TELEX
RADIO DISPATCH PRODUCTS

Application Guide

MOTOTRBO DMR
Interface for IP-224

VOIProven

TELEX
Radio Dispatch

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Claims

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MOTOTRBO Claim

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Warning

This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

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OpenSSL Project

This product includes software developed by the OpenSSL Project for use in the OpenSSL Toolkit (http://www.openssl.org/). This product includes cryptographic software written by Eric Young (eay@cryptsoft.com). This product includes cryptographic software written by Tim Hudson (tjh@cryptsoft.com)

Table of Contents

1.0 Introduction

The MOTOTRBO DMR radio interface is designed as an add-on option in the Telex Radio Dispatch system. This application guide describes the Telex Radio Dispatch MOTOTRBO DMR feature set and how to configure the interface for the IP-224 and C-Soft.

NOTE: The MOTOTRBO DMR Interface only works with C-Soft, not with hardware dispatch consoles.

NOTE: For more information, see the IP-224 Technical Manual (P/N F.01U.218.562), the C-Soft Software Manual (P/N F.01U.218.561), and the Radio Manufacturer's technical documentation.

2.0 Hardware Requirements

- IP-224 Ethernet Adapter Panel (P/N F.01U.306.547)
- IP-224 to MOTOTRBO Interface Cable (P/N F.01U.306.549)
- MOTOTRBO DMR Radio

NOTE: The IP-224 supports only one (1) of these interfaces, the unused line can then be used for a different interface.

NOTE: See IP-224 Firmware Release Notes for the radio firmware revision tested.

3.0 Software Requirements

- C-Soft version 6.500 or later
- IP-224 version 2.300 or later
- IP-224 Advanced Interface Option (North American) Access Key
- Telex System Manager (TSM) version 2.300 or later
- Windows 7 (32-bit or 64-bit)
- Windows 8.1
- MOTOTRBO CPS (Customer Programmer Software)

4.0 Supported Features

MOTOTRBO DMR Radio Supported Features					
Feature	**Analog Support**	**Digital Support**	**Feature**	**Analog Support**	**Digital Support**
Channel/Talkgroup Change	Yes	Yes	Emergency Acknowledgement	No	Yes
Zone Change	Yes	Yes	Encryption On/Off	No	No
			GPS Read	No	*
Group Call	No	Yes	GPS Trigger On/Off	No	*
Private Call	No	Yes	Monitor On/Off	Yes	Yes
			Radio Call Alert	No	Yes
ANI Decode	Yes	Yes	Radio Check	No	Yes
Call Alert Decode	Yes	Yes	Radio Enable/Disable	No	Yes
Emergency Decode	Yes	Yes	Radio Select Call	No	No
Status Message Decode	No	No	Radio Remote Monitor	No	Yes
Text Message Decode	No	*	Radio Send Text Message	No	*
			Radio Status (Send Status Message)	No	No
Query Encryption	No	No	Radio Status Request	No	No
Query Monitor	No	No	Scan Add/Delete	No	No
Query Scan	No	No	Scan On/Off	Yes	Yes
Query Talk Around	No	No	Talk Around On/Off	No	No

*Not fully supported, please see the Known Limitations section.

5.0 Known Limitations

MOTOTRBO DMR Interface Digital System Limitations				
	IP Site Connect	**Capacity Plus**	**Linked Capacity Plus**	**Connect Plus**
GPS Read	Yes	Yes	Yes	** Currently not supported
GPS Trigger On/Off	Yes	Yes	Yes	** Currently not supported
Radio Send Text Message	Yes	Yes	Yes	** Currently not supported
Text Message Decode	Yes	Yes	Yes	** Currently not supported

6.0 Cable Diagram

The IP-224 to MOTOTRBO Interface Cable allows the IP-224 to control a MOTOTRBO DMR radio. A total of 13 pins from the MOTOTRBO radio are needed for all features to be supported in C-Soft.

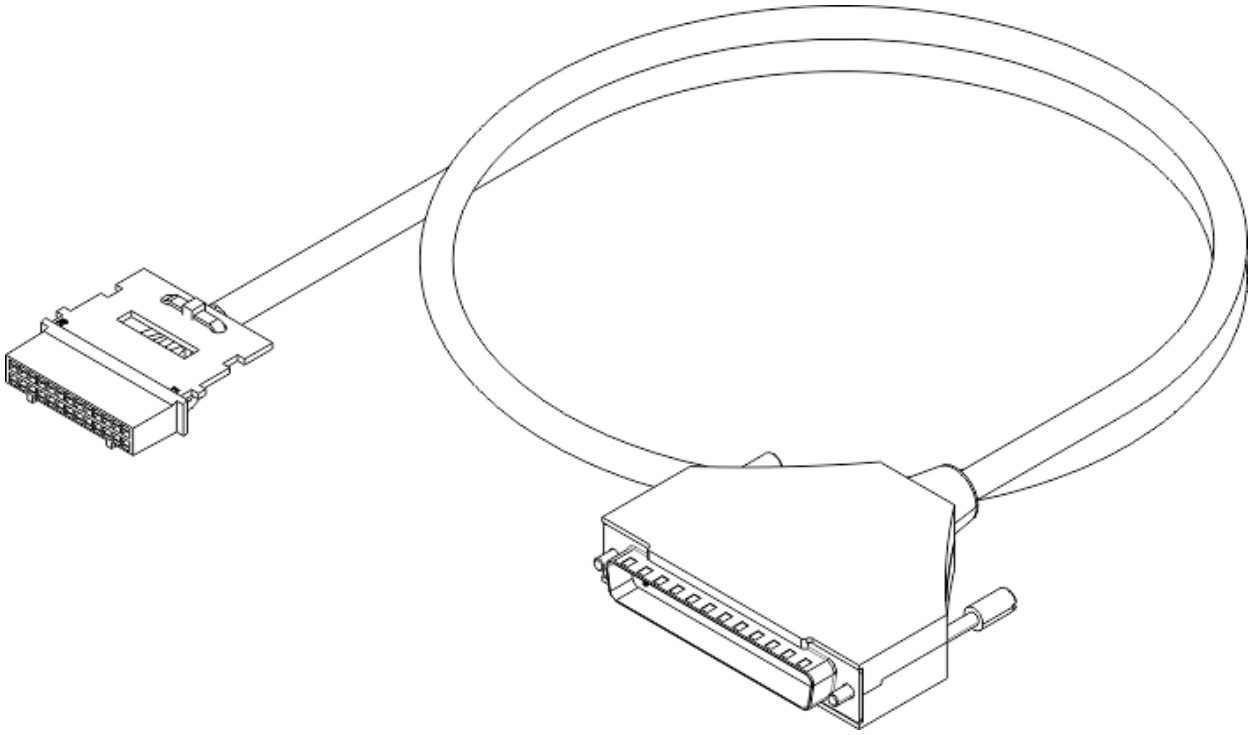


FIGURE 1. IP-224 to MOTOTRBO Interface Cable

Cable diagram for MOTOTRBO Radio and IP-224 Interface		
IP-224 DB-37 Connector	**IP-224 Pin Description**	**MOTOTRBO Radio Connector (DIN 26) and IP-224 Connector (DB-37)**
DB-37 Pin 1	TX+ Audio	DIN 26 Pin 11
DB-37 Pin 15	COR Input	DIN 26 Pin 19 and Pin 20
DB-37 Pin 18	USB Vbus/+5Vdc Output	DIN 26 Pin 3
DB-37 Pin 19	USB D+	DIN 26 Pin 1
DB-37 Pin 20	RX+ Audio	DIN 26 Pin 14
DB-37 Pin 21	RX- Audio	DB-37 Pin 29
DB-37 Pin 24	PTT Relay N.O. Contact	DIN 26 Pin 17 and Pin 21
DB-37 Pin 29	Ground	DIN 26 Pin 4, Pin 12, Pin 16, Pin 18 DB-37 Pin 21
DB-37 Pin 37	USB D-	DIN 26 Pin 2

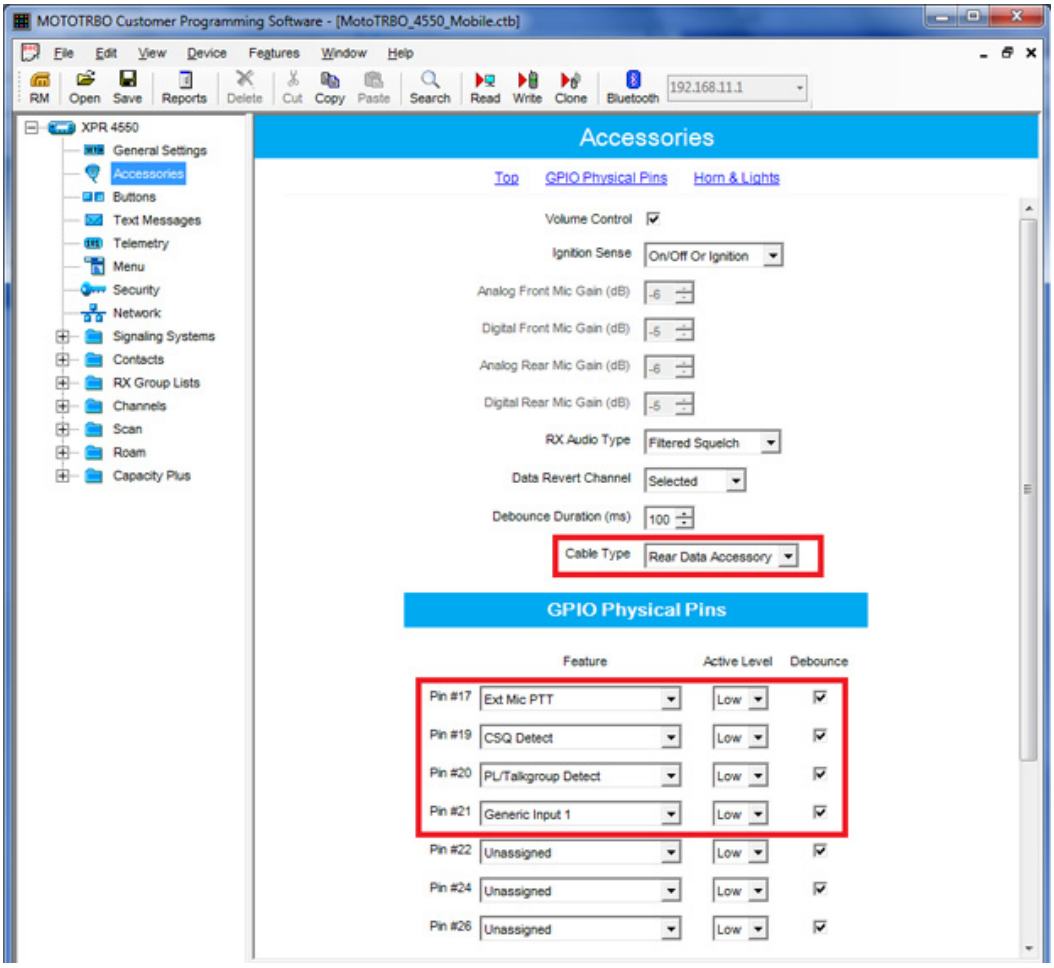
7.0 Radio Programming Application Setup

7.1 MOTOTRBO CPS Configuration

The MOTOTRBO **CPS** (Customer Programming Software) is used to configure the MOTOTRBO DMR radio to interface properly with the IP-224.

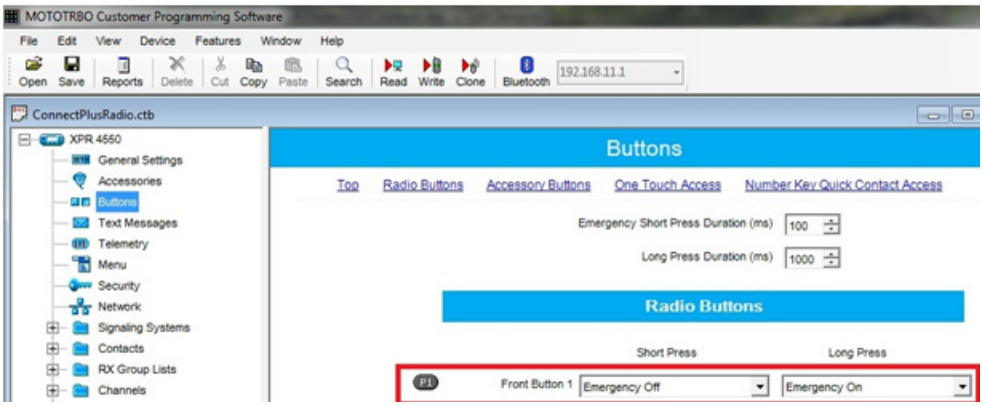
To **set up the radio**, do the following:

1. Open the **MOTOTRBO CPS** and read the **radio settings**.
2. In the left navigation, click **Accessories**.
   The Accessories page appears.



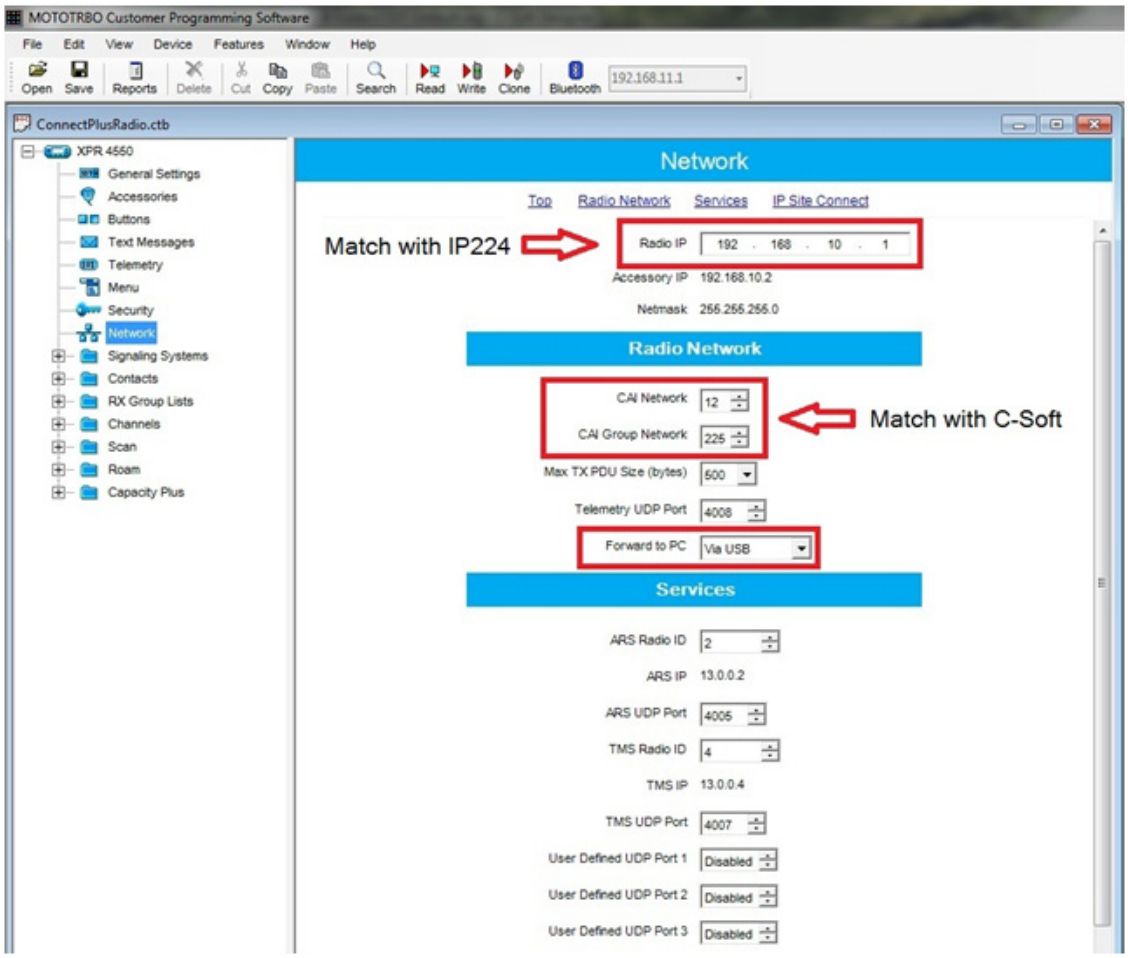
3. From the Cable Type drop down menu, select **Rear Data Accessory**.
4. From the Pin #17 drop down menu, select **Ext Mic PTT**, with the **Active Level at Low**, and the **Debounce check box selected**.
5. From the Pin #19 drop down menu, select **CSQ Detect**, with the **Active Level at Low**, and the **Debounce check box selected**.
6. From the Pin #20 drop down menu, select **PL/Talkgroup Detect**, with the **Active Level at Low**, and the **Debounce check box selected**.
7. From the Pin #21 drop down menu, select **Generic Input 1**, with **Active Level at Low**, and the **Debounce check box selected**.

8. In the left navigation, click **Buttons**.
   The Buttons page appears.



9. From the P1 Front Button 1 Short Press drop down menu, select **Emergency Off**.
10. From the P1 Front Button 1 Long Press drop down menu, select **Emergency On**.

11. In the left navigation, click **Network**.
The Network page appears.



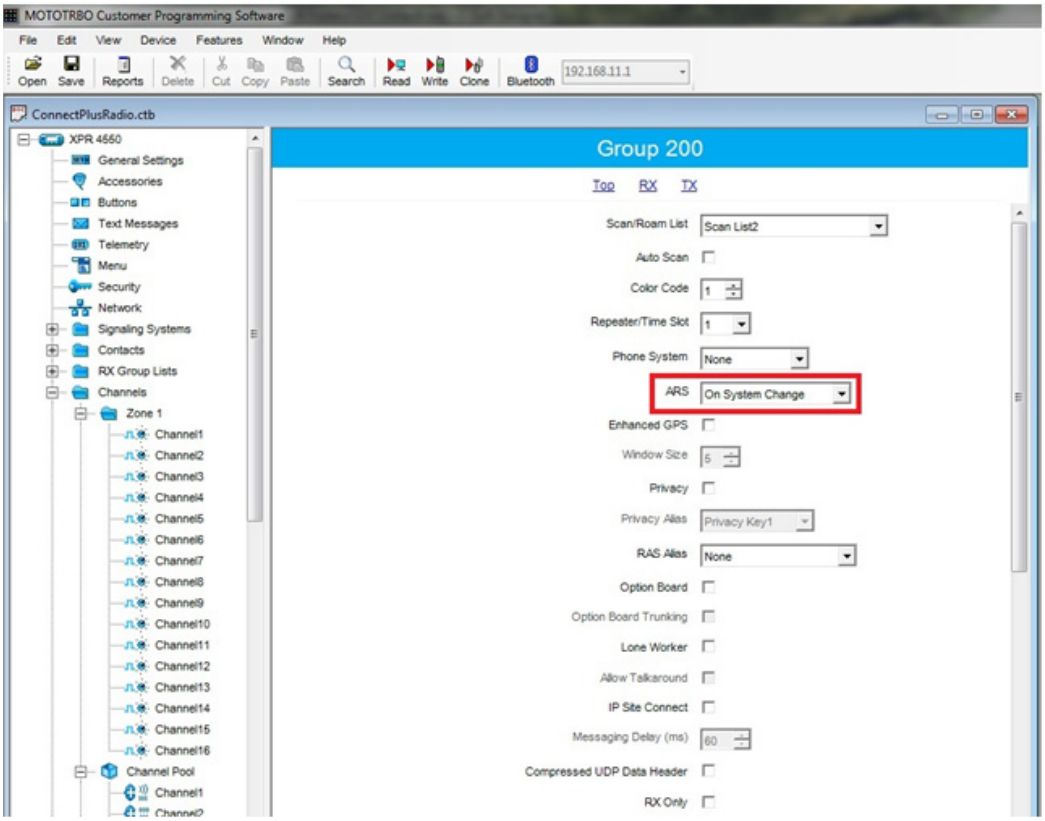
NOTE: The Radio IP address must match with the IP-224 Radio IP entered in the Multicast Setup - > MOTOTRBO Radio Setup - > Radio IP field.

12. In the Radio IP field, enter the **IP Address for the radio**.

NOTE: The CAI Network and CAI Group Network values must match the C-Soft configuration in the MOTOTRBO Setup. If the values do not match, C-Soft will not be able to receive or send text messages.

13. In the CAI Network spin box, select the **CAI Network** for the radio.
14. In the CAI Group Network spin box, select the **CAI Group Network** for the radio.
15. From the Forward to PC drop down menu, select **Via USB**.

16. In the left navigation, click **Channels**.
    The Channels page appears.



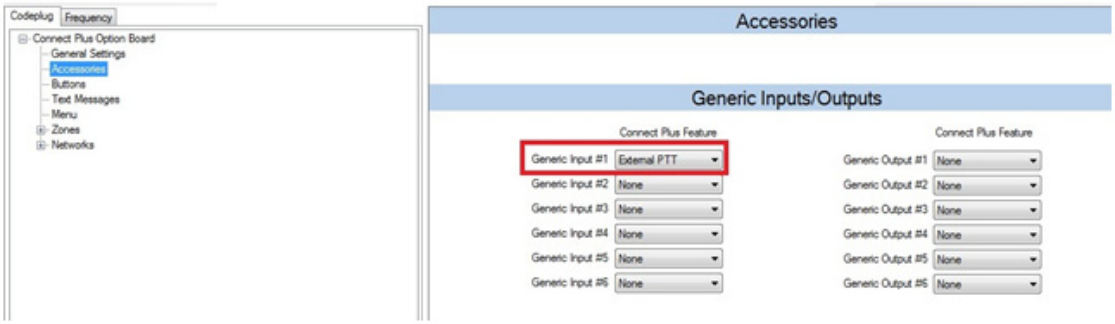
17. From the ARS drop down menu, select **On System Change**.

7.2 MOTOTRBO Connect Plus Option Board CPS Configuration

The MOTOTRBO Connect Plus Option Board CPS (Customer Programming Software) is used to configure the MOTOTRBO radio with a Connect Plus option board to interface properly with the IP-224. If using the Connect Plus option board, complete the following steps to ensure proper functionality.

To **configure the radio with the Connect Plus option board**, do the following:

1. Open the **MOTOTRBO Connect Plus Option Board CPS**.
2. In the left navigation, click **Accessories**.
   The Accessories page appears.



3. From the Generic Input #1 drop down menu, select **External PTT**.

8.0 IP-224 Access Key Installation

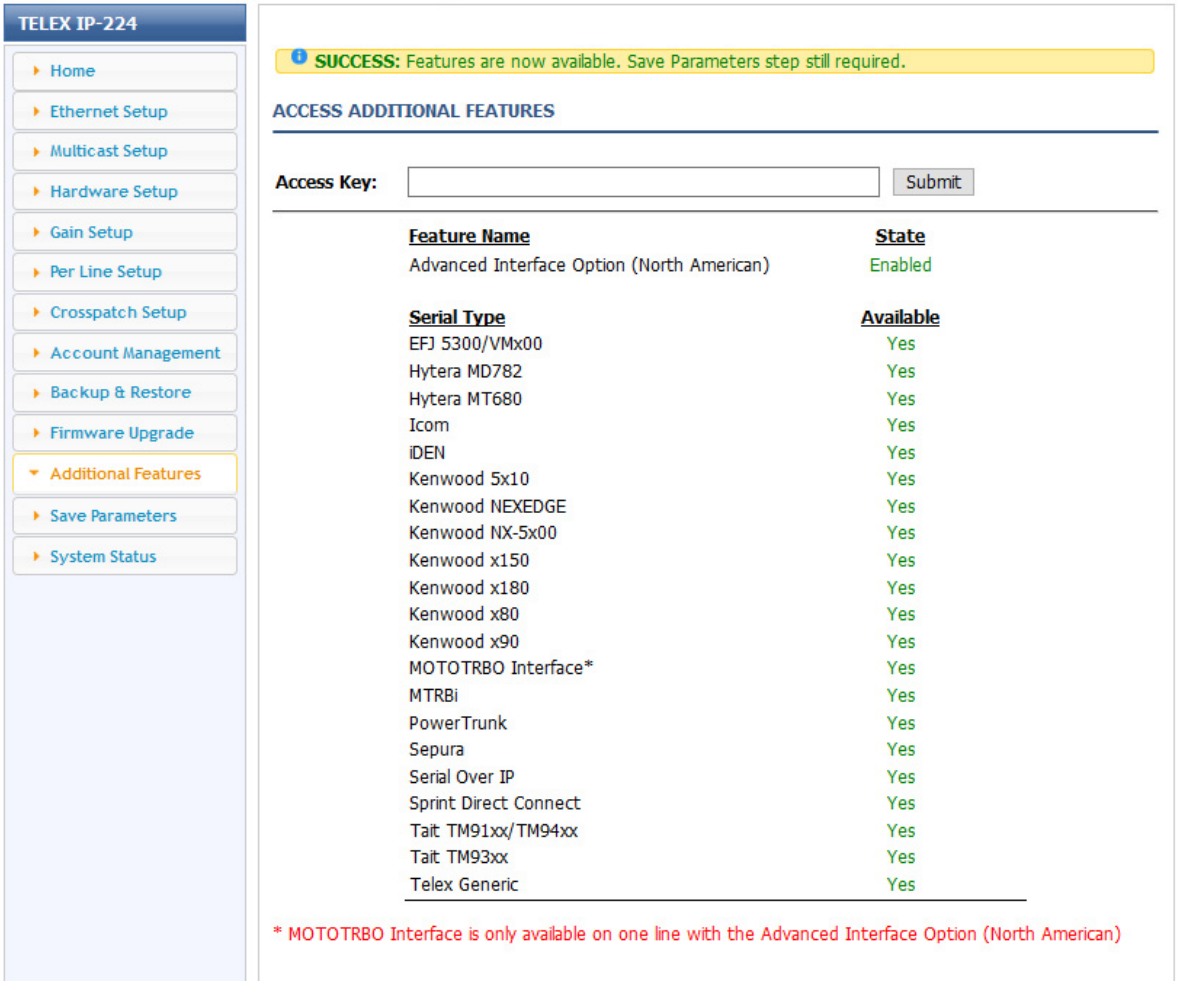
The Motorola DMR radio interface requires an Advanced Interface Option (North American) on the IP-224.

NOTE:

- The Advanced Interface Option (North American) Access Key must be purchased before you can activate the MOTOTRBO Interface Serial Type. The Advanced Interface Option (North American) requires an access key to be generated specifically for each IP-224.
- If the Advanced Interface Option (North American) Access Key was purchased as a factory installation [(F.01U.347.907) IP-224 Radio Gateway Advanced Options NA (factory installed)] the access key was activated by the factory prior to shipping.
- Activating the Advanced Interface Option (North American) via the IP-224 web interface is only required if this is a field installation [(F.01U.343.869) Field Code Advanced Options NA (customer purchased option)].

To **activate the Advanced Interface Option (North American) Access Key**, do the following:

1. Open the **IP-224 webpage**.
2. From the left navigation, select **Additional Features**.
   The Additional Features page appears.
3. In the Access Key field, enter the **32-character access key**.
4. Click the **Submit button**.
   The changes are sent to the IP-224 in temporary storage.

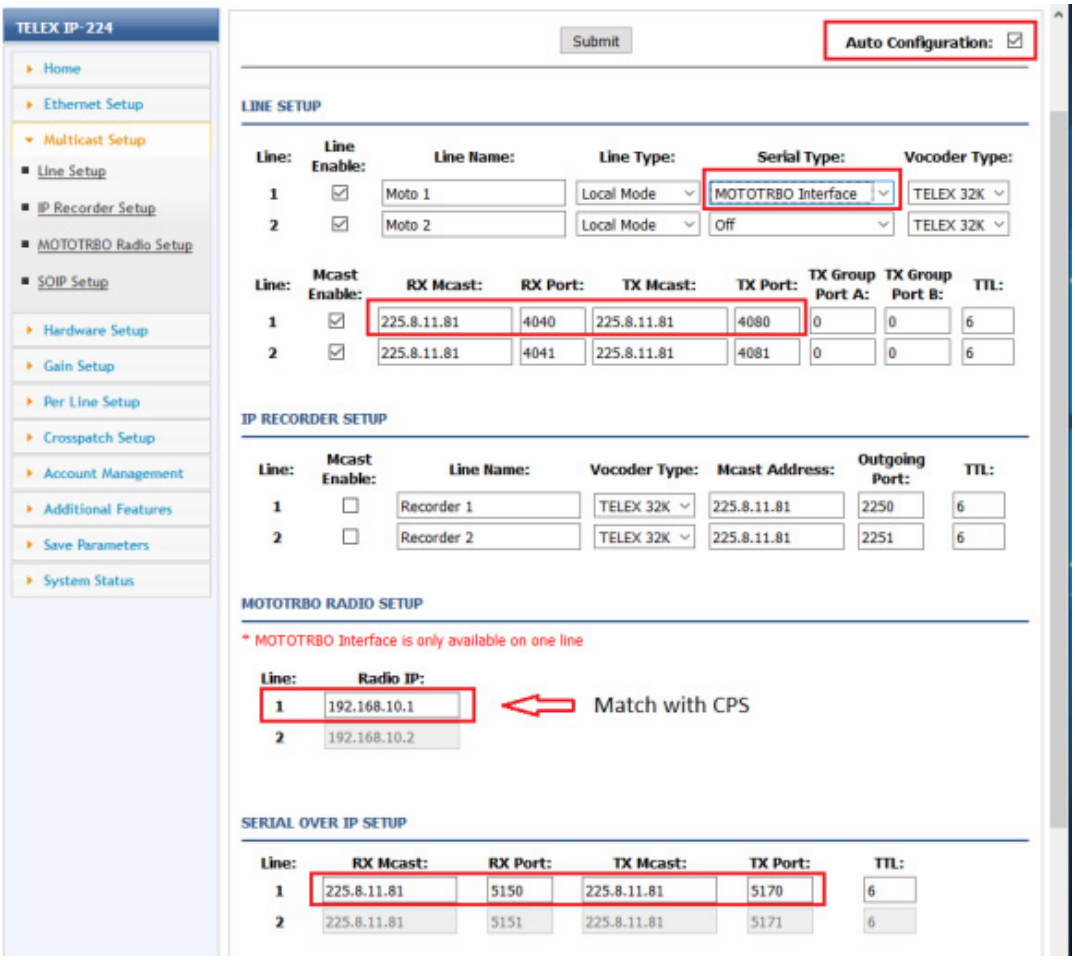


5. From the left navigation, select **Save Parameters**.
   The Save Parameters page appears.
6. Click the **Save Parameters button**.
   Changes are now permanently saved to the IP-224 console.

9.0 IP-224 Setup

To **configure the IP-224**, do the following:

1. Open the **IP-224 web application**.
   The IP-224 Window appears.
2. From the left navigation, select **Multicast Setup**.



3. Select the **Auto Configuration** check box.

Under LINE SETUP

4. From the Serial Type drop down menu, select **MOTOTRBO Interface**.
5. In the RX Mcast field, enter **Receive Multicast IP Address**.
6. In the RX Port field, enter the **Receive Multicast Port number**.
7. In the TX Mcast field, enter the **Transmit Multicast IP Address**.
8. In the TX Port field, enter the **Transmit Multicast Port number**.

Under MOTOTRBO RADIO SETUP

9. In the Radio 1 Radio IP field, enter the **IP Address** for the connected MOTOTRBO radio.

NOTE: The Radio IP address must match with the Radio IP address entered into the MOTOTRBO Customer Programming Software.

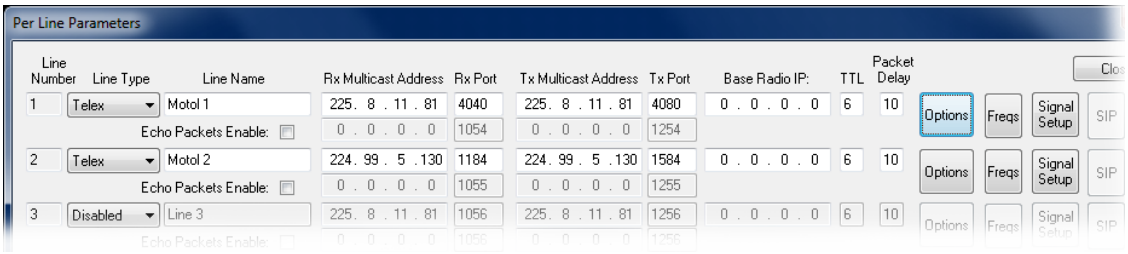
Under SERIAL OVER IP SETUP

10. In the RX Mcast field, enter the **Receive Multicast Serial Over IP Address**.
11. In the RX Port field, enter the **Receive Multicast Serial Over IP Port number**.
12. In the TX Mcast field, enter the **Transmit Multicast Serial Over IP Address**.
13. In the TX Port field, enter the **Transmit Multicast Serial Over IP Port number**.
14. Click the **Submit** button.
    The changes are sent to the IP-224 in temporary storage.
15. In the left navigation, select **Save Parameters**.
    The Save Parameters page appears.
16. Click the **Save Parameters button**.
    Changes are now saved permanently to the IP-224 console.

10.0 C-Soft Designer Setup

10.1 MOTOTRBO Setup

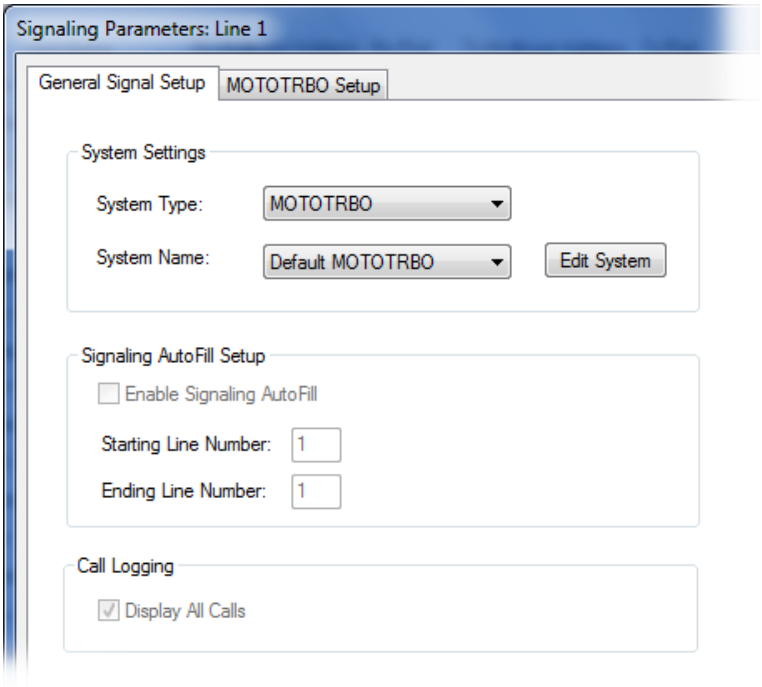
1. Open **C-Soft Designer**.
2. From the Edit menu, select **Setup Per Line Parameters**.
   The Per Line Parameters window appears.



3. In the Rx Multicast Address field, enter the **Receive Multicast IP Address** of the connected IP-224.
4. In the Rx Port field, enter the **Receive Multicast Port number** of the connected IP-224.
5. In the Tx Multicast Address field, enter the **Transmit Multicast IP Address** of the connected IP-224.
6. In the Tx Port field, enter the **Transmit Multicast Port number** of the connected IP-224.
7. In the Base Radio IP field, enter the **IP address** of the connected IP-224.

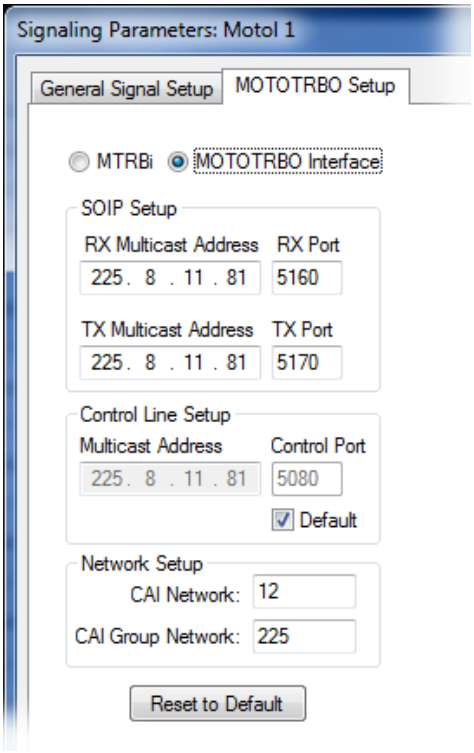
NOTE: The Multicast settings of IP-224 and C-Soft must match for the interface to function properly. Verify the RX and TX Multicast Addresses match, as well as RX and TX Ports.

8. Click the **Signal Setup button**.
   The Signaling Parameters window appears.



9. From the System Type drop down menu, select **MOTOTRBO**.
   The MOTOTRBO Setup tab appears.

10. Click the **MOTOTRBO Setup tab**.
    The MOTOTRBO Setup page appears.



11. Select the **MOTOTRBO Interface radio button**.

Under SOIP Setup

NOTE: The C-Soft SOIP Setup information must match the IP-224 Serial Over IP Setup information.

12. In the RX Multicast Address field, enter the **Receive Multicast Serial Over IP Address**.
13. In the RX Port field, enter the **Receive Multicast Serial Over IP Port number**.
14. In the TX Multicast Address field, enter the **Transmit Multicast Serial Over IP Address**.
15. In the TX Port field, enter the **Transmit Multicast Serial Over IP Port number**.
16. Under Network Setup
17. The C-Soft Network Setup information must match the MOTOTRBO CPS Network information.
18. In the CAI Network field, enter the value for the **CAI Network** configured in the radio.
19. In the CAI Group Network field, enter the **CAI Group Network** configured in the radio.
20. Click the **OK button**.

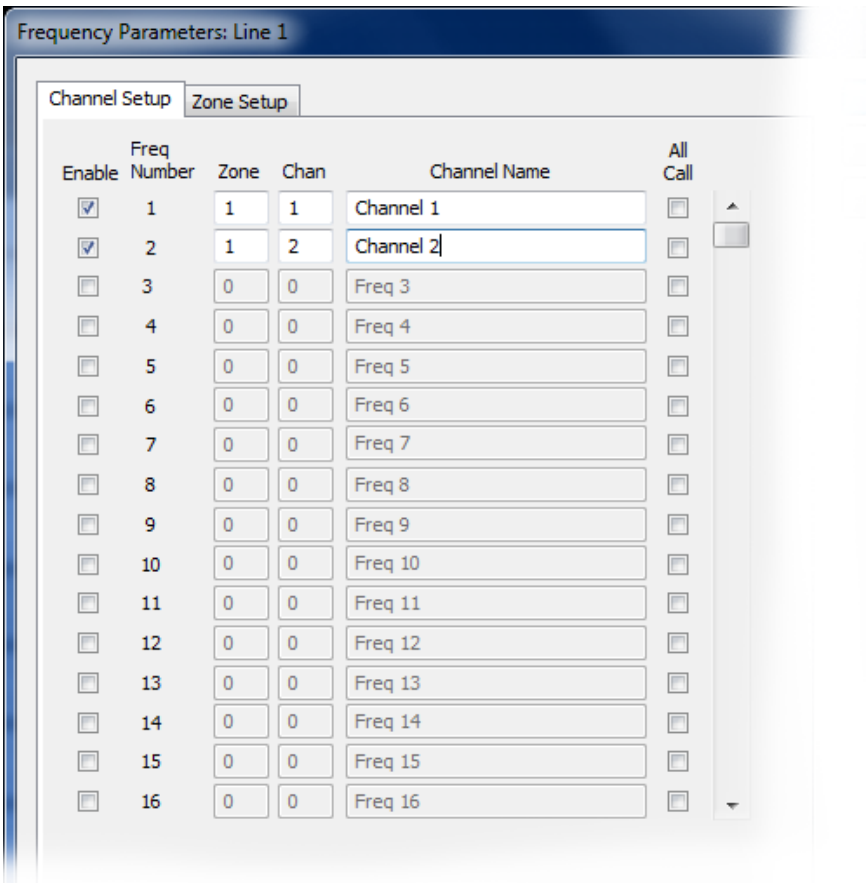
10.2 Frequency Setup

The MOTOTRBO DMR Interface has the ability to read in all the channel names from the mobile radio. If there is an issue with a firmware version where this does not work, the names must be manually entered into the Channel Setup window matching the channel order in the MOTOTRBO CPS (with the exception of channel pool).

To **enter the channels manually**, do the following:

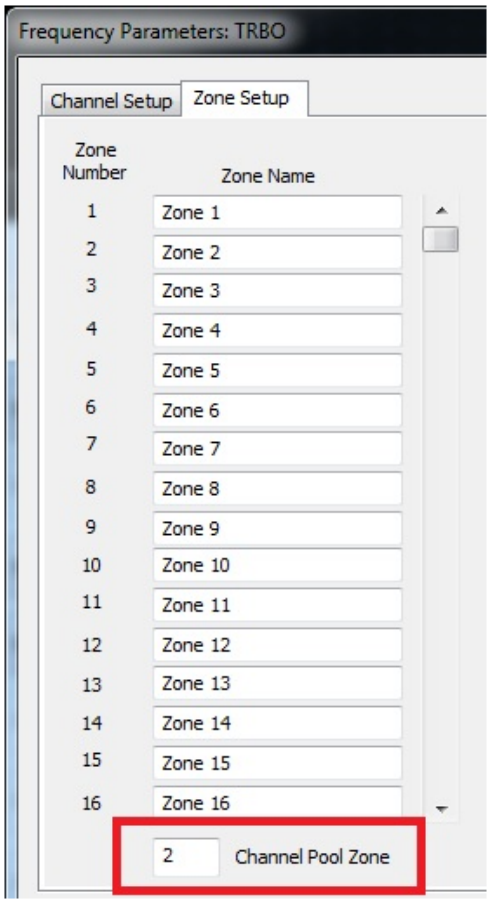
1. Open **C-Soft Designer**.
2. From the Edit drop down menu, select **Setup Per Line Parameters**.
   The Per Line Parameters window appears.
3. Click the **Freqs button**. 

   The Frequency Parameters window appears.
4. Using the MOTOTRBO CPS channel order as a guide, fill in the **Channel Setup page exactly as seen in the MOTOTRBO CPS**.



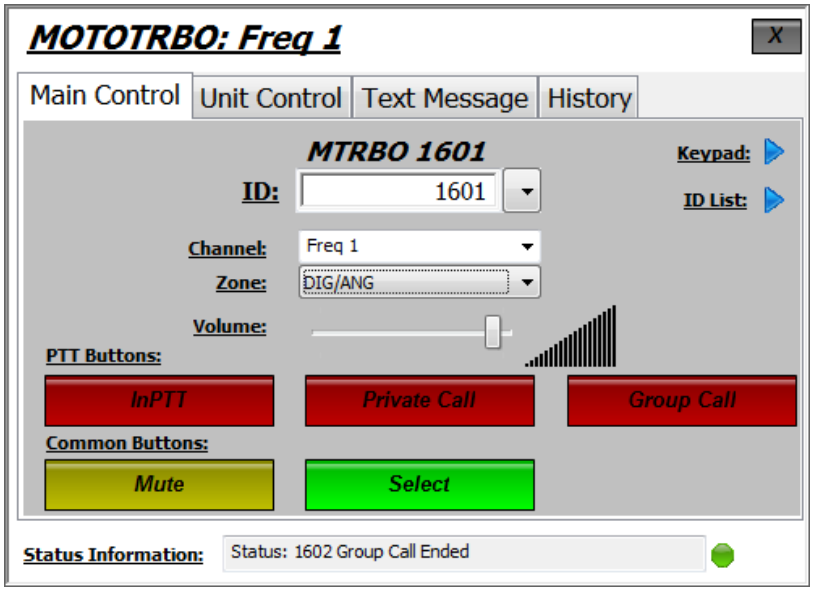
5. Click the **Zone Setup tab**.
   The Zone Setup page appears.
6. In the Zone 2 field, enter **Channel Pool**.

NOTE: Verify Zone 2 is set up as Channel Pool in the MOTOTRBO CPS.



11.0 C-Soft Runtime

11.1 Main Control Page



ID Field and Drop Down Menu

The **ID** field and drop down menu is used to enter the ID so users can place private or group calls to the radio or group selected.

Channel Drop Down Menu

The **Channel** drop down menu is used to select the current channel for the line.

Zone Drop Down Menu

The **Zone** drop down menu is used to select the current zone for the line.

Volume Slider

The **Volume** slider is used to change the volume level for the line. Move the slider to the right to increase the volume.

InPTT Button

The **InPTT** button is used to transmit on the selected channel.

Private Call Button

The **Private Call** button is used to transmit to the ID in the ID field for a private call.

Group Call Button

The **Group Call** button is used to transmit to the ID in the ID field for a group call.

Mute Button

The **Mute** button is used to mute or unmute the line's volume.

Select Button

The **Select** button is used to select or deselect the line.

Status Information Field

The **Status Information** field displays all incoming and outgoing MOTOTRBO radio status information.

Keypad Arrow

The **Keypad** arrow is used to open the DTMF Keypad flyout window.

ID List Arrow

The **ID List** arrow is used to open the ID List flyout window.

11.2 Unit Control Page

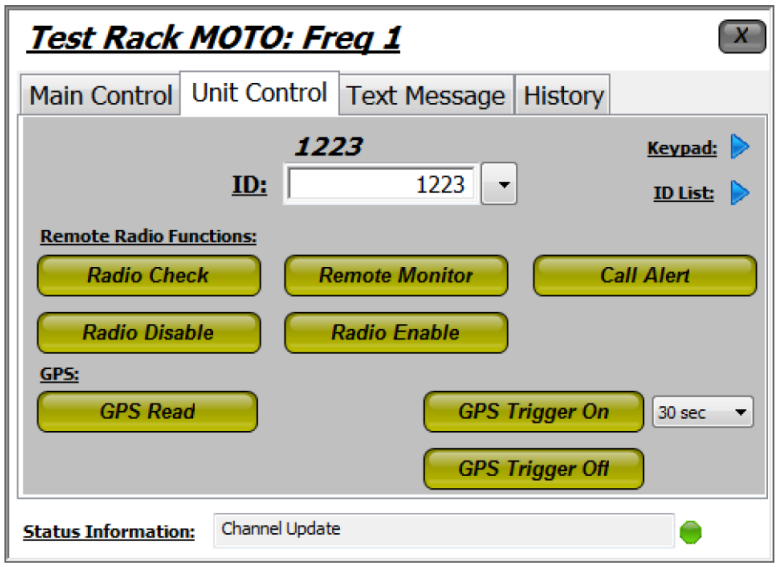


FIGURE 2. Unit Control Page

ID Field and Drop Down Menu

The **ID** field and drop down menu is used to select the private ID so users can perform a radio check, a remote monitor, a call alert, a radio disable, a radio enable, or GPS operations.

Remote Radio Functions

Radio Check Button

The **Radio Check** button is used to verify if the radio is currently online and functional.

Radio Disable Button

The **Radio Disable** button is used to disable a radio from use.
This feature can be used in the case of a lost or stolen radio.

Remote Monitor Button

The **Remote Monitor** button is used to monitor the radio remotely.

Radio Enable Button

The **Radio Enable** button is used to enable the radio for use.
This feature is used to enable a radio if it has been disabled with the Radio Disable button.

Call Alert Button

The **Call Alert** button is used to send an alert to the selected radio.

GPS Read Button

The **GPS Read** button is used to request a read of the selected radio's current location.

GPS Trigger On Button and Drop Down Menu

The **GPS Trigger On** button is used to set the time the radio periodically sends a GPS update. Select the amount of time drop down menu to schedule how much time passes between updates.

GPS Trigger Off Button

The **GPS Trigger Off** button turns an active trigger off.

Keypad Arrow

The **Keypad** arrow is used to open and close the DTMF Keypad flyout window.

ID List Arrow

The **ID List** arrow is used to open the ID List flyout window. When the ID List is open, a list of available MOTOTRBO IDs is displayed. MOTOTRBO IDs that appear in bold indicate that a GPS Trigger is active.

11.3 Text Message Page

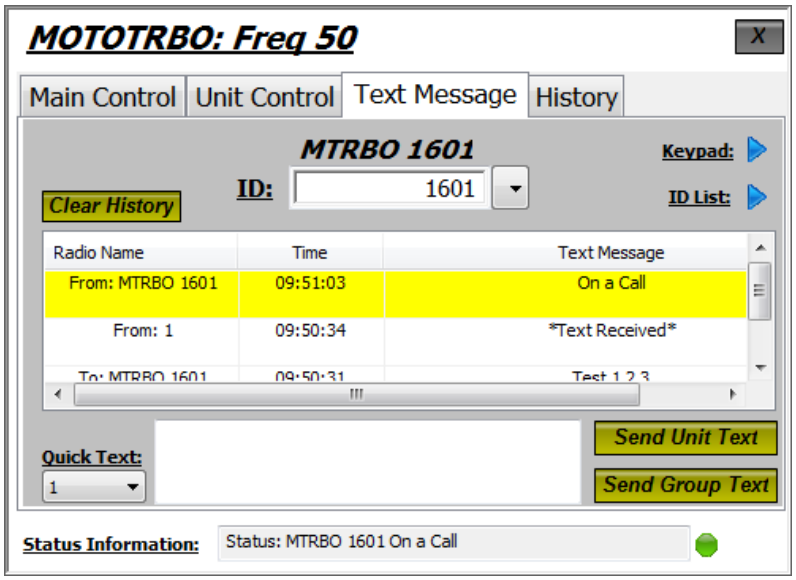


FIGURE 3. Text Message Page

ID Field and Drop Down Menu

The **ID** field and drop down menu is used to enter the ID so users can place private or group texts to the radio or group selected.

Clear History Button

The **Clear History** button is used to clear the text history table.

Radio Name Column

The **Radio Name** column displays the name of the radio from which the text message was received.

Time Column

The **Time** column displays the time of the text message.

Text Message Column

The **Text Message** column displays the text message.

Quick Text Drop Down Menu

The **Quick Text** drop down menu is used to select a pre-defined text message. Pre-defined text messages are created in C-Soft Designer (Edit|Edit Text Message ID List).

Text Field

The **Text** field is used to enter a unique text message to send to a radio or group.

Send Unit Text Button

The **Send Unit Text** button is used to send a text message to the private Radio ID in the ID drop down menu.

Send Group Text Button

The **Send Group Text** button is used to send a text message to the Group ID in the ID drop down menu.

11.4 History Page

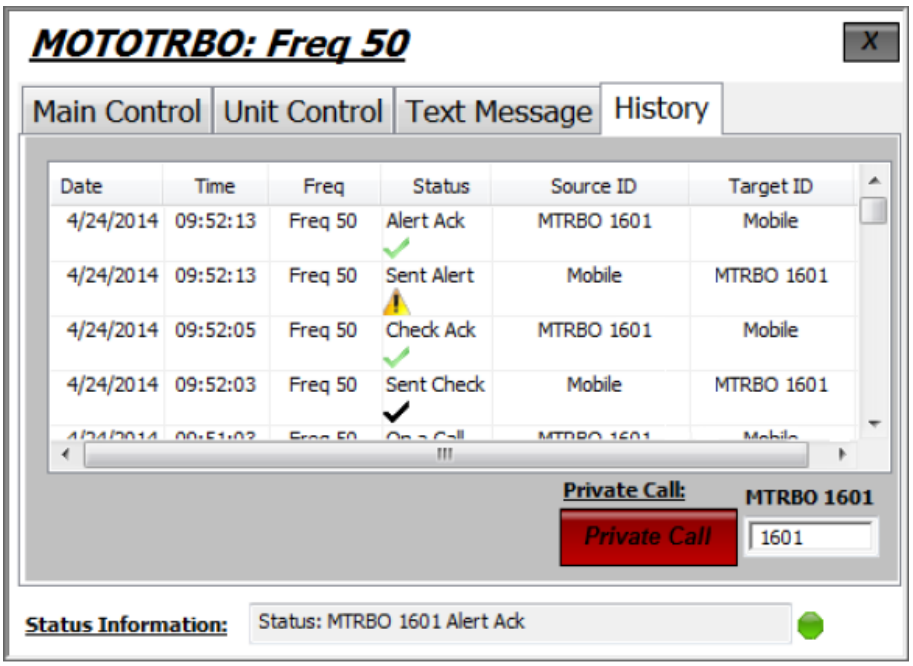


FIGURE 4. History Page

Date Column

The **Date** column displays the date of the call.

Time Column

The **Time** column displays the time of the call.

Freq Column

The **Freq** column displays the frequency of the call.

Status Column

The **Status** column displays the current status of the call.

Source ID Column

The **Source ID** column displays the ID of the call originator.

Target ID Column

The **Target ID** column displays the ID of the call receiver.

Private Call Button

The **Private Call** button is used to make a private call to a radio ID specified in the ID field.

NOTE: Clicking on a line in the History window puts the radio ID into the ID field next to the Private Call button.

ID Field

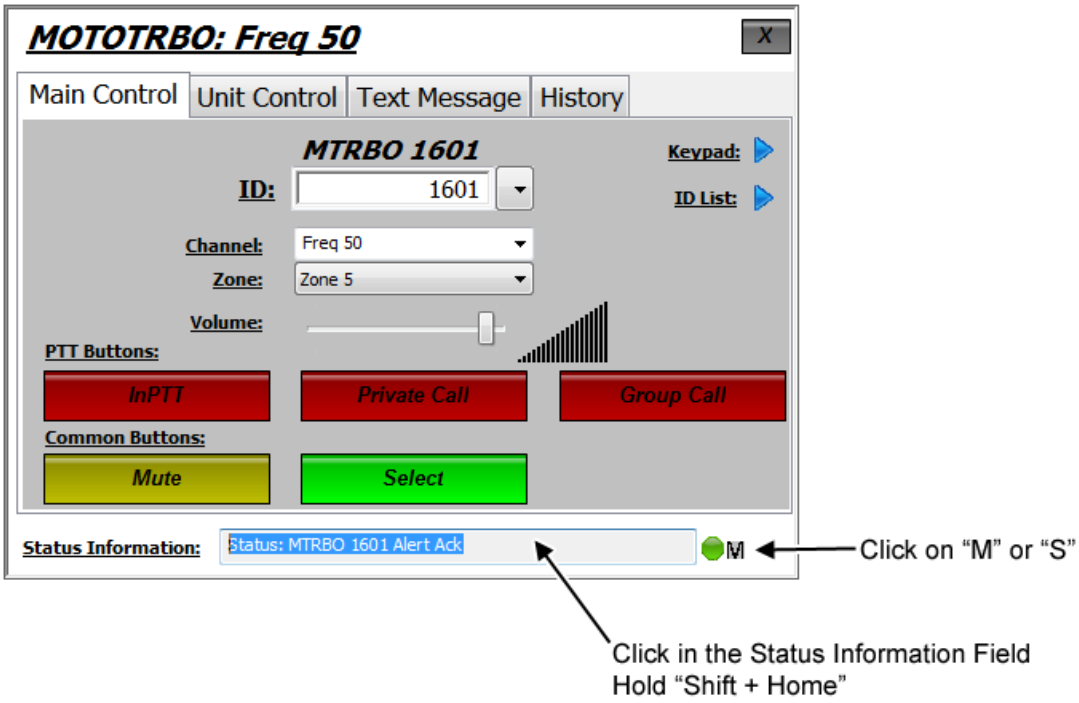
The **ID** field displays the identification for the private radio ID.

11.5 Master/Slave Detection

A **Master/Slave** configuration means a (master) device communicates one-way with one (1) or more devices (slaves). When C-Soft is opened, it starts as a slave. The C-Soft session waits a user-defined amount of time, waiting for a master heartbeat. If no heartbeat is detected, C-Soft becomes the master. If a heartbeat is received on the control line, it stays in slave mode. As a master, the application sends out a heartbeat on the control line every second.

To **find the master or slave C-Soft console**, do the following:

1. Open the **MOTOTRBO Dispatch** window.
2. Click the **Main Control tab**.
   The Main Control page appears.



3. Click in the **Status Information** field.
4. Hold the **Shift** and **Home buttons**.
   M or S appears next to the green LED.
   M = Master
   S = Slave

NOTE: Left-click on the M or S to see the Master's computer name.

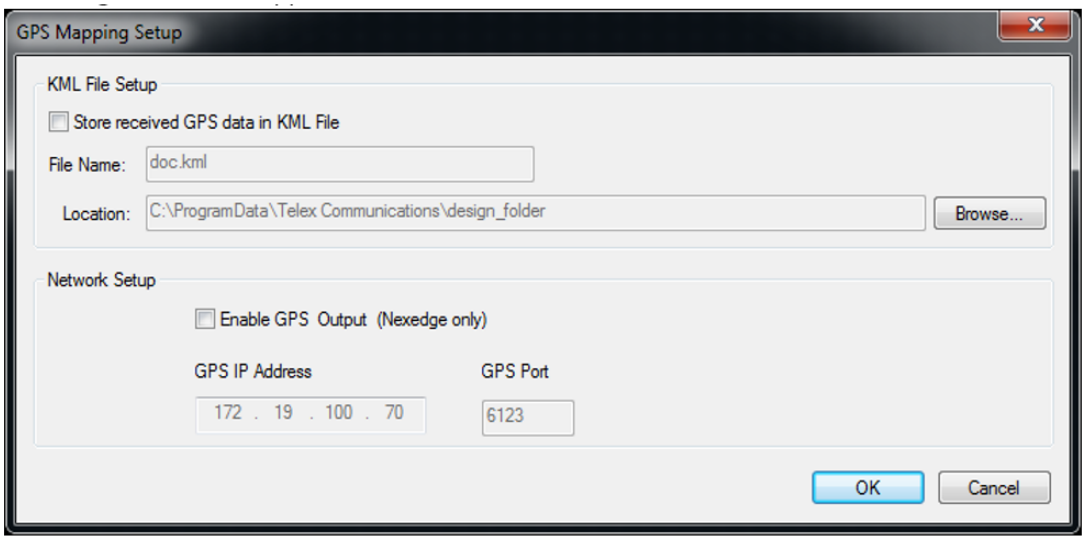
12.0 Google Earth Network Link

Beginning in version 7.100, C-Soft interfaces with Google Earth via a .kml file configured as a Network Link in Google Earth.

12.1 C-Soft Designer Configuration

To **configure C-Soft Designer**, do the following:

1. Open **C-Soft Designer**.
2. Select **Edit | Setup GPS Mapping**.
   The GPS Mapping Setup window appears.



3. Check the **Store received GPS data in KML File checkbox** to enable C-Soft to write received GPS coordinates to the file.
4. Specify the **File Name and folder location** where the .kml file should be located.

NOTE: This file can be located in a shared folder location to allow multiple users to access the same file.

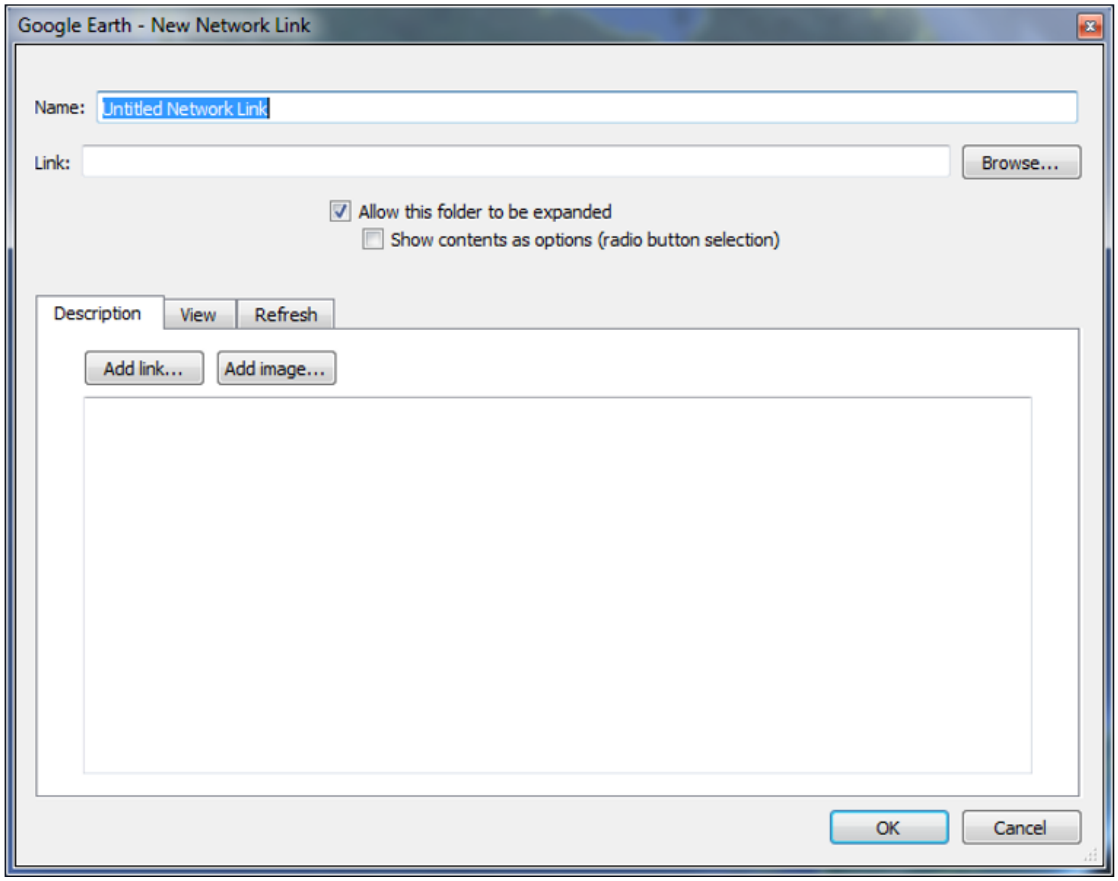
5. Click **OK** to close the GPS Mapping Setup window.

12.2 Google Earth Configuration

NOTE: Open C-Soft Runtime at least once before performing the Google Earth configuration. Running C-Soft Runtime creates the .kml file and makes the Google Earth Configuration easier.

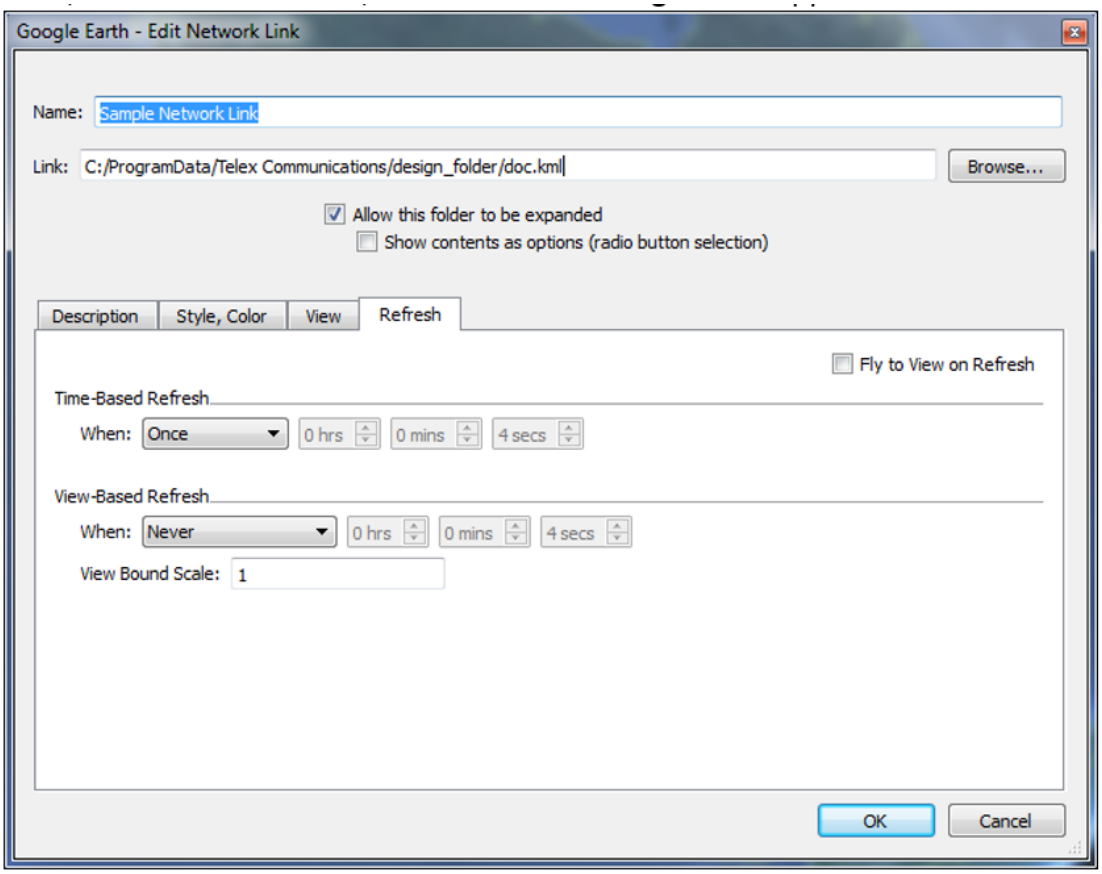
To **configure Google Earth**, do the following:

1. Open **Google Earth**.
2. Go to **Add | Network Link**.
   The Google Earth- New Network Link window appears.



3. In the Name field, enter a **name** for the Network Link.
4. Click the **Browse button**.
5. Select the **folder location and file name specified for the .kml file** in C-Soft Designer.
6. Click the **Open button**.

7. Click the **Refresh tab**.
   The Google Earth - Edit Network Link window appears.



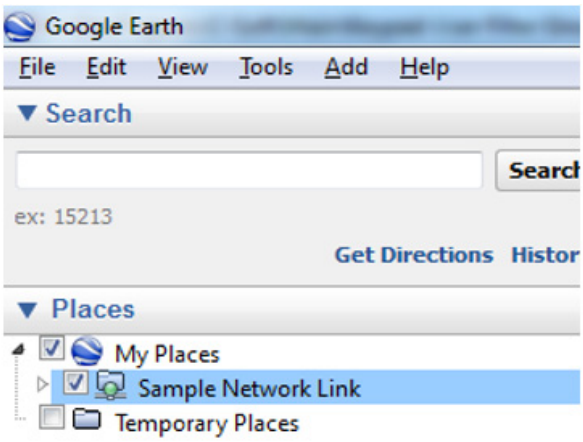
Under Time-Based Refresh

8. In the When field from the drop down menu, select **Periodically**.
9. In the Time fields, enter **an appropriate time period** for how often the map should be refreshed.

NOTE: This time period is dependent on how often GPS updates are sent by radios in the field. A suggested starting value is 1 minute.

10. Click the **OK button**.

11. Verify the **Network Link was added to the Places view in Google Earth**.

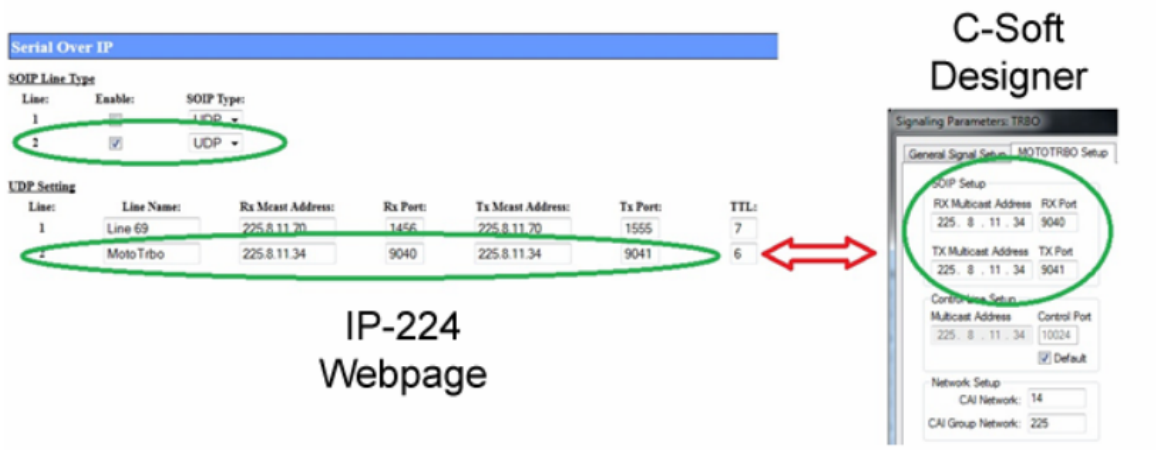


NOTE: The Google Earth application reads the.kml file generated by C-Soft and displays the received GPS.

13.0 Frequently Asked Questions

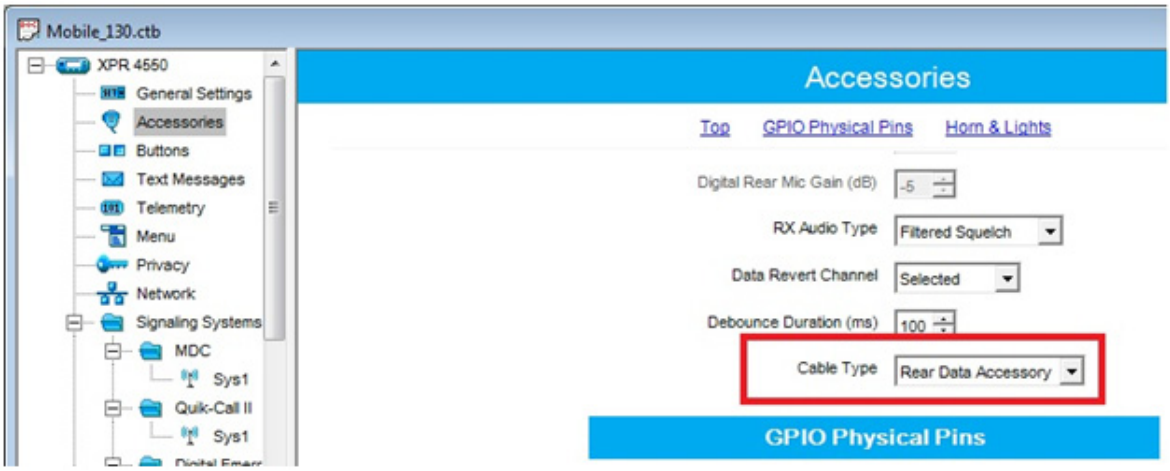
The Status Indicator on the MOTOTRBO window is RED

- If the MOTOTRBO front programming cable is connected to the radio, the rear accessory port is disabled, therefore the data is not transmitted between the radio and the IP-224. The MOTOTRBO programming cable must be removed from the front of the radio before the MOTOTRBO Interface functions.
- Check the **connection of the MOTOTRBO cable**.
- Verify the **SOIP configuration** in C-Soft Designer and the IP-224 webpage match.



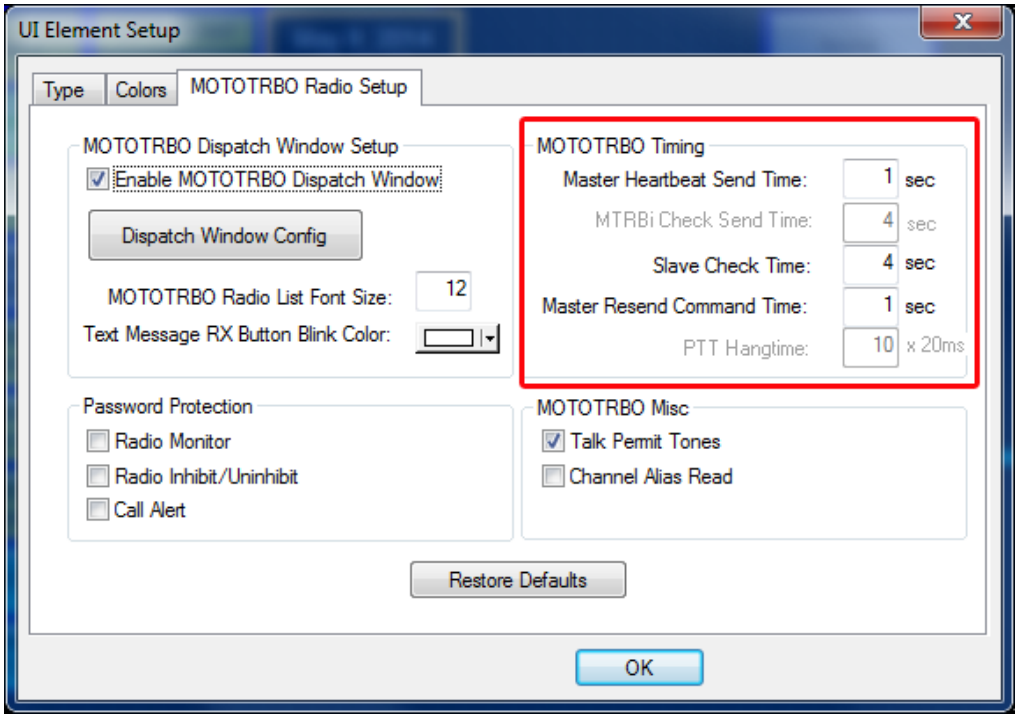
The Status Indicator on the MOTOTRBO window is GREEN, but the channels are not read in

1. Verify the **Rear Data Accessory** is selected for the Cable Type in the Accessories page.



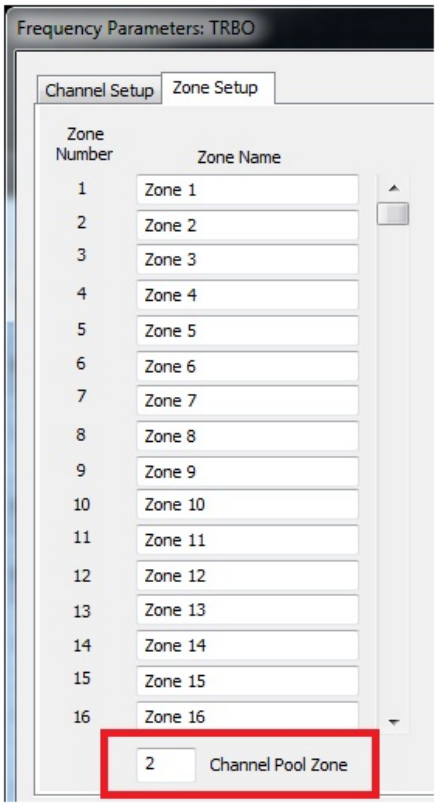
2. Verify **9600,N,8,2** is configured for the Serial Port Mode in the IP-224.

3. Verify the appropriate **timing** is configured for the current system.



The Emergency ACK does not work

- Verify the **Channel Pool Zone number** is configured properly in C-Soft Designer.

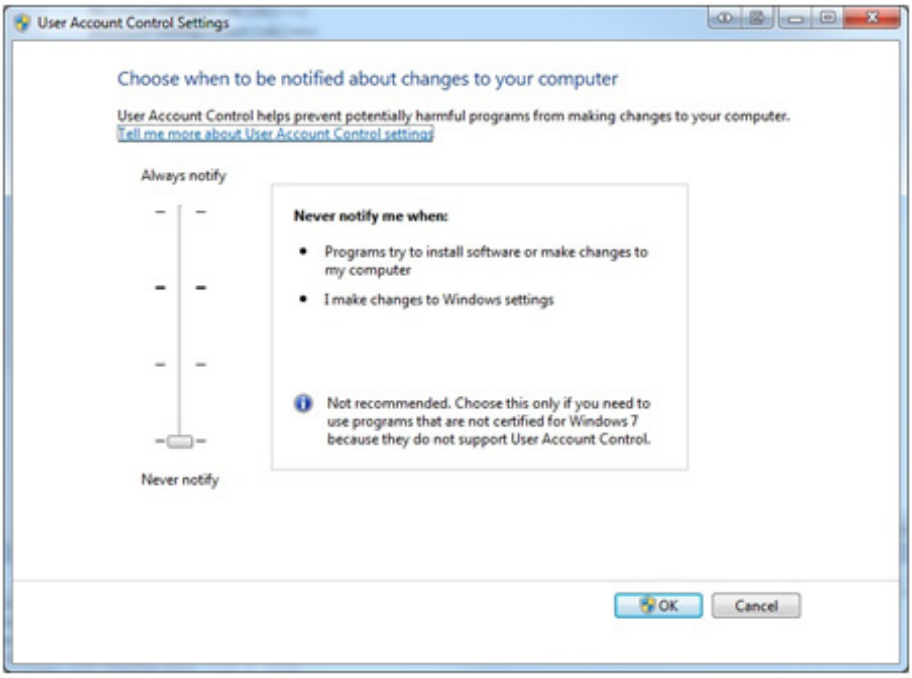


No Receive Audio on C-Soft Runtime

1. Check the **MOTOTRBO cable connection**.
2. Verify the **Multicast Address match in C-Soft Designer and the IP-224**.
3. If COR is enabled, verify **COR is configured correctly on the IP-224 webpage** and the Mobile Radio's **GPIO Physical Pins are correctly configured**.

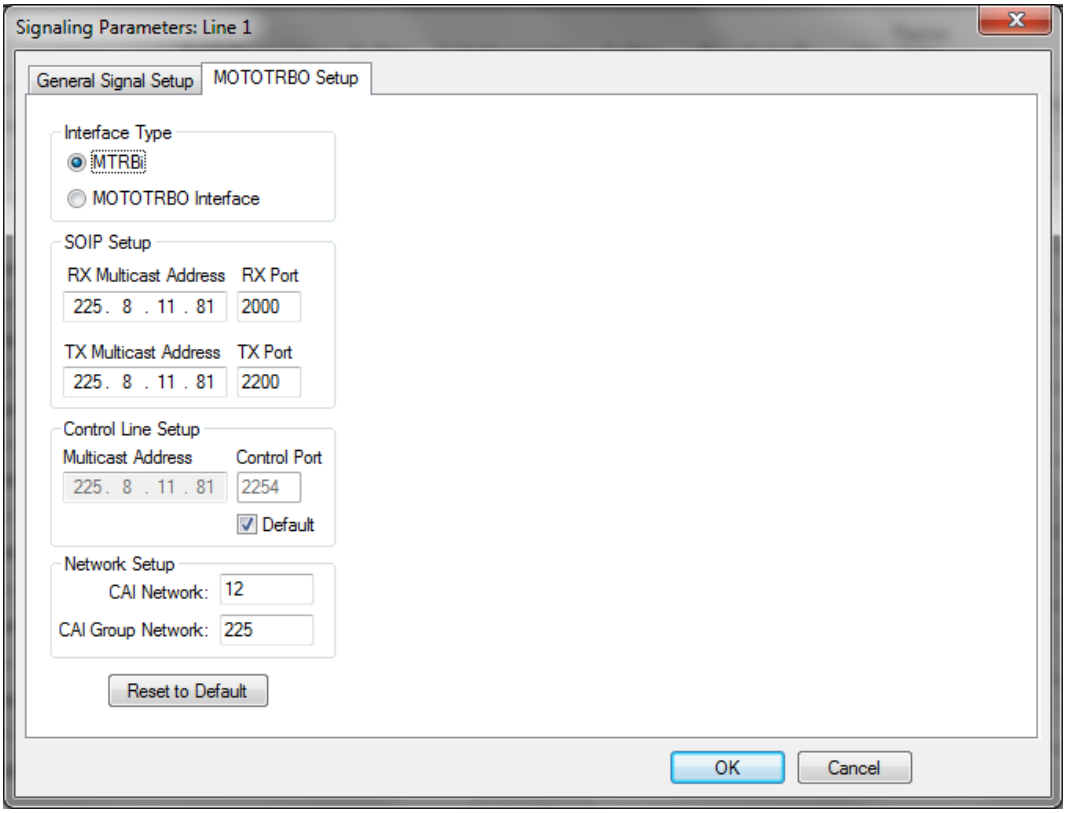
KML file is not updating

- In Windows 7, the User Account Control Settings must be set to "**Never Notify**." Without this setting, the KML file may not be allowed to be overwritten.



C-Soft cannot receive nor transmit text message

- Verify the CAI Network and CAI Group Network fields match in both C-Soft Designer and the MOTOTRBO CPS Setup.



NOTES:

Suggestions or comments:
Contact technical support with suggestions or comments concerning this application note.

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