24 "303030"               "RW" }
  { 11 "RSSI"         rs "-120"                 "RW" }
  { 12 "Length"       l4 "00000000"             "RO" }
  { 13 "Seq No"       sn "00"                   "RW" }
  { 14 "Data"         nt
"12345678901234567890123456789012345678901234567890123456789012345678
901234567890123456789012345678901234567890123456789012345"         "RW" }
  { 15 "CRC32"        ck "00000000"             "RO" }
}
set ::ERparms {
  { 0 "Type"           8 "00"                   "RW" }
  { 1 "Ver"            8 "00"                   "RW" }
  { 2 "Radio ID"      32 "00000000"             "RW" }
  { 4 "Timeslot"      ts "07"                   "RW" }
  { 5 "TX Freq MHz"   32 "30323139"             "RW" }
  { 6 "TX Freq kHz"   24 "303030"               "RW" }
  { 7 "TX Freq Hz"    24 "303030"               "RW" }
  { 8 "RX Freq MHz"   32 "30323139"             "RW" }
  { 9 "RX Freq kHz"   24 "303030"               "RW" }
  { 10 "RX Freq Hz"   24 "303030"               "RW" }
  { 11 "RSSI"         rs "-120"                 "RW" }
  { 12 "CRC32"        ck "00000000"             "RO" }
}
```

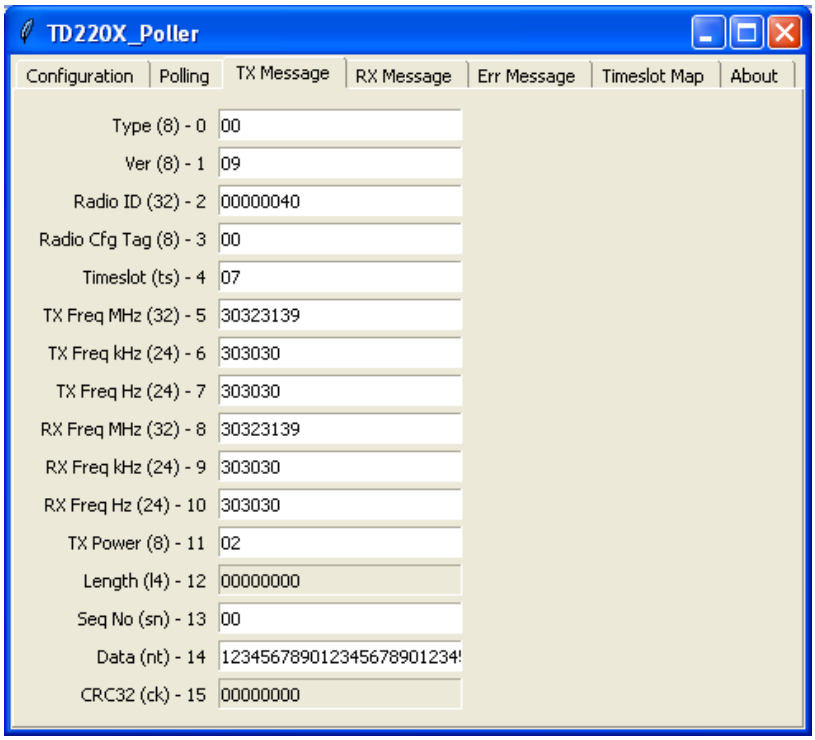
9. Set up the Poller as shown below, where 10.4.144.100 is replaced with the IP address of your base radio. Note: Set GPS Serial Port to None to prevent the utility opening a serial port.



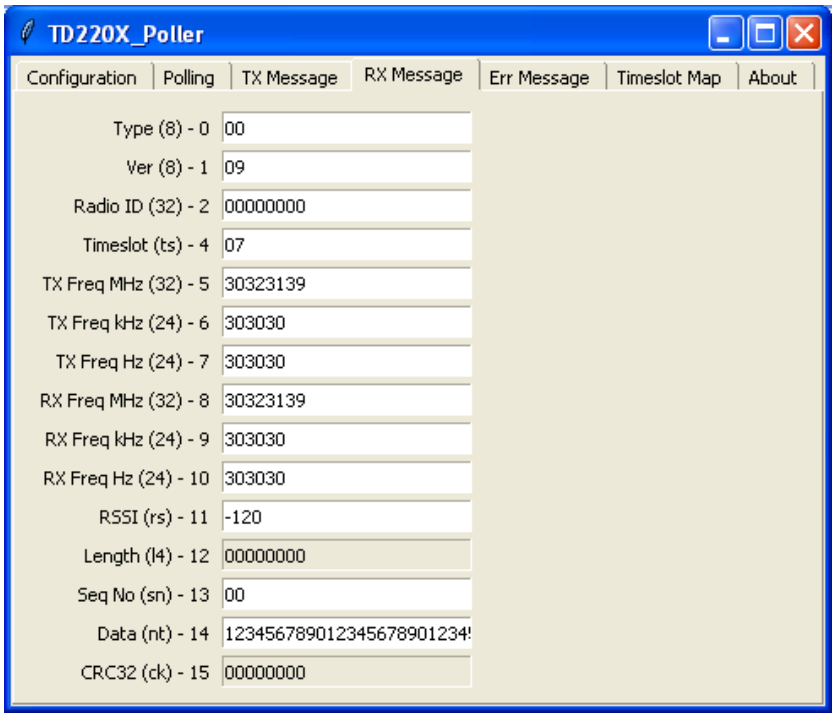
10. Click Start Polling and observe the message counts and sequence number increment. The test will show 100% success if all messages sent to the base radio were transmitted over the air, received by the mobile radio, and forwarded back to the Poller.



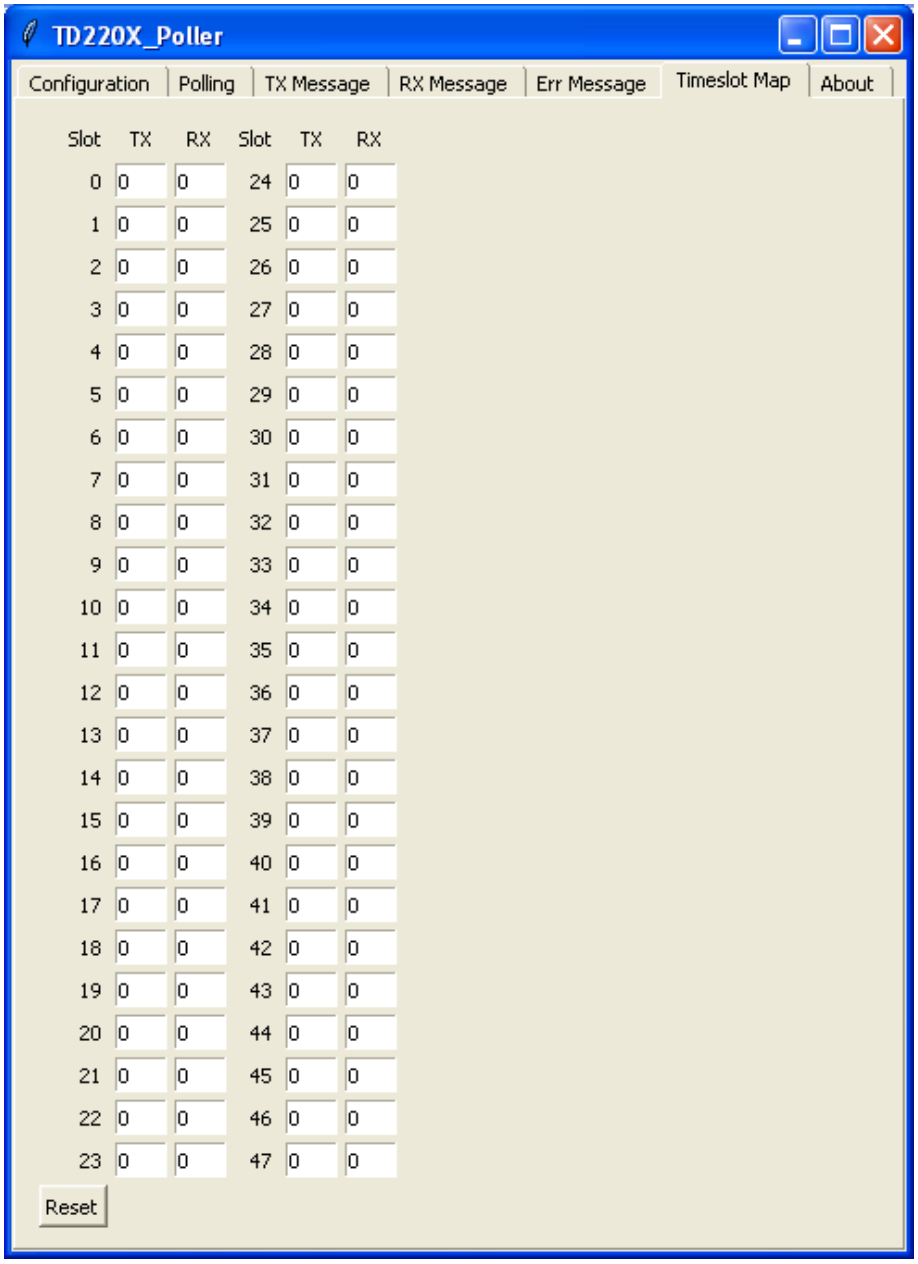
11. The TX Message tab updates as messages are sent to the base radio.



12. The RX Message tab updates as messages are received from the mobile radio.



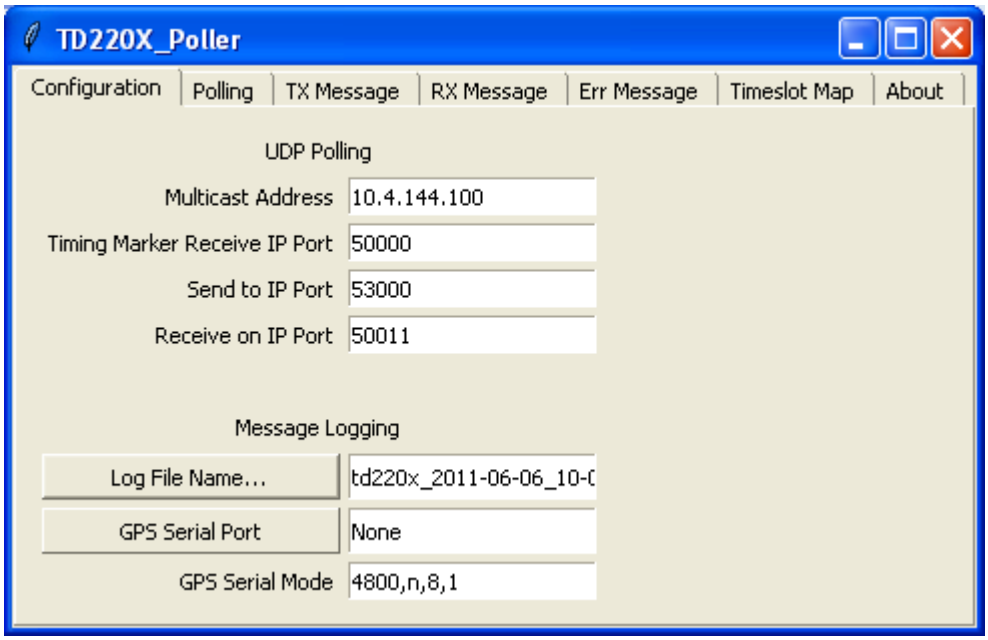
13. The Timeslot Map tab updates as messages are sent and received to show the distribution of messages across the available timeslots. **Note: Only 48 timeslots are shown, supporting up to a 6 second epoch.**



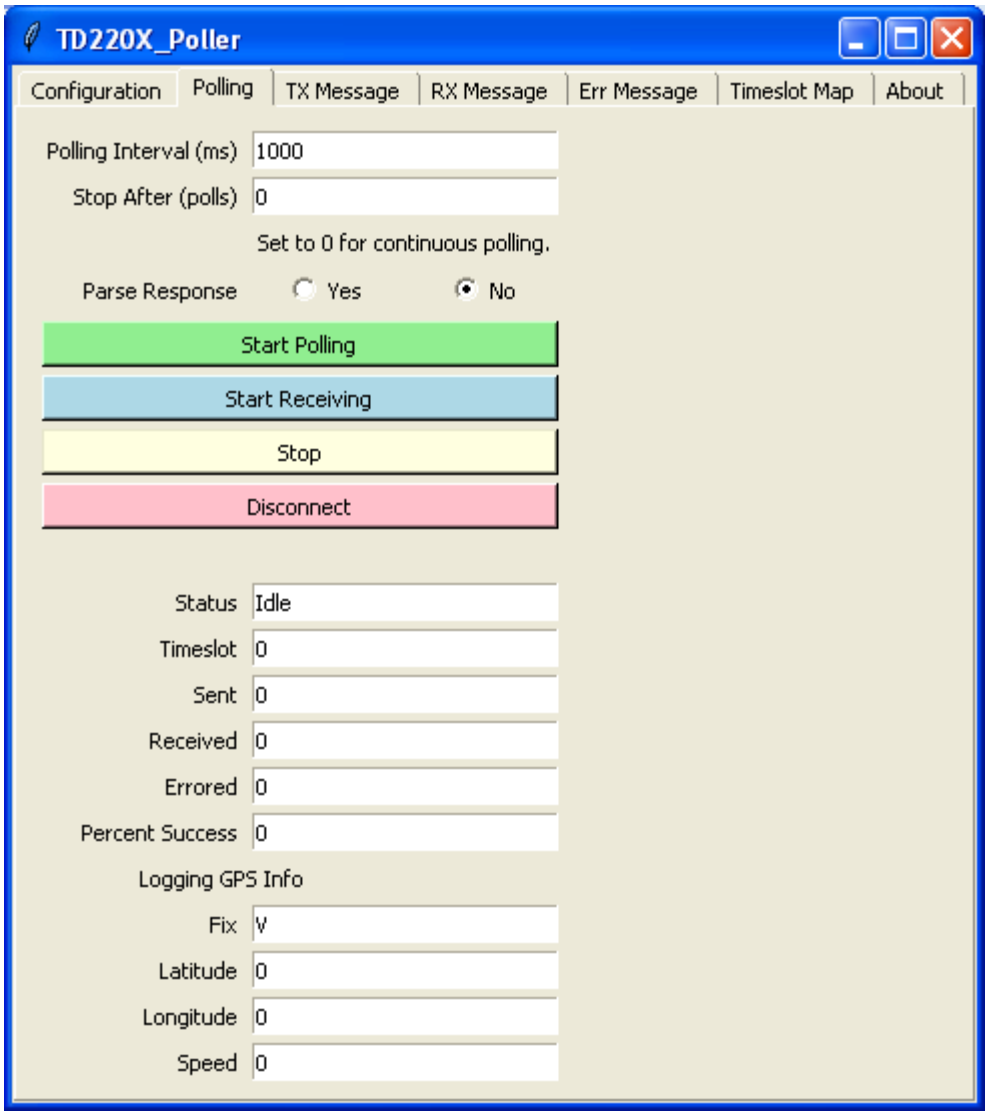
4.8 Perform Field Survey

4.8.1 Set up the Base System

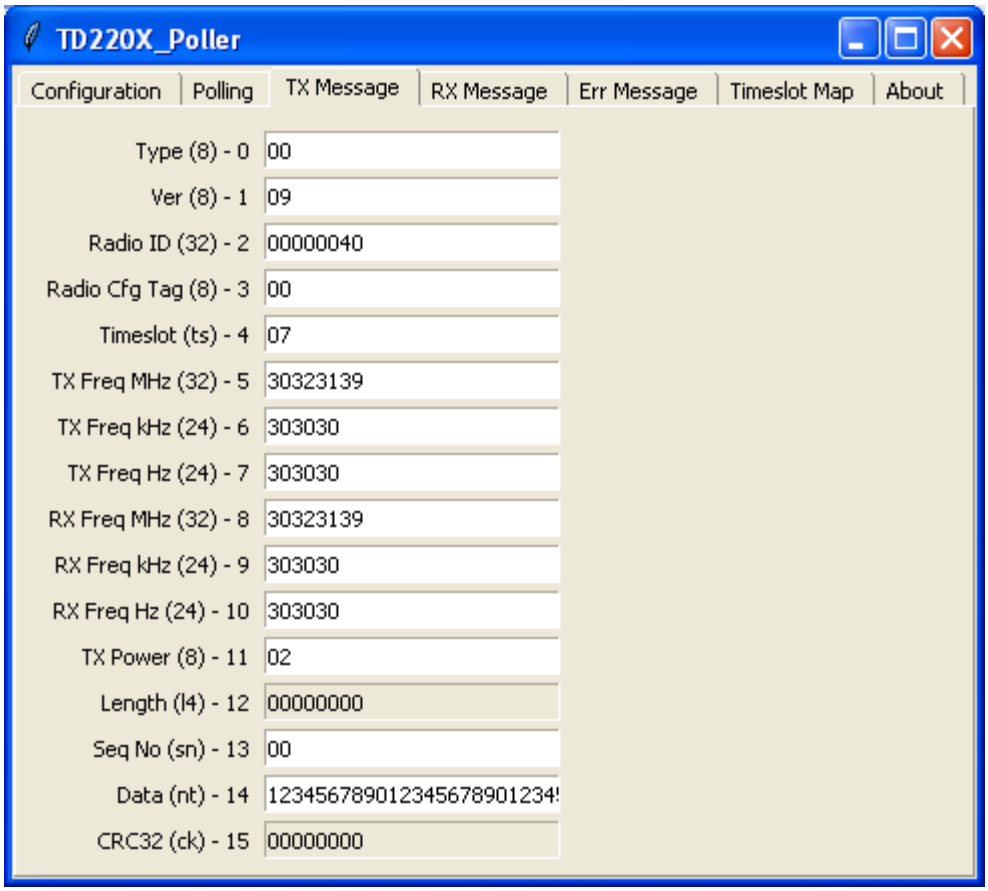
1. Set up a Base radio as above, using either a GPS or PTP timing configuration.
2. Erect a representative antenna system and connect the antenna system to the radio with representative feedline.
3. Ensure the radio is supplied with sufficient DC power to accommodate the intended transmit power setting.
4. Ensure you have a license to operate the radios and in the configuration settings below, ensure the frequency setting matches your license.
5. Run the Poller application on a PC at the fixed base location, setting it up according to the screen shots below.
6. Once the Base Radio is set up properly, start polling.



Notes: Set the IP address to that of the Base Radio. Set "GPS Serial Port" to "None" to prevent the base Poller from attempting to open communications with a GPS receiver. You can set the Receive on IP Port to any value, because the base Poller will transmit only.



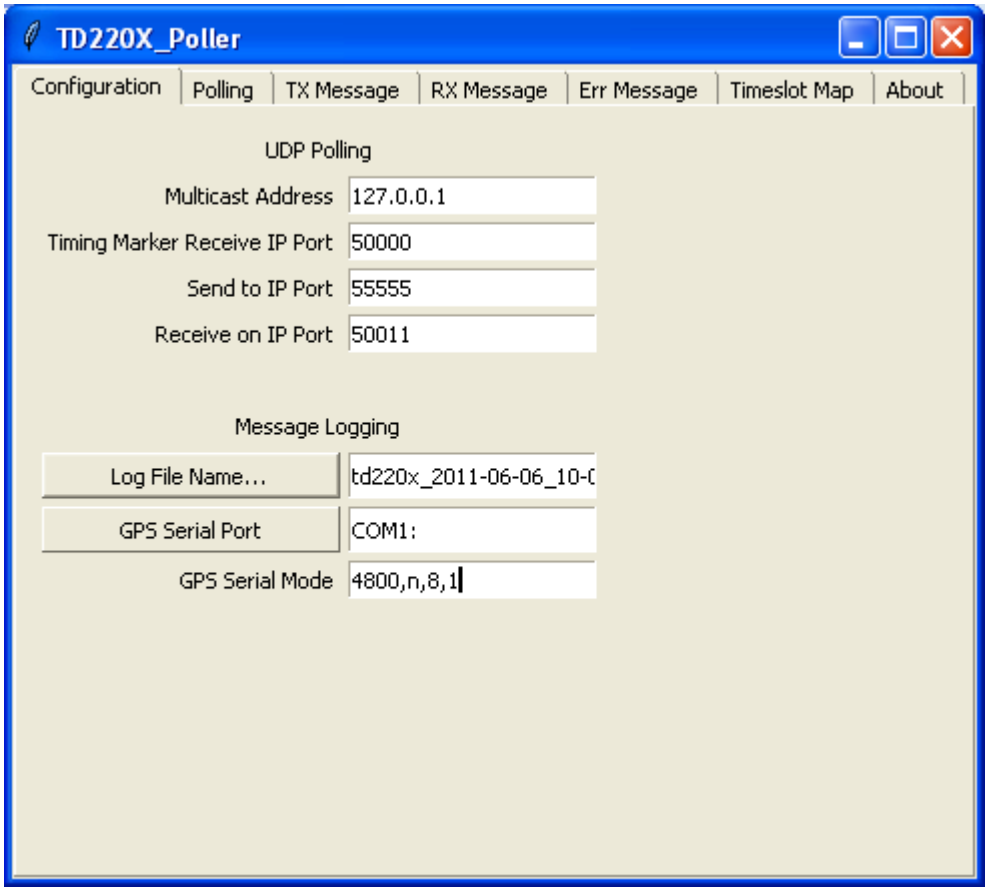
Notes: The Polling interval should be set to something fairly short to make sure the survey territory is adequately painted, however setting it below 500 ms or so may exceed the transmit duty cycle of the radio and/or overflow the radio's input buffer and should be avoided. Setting "Stop After (polls)" to zero causes the base Poller to continue transmitting messages indefinitely. "Parse Response" can be set to "No" as the base Poller will transmit only.



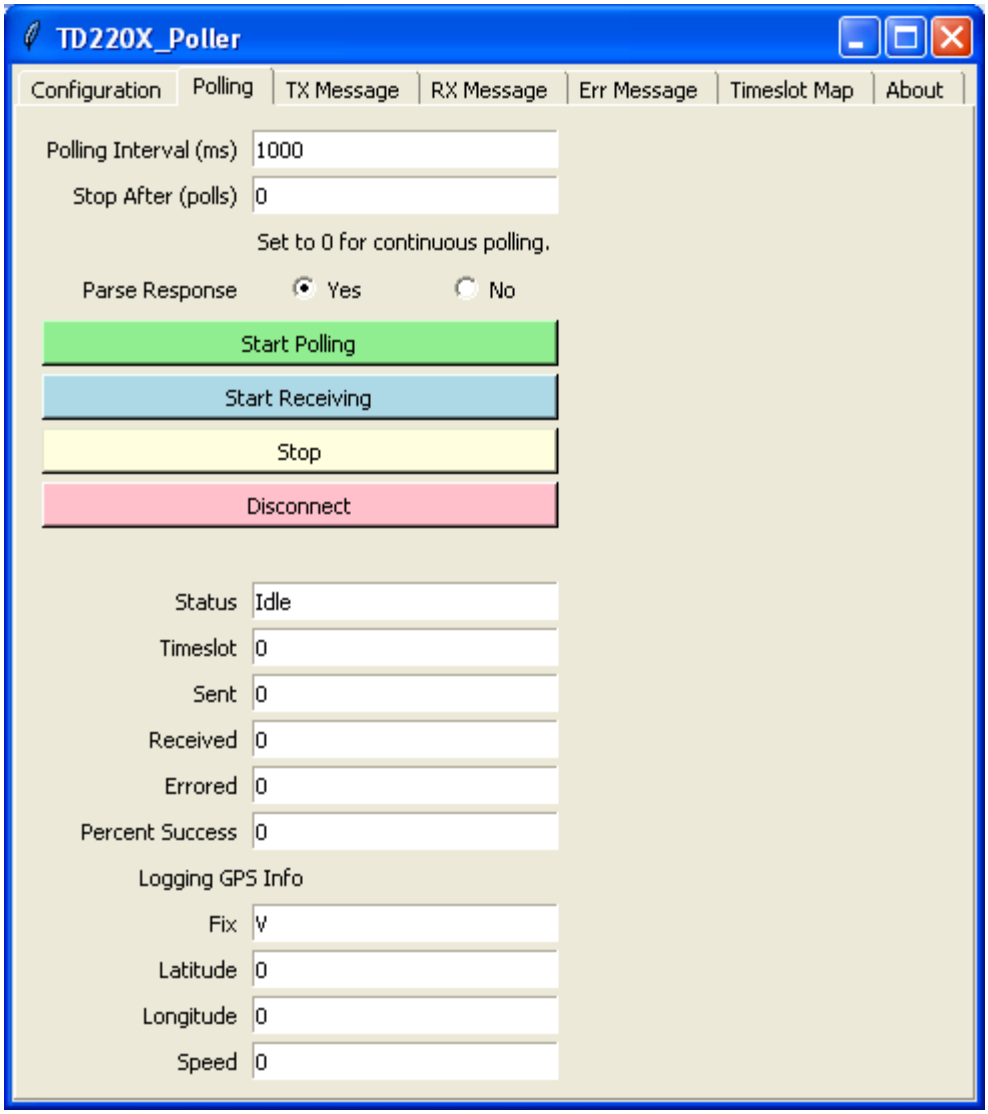
Note: Again, make sure you are authorized to transmit on the TX frequency you configure here. Make sure the transmit power is appropriate for the survey you are undertaking. 2 Watts shown above is the minimum power the radio puts out stand-alone. With an external PA, the radio is set to 2 Watts and the PA is adjusted to obtain the desired transmit power level. The power setting is in hex, so 25 Watts would be entered as 19 for example.

4.8.2 Set up the Mobile System

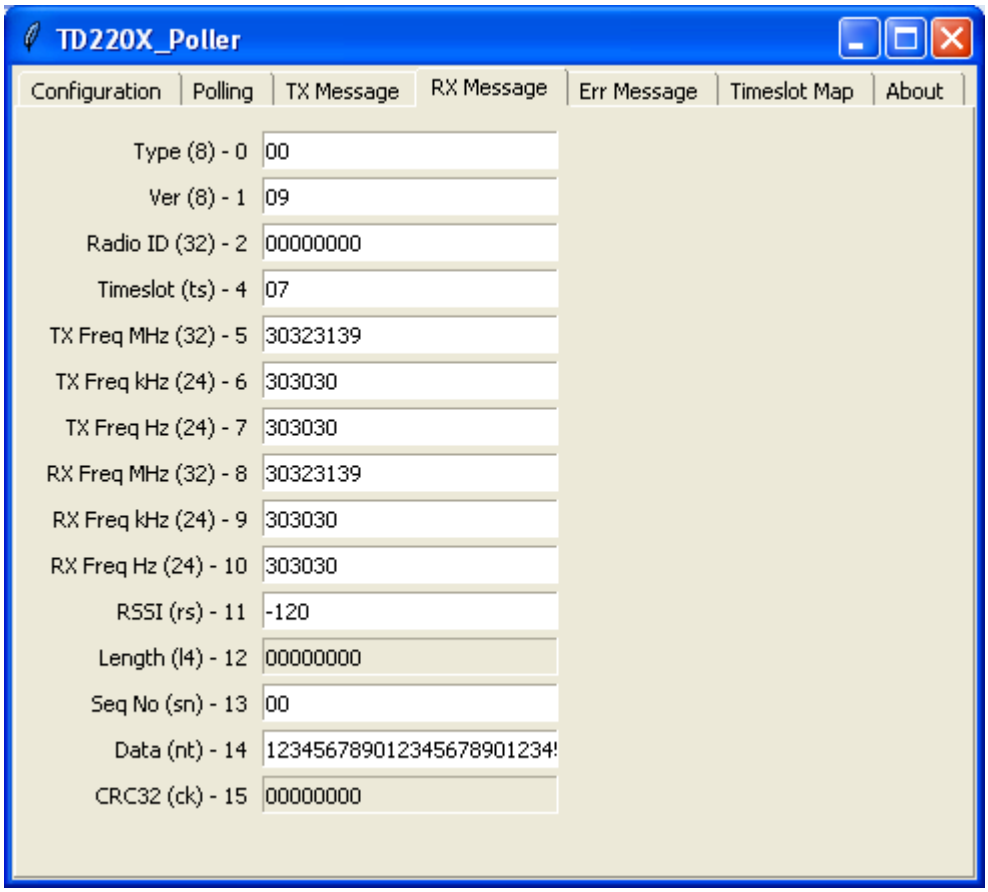
1. Set up the Mobile Radio as above, such that it obtains its system timing "OTA" or over the air using beacons from the Base Radio.
2. Obtain a GPS receiver that can output NMEA serial messages to a portable PC for logging purposes.
3. Configure the GPS receiver to output only $GPRMC sentences.
4. Run the Poller application on a portable PC or laptop to travel with the mobile radio.
5. Set up the mobile Poller application as shown in the following screen shots.
6. When you start the test from the Mobile Poller application, use the "Start Receiving" button instead of the "Start Polling" button. This puts the utility into receive-only mode.



Notes: You should set the mobile Poller to send to the portable PC's IP address (or 127.0.0.1) and an unused port like 55555 because the mobile radio is not intended to transmit for this test. Set the mobile Poller to log to the desired file. This file will contain your survey data including date, time, GPS location and received signal strength. Set the Poller application to accept GPS NMEA data from a GPS receiver via the appropriate serial port and mode.



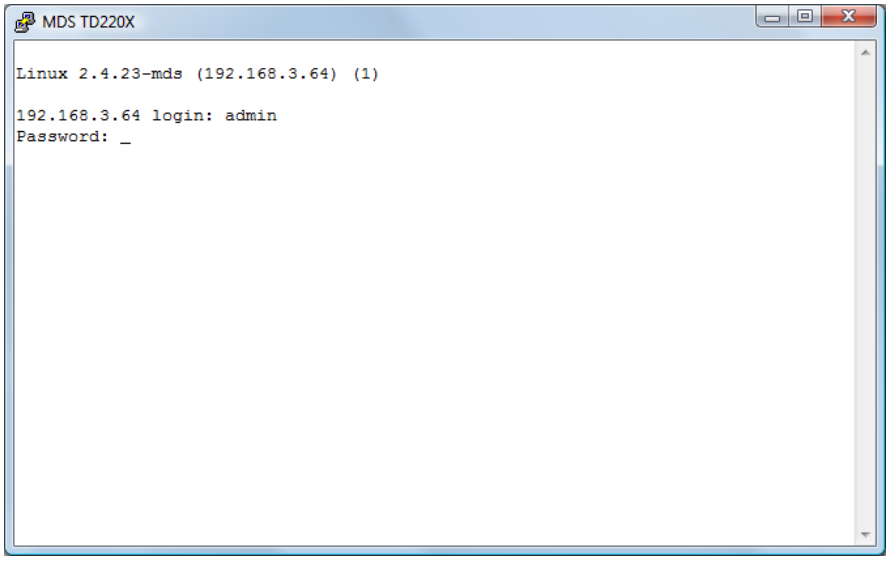
Notes: Set the mobile Poller's "Stop After (polls)" value to zero to cause it to run until stopped manually. Set the mobile Poller's "Parse Response" field to "Yes".



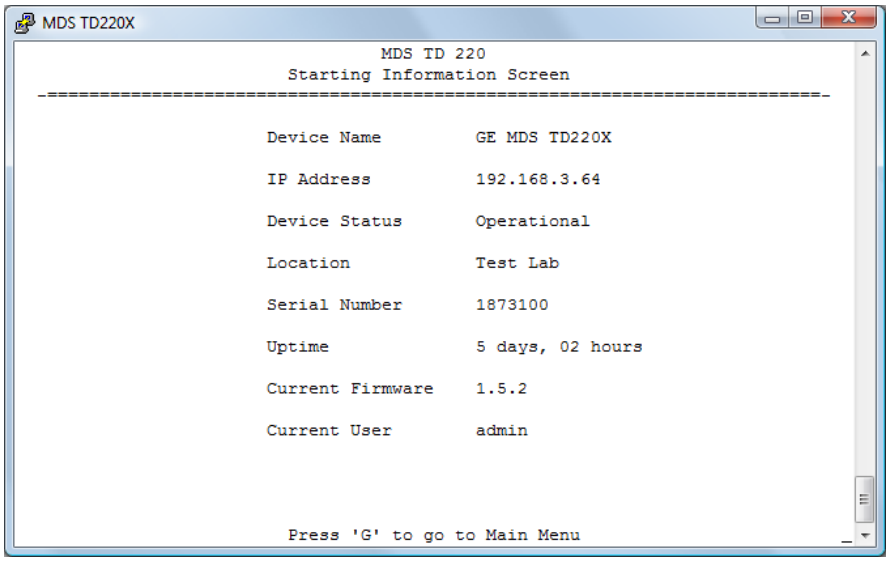
Notes: Make sure the RX Message tab looks like this. This tab is set up via the TD220X_Poller.parms file as shown above.

5 Menu Interface

Login with the administrator user name and password



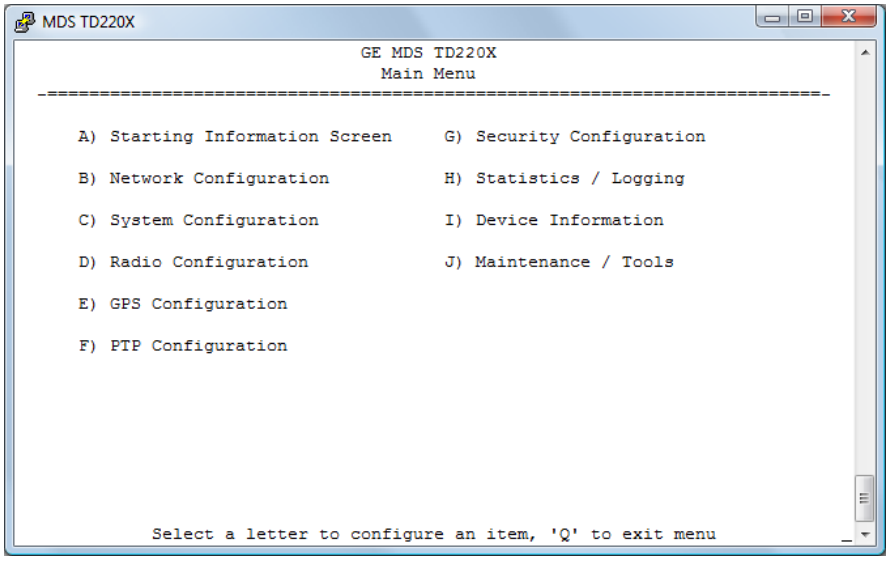
When logged in, the Starting Information Screen is displayed.



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.

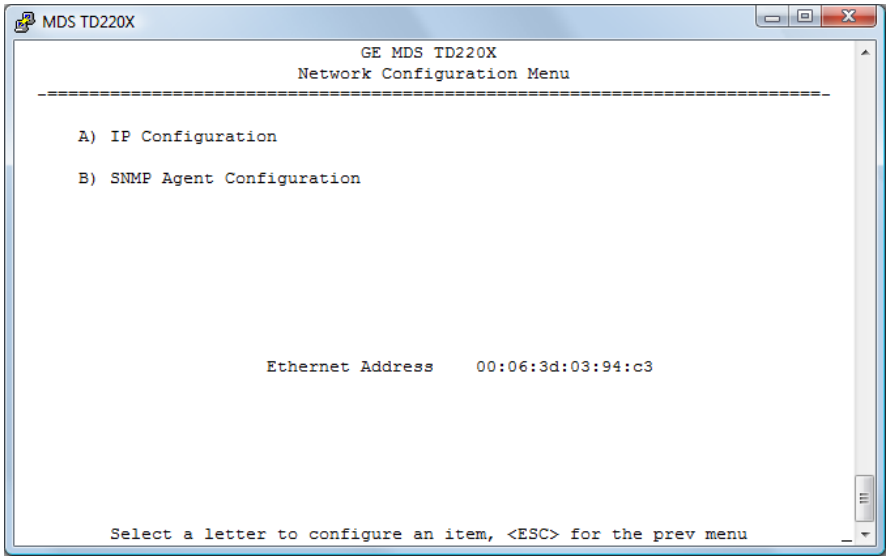
R* - This parameter is writable from another menu.

5.1 Main Menu

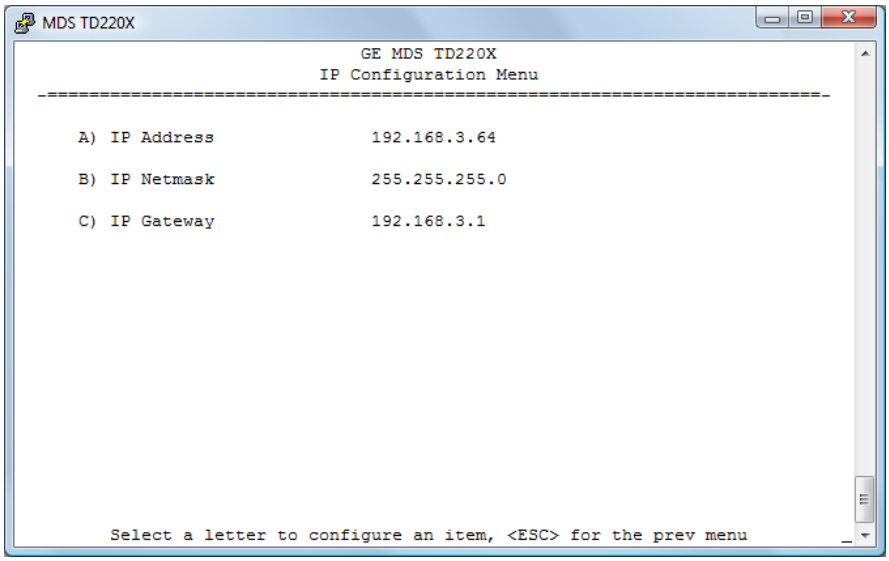


Parameter	R/W	Description
A) Starting Information Screen		Returns to the opening menu.
B) Network Configuration		Set the radio's IP Address, Netmask, and Gateway.
C) System Configuration		Set the radio's timing source (GPS/PTP/OTA) and other application-specific operating parameters.
D) Radio Configuration		Set the radio's Frequencies, RF Power Output, External PA Enable and access the Force TX Key function.
E) GPS Configuration		Set up the GPS NMEA and PPS connections
F) PTP Configuration		Set up the Precision Time Protocol (PTP) configuration.
G) Security Configuration		Set up how the radio may be accessed.
H) Statistics / Logging		Obtain historical and current statistics about the radio's payload performance, and access STFP Logging configuration.
I) Device Information		Set up the radio's Date, Time, Console Baud Rate and Names. Review the radio's Model, Serial Number, and Uptime.
J) Maintenance / Tools		Access the radio's Firmware Reprogramming, Configuration Script, and Ping Utility menus.

5.2 Network Configuration Menus

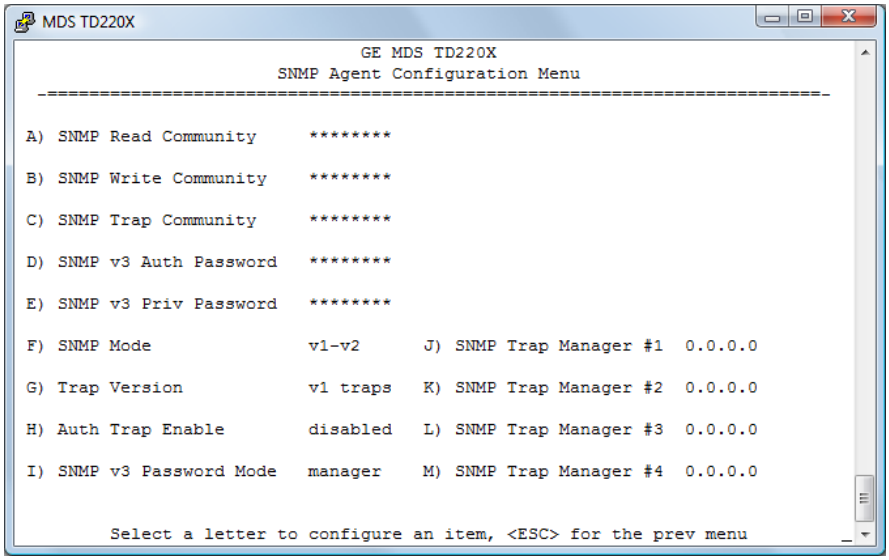


Parameter	R/W	Description
A) IP Configuration		Access the IP Configuration menu to set the IP Address, Netmask, and Gateway IP Address.
B) SNMP Agent Configuration		Access the SNMP Agent Configuration Menu.
Ethernet Address	R	Displays the hardware MAC address for the Ethernet port.



Parameter	R/W	Description
A) IP Address	R/W	The IP address that this radio will use for its Ethernet interface.
B) 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.

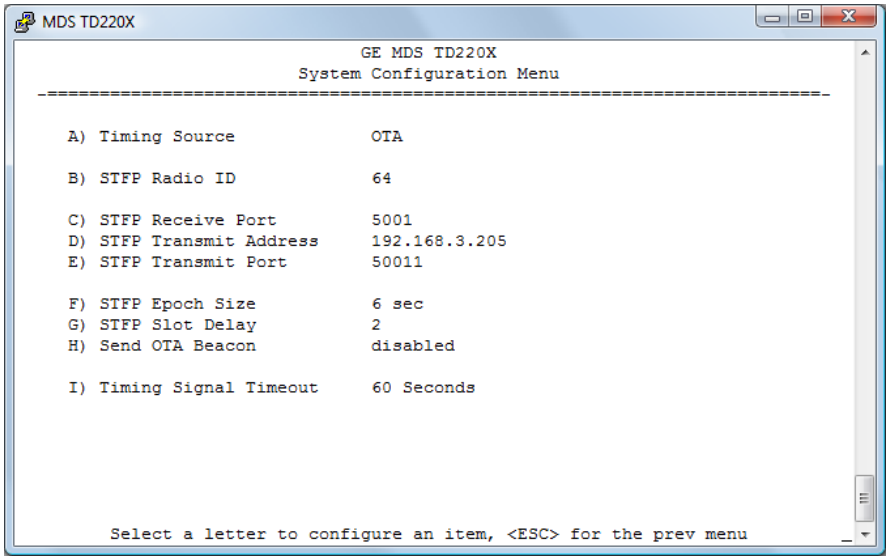
Note: The IP Address and IP Gateway must be on the same subnet or a Network Interface error will occur.



Parameter	R/W	Description
A) SNMP Read Community	R/W	SNMP community string used for SNMPv1/SNMPv2c read access. This string can be up to 30 alphanumeric characters.
B) SNMP Write Community	R/W	SNMP community string used for SNMPv1/SNMPv2c write access. This string can be up to 30 alphanumeric characters.
C) SNMP Trap Community	R/W	SNMP community string used for SNMPv1/SNMPv2c trap access. This string can be up to 30 alphanumeric characters.
D) SNMP v3 Auth Password	R/W	Authentication password stored in flash. Will be used when Agent is managing passwords locally or initially for all cases on reboot. This is the SNMPv3 password used for Authentication (currently only MD5 is supported). This string can be up to 30 alphanumeric characters.
E) SNMP v3 Priv Password	R/W	Privacy password stored in flash. Will be used when Agent is managing passwords locally or initially for all cases on reboot. This is the SNMPv3 password used for Privacy (DES encryption). This string can be between 8 and 30 alphanumeric characters.
F) SNMP Mode	R/W	This specifies the mode of operation of the SNMP Agent. Choices are disabled, v1_only, v2_only, v3_only, v1-v2, and v1-v2-v3. If the mode is disabled, then the Agent will not respond to any SNMP traffic. If the mode is v1_only, v2_only, or v3_only, then the Agent will only respond to that version of SNMP traffic. If the mode is v1-v2, or v1-v2-v3, then the Agent will respond to the specified version of SNMP traffic. The default mode is v1-v2-v3 (trilingual).
G) Trap Version	R/W	This specifies what version of SNMP will be used to encode the outgoing traps. The different versions of SNMP will include different information in the traps. The choices are v1_traps, v2_trap, and v3_traps. When v3_traps are selected, v2-style traps will be sent but with a v3 header.
H) Auth Trap Enable	R/W	Indicates whether or not traps will be generated for login events.
I) SNMP v3 Password Mode	R/W	Determines whether v3 passwords are managed locally or via an SNMP Manager. The different behaviors of the Agent depending on the mode specified here are described above.
J) SNMP Trap Manager #1	R/W	Specifies an SNMP Manager on the network that traps will be sent to.

Parameter	R/W	Description
K) SNMP Trap Manager #2	R/W	Specifies an SNMP Manager on the network that traps will be sent to.
L) SNMP Trap Manager #3	R/W	Specifies an SNMP Manager on the network that traps will be sent to.
M) SNMP Trap Manager #4	R/W	Specifies an SNMP Manager on the network that traps will be sent to.

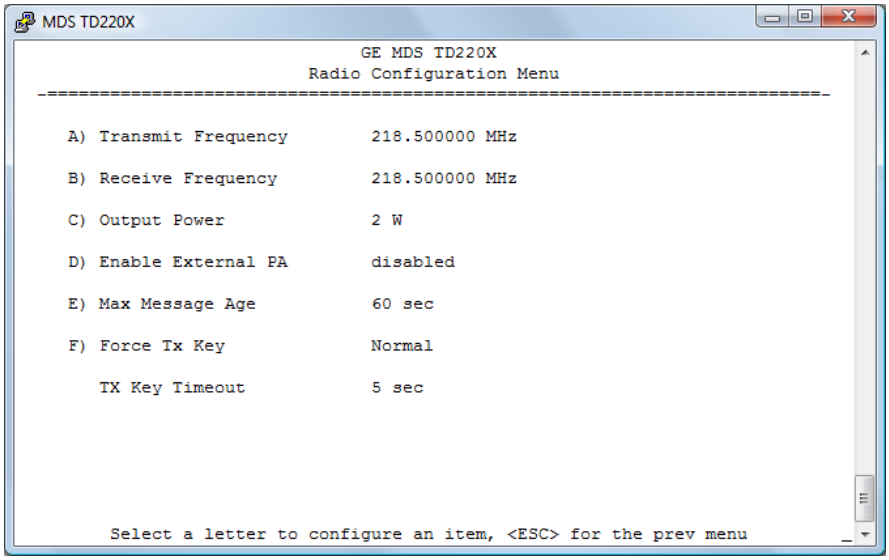
5.3 System Configuration Menu



Parameter	R/W	Description
A) Timing Source	R/W	The timing source used by the radio to precisely determine current time and the start of each second. Valid values are Global Positioning System (GPS), Precision Time Protocol (PTP), GPS with PTP fallback, PTP with GPS fallback, and over-the-air (OTA). Base radios are configured for GPS, PTP, GPS with PTP fallback, or PTP with GPS fallback. Mobile radios are configured for OTA. An OTA radio requires either a GPS or PTP radio within range in order to synchronize timing.
B) STFP Radio ID	R/W	Uniquely identifies the radio to the Communication Manager.
C) STFP Receive Port	R/W	This IP Port is used to receive STFP messages from the Communication Manager.
D) STFP Transmit Address	R/W	This is the IP Address of the Communication Manager.
E) STFP Transmit Port	R/W	This is the IP Port used by the Communication Manager to receive STFP messages from the radio.
F) STFP Epoch Size	R/W	This is the number of seconds constituting an epoch. Valid values are 1, 2, 3, 4, 5, 6, 10, 12, 15, 20, and 30. The number of timeslots equals 8 times the epoch size chosen. **Note: This parameter must match for all radios communicating.**
G) STFP Slot Delay	R/W	This is the number of slots (125ms each) in advance that the radio will request data from the Communication Manager. This delay encompasses the time needed for timing markers to transit the network, processing by the Communication Manager, and resulting payload messages to transit the network.
H) Send OTA Beacon	R/W	This parameter requests the radio to transmit beacons in the first time slot of each second when no message is received from the Communication Manager for the time slot. Beacons are required to maintain OTA timing of mobiles. **Note: This parameter is ignored and no beacons are sent when the timing source is set to OTA.**
I) Timing Signal	R/W	If the selected timing input is missing for this duration, the radio

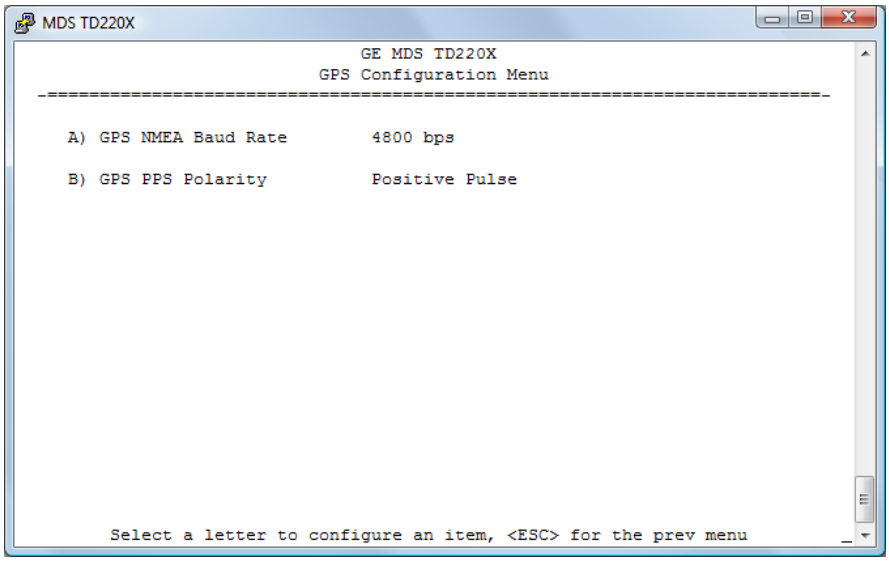
Timeout		asserts an alarm and if configured fails over to the selected alternate timing source.

5.4 Radio Configuration Menu



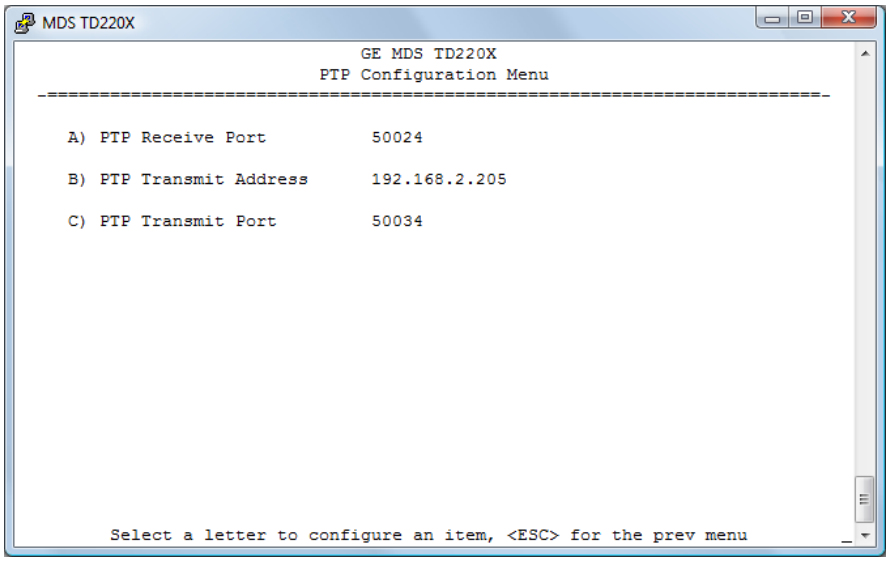
Parameter	R/W	Description
A) Transmit Frequency	R/W	The initial frequency in the 216.0 to 221.99875 MHz range that the radio uses for over the air transmissions upon booting. **Note: STFP messages specify the frequency to be used when transmitting. This parameter is ignored once an STFP message has been received.**
B) Receive Frequency	R/W	The initial frequency in the 216.0 to 221.99875 MHz range that the radio uses for receiving over the air transmissions upon booting. **Note: STFP messages specify the frequency to be used when receiving. This parameter is ignored once an STFP message has been received.**
C) Output Power	R/W	The RF Output Power from 2 to 25 Watts with which the radio transmits. **Note: STFP messages specify the power to be used when transmitting. This parameter is ignored once an STFP message has been received.**
D) Enable External PA	R/W	If enabled the radio ignores per message power values specified by STFP and forces transmissions at a lower power level suitable for driving the external PA (around 200 mW).
E) Max Message Age	R/W	The maximum age a transmit message can remain in the queue before it is dropped. This time is measured from when the message is received via UDP until it is about to be placed into a packet for transmission OTA.
F) Force TX Key	R/W	"Normal" to allow the radio to operate in data mode, "Forced" to key the transmitter for test purposes.
TX Key Timeout	R	If TX Key is Forced, the radio will automatically De-Key after this timeout.
Need to add information on duty cycle setup.		

5.5 GPS Configuration Menu



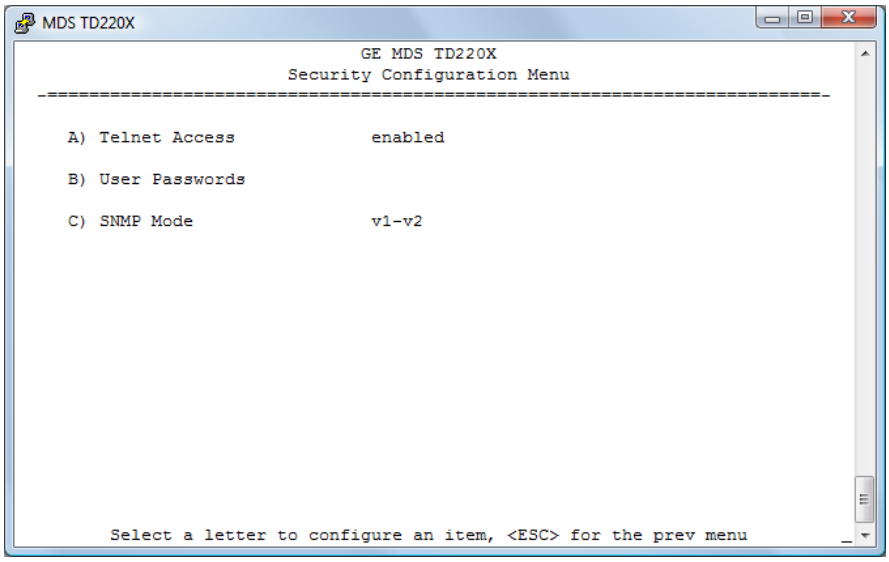
Parameter	R/W	Description
A) GPS NMEA Baud Rate	R/W	This is the Baud Rate used on the radio port to receive NMEA Sentences.
B) GPS PPS Polarity	R/W	Indicates if the TTL PPS Pulse is Active High (Positive Pulse) or Active Low (Negative Pulse).

5.6 PTP Configuration Menu



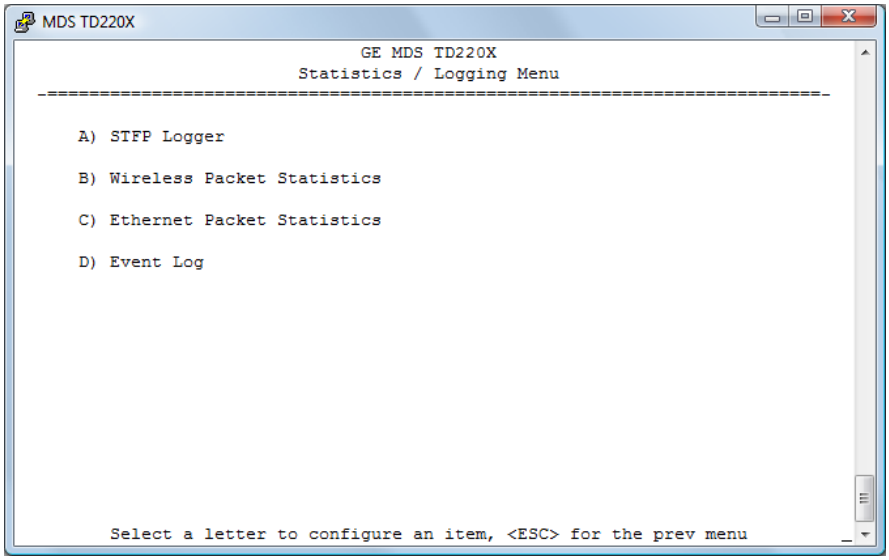
Parameter	R/W	Description
A) PTP Receive Port	R/W	This IP Port is used by the radio to receive messages from the PTP grandmaster Clock.
B) PTP Transmit Address	R/W	This is the IP Address of the PTP Grandmaster Clock to which the radio will send PTP messages.
C) PTP Transmit Port	R/W	This is the IP Port of the PTP Grandmaster Clock to which the radio will send PTP messages.

5.7 Security Configuration Menu

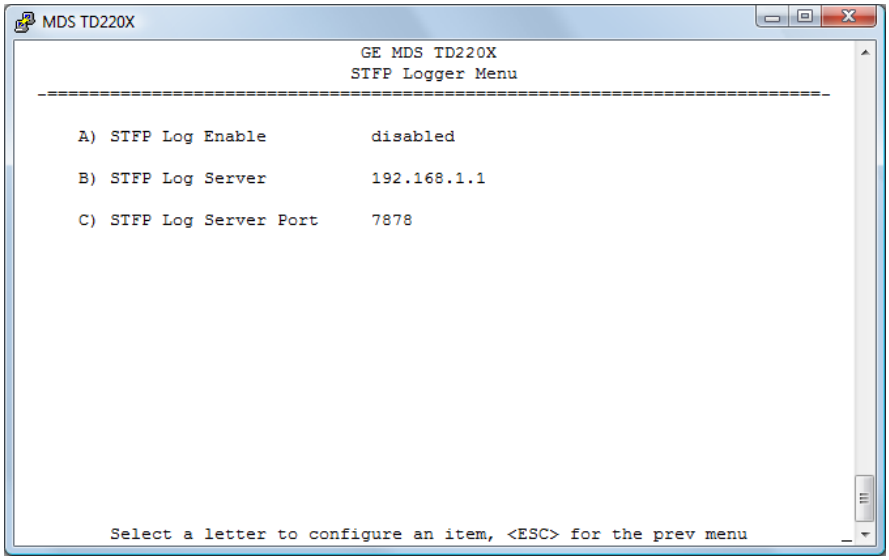


Parameter	R/W	Description
A) Telnet Access	R/W	If "enabled", the radio allows users to Telnet to the radio via Ethernet. If "disabled", users must manage the radio via SNMP or the serial console.
B) User Passwords		Allows modification of the admin password.
F) SNMP Mode	R/W	This specifies the mode of operation of the SNMP Agent. Choices are disabled, v1_only, v2_only, v3_only, v1-v2, and v1-v2-v3. If the mode is disabled, then the Agent will not respond to any SNMP traffic. If the mode is v1_only, v2_only, or v3_only, then the Agent will only respond to that version of SNMP traffic. If the mode is v1-v2, or v1-v2-v3, then the Agent will respond to the specified version of SNMP traffic. The default mode is v1-v2-v3 (trilingual).

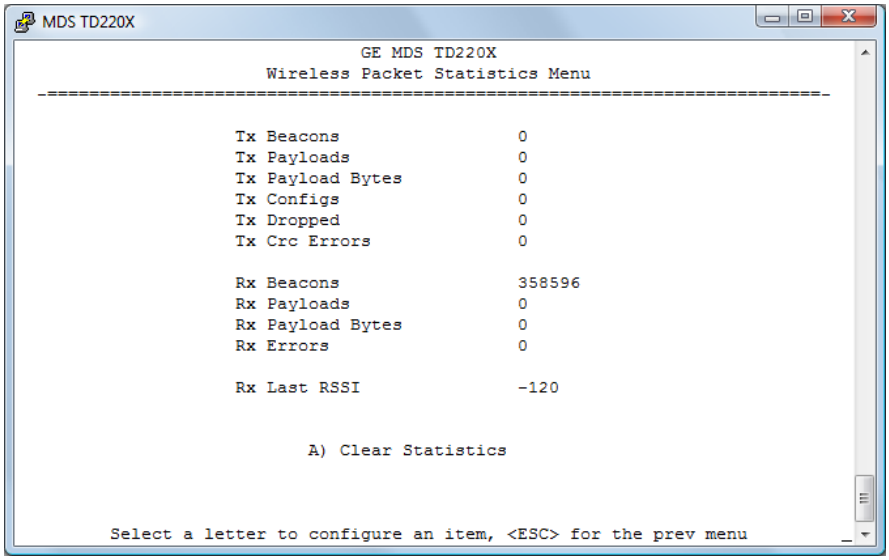
5.8 Statistics/Logging Menus



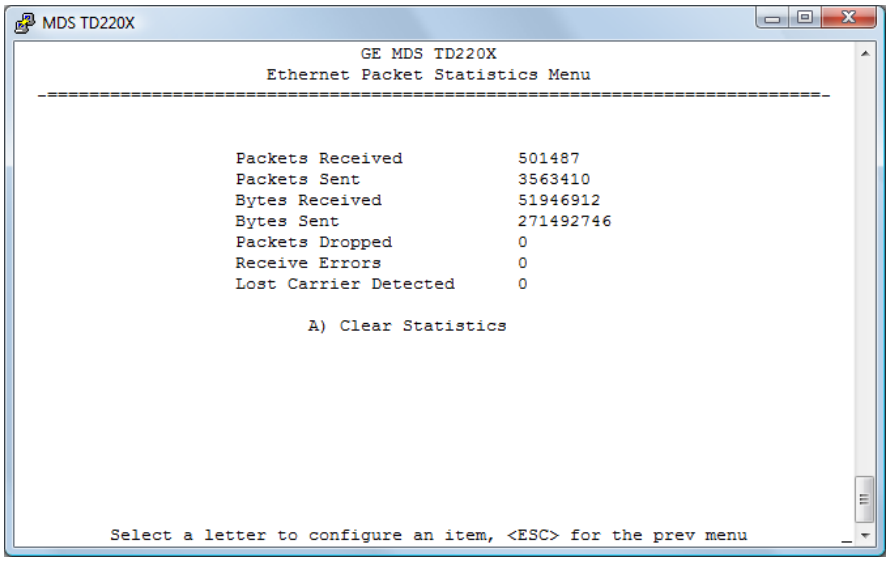
Parameter	R/W	Description
A) STFP Logger		Access the STFP Logger menu.
B) Wireless Packet Statistics		Access the Wireless Packet Statistics menu where you can view the number of messages passed over the air.
C) Ethernet Packet Statistics		Access the Ethernet Packet Statistics menu where you can view 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.



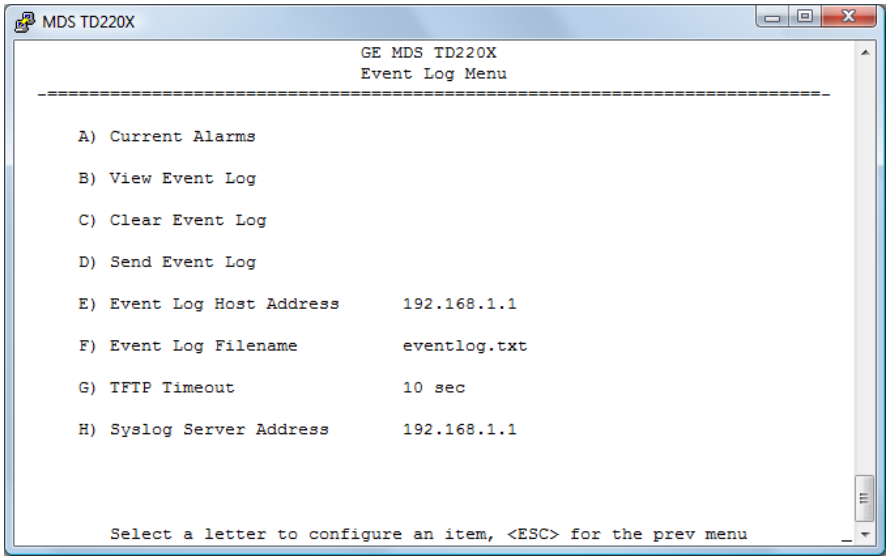
Parameter	R/W	Description
A) STFP Log Enable	R/W	If "enabled", the radio will send UDP messages to a logging host.
B) STFP Log Server	R/W	The IP address to send UDP messages for logging STFP traffic.
C) STFP Log Server Port	R/W	The IP port number to send UDP messages for logging STFP traffic.



Parameter	R/W	Description
Tx Beacons	R	The number of beacon messages transmitted over the air. Beacon messages are messages sent in the first time slot of a second that contain no payload. If a message with payload is sent during the first time slot of a second, it is still used by OTA radios to synchronize time but it is not included in this statistic.
Tx Payloads	R	The number of packets containing payload transmitted over the air.
Tx Payload Bytes	R	The number of bytes for all packets containing payload transmitted over the air.
Tx Configs	R	The number of STFP configuration messages processed by the radio. STFP configuration messages are used to change the radio receive and transmit frequencies.
Tx Dropped	R	The number of packets to be transmitted over the air that were dropped by the radio before sending. There can be various reasons for this. For example, an STFP message could not be properly decoded by the radio, or a message could not be transmitted because the radio is in an alarm state.
Tx Crc Errors	R	The number of packets to be transmitted over the air that were dropped by the radio before sending because the STFP CRC did not match.
Rx Beacons	R	The number of beacon messages received over the air. Beacon messages are messages sent in the first time slot of a second that contain no payload.
Rx Payloads	R	The number of packets containing payload received over the air.
Rx Payload Bytes	R	The number of bytes for all packets containing payload received over the air.
Rx Errors	R	The number of packets received over the air for which the radio detected an error that could not be compensated for using forward error correction. This will match the number of STFP error messages generated by the radio.
Rx Last RSSI	R	The RSSI of the last message received.
A) Clear Statistics		Reset all results to zero.

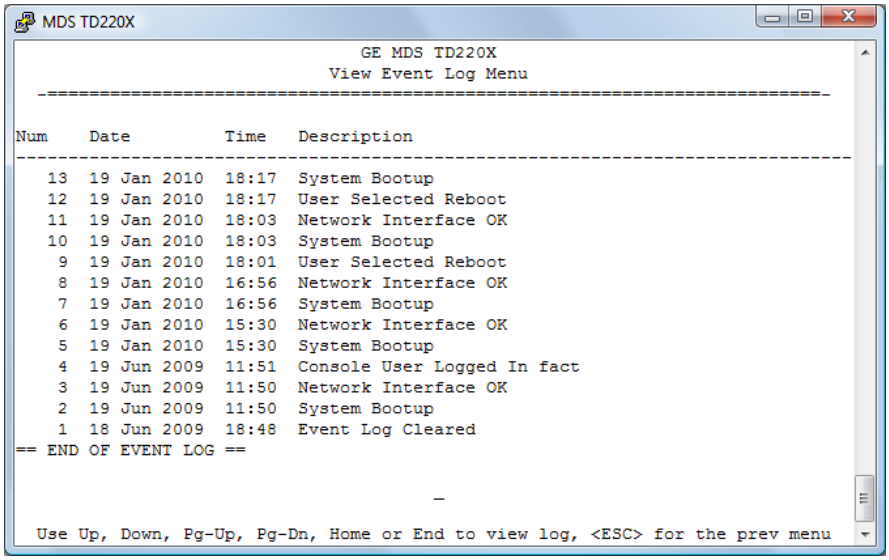


Parameter	R/W	Description
Packets Received	R	The number of packets received over Ethernet.
Packet Sent	R	The number of packets transmitted over Ethernet.
Bytes Received	R	The number of bytes for all packets received over Ethernet.
Bytes Sent	R	The number of bytes for all packets transmitted over Ethernet.
Packets Dropped	R	The number of packets that were dropped due to the Ethernet interface being busy.
Receive Errors	R	The number of messages received over Ethernet that did not decode properly.
Lost Carrier Detected	R	The number of times a message could not be sent over Ethernet because the cable was unplugged.
A) Clear Statistics		Reset all results to zero.

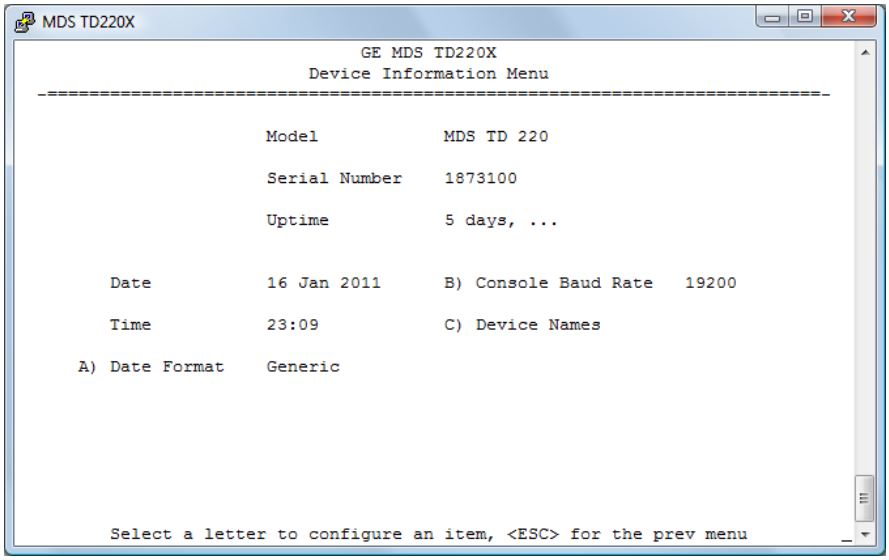


Parameter	R/W	Description
A) Current Alarms		Display a list of the alarms currently active within the radio.
B) View Event Log		Scroll through the historical list of radio events and alarms.
C) Clear Event Log		Erase all history of radio events and alarms.
D) Send Event Log		Begin a TFTP transfer of 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.

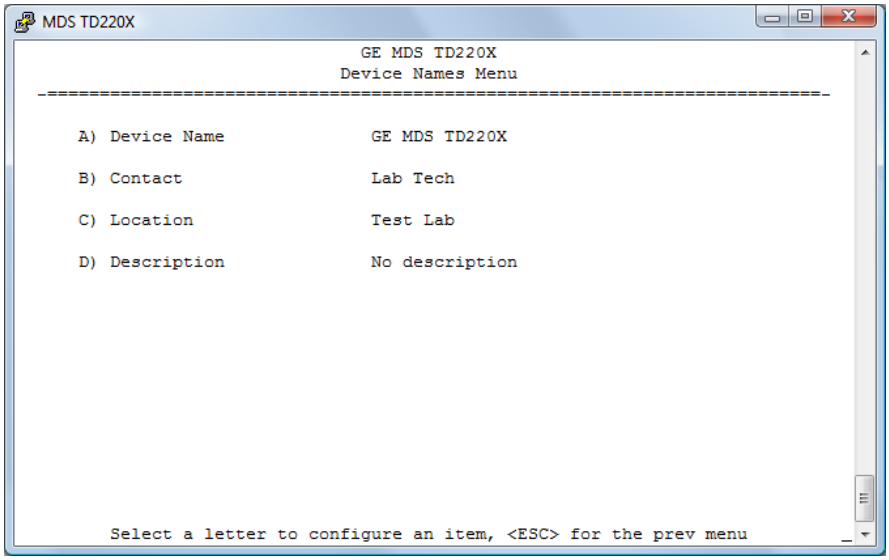
This screen displays the event number, date and time, and event or alarm for each occurrence.



5.9 Device Information Menus

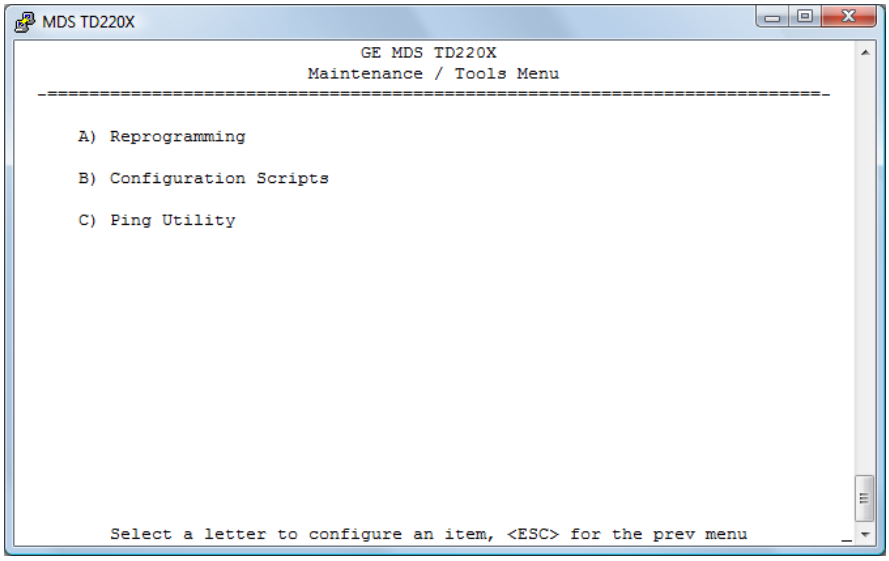


Parameter	R/W	Description
Model	R	The Model Type of the radio.
Serial Number	R	The factory-assigned unique radio Serial Number.
Uptime	R	The number of elapsed hours, minutes, and seconds since the radio last rebooted.
Date	R	The Date from the GPS receiver.
Time	R	The Time from the GPS receiver.
A) Date 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.

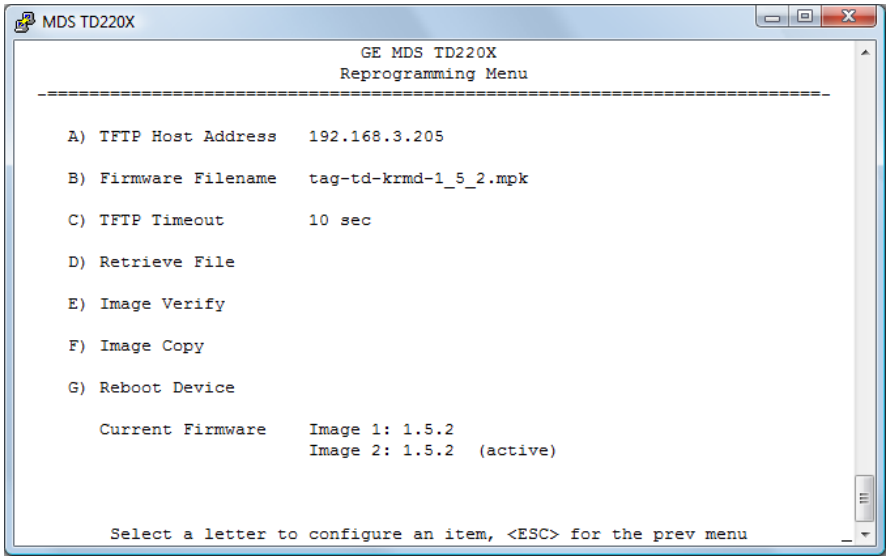


Parameter	R/W	Description
A) Device Name	R/W	Free-form field where you can enter a nickname for this radio.
B) Contact	R/W	Free-form field where you can indicate who to contact in case the radio needs service.
C) Location	R/W	Free-form field where you can describe the site at which the radio is installed.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

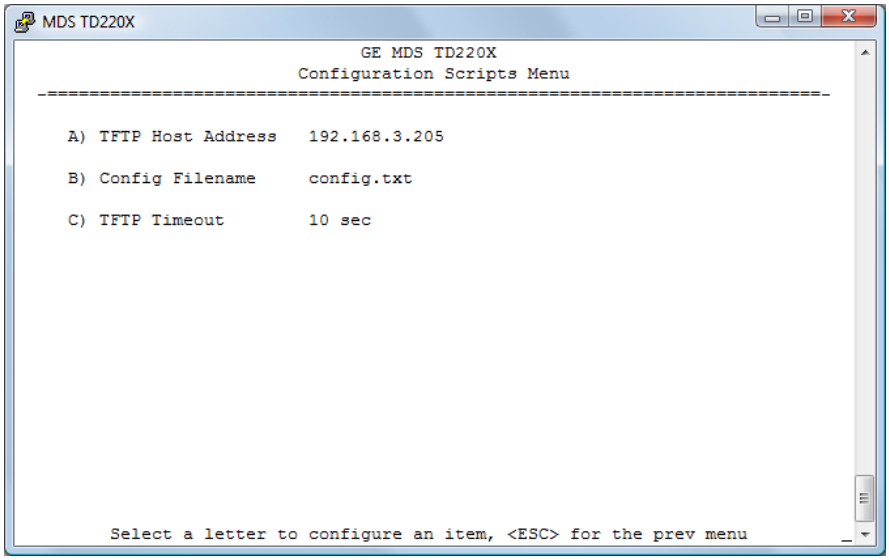
5.10 Maintenance/Tools Menus



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.

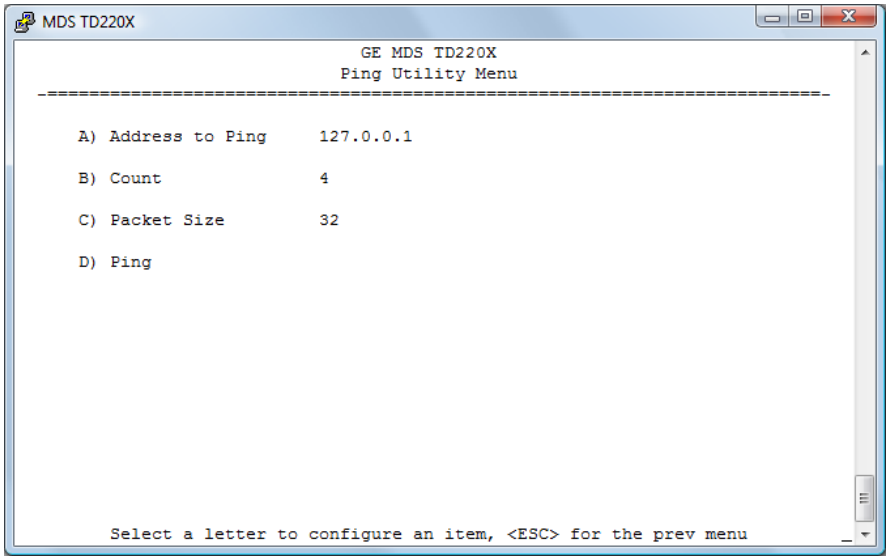


Parameter	R/W	Description
A) TFTP Host Address	R/W	The IP address of the TFTP server from which you will download a new firmware image.
B) Firmware Filename	R/W	The file name for the firmware image. This file must exist on the server.
C) TFTP Timeout	R/W	If the radio cannot reach the TFTP server, it 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.



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.



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.

6 Troubleshooting

Here are some tips to help resolve issues when operating the TD220X.

Symptom	Possible Cause
Radio is alarmed (PWR LED is flashing)	Check the alarm list accessible from the Starting Information Screen.
Alarm: GPS PPS Not Available	Radio is not receiving a PPS.
Alarm: GPS Signal Inverted	Although a PPS has been detected, it is in the ACTIVE state for more than a half of a second. Try switching the PPS Polarity setting on the GPS Configuration Menu.
Alarm: NMEA Data – Invalid	The radio is not receiving valid NMEA GGA Sentences. Verify that the NMEA Baud rate is set correctly and verify that the GPS is outputting ASCII GGA sentences (and no others, if possible).
Alarm: OTA Sync Lost	The radio has lost over the air synchronization because it is no longer receiving wireless beacons from a GPS or PTP radio.
Alarm: PTP Sync Lost	The radio is not receiving time updates from the configured PTP Grandmaster Clock.
Radio shows messages are received via Ethernet, but it will not transmit over the air.	Radio is alarmed.

7 Change Log

Version	Date	Author	Changes
1	1/17/2011	L. Lowe	• Initial release for TD220X
2	1/20/2011	T. Mayo	• Updated FCC notices • Updated power supply current requirements
3	2/15/2011	T. Mayo	• Clarified 1PPS input levels.
4	2/24/2011	T. Mayo	• Updated screenshots for the Poller application. • Added a section on field surveying using the Poller application.
5	2/28/2011	T. Mayo	• Removed references to Parm Poller, the old name for TD220X Poller.
6	3/7/2011	K. Tuttle	• Added the “Upgrading the Firmware” section
7	6/6/2011	T. Mayo	• Adjusted parts of the bench and field test sections to make configuration more foolproof.
8	5/15/2012	T. Mayo	• Added information on COM1 port defaults. • Changed links to point to Support Central.
9	7/30/2014	T. Mayo	• Added information for DB-25 aggregated alarm output (pin 8). • Added information for fallback timing sources. • Corrected frequency ranges for Radio Configuration menu. • Need to add information on duty cycle setup. • Made corrections based on agency compliance feedback.
10	7/30/2014	T. Mayo	• Added part number.
11	7/31/2014	T. Mayo	• Clarified duty cycle information.