TRBOnet Enterprise/PLUS

Linked Capacity Plus

Deployment Guide

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Contents

1 Introduction

1.1 About This Document

The information in this guide is intended for administrators setting up evaluation and proof-of-concept deployments of MOTOTRBO Dispatch over IP solutions. The document describes the steps required to configure communication with a MOTOTRBO Linked Capacity Plus system.

For more comprehensive information on the Neocom TRBOnet family of radio network software tools, refer to the Documentation section of our web site.

1.2 About TRBOnet

TRBOnet is a suite of professional applications for MOTOTRBO digital two-way radio networks. TRBOnet manages voice and data communication paths across network endpoints. It provides a unified graphical dispatcher workbench interface for the entire range of workforce fleet management tasks.

1.3 Contacts

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EMEA	+44 203 608 0598	info@trbonet.com — general and commercial inquiries support@trbonet.com — technical support http://kb.trbonet.com — online knowledge base
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2 System Components and Terms

2.1 TRBOnet Software

The TRBOnet software consists of several modules, a combination of which enables you to build enterprise dispatch solutions of different levels of complexity and redundancy. The first step in implementing the best solution is determining the topology for the customer's system; then identifying the combination of modules to implement the best customer solution.

2.2 IP Connection (Wireline Connection)

TRBOnet Server can be connected to a two-way radio system via an IP connection creating a direct communications path for all voice and data information between them. The topologies can be in the form of a LAN, WAN, or VLAN and/or any combination thereof.

2.3 Wireless Connection (Control Stations)

If TRBOnet Server doesn’t have an IP connection to the radio system, it can be connected via control stations (also known as control radios or donor radios). The number of control stations depends on how many talk groups and revert channels are registered in your system.

2.4 Using Routers

All repeaters at a site must be on the same LAN, in other words, they must be behind the same router and plugged into the same network switch. It is strongly recommended that no other device be present on the LAN.

3 System Topology

Linked Capacity Plus (also known as Capacity Plus Multi Site) is a digital trunked multisite two-way MOTOTRBO system that enables you to accommodate high volume and wide area communication that is required for your business allowing you to connect via IP up to 15 single Linked Capacity Plus sites located in one place or in separated territories. This system type allows you to increase the RF coverage area and the number of channels for voice and data transmission between the radio units and control centers. The main objective of Linked Capacity Plus is to support more simultaneous voice and data transmissions regardless of the distance.

Note that, according to the Motorola MOTOTRBO System Planner, all repeaters at a site must be on the same LAN, in other words, they must be behind the same router and plugged into the same network switch. Also note that each site in a Linked Capacity Plus system must be equipped with a router. In addition, the PC with TRBOnet Server must not reside on the same LANs with the repeaters.

3.1 Linked Capacity Plus without NAI

3.1.1 System with Trunked Control Stations

TRBOnet Server can be connected to a Linked Capacity Plus system using one or more Trunked Control Stations. The number of Trunked Control Stations depends on how many talk groups are registered in your system. To make a call to a talk group, the dispatcher uses the Trunked Control Station associated with the group.

Note: It is reasonable that the number of Trunked Control Stations shouldn't be greater than the total number of repeaters slots.

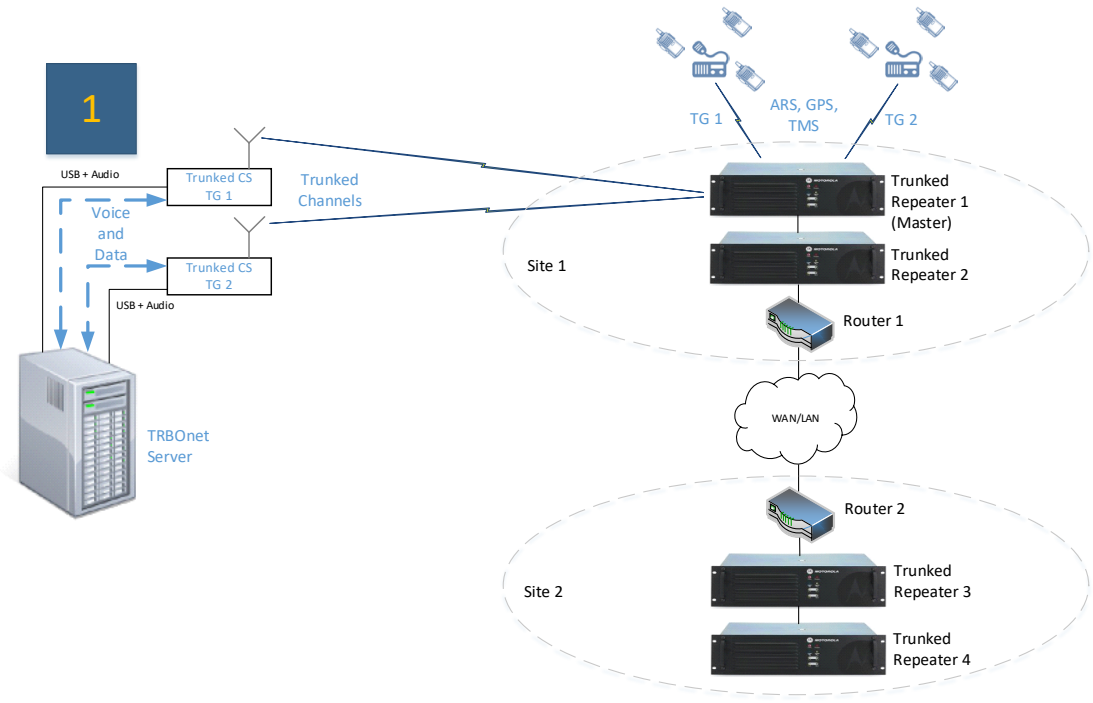


Figure 1: System with Trunked Control Stations

3.1.2 System with Trunked Control Stations and Wide Area Revert Control Stations

For a higher data throughput, the preferred configuration is to have channels dedicated for data only. Such channels are defined as Data Revert Channels. If Data Revert Repeaters are present in the system, then one Revert Control Station is required per Data Revert Slot.

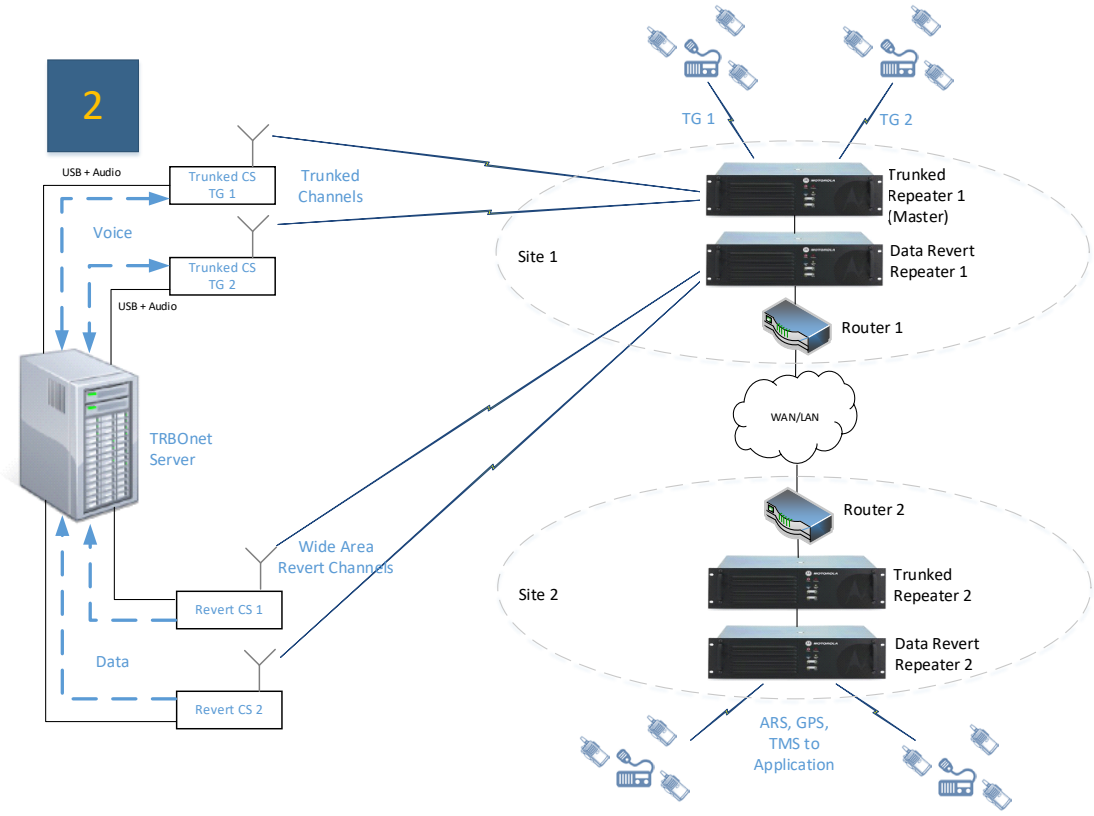


Figure 2: System with Trunked Control Stations and Wide Area Revert Control Stations

3.1.3 System with Trunked Control Stations and Local Revert Control Stations

In this configuration, Local Revert Channels are used to gather data from a Data Revert Repeater, that is data are gathered from a single site only.

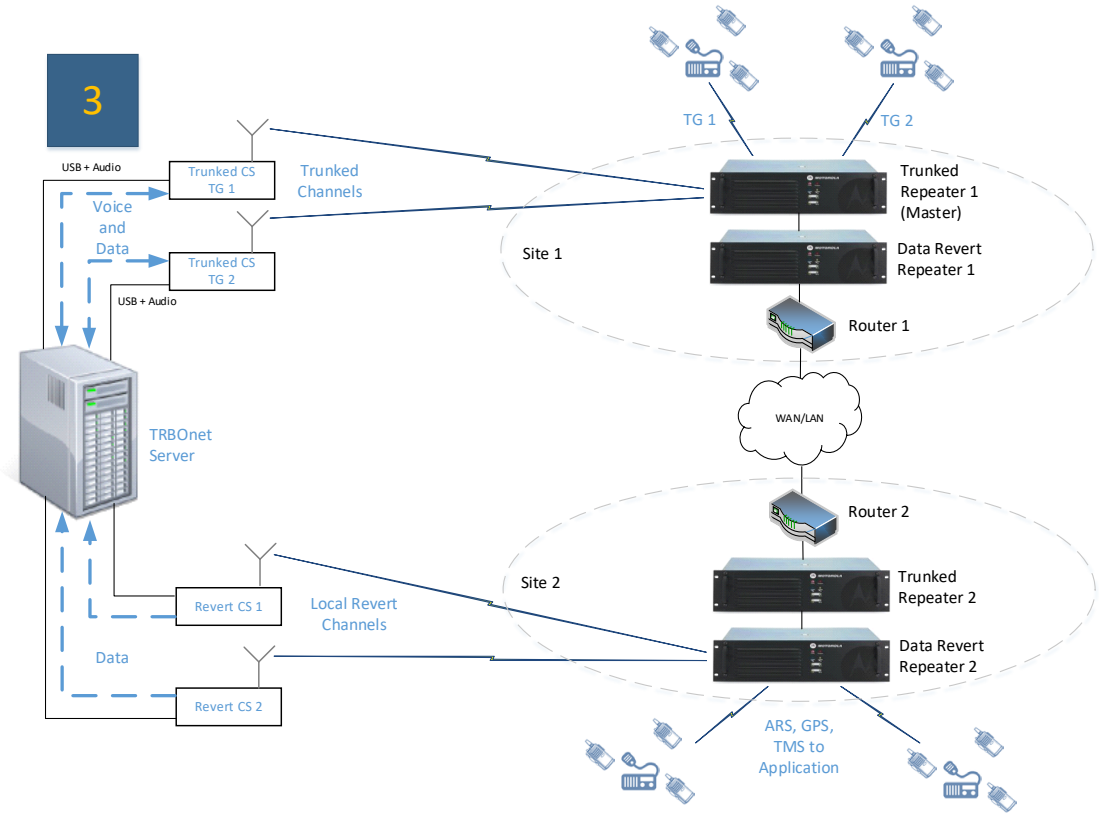


Figure 3: System with Trunked Control Stations and Local Revert Control Stations

3.2 Linked Capacity Plus with NAI

In the following configurations, Motorola's NAI Data and NAI Voice protocols are used, which provide two-way transmission of data and voice over IP connection.

3.2.1 System with NAI Data and Trunked Control Stations

In this configuration, TRBOnet Server has an IP connection to Data Revert Repeaters as well as to Trunked Repeaters. In addition, NAI Data protocol is used on Data Revert repeaters and Trunked repeaters.

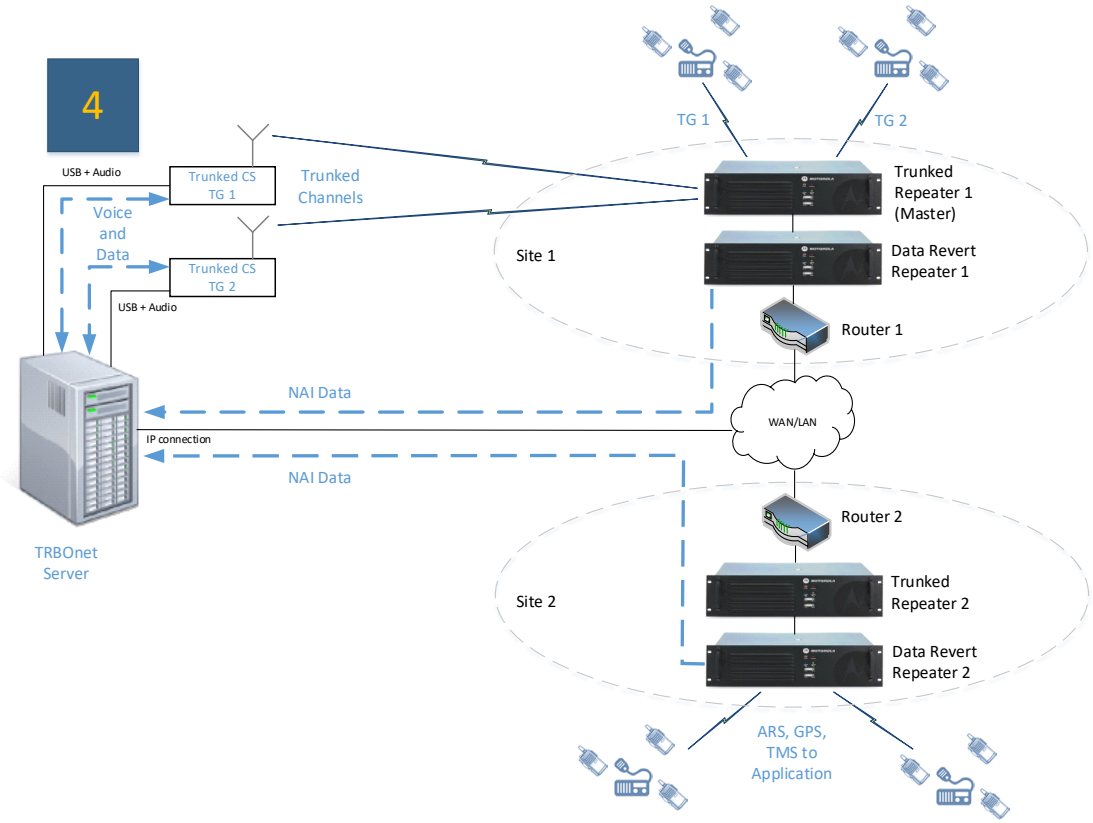


Figure 4: System with NAI Data and Trunked Control Stations

3.2.2 System with NAI Data and NAI Voice

This is the most advanced configuration using the power of NAI Data and NAI Voice protocols. All voice and data will be received and transmitted over an IP connection, that is, no Control Stations are required. Note that TRBOnet PLUS is required to utilize this system topology.

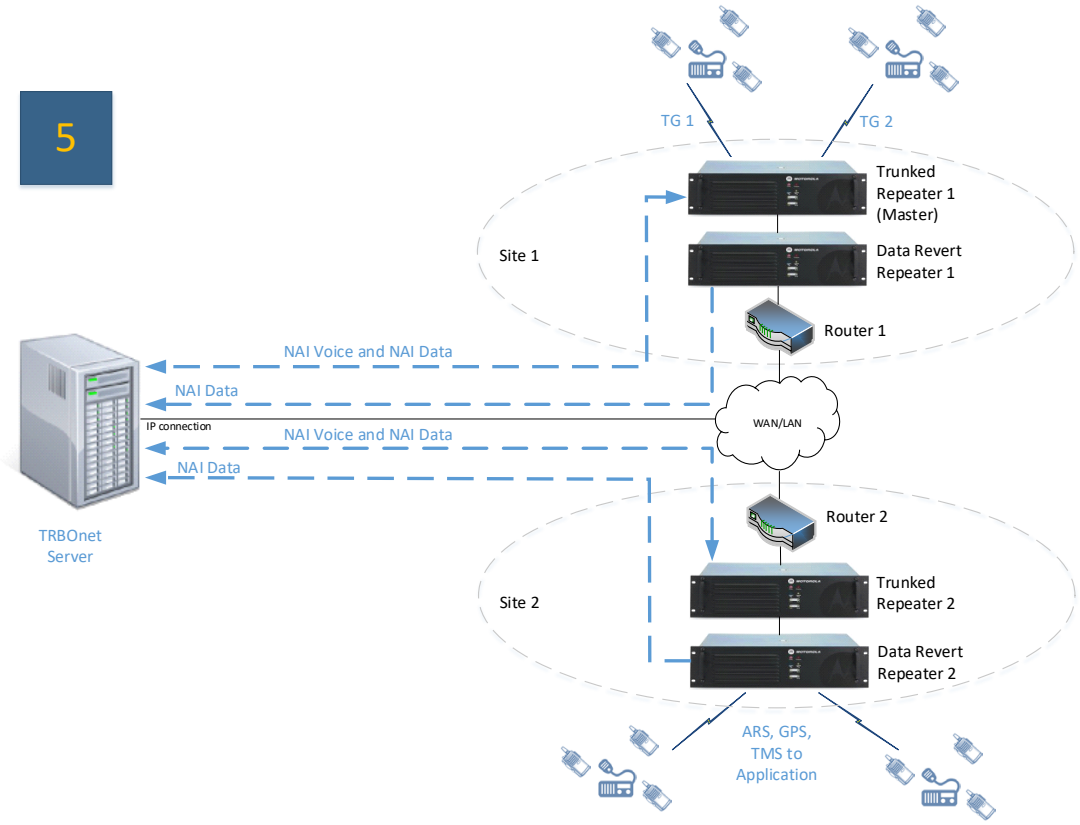


Figure 5: System with NAI Data and NAI Voice

4 Configuring MOTOTRBO Equipment

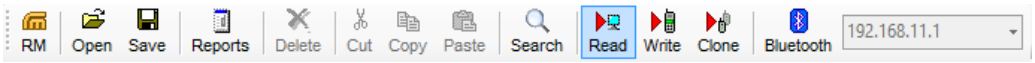
This section describes how to configure MOTOTRBO equipment, such as repeaters, control stations and subscriber radios, using MOTOTRBO Customer Programming Software (CPS).

- Launch MOTOTRBO CPS.
- On the menu bar, select **View > Expert**.

4.1 Configuring a Repeater

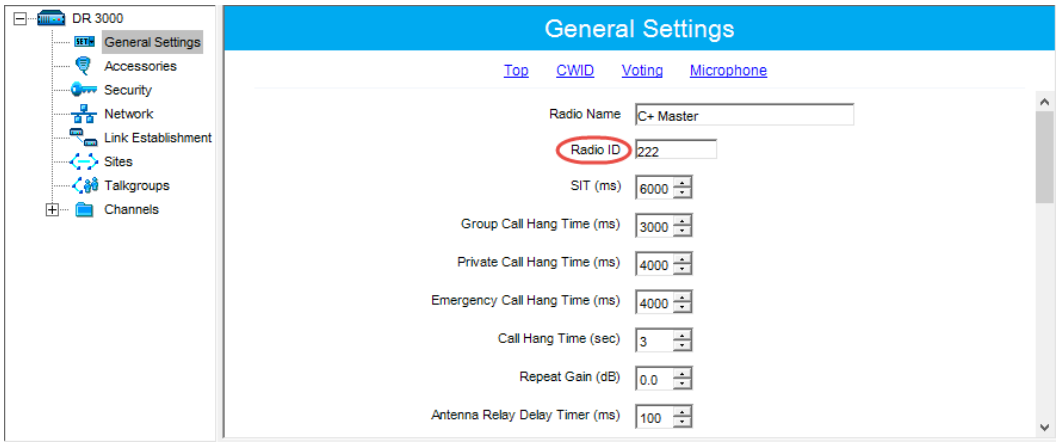
This section describes how to configure a repeater to be used in a Linked Capacity Plus system.

- Connect your repeater to the PC via a programming cable (USB).
  Or, if an IP connection is available and the network parameters are known (**Remote > IP System Settings**), establish a connection to your remote repeater (**Remote > Connect**).
- Click the **Read** button on the toolbar.



4.1.1 General Settings

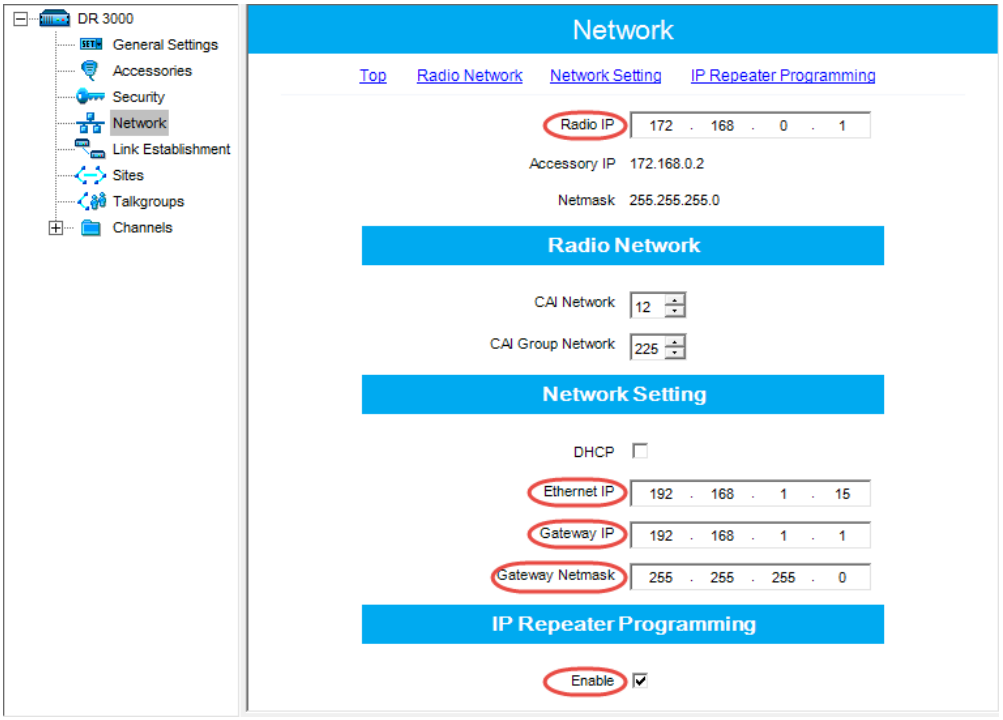
- In the left pane, select **General Settings**.



- In the **General Settings** pane, specify the **Radio ID** of the repeater. This must be a unique Peer ID among the repeaters in a radio system and also not in conflict with any other third party application Peer ID. The recommended range is from 1 to 255.

4.1.2 Network

- In the left pane, select **Network**.



- In the **Network** pane, specify the following parameters:
  - **Radio IP**
    This is the IP address used by the radio to communicate with a PC (using USB connection) and has to be unique. To avoid conflicts in case there are several stations connected with USB, you can change the third octet of the address.

Network Setting

If your radio system is on a Private Network, specify the following network parameters:

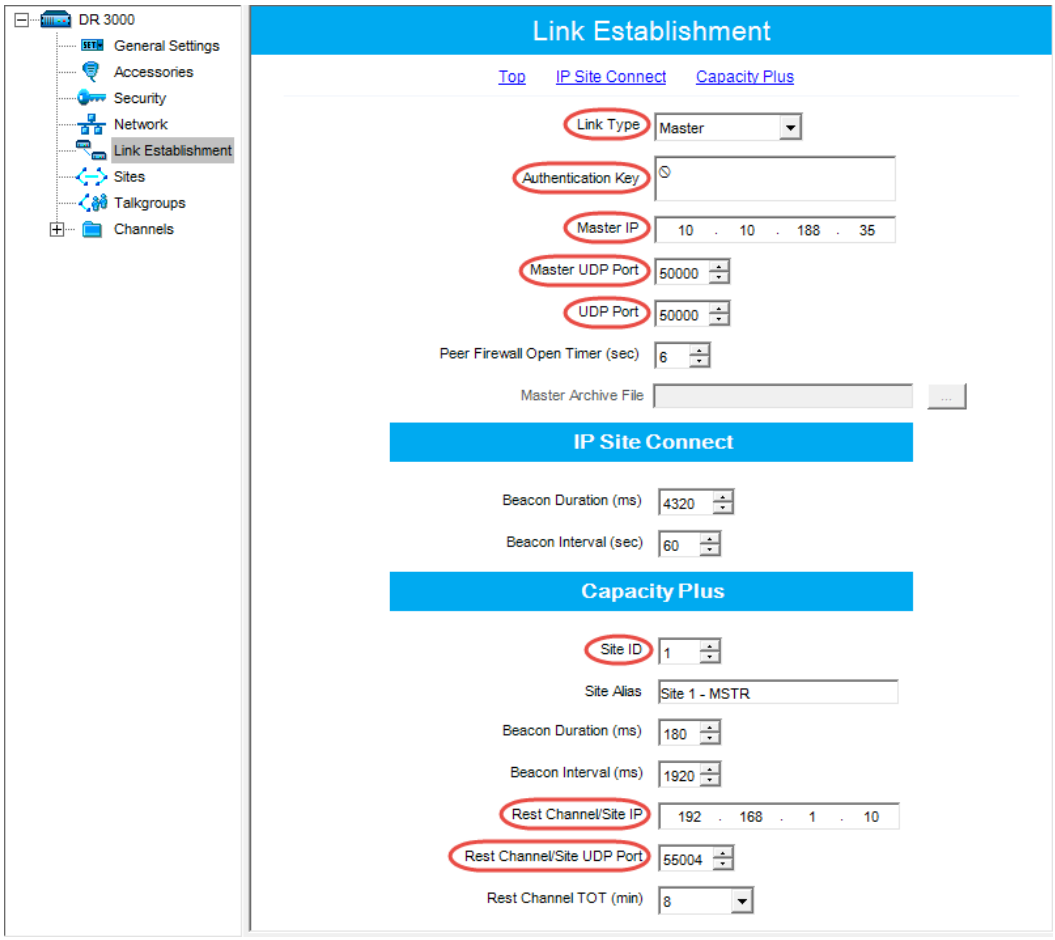
- **Ethernet IP**
  This is the LAN address of the repeater that can be obtained from your network details; the last octet of the IP address must be unique for the system's local network.
- **Gateway IP**
  This is the address of an upstream system (router). If a router exists, specify its LAN address here.
- **Gateway Netmask**
  Set the Subnet Mask, for example, **`255.255.255.0`** or **`255.255.0.0`** depending on the subnet.

IP repeater Programming

- **Enable**
  Select this checkbox to provide the ability to remotely program the repeater.

4.1.3 Link Establishment

- In the left pane, select **Link Establishment**.



- In the **Link Establishment** pane, specify the following parameters:
  - **Link Type**
    From the drop-down list, select **Master** if you are configuring a master repeater, or **Peer** if you are configuring a peer repeater.
  - **Authentication Key**
    Specify the authentication key that can optionally be used to access the repeater.
  - **Master IP**
    - If you are configuring a master repeater and peer repeaters residing on other sites:
      ✓ Enter the WAN IP address of the main site router behind which the master repeater resides.

- If you are configuring peer repeaters residing on the master site:
  - ✓ Enter the WAN IP address of the main site router if a NAT loopback is enabled and the port forwarding rules are specified for all the repeaters and the rest channel on the main site router.
  - ✓ Enter the LAN IP address of the master repeater if you are configuring a peer repeater and a NAT loopback is disabled on the router.

Note: In all the cases, the port forwarding rules must be specified for both the master repeater and the rest channel on the main site router.

- **Master UDP Port**
  Enter the UDP port number of the master repeater.
- **UDP Port**
  Enter the UDP port number of this repeater. If you are configuring a master repeater, set this value the same as that for **Master UDP Port**.
- **Site ID**
  Enter the ID of the site that the Repeater is on.

Note: All the Repeaters on the same site must have the same ID.

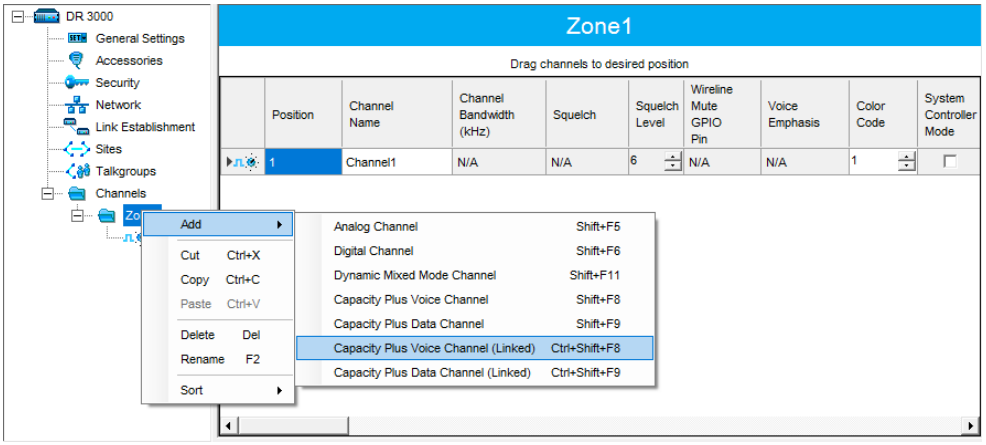
- **Rest Channel/Site IP**
  This is a private network IP address that is required for correct operation of a Linked Capacity Plus system. This IP address MUST be the same for all repeaters.
- **Rest Channel/Site UDP Port**
  This is the UDP port of the Repeater's rest channel. This UDP port MUST be the same for all repeaters.

4.1.4 Linked Capacity Plus Channel

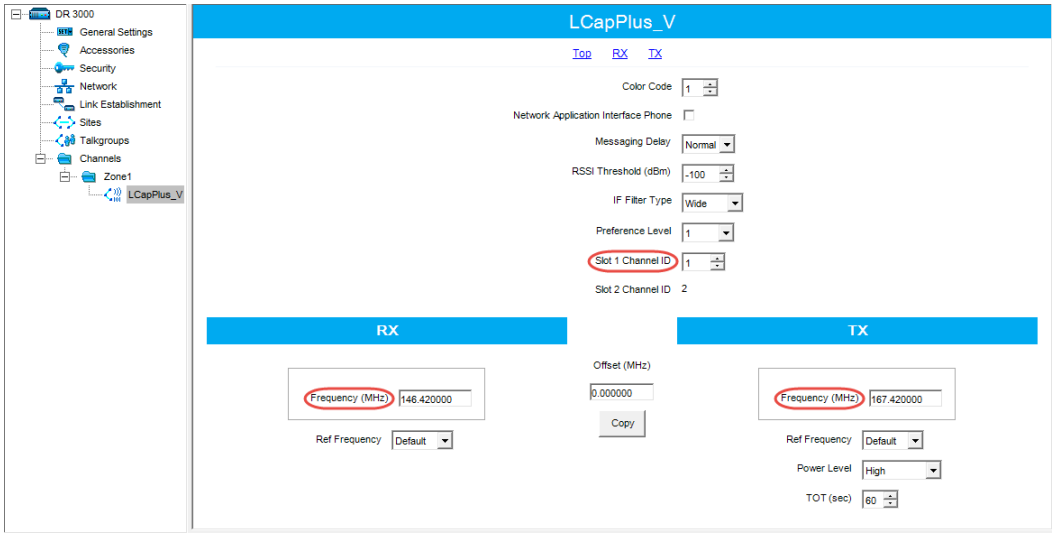
Depending on its role in a Linked Capacity Plus system (Trunked or Data Revert Repeater), the repeater can be configured either with a Voice Channel or with a Data Channel, respectively.

4.1.4.1 Adding a Voice Channel

- In the left pane, under **Channels**, right-click **Zone** and from the drop-down menu, select **Add > Capacity Plus Voice Channel (Linked)**.

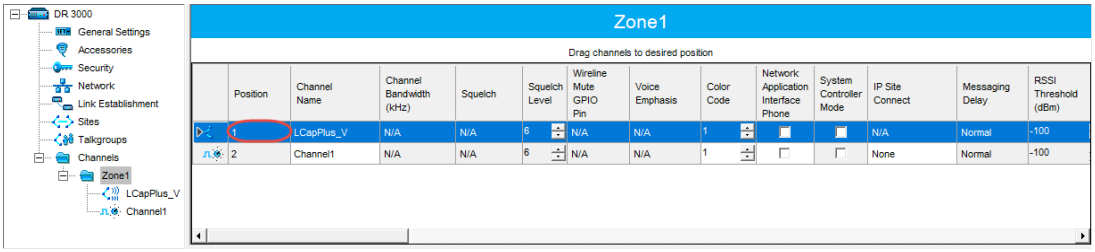


- In the left pane, right-click the channel you have added and from the drop-down menu select **Rename**, or select the channel and just press **F2** on the keyboard. Enter a new name for the channel, for example, "LCapPlus_V".



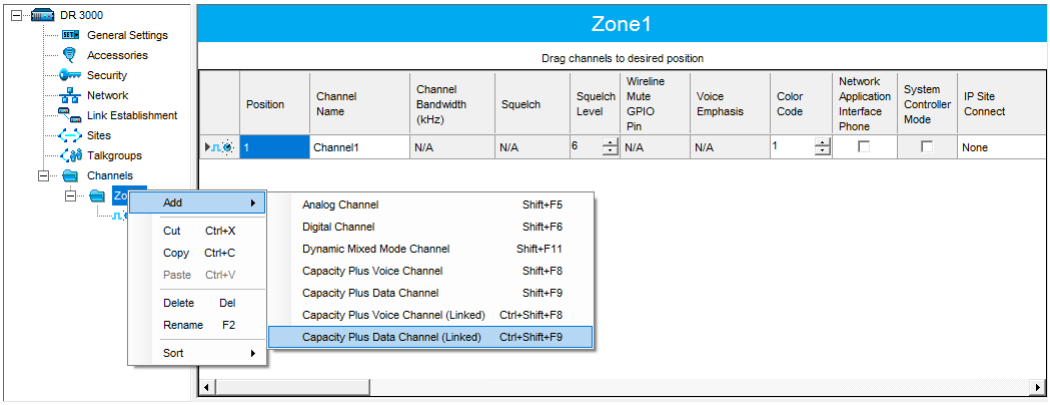
- In the **Channel** pane, specify the following channel-related parameters.
  - **Slot 1 Channel ID**
    Specify the Channel ID of Slot 1 for voice channels. This also determines the value for **Slot 2 Channel ID** which is always one increment higher than the value of Slot 1 Channel ID.
  - In the **RX Frequency** box, enter the radio frequency the repeater will receive on.
  - In the **TX Frequency** box, enter the radio frequency the repeater will transmit on.

Note: Make sure that the channel you have added is the first in the list of channels as the repeater will work on the channel which is on top of the list.

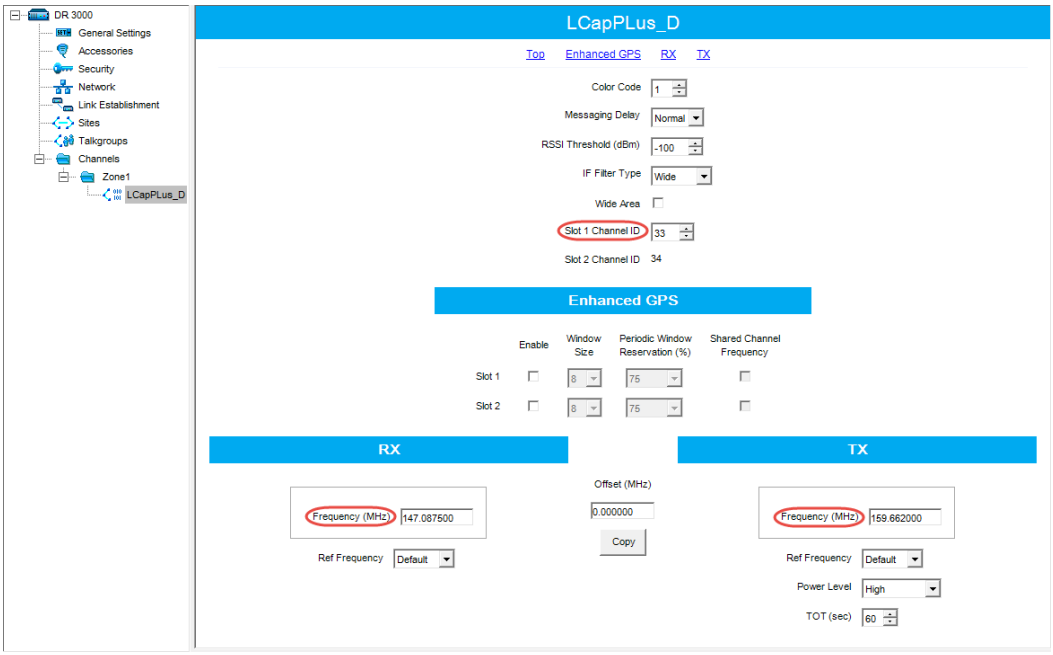


4.1.4.2 Adding a Data Channel

- In the left pane, under **Channels**, right-click **Zone** and from the drop-down menu, select **Add > Capacity Plus Data Channel (Linked)**.



- In the left pane, right-click the channel you have added and from the drop-down menu select **Rename**, or select the channel and just press **F2** on the keyboard. Enter a new name for the channel, for example, "LCapPlus_D".



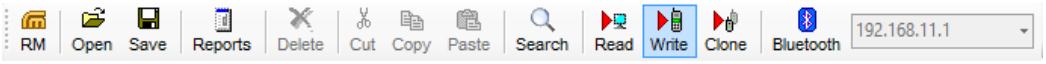
- In the **Channel** pane, specify the following channel-related parameters.

- **Slot 1 Channel ID**
  Specify the Channel ID of Slot 1 for voice channels. This also determines the value for **Slot 2 Channel ID** which is always one increment higher than the value of Slot 1 Channel ID.

  Note: The allowed range for **Slot 1 Channel ID** is from 33 to 253.

- In the **RX Frequency** box, enter the radio frequency the repeater will receive on.
- In the **TX Frequency** box, enter the radio frequency the repeater will transmit on.

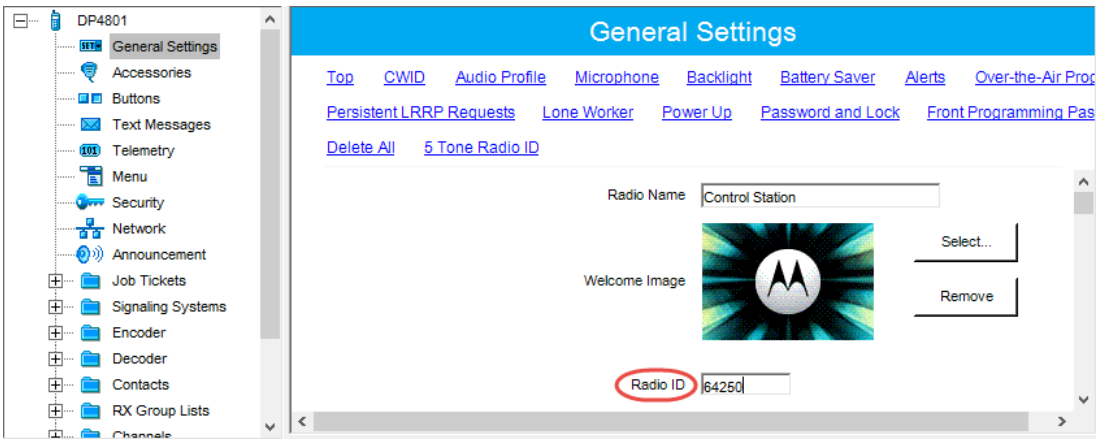
- Once you have finished configuring the desired repeater parameters, click the **Write** button on the toolbar.



4.2 Configuring a Control Station

This section describes how to configure the radio to be used as a control station in a Linked Capacity Plus system. Control stations are used in the topologies depicted in Figures 1-6.

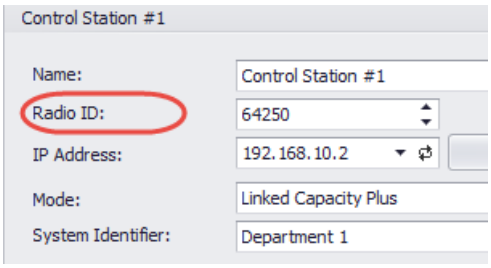
- Connect your radio to the PC via a programming cable.
- Turn on the radio.
- Click the **Read** button on the toolbar.



4.2.1 General Settings

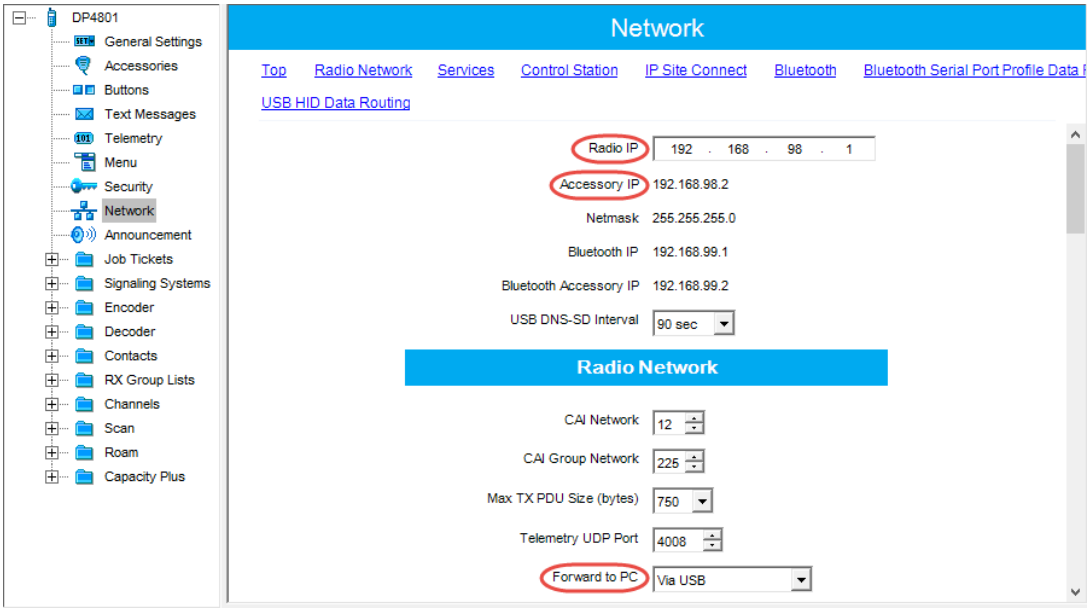
- In the left pane, select **General Settings**.
- In the General Settings pane, specify the following:
  - **Radio ID**
    Enter the Radio ID of the control station. The default value is **64250**.

Note: This value will then be used as the control station's **Radio ID** when connecting a control station to the TRBOnet Server. See section 5.1.2, Adding a Control Station.



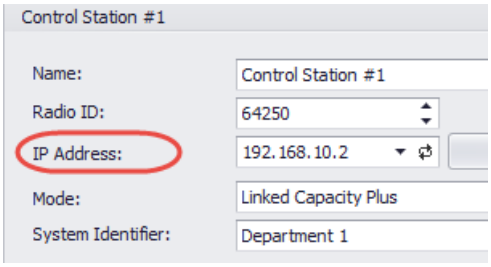
4.2.2 Network

- In the left pane, select **Network**.



- In the **Network** pane, specify the following parameters:
  - **Radio IP**
    This is the IP address used by the radio to communicate with the PC (using the USB connection) and has to be unique. To avoid conflicts in case there are several stations connected with USB, you can change the third octet of the address.
  - **Accessory IP**
    This is the IP address that is given to the PC by the radio that is connected to it.

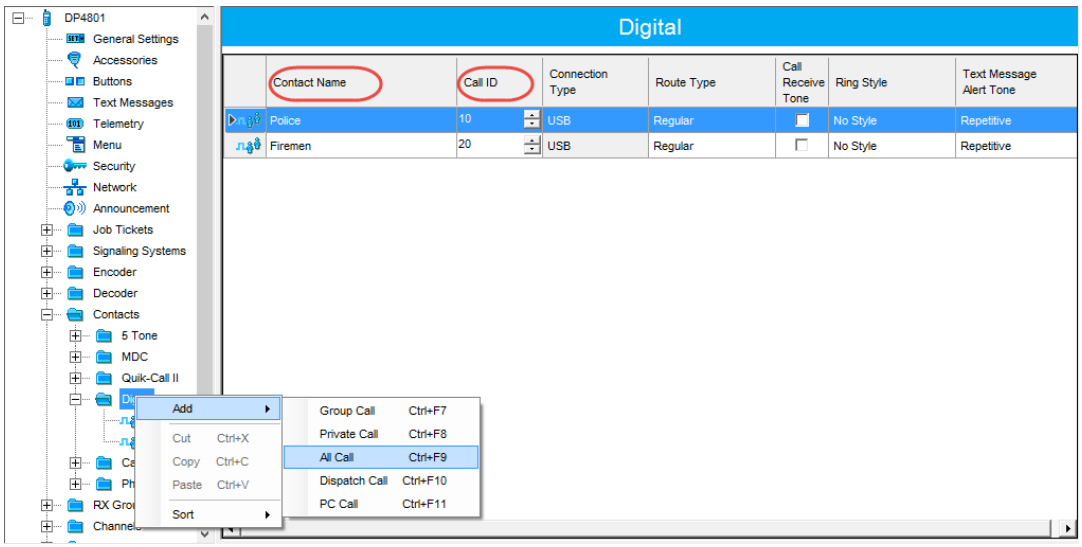
    Note: This value will then be used as the control station's **IP Address** when connecting a control station to the TRBOnet Server. See section 5.1.2, Adding a Control Station.



  - **Forward to PC**
    From the drop-down list, select **Via USB**.

4.2.3 Contacts

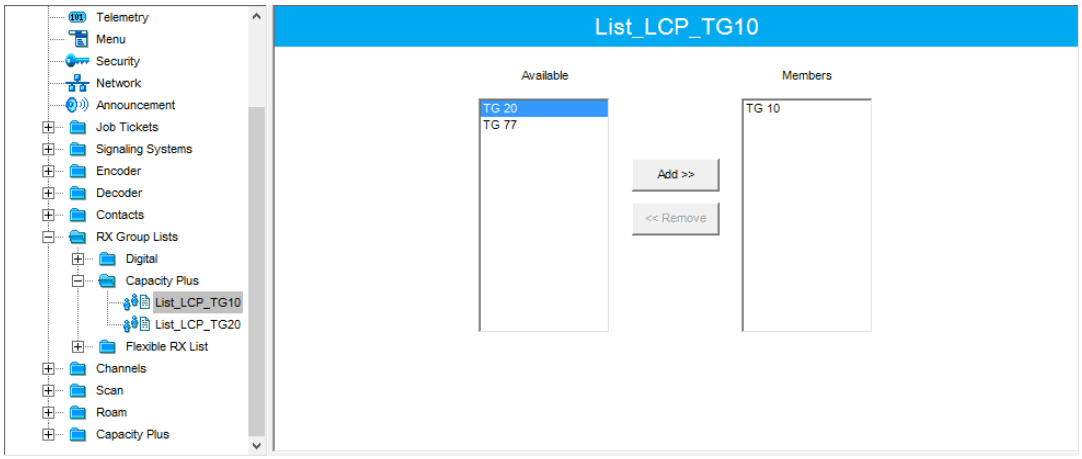
- In the left pane, select **Contacts** > **Capacity Plus** and right-click it. Click **Add** > and from the drop-down menu select the type of a call you want to add a contact for.



- Enter the **Contact Name** and **Call ID** for the contacts you have added.

4.2.4 RX Group Lists

- In the left pane, select **RX Group Lists** > **Capacity Plus**. Right-click it, and choose **Add** > **RX Group List**.



- In the left pane, select the group you have added.
- In the right pane, in the **Available** list select a group, or multiple groups using the SHIFT key, and click the **Add** button.

  As a result, the group(s) will appear in the **Members** list.

4.2.5 Channel

4.2.5.1 Important Notes

Depending on its role in a Linked Capacity Plus system (Trunked Control Station or Data Revert Control Station), the control station can be configured either with a Linked Capacity Plus Personality Channel or with a Digital Channel, respectively.

When using the configurations depicted on figures 1, 4, 5, you are employing a Linked Capacity Plus Personality Channel.

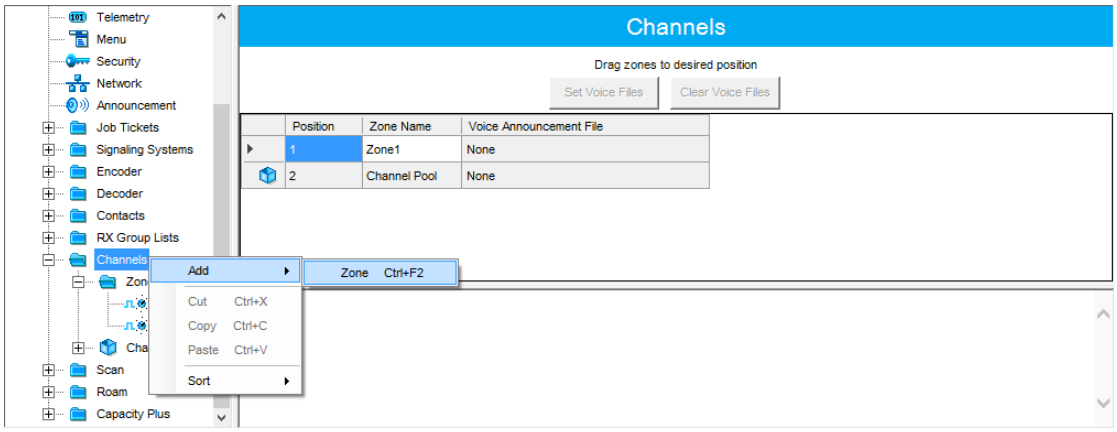
In the configurations depicted in figs. 2 and 3, that is configurations with the data revert repeater, you will need to use a Digital Channel. The fact is that there are no rest channels on a data revert repeater. Thus, to send data to TRBOnet Server, the subscriber radios will use a data revert channel. In this case, you'll have to forcibly set the control station to the corresponding frequencies of the data revert repeater.

A single data revert control station may receive data from only one data revert slot. If there is only one data revert control station in the radio system, then all subscribers must send data only to the slot with which this control station operates. The Radio ID of this data revert control station must match the Radio ID of at least one voice control station. If the system has several data revert control stations, their Radio ID's be the same and match at least one voice control station.

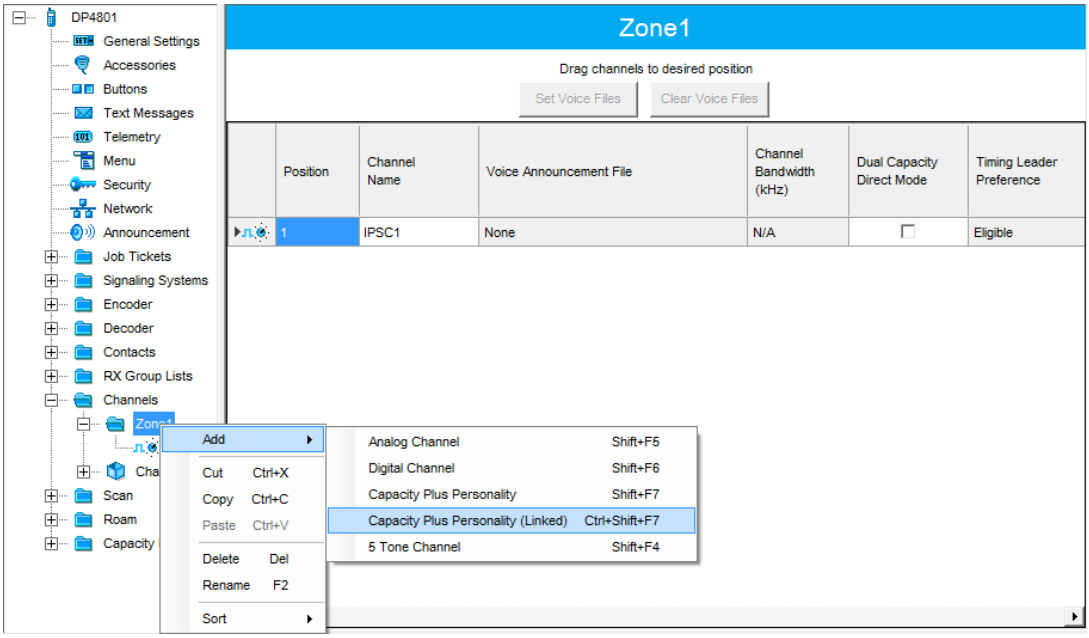
Also note that the system identifier in TRBOnet Server should be the same for all control stations and repeaters used in the same radio system.

4.2.5.2 Adding a Capacity Plus Personality Channel

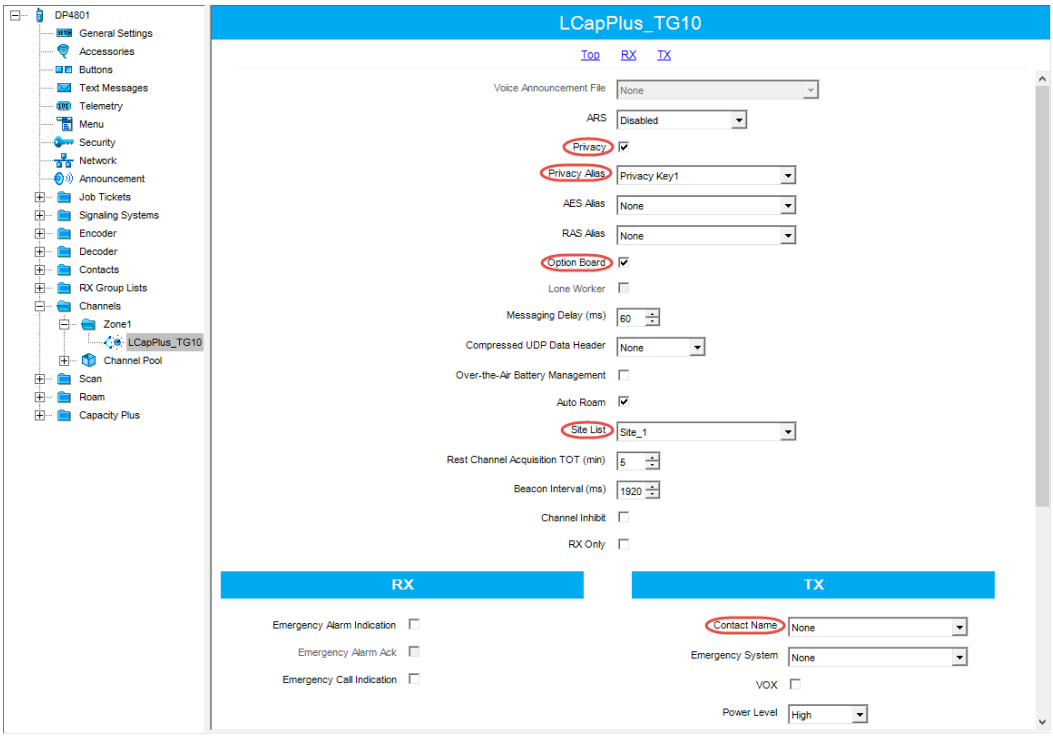
- In the left pane, select **Channels**. Right-click it, and choose **Add > Zone**.



- In the left pane, select the zone you have added. Right-click it, and choose **Add > Capacity Plus Personality (Linked)**.



- In the left pane, select the channel (for example, named LCapPlus_TG10) that has previously been added.



- In the right pane, specify the following parameters:
  - **Privacy**
    Select this option to allow privacy on the channel.

Note: The **Privacy** option is available if the Basic or Enhanced Privacy Type has been selected in the Security section.

- **Privacy Alias**
  From the drop-down list, select the Key Alias.

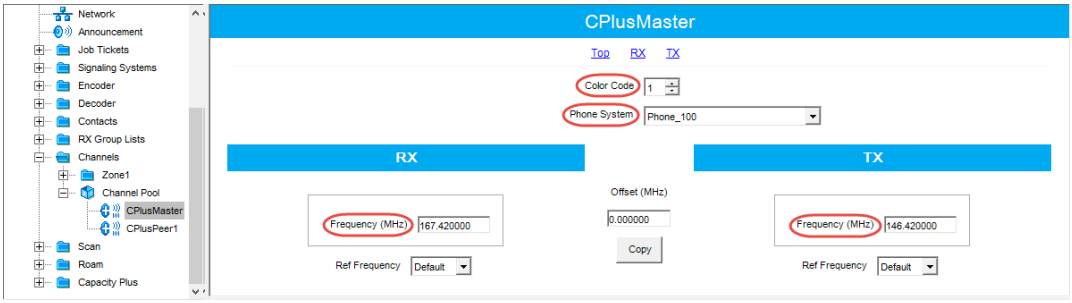
  Note: The **Privacy Alias** option is available if the Enhanced Privacy Type has been selected in the Security section. The same Key Alias must be used on all system nodes (repeaters and radios).

- **Option Board**
  Select this option to enable the option board capability on the channel. The option board must be installed and enabled in the radio otherwise this feature will not function.
- **Site List**
  Select the Linked Capacity Plus Site List you have specified in section 4.2.7, Capacity Plus Site List.
- **TX Contact Name**
  Select the contact to which a call will be initiated on the channel when pressing the PTT button. The contact is selected from the Contact list you have created in section 4.2.3, Contacts.

4.2.5.3 Adding Channels to Channel Pool

Channel Pool is used for organizing channels in the radio that are not tied to a channel selector position. The Channel Pool is not visible when the radio user navigates through the zones.

- In the left pane, select **Channels > Channel Pool**. Right-click on it, and choose **Add > Capacity Plus Voice Channel**.
- In the left pane, select the first channel (for example, named CPlusMaster) that has previously been added.



- **Color Code**
  Enter the color code for the radio. Note that the color codes on the radios must match the color code of the repeater.
- **Phone System**
  Select the phone system you have specified in section 4.3.9, Phone System.
- In the **RX Frequency** box, specify the radio frequency the radio will receive on.

- In the **TX Frequency** box, specify the radio frequency the radio will transmit on.

Note: The RX and TX frequencies of the radio must be the opposite to the RX and TX frequencies of the repeater. In other words, the RX frequency of the repeater must be the same as the TX frequency of the radio; the TX frequency of the repeater must be the same as the RX frequency of the radio.

4.2.5.4 Adding a Digital Channel for Receiving Data

This section describes how to configure a data revert channel for receiving data on a control station (see also section 4.2.5.1, Important Note).

- In the left pane, select the zone you have added. Right-click it, and choose **Add > Digital Channel**.
- In the left pane, select the channel (for example, named DataChannel1) that has previously been added.

- **Color Code**
  Enter the color code for the radio. Note that the color codes on the radios must match the color code of the data repeater.
- **Repeater/Time Slot**
  Select one of the data repeater time slots.
- **Privacy**
  Select this option to allow privacy on the channel.

Note: The **Privacy** option is available if the Basic or Enhanced Privacy Type has been selected in the Security section.

- **Privacy Alias**
  From the drop-down list, select the Key Alias.

Note: The **Privacy Alias** option is available if the Enhanced Privacy Type has been selected in the Security section. The same Key Alias must be used on all system nodes (repeaters and radios).

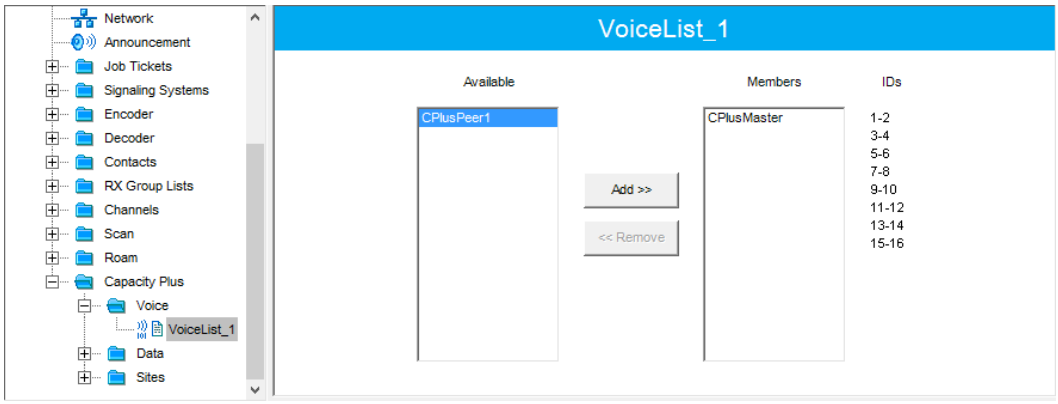
- In the **RX Frequency** box, specify the radio frequency the radio will receive on.
- In the **TX Frequency** box, specify the radio frequency the radio will transmit on.

Note: The RX and TX frequencies of the radio must be the opposite to the RX and TX frequencies of the corresponding data repeater. In other words, the RX frequency of the repeater must be the same as the TX frequency of the radio; the TX frequency of the repeater must be the same as the RX frequency of the radio.

4.2.6 Capacity Plus Voice List

This section describes how to add the channels contained in the Channels Pool to a Capacity Plus Voice List.

- In the left pane, select **Capacity Plus** > **Voice**. Right-click on it, and choose **Add** > **Capacity Plus Voice List**.



- In the left pane, select the Voice List you have added.
- In the right pane, in the **Available** list select a channel, or multiple channels using the SHIFT key, and click the **Add** button.

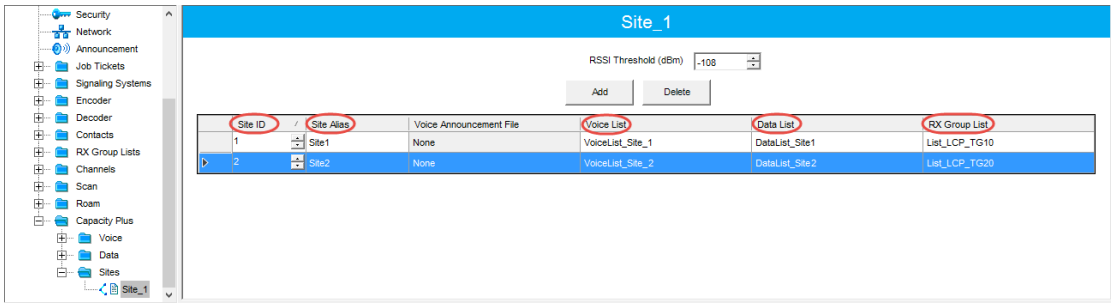
  As a result, the channel(s) will appear in the **Members** list.

Note: The order of the channels in the Members list must follow the order of their respective Slot IDs, for example 1-2, 3-4, and so on.

4.2.7 Capacity Plus Site List

This section describes how to add the sites to a Capacity Plus Site List.

- In the left pane, select **Capacity Plus > Sites**. Right-click on it, and choose **Add > Capacity Plus Site List**.
- In the left pane, select the Site List you have added (for example, named Site_1).



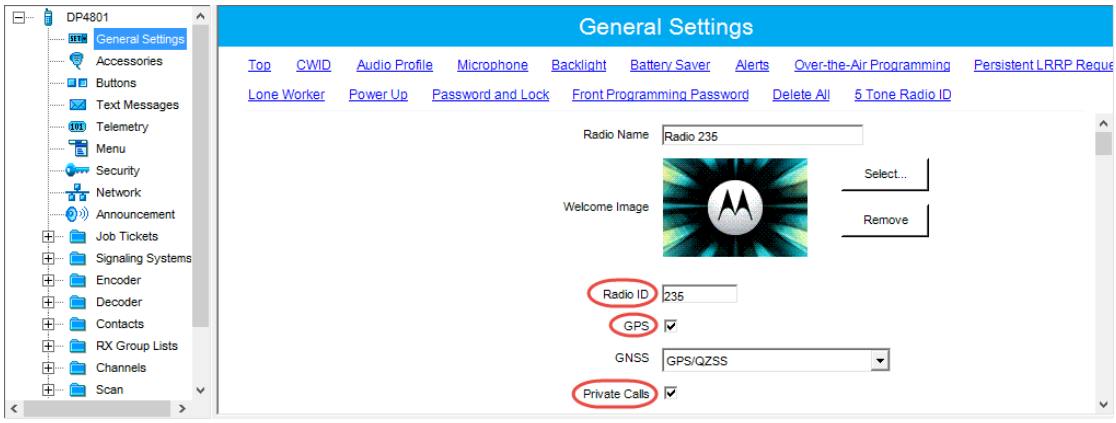
- In the right pane, click the **Add** button.
- For the site you have added, specify the following parameters:
  - **Site ID**
    Enter the ID of the site that the radio will connect to.
  - **Site Alias**
    Enter a name for the site that the radio will connect to.
  - **Voice List**
    From the drop-down list, select a Capacity Plus Voice Channel List that the radio will use to make voice calls when on the site.
  - **Data List**
    From the drop-down list, select a Capacity Plus Data Channel List that the radio will use to make data calls when on the site.
  - **RX Group List**
    From the drop-down list, select an RX Group List that the radio will use to make Group Calls when on the site.

- Once you have finished configuring the desired radio parameters, click the **Write** button on the toolbar.

4.3 Configuring a Subscriber Radio

This section describes how to configure a subscriber radio to be used in a Linked Capacity Plus system.

- Connect your radio to the PC via a programming cable.
- Turn on the radio.
- Click the **Read** button on the toolbar.

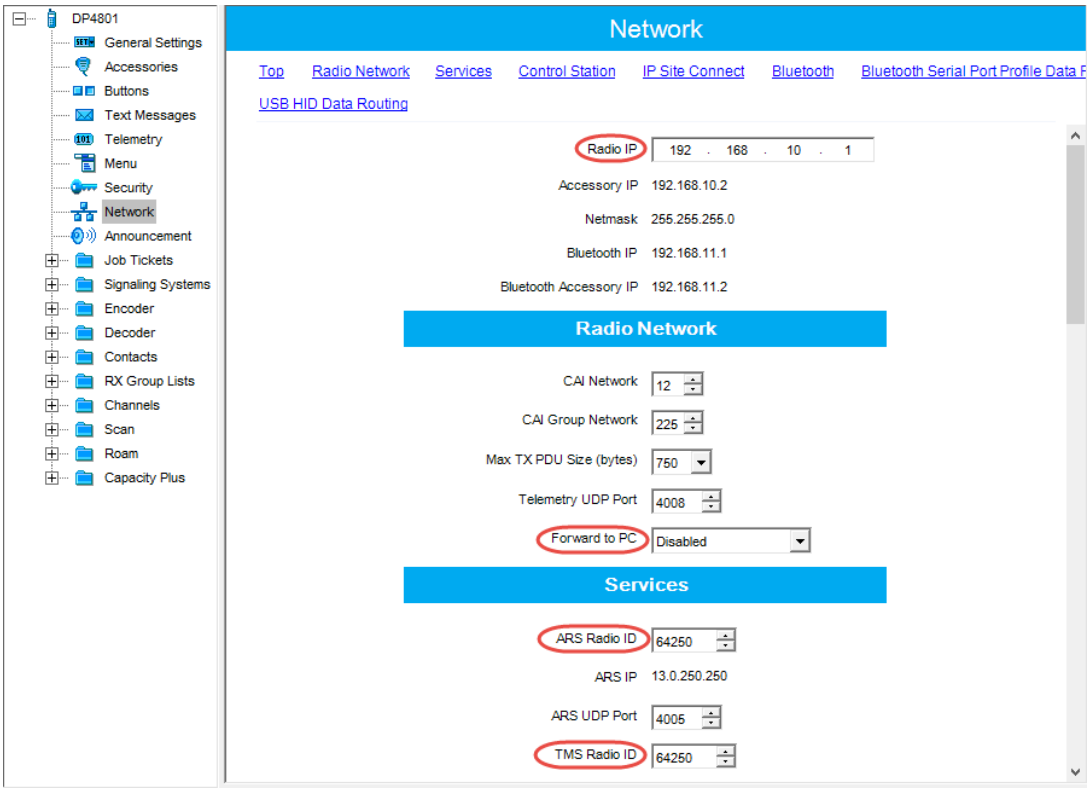


4.3.1 General Settings

- In the left pane, select **General Settings**.
- In the General Settings pane, specify the following:
  - **Radio ID**
    Enter the Radio ID of the radio. This ID is used by other calling radios when addressing the radio, for instance, when making a private call or sending a text message.
  - **GPS**
    Select this checkbox to track the location of the radio if the radio is equipped with a GPS module.
  - **Private calls**
    Select this checkbox to enable the initiation of a Private Call on a digital channel. When disabled, a prohibit tone will sound when the user tries to initiate a Private Call.

4.3.2 Network

- In the left pane, select **Network**.
- In the **Network** pane, click the **Radio Network** link, or scroll down to the Radio Network section.

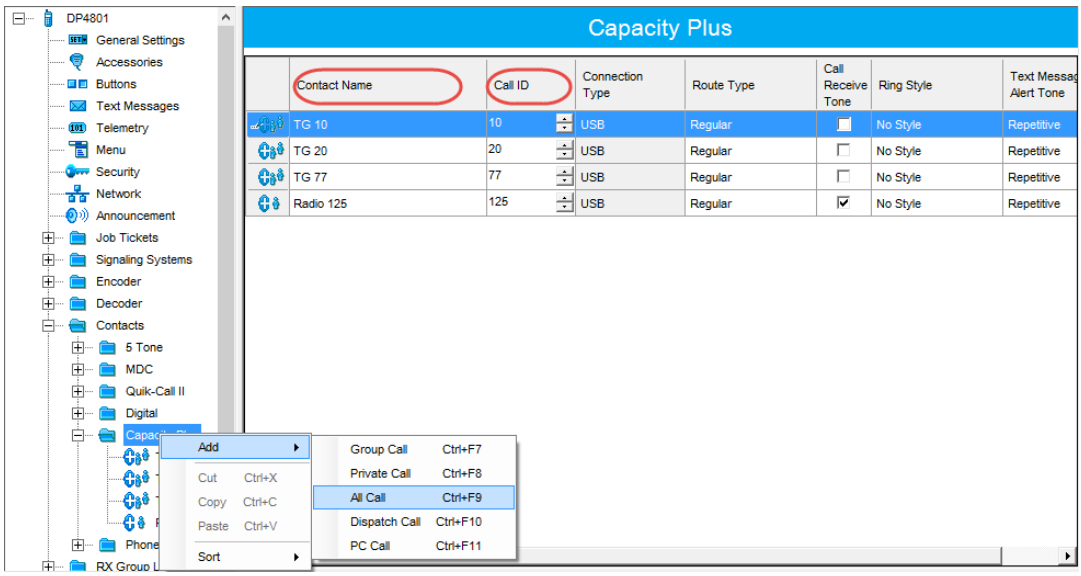


- In the **Radio Network** section, specify the following parameter:
  - **Forward to PC**
    From the drop-down list, select **Disabled**.
- In the **Services** section, specify the following parameters:
  - **ARS Radio ID**
    Specify the Radio ID of the ARS server.
  - **TMS Radio ID**
    Specify the Radio ID of the TMS server.

Note: The **ARS Radio ID** and **TMS Radio ID** must be the same as either **TRBOnet Radio ID** in the Repeater settings if the master repeater is connected to TRBOnet Server via a wireline connection (see section 5.1.1, Adding a Master Repeater), or **Radio ID** in the Control Station settings if the control station is connected to TRBOnet Server via USB (see section 5.1.2, Adding a Control Station), or **MNIS Application ID**, if MNIS is enabled (see section 4.5, Configuring MOTOTRBO MNIS).
The recommended value is **64250** for both parameters.

4.3.3 Contacts

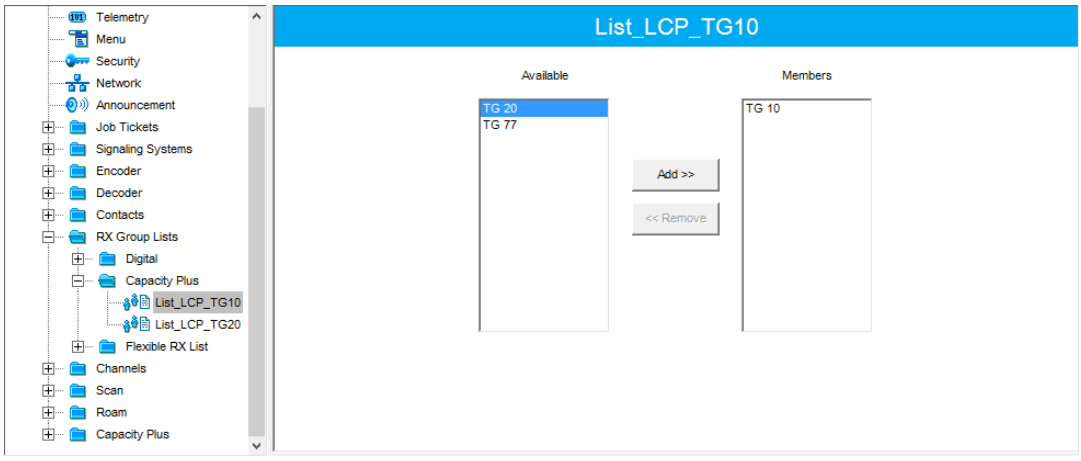
- In the left pane, select **Contacts** > **Capacity Plus** and right-click on it. Click **Add** > and from the drop-down menu select the type of a call you want to add a contact for.



- Enter the **Contact Name** and **Call ID** for the contacts you have added.

4.3.4 RX Group Lists

- In the left pane, select **RX Group Lists** > **Capacity Plus**. Right-click on it, and choose **Add** > **RX Group List**.



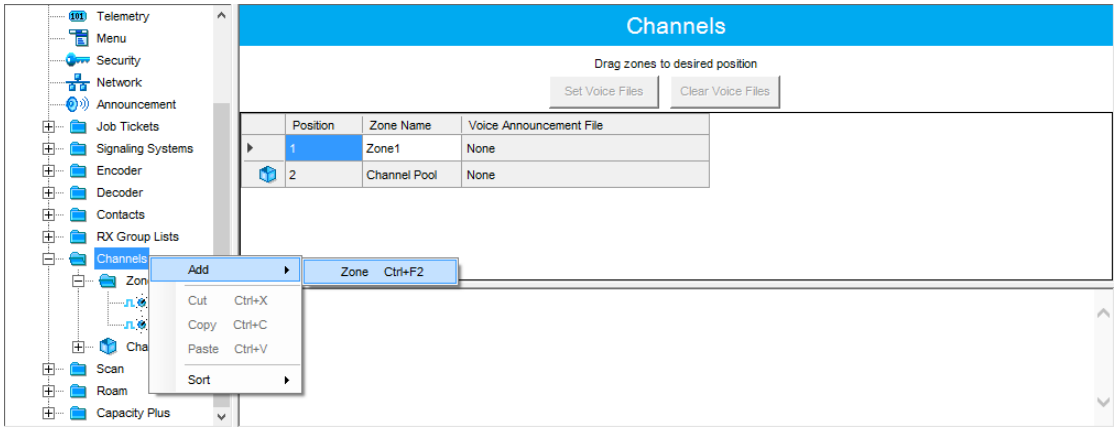
- In the left pane, select the group you have added.
- In the right pane, in the **Available** list select a group, or multiple groups using the SHIFT key, and click the **Add** button.

  As a result, the group(s) will appear in the **Members** list.

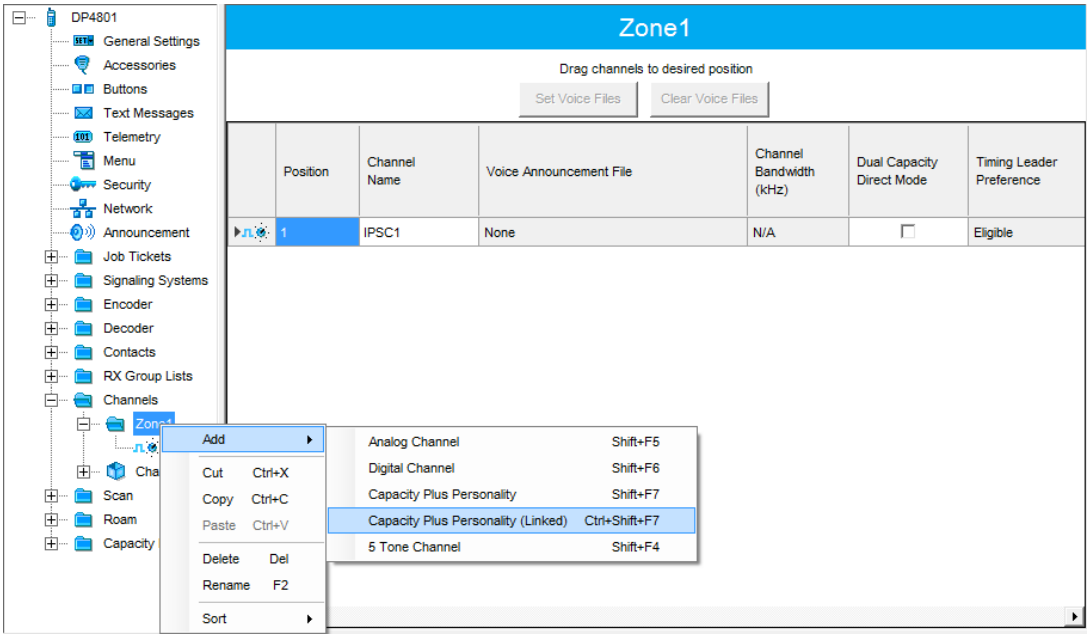
4.3.5 Channels

4.3.5.1 Adding a Capacity Plus Personality Channel

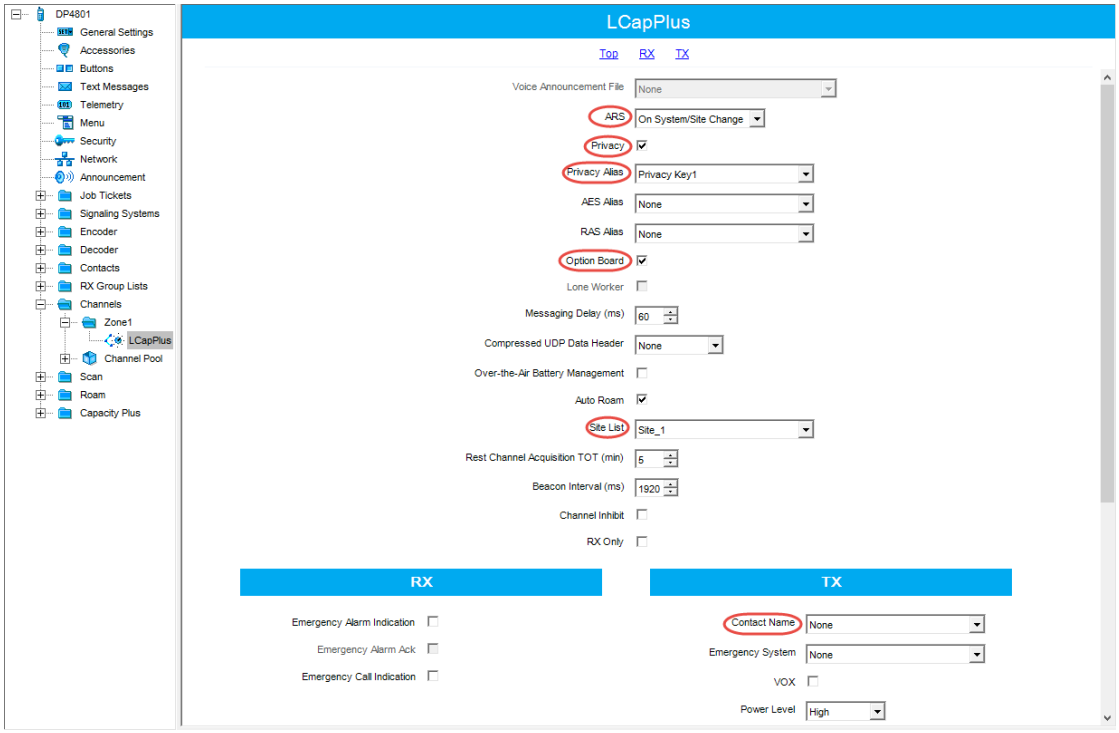
- In the left pane, select **Channels**. Right-click on it, and choose **Add > Zone**.



- In the left pane, select the zone you have added. Right-click on it, and choose **Add > Capacity Plus Personality (Linked)**.



- In the left pane, select the first channel (for example, named LCapPlus) that has previously been added.



- In the right pane, specify the following parameters:
  - **ARS**
    Select **On System/Site Change** to provide the automated registration for the radio.
  - **Privacy**
    Select this option to allow privacy on the channel.

    Note: The **Privacy** option is available if the Basic or Enhanced Privacy Type has been selected in the Security section.
  - **Privacy Alias**
    From the drop-down list, select the Key Alias.

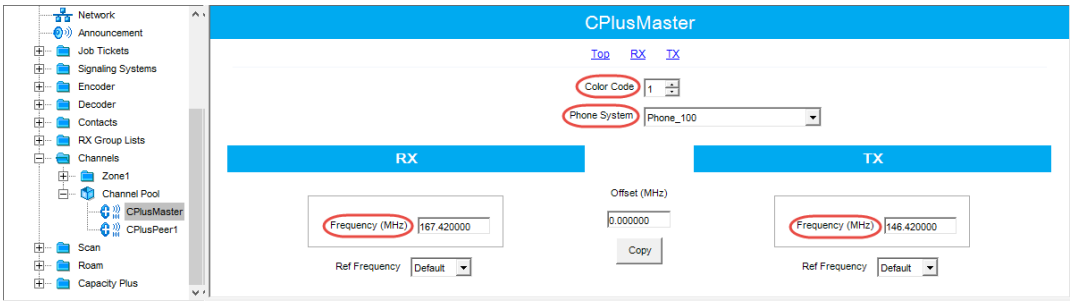
    Note: The **Privacy Alias** option is available if the Enhanced Privacy Type has been selected in the Security section. The same Key Alias must be used on all system nodes (repeaters and radios).
  - **Option Board**
    Select this option to enable the option board capability on the channel. The option board must be installed and enabled in the radio or this feature will not function.
  - **Site List**
    Select the Linked Capacity Plus Site List you have specified in section 4.3.8, Capacity Plus Site List.

- **TX Contact Name**
  Select the contact to which a call will be initiated on the channel when pressing the PTT button. The contact is selected from the Contact list you have created in section 4.3.3, Contacts.

4.3.5.2 Adding Channels to Channel Pool

Channel Pool is used for organizing channels in the radio that are not tied to a channel selector position. The Channel Pool is not visible when the radio user navigates through the zones.

- In the left pane, select **Channels > Channel Pool**. Right-click on it, and choose **Add > Capacity Plus Voice Channel**.
- In the left pane, select the first channel (for example, named CPlusMaster) that has previously been added.



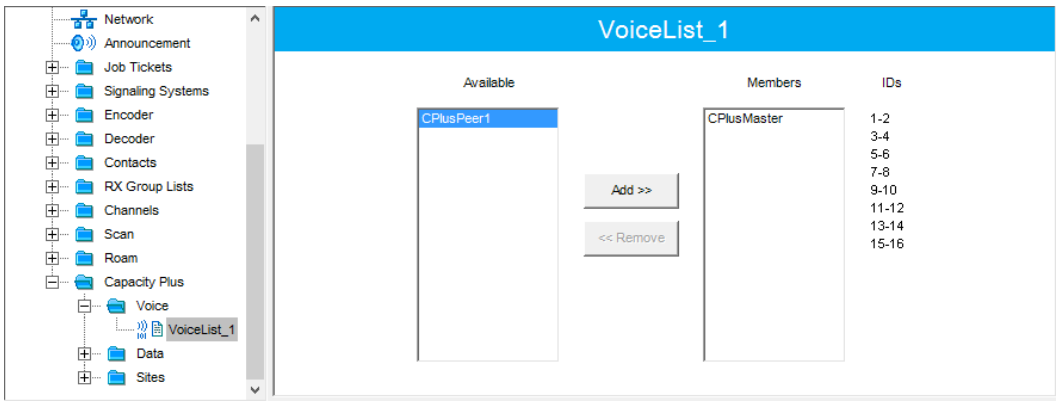
- **Color Code**
  Enter the color code for the radio. Note that the color codes on the radios must match the color code of the repeater.
- **Phone System**
  Select the phone system you have specified in section 4.3.9, Phone System.
- In the **RX Frequency** box, specify the radio frequency the radio will receive on.
- In the **TX Frequency** box, specify the radio frequency the radio will transmit on.

Note: The RX and TX frequencies of the radio must be the opposite to the RX and TX frequencies of the repeater. In other words, the RX frequency of the repeater must be the same as the TX frequency of the radio; the TX frequency of the repeater must be the same as the RX frequency of the radio.

4.3.6 Capacity Plus Voice List

This section describes how to add the channels contained in the Channels Pool to a Capacity Plus Voice List.

- In the left pane, select **Capacity Plus** > **Voice**. Right-click on it, and choose **Add** > **Capacity Plus Voice List**.



- In the left pane, select the Voice List you have added.
- In the right pane, in the **Available** list select a channel, or multiple channels using the SHIFT key, and click the **Add** button.

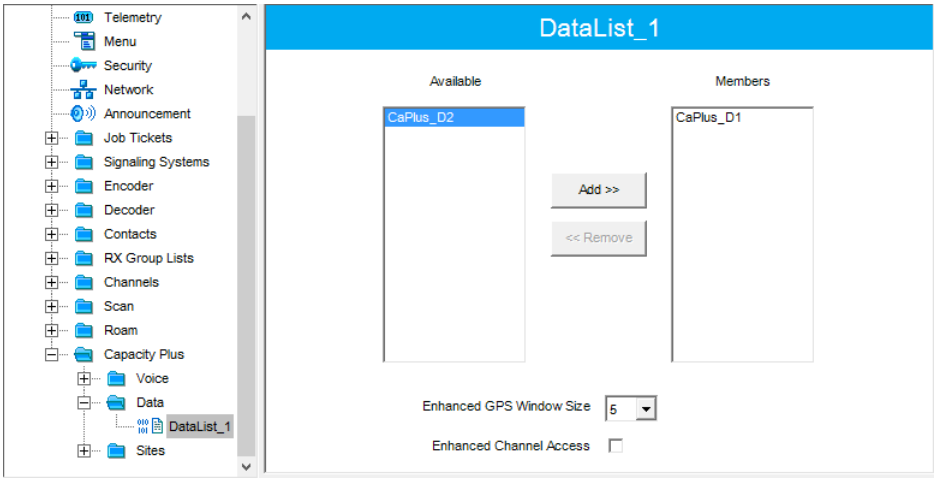
  As a result, the channel(s) will appear in the **Members** list.

Note: The order of the channels in the Members list must follow the order of their respective Slot IDs, for example 1-2, 3-4, and so on.

4.3.7 Capacity Plus Data List

This section describes how to add the channels contained in the Channels Pool to a Capacity Plus Data List.

- In the left pane, select **Capacity Plus** > **Data**. Right-click on it, and choose **Add** > **Capacity Plus Data List**.



- In the left pane, select the Voice List you have added.

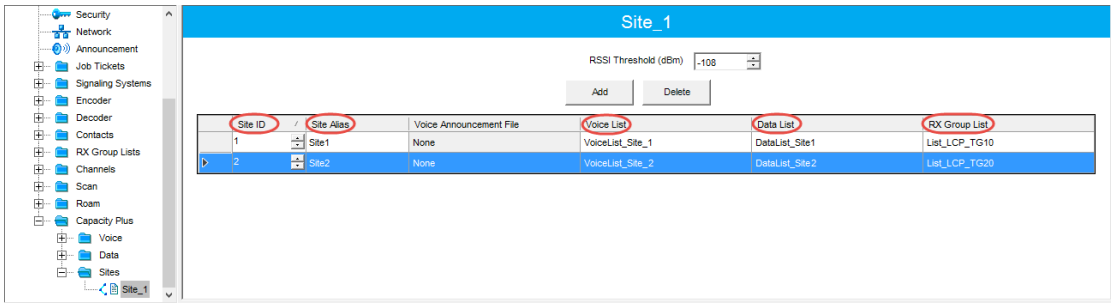
- In the right pane, in the **Available** list select a channel, or multiple channels using the SHIFT key, and click the **Add** button.

  As a result, the channel(s) will appear in the **Members** list.

4.3.8 Capacity Plus Site List

This section describes how to add the sites to a Capacity Plus Site List.

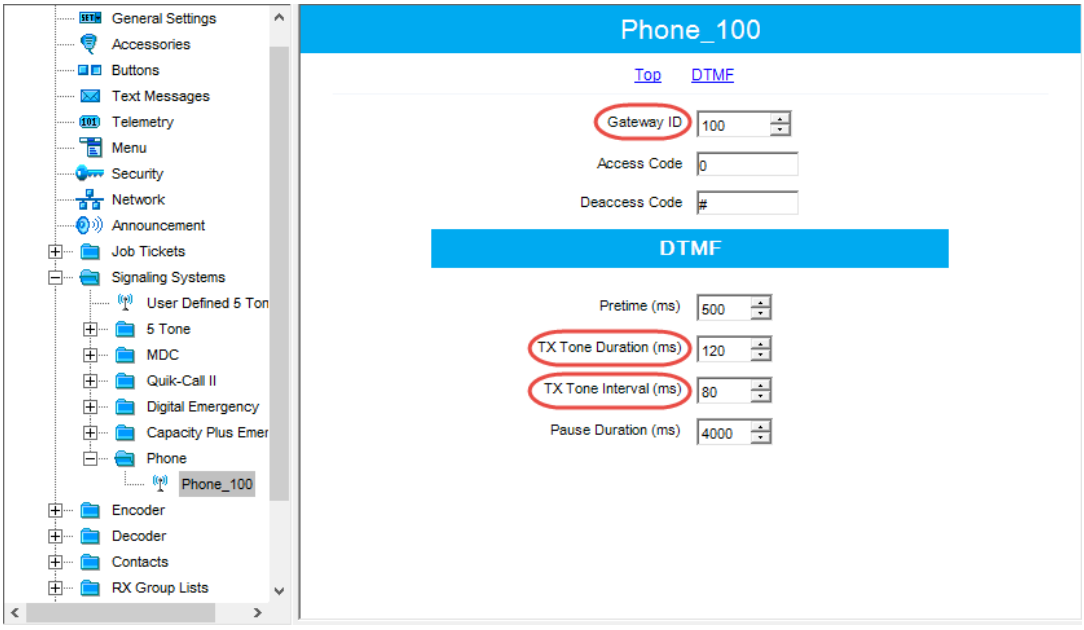
- In the left pane, select **Capacity Plus** > **Sites**. Right-click on it, and choose **Add** > **Capacity Plus Site List**.
- In the left pane, select the Site List you have added (for example, named Site_1).



- In the right pane, click the **Add** button.
- For the site you have added, specify the following parameters:
  - **Site ID**
    Enter the ID of the site that the radio will connect to.
  - **Site Alias**
    Enter a name for the site that the radio will connect to.
  - **Voice List**
    From the drop-down list, select a Capacity Plus Voice Channel List that the radio will use to make voice calls when on the site.
  - **Data List**
    From the drop-down list, select a Capacity Plus Data Channel List that the radio will use to make data calls when on the site.
  - **RX Group List**
    From the drop-down list, select an RX Group List that the radio will use to make Group Calls when on the site.

4.3.9 Phone System

- In the left pane, select **Signaling Systems > Phone**. Right-click on it, and choose **Add > System**.
- In the left pane, under **Phone**, select the phone system that has been just added.



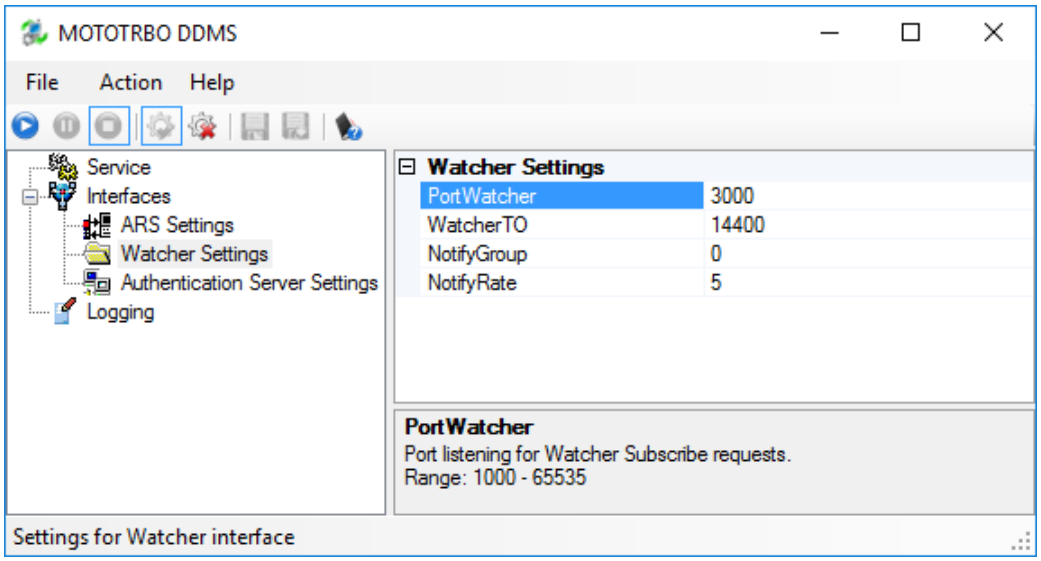
- In the right pane, specify the following parameters:
  - **Gateway ID**
    Enter the same ID as **TRBOnet Peer ID** in the Repeater settings of TRBOnet Server.
  - **TX Tone Duration (ms)**
    Enter the duration of the DTMF tone digits, in milliseconds, for the phone system. It is recommended to set this value to **120**.
  - **TX Tone Interval (ms)**
    Enter the duration of the intervals between the DTMF tone digits in a transmission sequence, in milliseconds, for the phone system. It is recommended to set this value to **80**.

- Once you have finished configuring the desired radio parameters, click the **Write** button on the toolbar.

4.4 Configuring MOTOTRBO DDMS

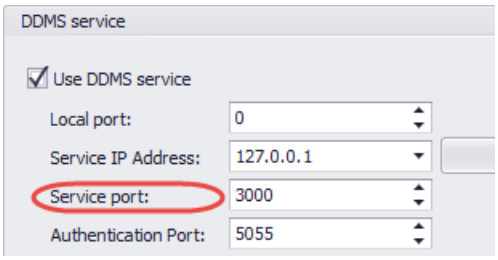
The DDMS, or Device Discovery and Mobility Service is a service for tracking the presence of radio subscribers in the radio network and transmitting the data to the server. The topologies using DDMS are depicted in Figures 6-7. This section describes how to configure and run MOTOTRBO DDMS service using MOTOTRBO DDMS Administrative Client.

- Launch MOTOTRBO DDMS Administrative Client.
- In the left pane, select **Watcher Settings**.

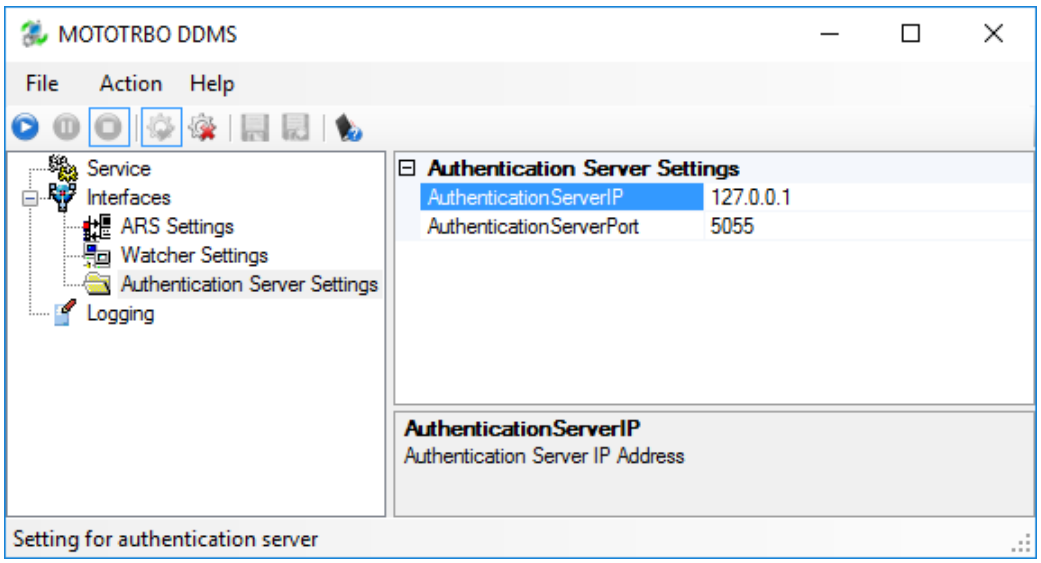


- **PortWatcher**
  This is the port number for listening TRBOnet Server requests.

Note: This value will be used when configuring DDMS parameters in section 5.1.1.3, DDMS Service, **Service port**.

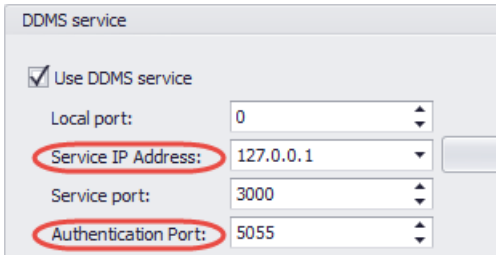


- In the left pane, select **Authentication Server Settings**.

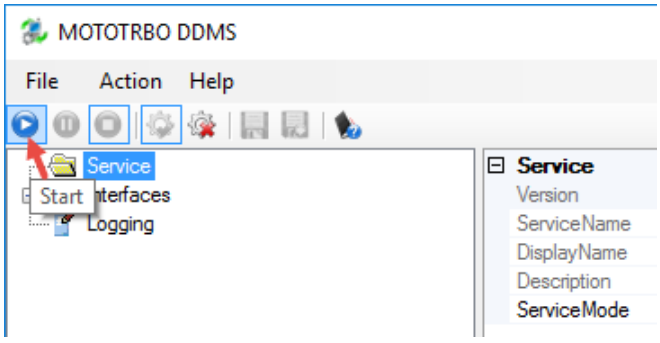


  - **AuthenticationServerIP**
    This is the authentication server IP address.
  - **AuthenticationServerPort**
    This is the authentication server port number.

Note: These values will be used when configuring DDMS parameters in section 5.1.1.3, DDMS Service, **Service IP Address** and **Authentication Port**, respectively.



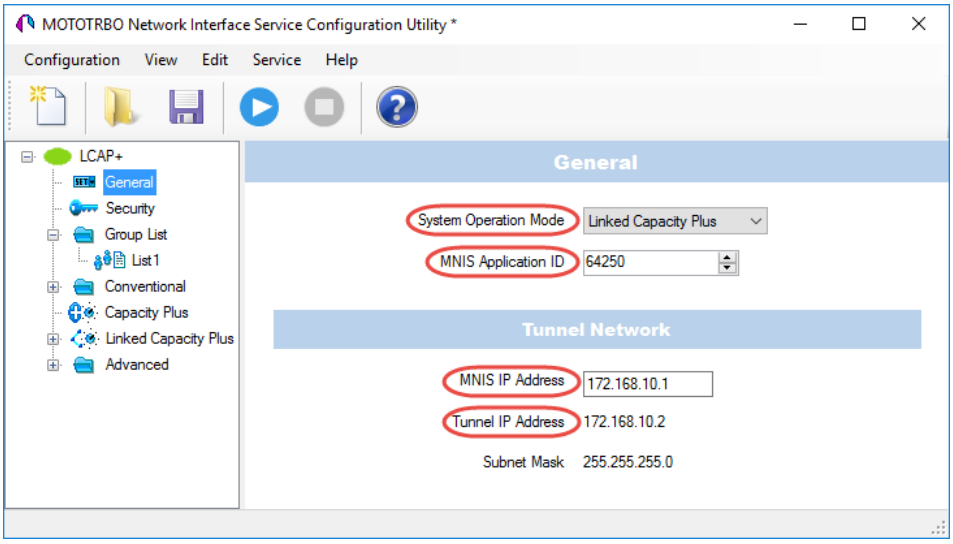
- Once you have finished configuring the desired DDMS parameters, click the **Start** button on the toolbar.



4.5 Configuring MOTOTRBO MNIS

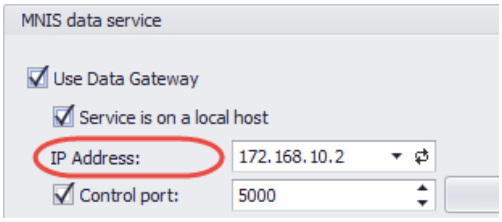
This section describes how to configure and run MOTOTRBO MNIS service using MNIS Configuration Utility.

- Launch MNIS Configuration Utility.
- In the left pane, select **General**.

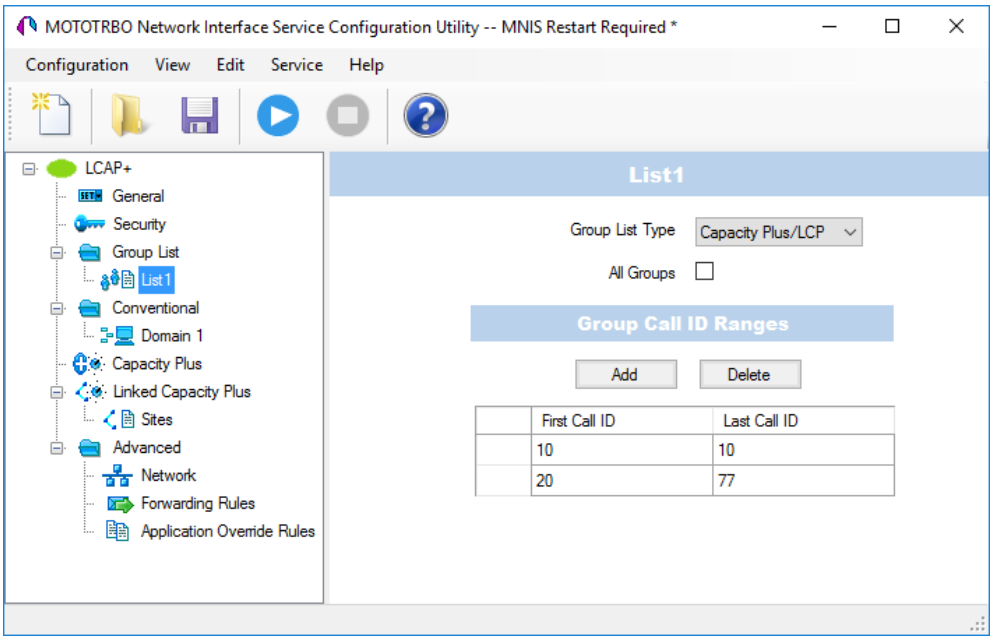


- **System Operation Mode**
  From the drop-down list, select **Linked Capacity Plus**.
- **MNIS Application ID**
  Configure an individual ID that uniquely identifies the MNIS application in the radio system. The recommended value is **64250**.

  Note: This is the ID that TRBOnet Server uses as its **Radio ID** when connecting a master repeater.
- **MNIS IP Address**
  It is recommended that the value of **172.168.10.1** is used unless there are conflicts with other network interfaces on the PC.
- **Tunnel IP Address**
  This is the IP Address used by the MNIS to communicate with TRBOnet Enterprise (see 5.1.1.4, MNIS Data Service, **IP Address**).

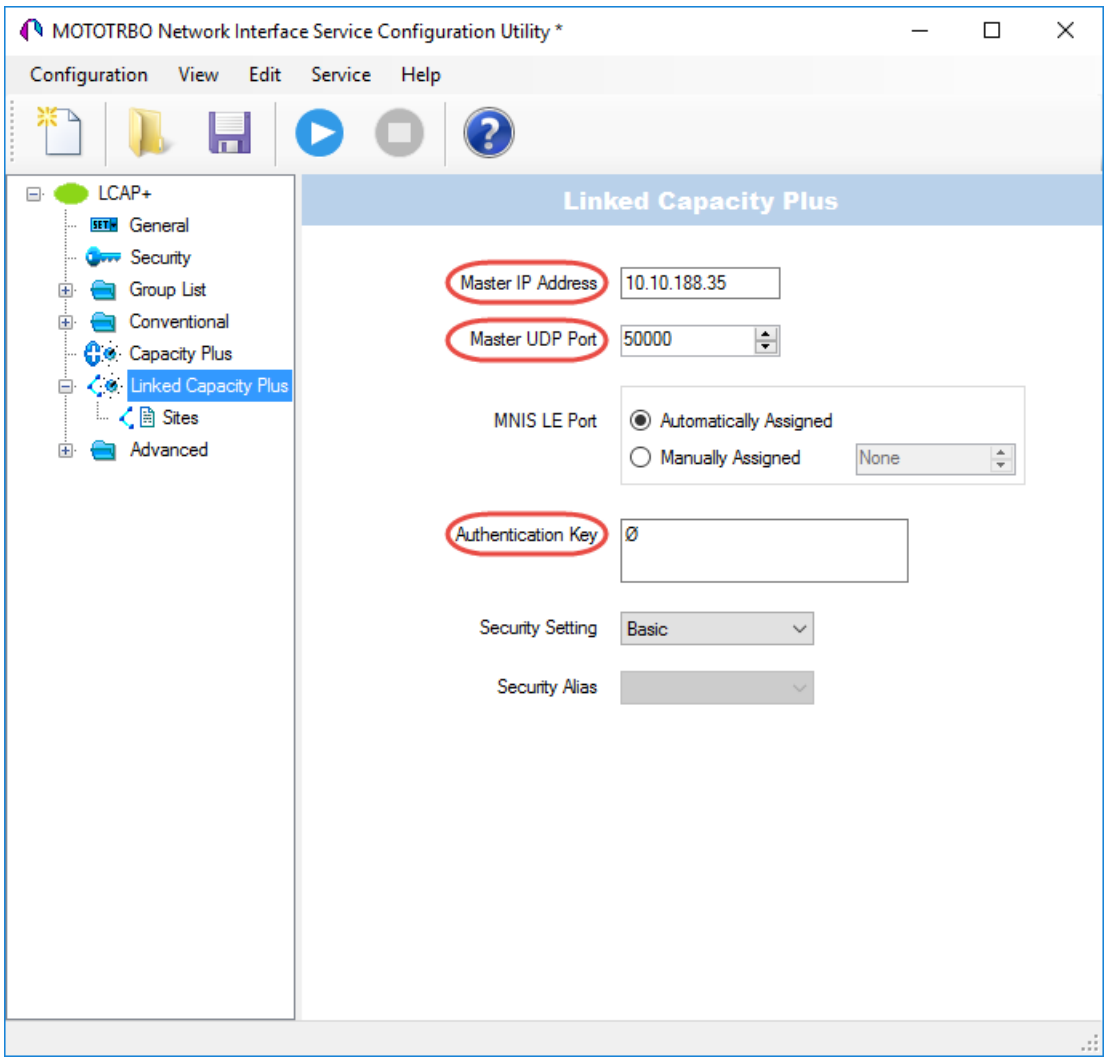


- In the left pane, right-click **Group List** and choose **Add**.
- In the left pane, under **Group List**, select the list you just added (for example, named **List1**).



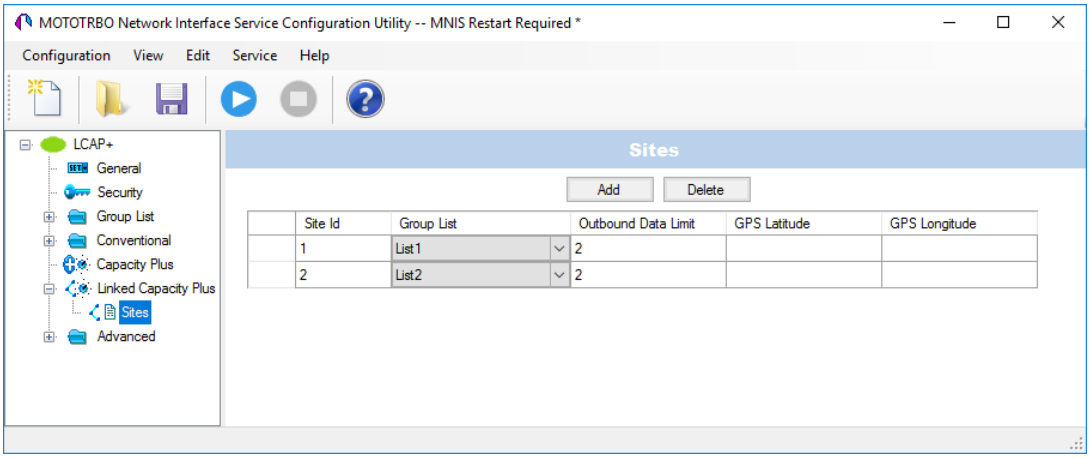
  - **Group List Type**
    From the drop-down list, select **Capacity Plus/LCP**.
  - **All Groups**
    If you select this option, then the list will contain all radio groups.
  - Click the **Add** button to add a new row to the Group List table.
  - **First Call ID** and **Last Call ID**
    If the values in these boxes are the same, then the row will represent a single radio group. If the value of **Last Call ID** is greater than the value of **First Call ID**, then the row will represent a corresponding range of the radio groups.

- In the left pane, select **Linked Capacity Plus**.



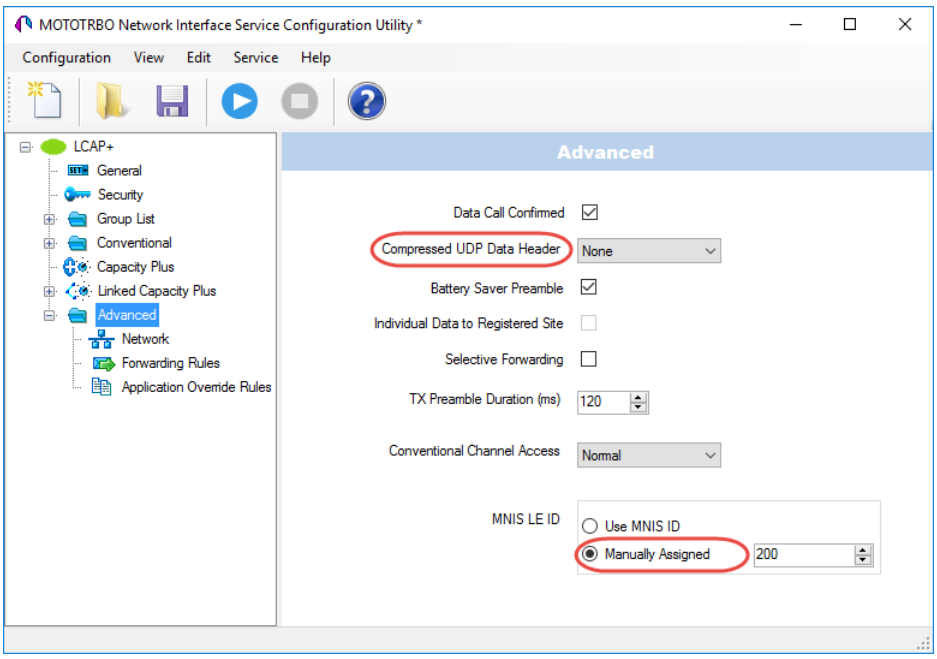
- **Master IP Address**
  Enter the Ethernet IP address of the master repeater.
- **Master UDP Port**
  Enter the UDP port number of the master repeater.
- **Authentication Key**
  Enter the master repeater's authentication key (if any).

- In the left pane, under **Linked Capacity Plus**, select **Sites**.



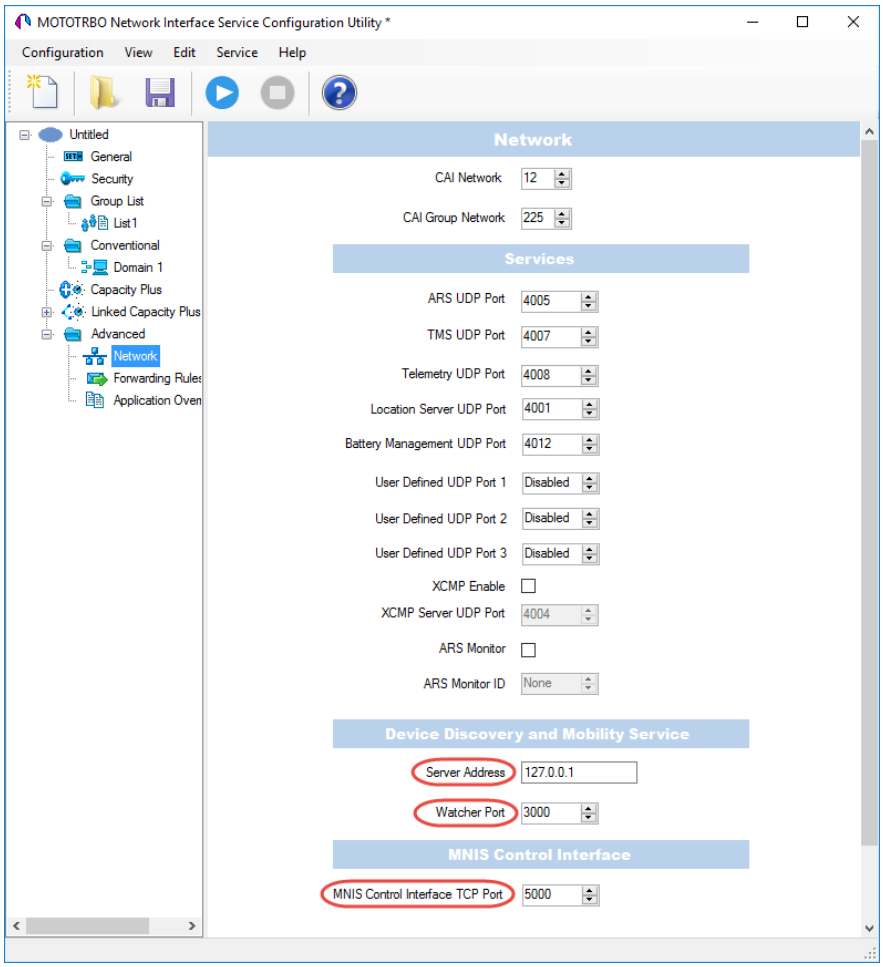
  - Click the **Add** button to add a new site to the list.
  - **Site Id**
    Enter the ID of the site.
  - **Group List**
    From the drop-down list, select a group list for the site.
  - **Outbound Data Limit**
    Enter a limit for the number of available trunked channel that may be simultaneously used by the Network Interface Service to source data calls. The MNIS will schedule messages up to this channel limit for each site at a given time. After the limit is reached it will not schedule another message until the previous messages are processed by the repeater.

- In the left pane, select **Advanced**.



- **Compressed UDP Data Header**
  From the drop-down list, select the type of compression protocol used for the UDP Data Header (None, MSI, DMR). It is recommended selecting **MSI**. Note that the same type must be set on all subscriber radio channels (*CPS>Channels>Compressed UDP Data Header*).
- **MNIS LE ID > Manually Assigned**
  Enter a unique Peer ID among the repeaters in a radio system.

- In the left pane, select **Network**

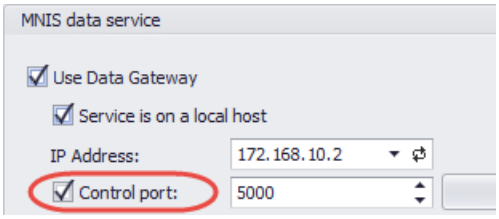


Device Discovery and Mobile Service

- **Server Address**
  This is the IP address of the MOTOTRBO Device Discovery and Mobility Service (DDMS). The recommended value is **`127.0.0.1`** if both DDMS and MNIS reside on the same PC.
- **Watcher Port**
  This is the port number on the MOTOTRBO Device Discovery and Mobility Service (DDMS) server to which the Watcher requests should be sent.

MNIS Control Interface

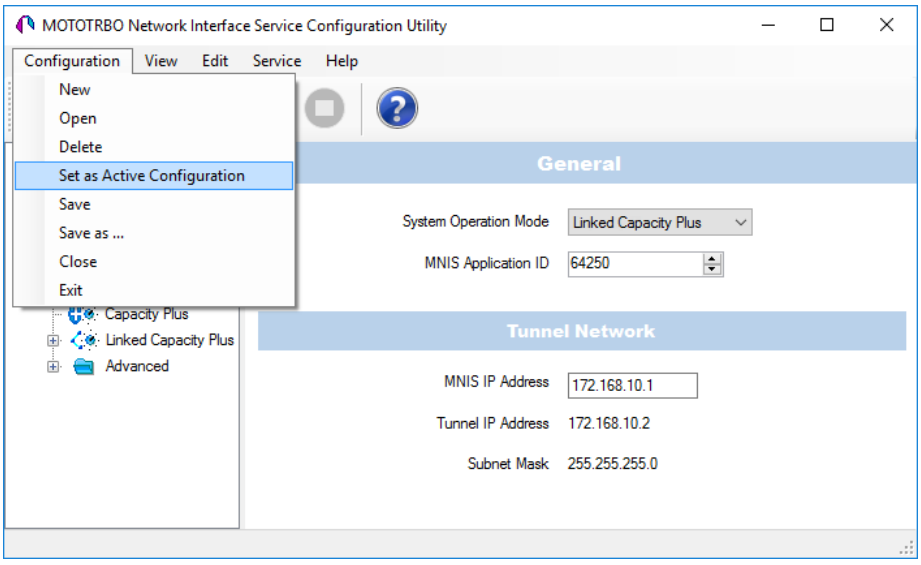
- **MNIS Control Interface TCP Port**
  This is the Transmission Control Protocol (TCP) port for the MNIS Control Interface server. This value is used when connecting TRBOnet Server to MNIS Service (see 5.1.1.4, MNIS Data Service, **Control port**).



Once you have finished configuring the desired MNIS parameters, do the following:

- Click the **Save** button on the toolbar.

- On the **Configuration** menu, click **Set as Active Configuration**.



- Click the **Start** button on the toolbar.

5 Configuring TRBOnet Enterprise

This section describes how to configure TRBOnet Enterprise software. By properly configuring TRBOnet Server and TRBOnet Dispatch Console, you will be able to utilize the full capabilities of your Linked Capacity Plus system.

5.1 Configuring TRBOnet Server

To start TRBOnet Server, click the corresponding shortcut on the desktop, or click **Start > All Programs > Neocom Software > TRBOnet Server x.x**

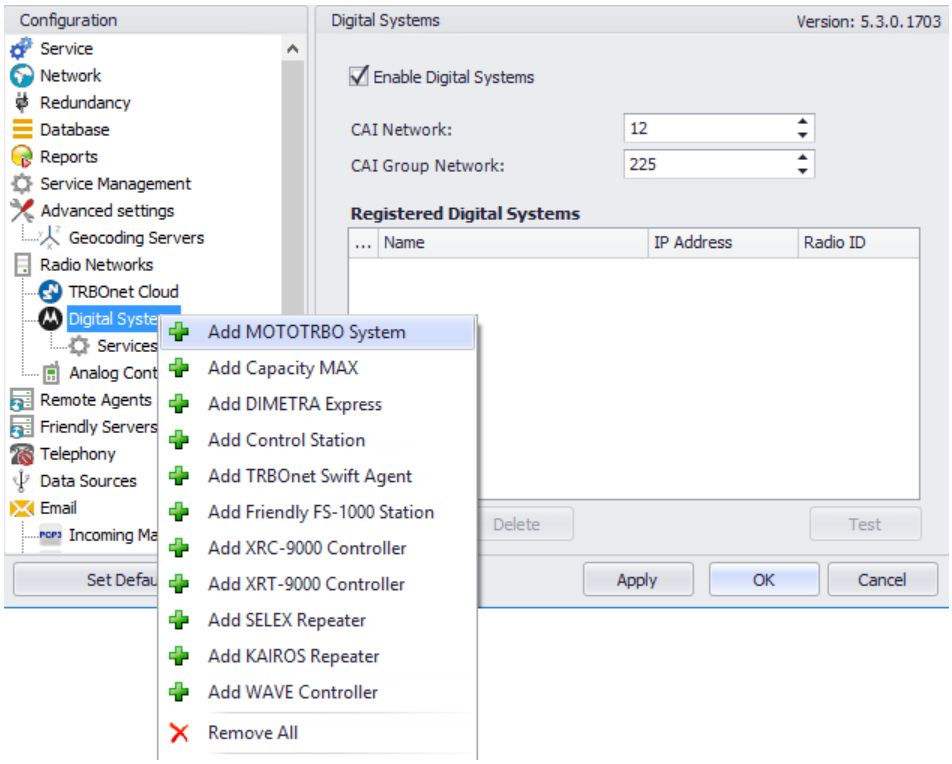
For how to configure TRBOnet Server's Database, Service, Network parameters, etc., refer to *TRBOnet Enterprise Quick Start Guide*.

5.1.1 Adding a Master Repeater

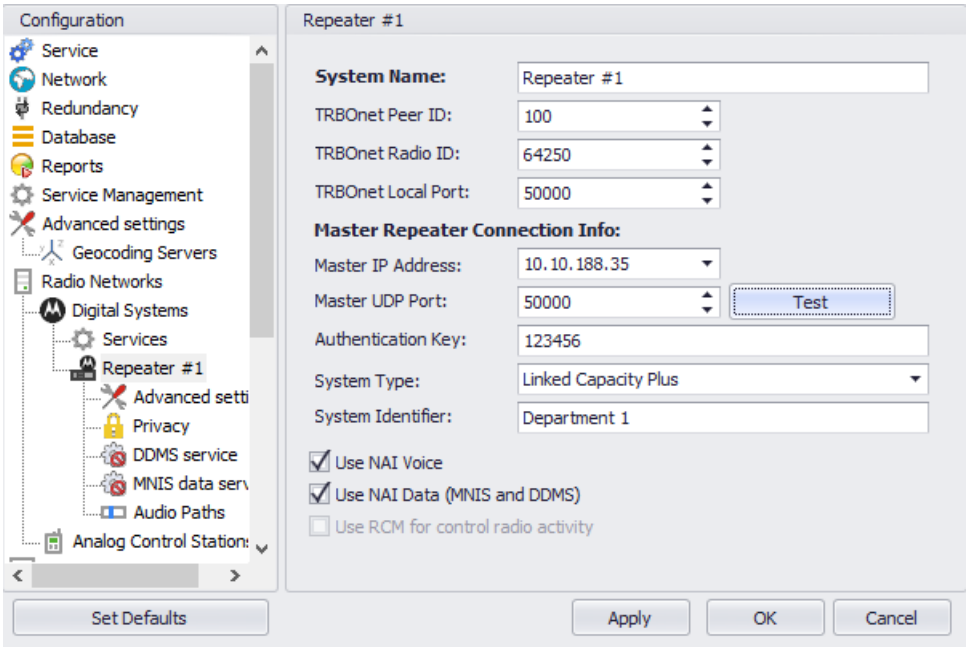
This section describes how to configure TRBOnet Server for communication with the master repeater of a Linked Capacity Plus system.

Note: Only the Master repeater needs to be added to TRBOnet Server.

- In the **Digital Systems** pane, click **Add**.
  Or, in the **Configuration** pane, right-click **Digital Systems**.
- In the drop-down menu, click **Add MOTOTRBO System**.



In the **Repeater** pane, specify the connection parameters. To ensure your connection parameters match the actual configuration of your radio network, you may need to use Motorola CPS to determine the values. Contact your radio network administrator, if you do not have this information.



- **System Name**
  Enter a name for the repeater. This name will be displayed in the Dispatch Console.
- **TRBOnet Peer ID**
  Enter a Peer ID for TRBOnet Server. The Peer ID must be unique among the repeaters in the radio system. Consult your radio network administrator to enter the correct value.
- **TRBOnet Radio ID**
  Enter the Radio ID of the gateway for voice and data in the radio system. This Radio ID is used as **ARS Radio ID** and **TMS Radio ID** in the Network settings of subscriber radios (see sections 4.3, Configuring a Subscriber Radio, 4.3.2, Network). The default value is **64250**.
- **TRBOnet Local Port**
  Enter the local port number that will be used by TRBOnet Server to establish a connection to the repeater. Use unique port numbers for each repeater connection if there are several repeaters connected.
- **Master IP Address**
  Enter the WAN IP address of the main site router behind which the master repeater resides.

  Note: This value is programmed for a repeater via MOTOTRBO CPS, in *Link Establishment>Master IP*. See section 4.1.3.
- **Master UDP Port**
  Enter the UDP port number of the master repeater.

  Note: This value is programmed for a repeater via MOTOTRBO CPS, in *Link Establishment>Master UDP Port*. See section 4.1.3.

- **Authentication Key**
  Enter the repeater's authentication key (if any).

  Note: This value is programmed for a repeater via MOTOTRBO CPS, in *Link Establishment>Authentication Key*. See section 4.1.3.

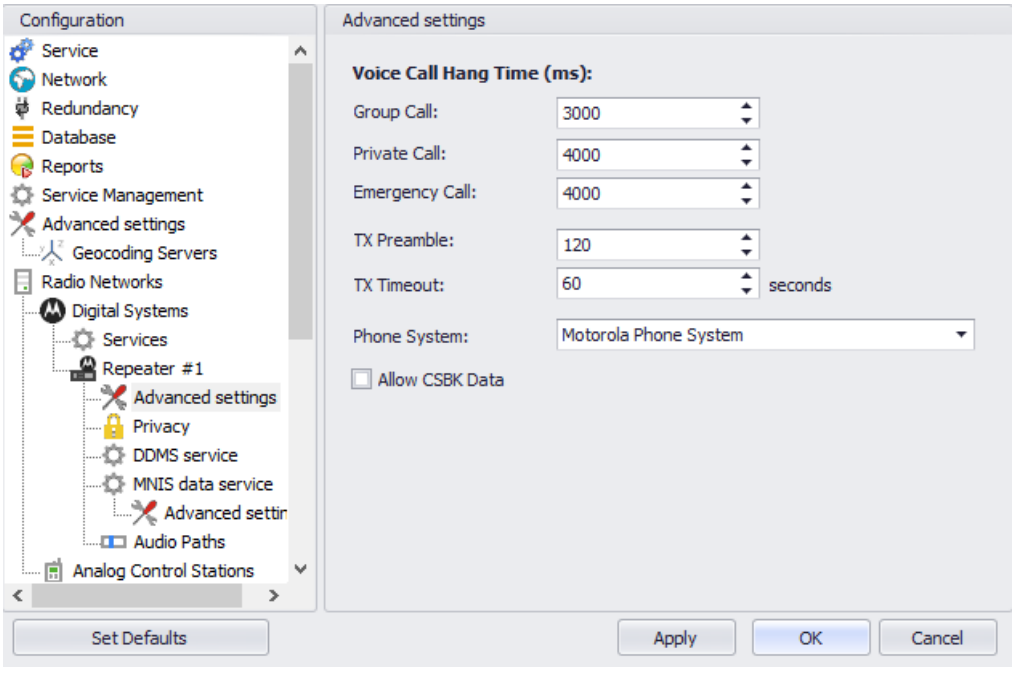
- **System Type**
  From the drop-down list, select **Linked Capacity Plus**.
- **Test**
  Click this button to check the connection to your master repeater. If the test is successful, you'll see the information on the repeater you are connected to, such as the serial number, firmware version, and other relevant information.
- **System Identifier**
  Enter the system identifier. Note that the system identifier should be the same for all control stations and repeaters used in the same radio system.
- **Use NAI Voice**, **Use NAI Data (MNIS and DDMS)**
  Select these options if the Network Application Interface Voice and Network Application Interface Data features are enabled on the repeaters.

Click **Apply** after entering all the required values. A confirmation dialog will appear, prompting you to save the configuration and restart the TRBOnet Server service. You can also restart the service manually.

5.1.1.1 Advanced Settings

- In the **Configuration** pane, under the corresponding **Repeater**, select **Advanced settings**.

Note: These settings are applicable only when **Use NAI Voice** and **Use NAI Data (MNIS and DDMS)** are deselected in the Repeater pane.



- In the **Advanced Settings** pane, specify the following repeater-related advanced settings:

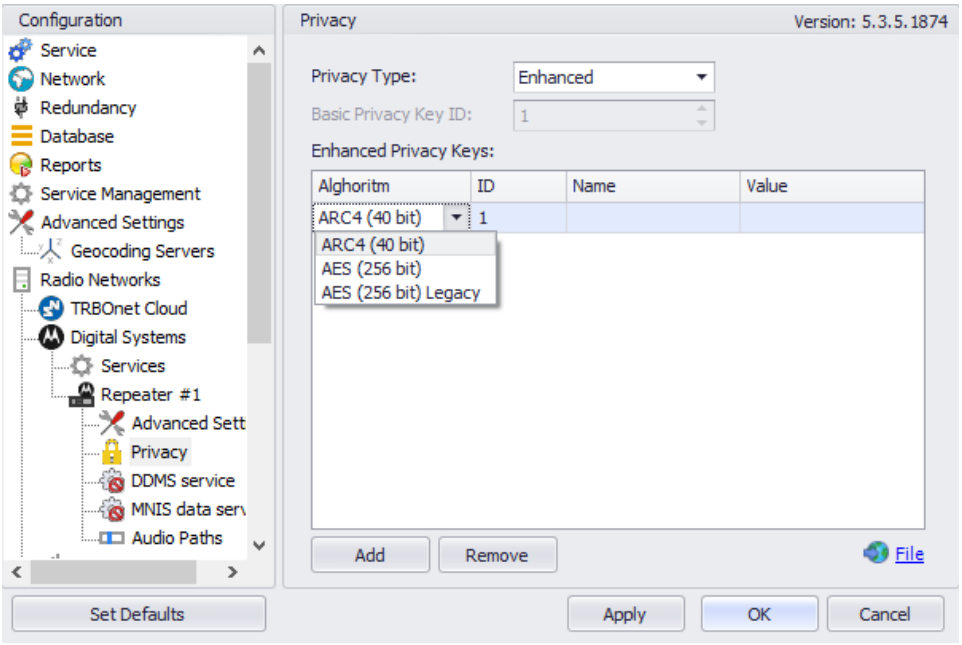
  Voice Call Hang Time (ms):

  - **Group Call**
    This value sets the duration the repeater reserves the channel after the end of a group call transmission. During this time, only members of the group that the channel is reserved for can transmit.
  - **Private Call**
    This value sets the duration a radio keeps the private call setup after a user releases the PTT button. This is to avoid setting up the call again each time a user presses the PTT button to transmit. During this time, other radios can still transmit since the channel is essentially idle. After the hang timer expires, the radio transmits using the *TX Contact Name* parameter specified for this channel in MOTOTRBO CPS.
  - **Emergency Call**
    This value sets the duration the repeater reserves the channel after the end of an emergency call transmission. During this time, only members of the Group that the channel is reserved for can transmit.

    Note: The values of the above three parameters must be taken from the corresponding parameter values programmed for the repeater via MOTOTRBO CPS in *General Settings*.
  - **TX Preamble**
    Enter the value of the TX Preamble. The TX Preamble is a string of bits added in front of a data or control message (Text Messaging, Location Messaging, Registration, Radio Check, Private Call, and other message types) before transmission. The acceptable range is 0 - 8640 ms. The recommended value is 120 ms.
  - **TX Timeout**
    Enter the time, in seconds, to be used as a voice session limit. When the dispatcher starts any voice session in the Dispatch Console, transmission will be interrupted after this TX Timeout expires.
  - **Phone system**
    From the drop-down list, select the system for phone calls:
    - **Motorola Phone System**
      This system uses a special call type with the parameters specified for a radio unit in MOTOTRBO CPS. The Motorola Phone System is recommended for IP Site Connect mode to minimize Radio response time.
    - **TRBOnet Phone System (TX Interrupt**)
      This is a phone call system based on the private call type using TX Interrupt feature. This phone system is available for radio systems with control stations.

5.1.1.2 Privacy

- In the **Configuration** pane, under the corresponding **Repeater**, select **Privacy**.

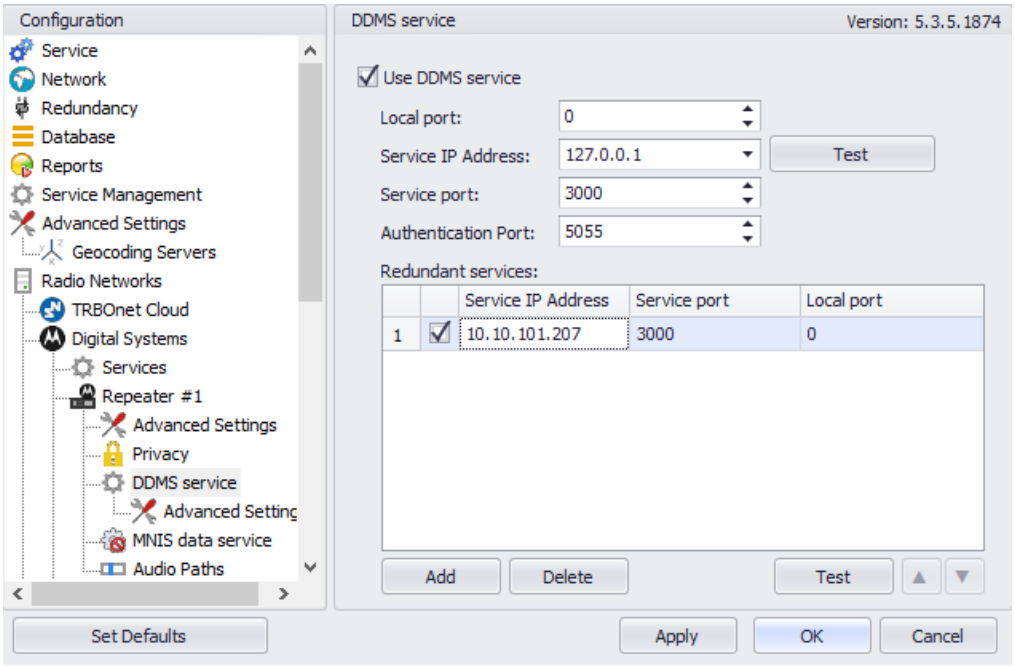


- In the **Privacy** pane, specify the following privacy-related settings:
  - **Privacy Type**
    From the drop-down list, select one of the privacy types: **None**, **Basic**, or **Enhanced**.
  - **Basic Privacy Key ID**
    Enter the Privacy Key ID available for the **Basic** privacy type.
  - **Enhanced Privacy Keys**
    Here you add enhanced privacy keys when the **Enhanced** privacy type is selected.
    - Click **Add** and specify the required **Algorithm**, **ID**, **Name**, and **Value** for the privacy key being added.
      ✓ **Algorithm**
      From the drop-down list, select one of the enhanced algorithms if you are going to use additional encryption.

5.1.1.3 DDMS Service

The DDMS, or Device Discovery and Mobility Service is a service for tracking the presence of radio subscribers in the radio network and transmitting the data to the server.

- In the **Configuration** pane, under the corresponding **Repeater**, select **DDMS service**.



- In the **DDMS service** pane, specify the following DDMS service-related settings:
  - **Use DDMS service**
    Select this option to enable the DDMS service for the server.
  - **Local Port**
    Enter the number of the local port to be used on a PC with TRBOnet Dispatch Software for DDMS service.
  - **Service IP Address**
    Enter the IP Address of the PC with the DDMS service installed and running.
  - **Service port**
    Enter the service port number.

    Note: This value is programmed for a DDMS service via MOTOTRBO DDMS Administrative Client, in *Interfaces>Watcher Settings>PortWatcher*.
  - **Authentication Port**
    Enter the authentication server port number.

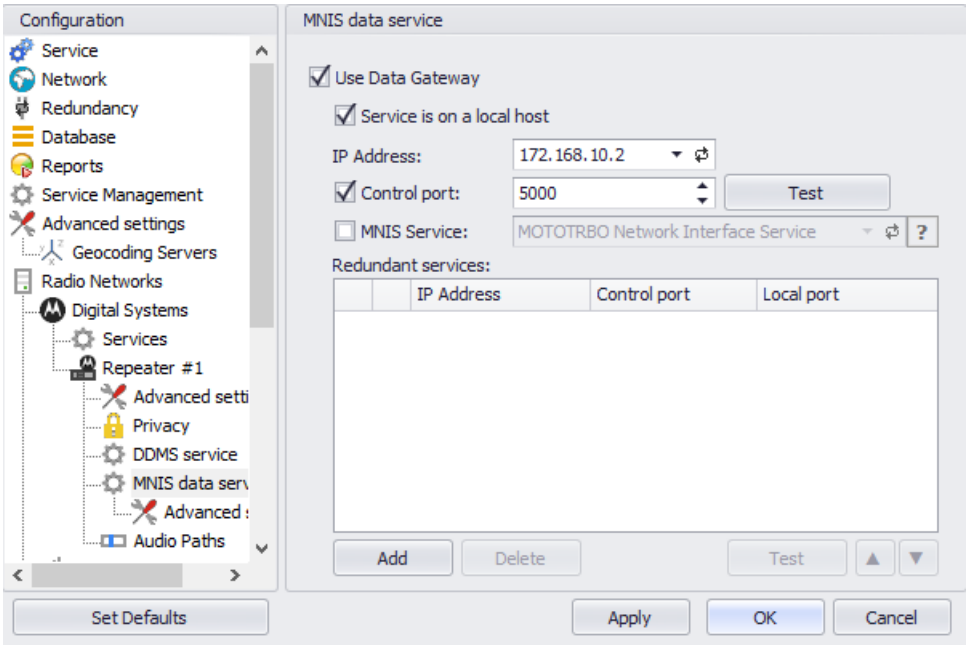
    Note: This value is programmed for a DDMS service via MOTOTRBO DDMS Administrative Client, in *Interfaces>Authentication Server Settings>AuthenticationServerPort*.
  - **Redundant services**
    Here you see the list of redundant DDMS services for failover purposes.
    - Click **Add** and specify the required parameters for the DDMS service being added.
    - Click **Test** to test if the selected DDMS service is available.

- Use the **Up** (▲) and **Down** (▼) buttons to move a selected DDMS service up and down in the priority list of DDMS services.

5.1.1.4 MNIS Data Service

The MNIS, or Motorola Network Interface Service, is a Windows application which acts as a data gateway between the data applications and the radio system. Data messages are routed through the MNIS.

- In the **Configuration** pane, under the corresponding **Repeater**, select **MNIS data service**.



- In the **MNIS data service** pane, specify the following MNIS data service-related settings:
  - **Use Data Gateway**
    Select this option to enable the MNIS data service for the server.
  - **Service is on a local host**
    Select this option if the MNIS data service will be used on the local PC.
  - **IP Address**
    Enter the IP Address used by the MNIS to communicate with the PC.

    Note: This value is programmed for a MNIS data service via MOTOTRBO MNIS Configuration Utility, and can be retrieved from *General>Tunnel Network>Tunnel IP Address*.
  - **Control port**
    Enter the number for the MNIS control port.

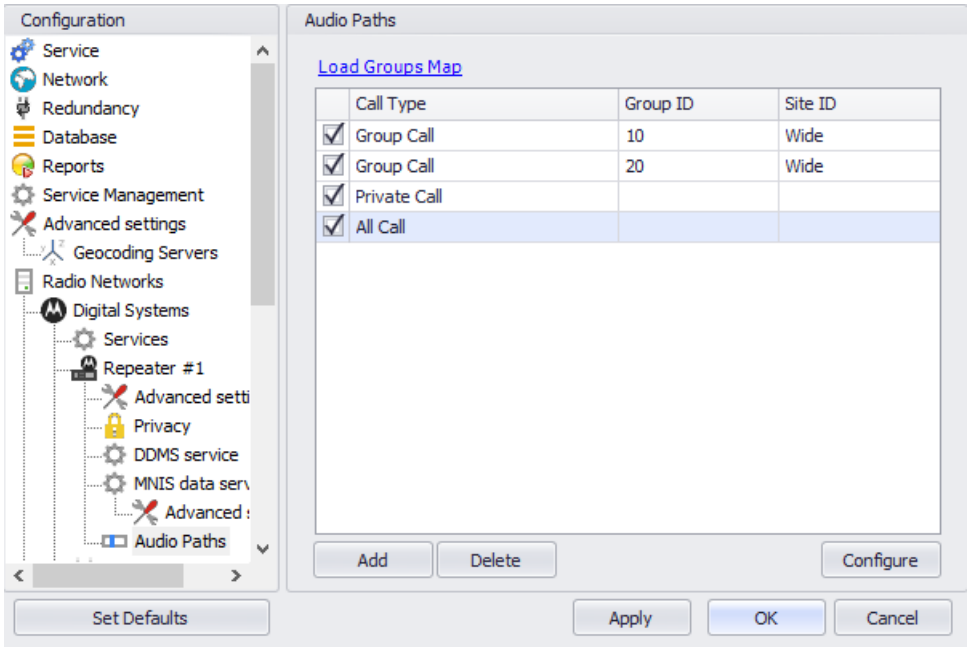
    Note: This value is programmed for a MNIS data service via MOTOTRBO MNIS Configuration Utility, in *Advanced>Network>MNIS Control Interface TCP Port*.

- **MNIS Service**
  Select this option, and from the drop-down list select the available MNIS service.
- **Redundant services**
  Here you see the list of redundant MNIS data services for failover purposes.
  - Click **Add** and specify the required parameters for the MNIS data service being added.
  - Click **Test** to test if the selected MNIS data service is available.
  - Use the **Up** (▲) and **Down** (▼) buttons to move a selected MNIS data service up and down in the priority list of MNIS data services.

5.1.1.5 Audio Paths

The Audio Paths are talk paths of the system to make and receive Voice Calls; in general, they are talk groups. TRBOnet Server requires that all audio paths of a Linked Capacity Plus system be registered in its configuration. If an audio path is not registered, the TRBOnet operator will not be able to receive and transmit to the corresponding talk group.

- In the **Configuration** pane, under the corresponding **Repeater**, select **Audio Paths**.



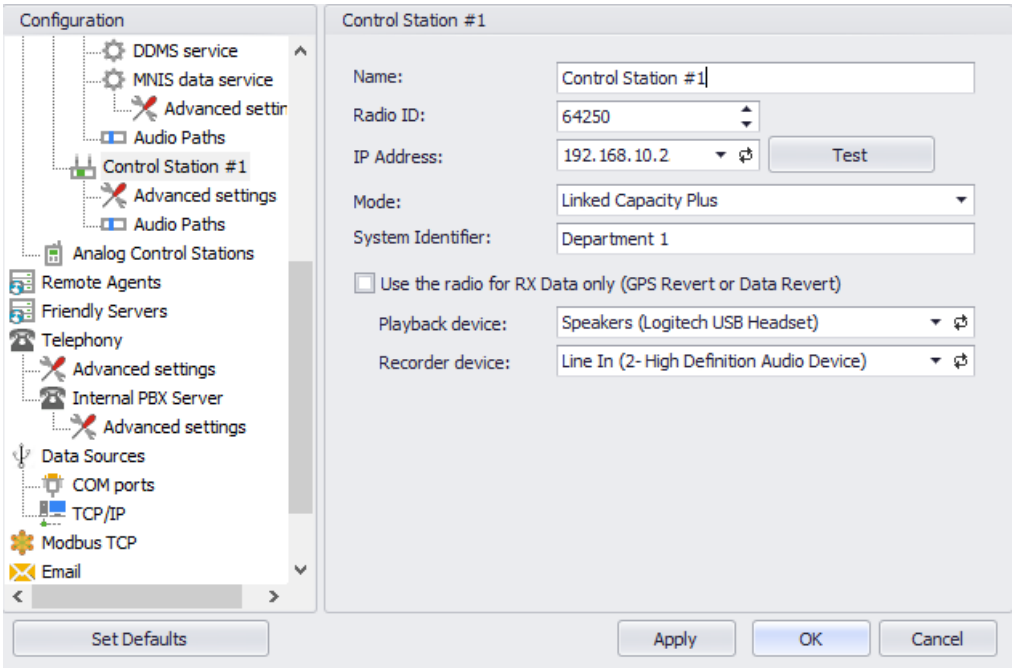
- In the **Audio Paths** pane, specify the following Audio Path-related settings:
  - To add an audio path to the system, click **Add**.
  - Make sure the check box in the first column is selected to make and receive voice calls from the selected subscriber.
  - From the drop-down list, select the **Call Type** for the audio path. The available call types are All Call, Group Call, and Private Call.

- Enter the **Group ID**, which is an ID of the talk group the dispatcher can make calls to. The Group ID is not applicable for Private Calls and All Calls.
- Enter the **Site ID** of the site the audio path will belong to in a Linked Capacity Plus system. Or, leave zero value in this column. In this case, the Site ID will be displayed as Wide, meaning that the audio path will belong to all sites in the system.
- To configure the selected audio path, click **Configure**.
- Specify the desired audio path settings similar to those for a common repeater slot.

5.1.2 Adding a Control Station

This section describes how to configure TRBOnet Server for communication with a control station in a Linked Capacity Plus system.

- In the **Digital Systems** pane, click **Add**.
  Or, in the **Configuration** pane, right-click **Digital Systems**.
- In the drop-down menu, click **Add Control Station**.



- In the **Control Station** pane, specify the following control station-related parameters:
  - **Name**
    Enter a name for the control station. This name will be displayed in the Dispatch Console.
  - **Radio ID**
    This is the Radio ID of the radio unit connected as a control station.

Note: This box is populated automatically once you have successfully tested the control station by clicking the **Test** button.

- **IP Address**
  Enter, or select from the list, the IP Address of the control station network interface.

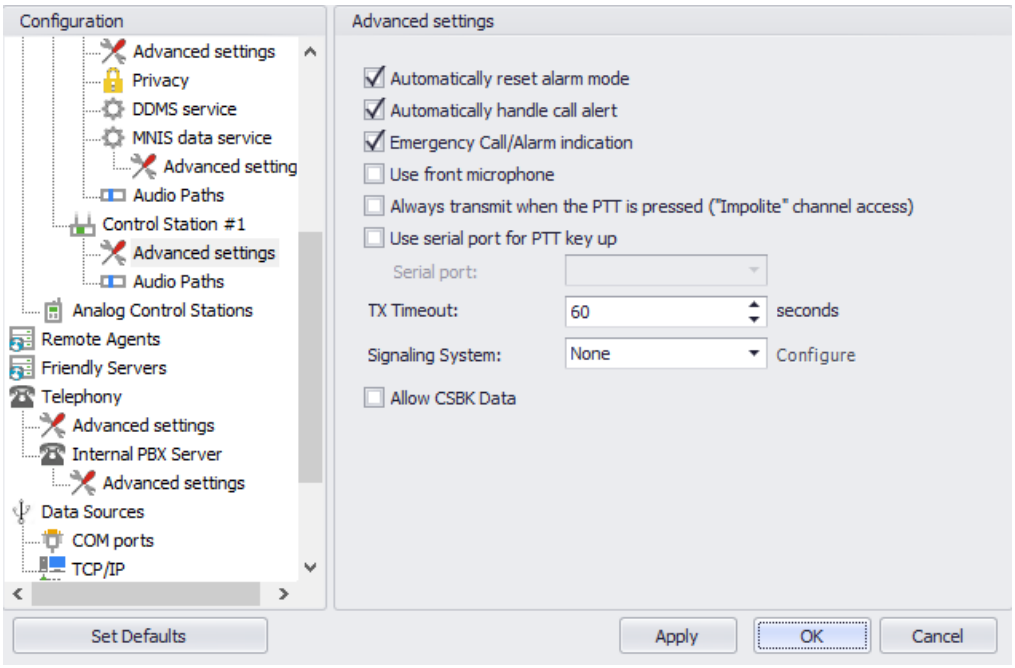
  Note: This value can be taken from the radio's configuration in MOTOTRBO CPS, in *Network>Accessory IP*.

- **Test**
  Click this button to check the connection to the control station. If the test is successful, you'll see the information on the control station you are connected to, such as radio ID, serial number, firmware version, and other relevant information.
- **Mode**
  From the drop-down list, select **Linked Capacity Plus**.
- **System Identifier**
  Enter the system identifier. Note that the system identifier should be the same for all control stations and repeaters used in the same radio system.
- **Use the radio for RX data only (GPS Revert or Data Revert)**
  Select this option to configure the radio channel so that it will only receive data, thus having no transmission capability.
- **Playback device**
  From the drop-down list, select the playback device on the PC that will be used to transfer audio data to the connected control station.
- **Recorder device**
  From the drop-down list, select the recording device on the PC that will be used to receive audio data from the control station connected via a line-in jack.

- Click **Apply** after entering all the required values. A confirmation dialog will appear, prompting you to save the configuration and restart the TRBOnet Server service. You can also restart the service manually.

5.1.2.1 Advanced Settings

- In the **Configuration** pane, under the corresponding **Control Station**, select **Advanced Settings**.



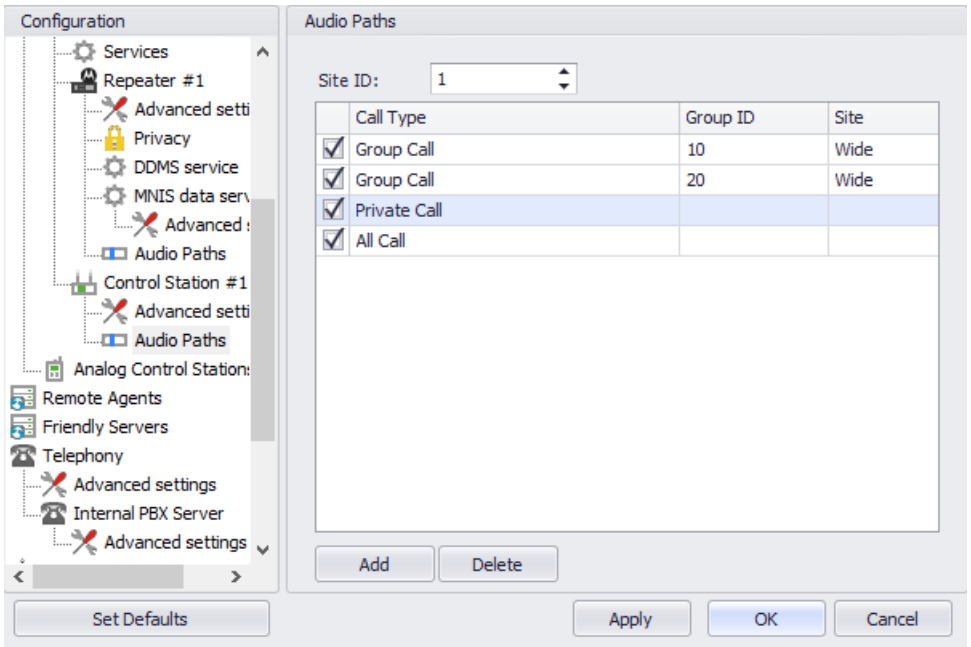
- In the **Advanced Settings** pane, specify the following control station-related advanced settings:
  - **Automatically reset alarm mode**
    Select this option to reset alarm mode on the control station radio automatically. It is recommended to enable this option.
  - **Automatically handle call alert**
    Select this option to automatically redirect call alerts from the control station radio to the Dispatch Console.
  - **Emergency Call/Alarm indication**
    Select this option so that audio and visual indication is given by the control station radio when an emergency Call/Emergency Alarm is received.
  - **Use front microphone (for PTT key up)**
    Select this option to use a remote control of the PTT button via a remote speaker microphone on the radio.
  - **Always transmit when the PTT is pressed ("Impolite" channel access)**
    Select this option so that when the PTT button is pressed, the radio will start transmitting regardless of whether the channel is free or not (that is any transmission in progress will be interrupted).
  - **Use serial port for PTT key up**
    Select this option to use a remote control of the PTT button via the serial port of the PC, and select the serial port from the drop-down list.

- **TX Timeout**
  Enter the time, in seconds, to be used as a voice session limit. When a dispatcher starts any voice session in the Dispatch Console, the ongoing transmission will be interrupted after this TX Timeout expires.
- **Signaling system**
  From the drop-down list, select the signaling system.
  - **MDC 1200** signaling is a Motorola data system using audio frequency shift keying (ASFK) using a 1,200 baud data rate. A general option is to enable or disable an acknowledgement (ACK) data packet.
  - **SELECT 5** (5 Tone Signaling System). In the 5 Tone Signaling Systems, each radio has a unique numeric identity (for example, 12345).
- **Allow CSBK Data**
  Select this option so that the GPS data are compressed into a single CSBK data.

5.1.2.2 Audio Paths

The Audio Paths are talk paths of the system to make and receive Voice Calls; in general, they are talk groups. TRBOnet Server requires that all audio paths of a radio system be registered in its configuration. If an audio path is not registered, the TRBOnet operator will not be able to receive and transmit to the corresponding talk group.

- In the **Configuration** pane, under the corresponding **Control Station**, select **Audio Paths**.



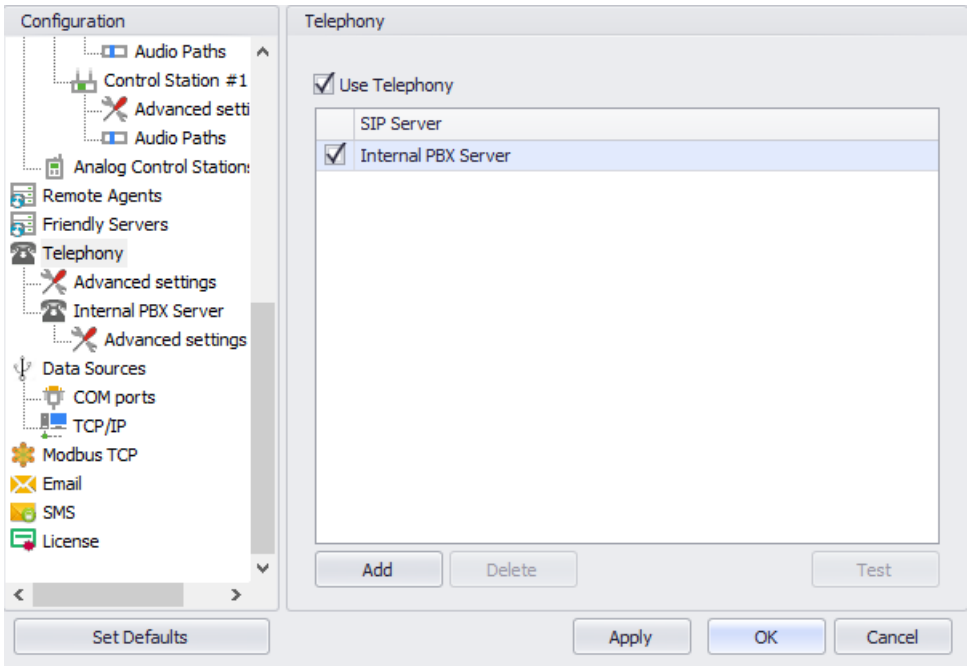
- In the **Audio Paths** pane, specify the following Audio Path-related settings:
  - To add an audio path to the system, click **Add**.
  - Make sure the check box in the first column is selected to make and receive voice calls from the selected subscriber.

- From the drop-down list, select the **Call Type** for the audio path. The available call types are All Call, Group Call, and Private Call.
- Enter the **Group ID**, which is an ID of the talk group the dispatcher can make calls to. The Group ID is not applicable for Private Calls and All Calls.
- In the **Site** column, select either Local or Wide. The value Wide means that the audio path will be to all sites in the system and not just to the local site.

5.1.3 Enabling Telephony

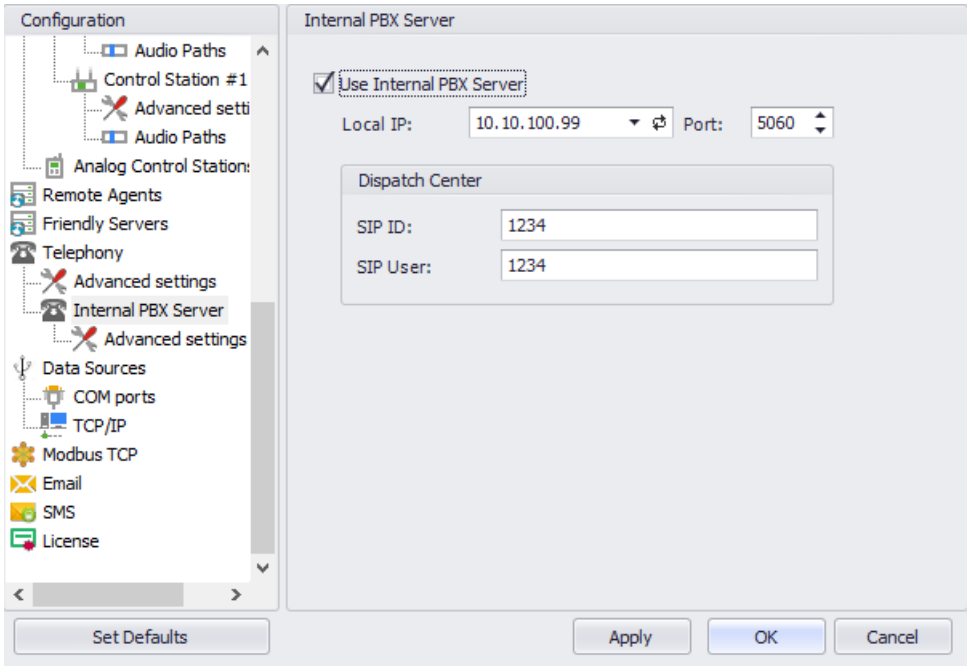
TRBOnet Server has its own built-in SIP server to support VoIP communications between the radios as well as other SIP-compliant clients.

- In the **Configuration** pane, select **Telephony**
- In the **Telephony** pane, select **Use Telephony**.



5.1.3.1 Internal PBX Server

- Make sure the **Internal PBX Server** option is selected in the **Telephony** pane.
- In the **Configuration** pane, select **Internal PBX Server**.



- In the **Internal PBX Server** pane, specify the following parameters:
  - **Local IP**
    Enter the IP address of the PC with TRBOnet Server.
  - **Port**
    Enter the local UDP port number for the SIP service (5060, by default).

  Dispatch Center

  - **SIP ID**
    Enter the SIP ID that will be used by the Dispatch Center.
  - **SIP user**
    Enter the SIP user name that will be used by the Dispatch Center.

5.2 Configuring TRBOnet Dispatch Console

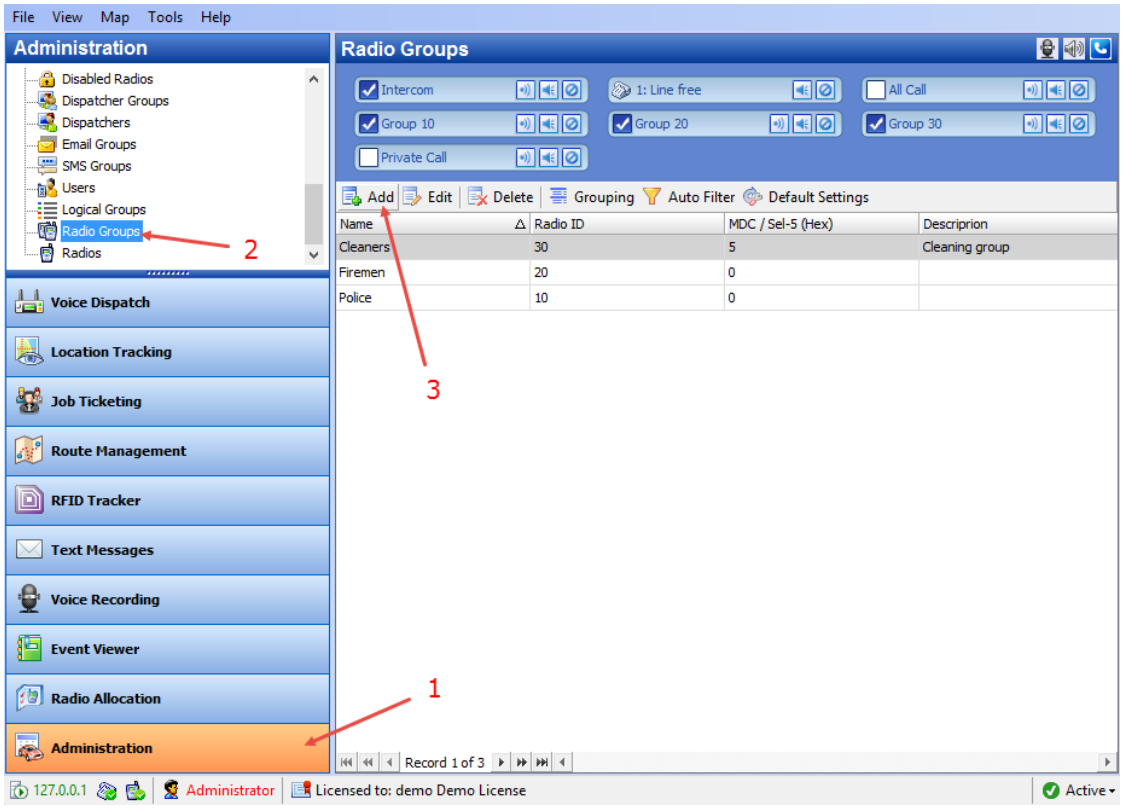
To start TRBOnet Server, click the corresponding shortcut on the desktop, or click **Start > All Programs > Neocom Software > TRBOnet Dispatch x.x**

The dialog box will appear prompting you to enter the TRBOnet Server IP address, User Name, and Password. The default Administrator credentials are ***admin*** for the login and ***admin*** for the password.

For a more detailed information on how to use TRBOnet Dispatch Console, refer to *TRBOnet Enterprise User Manual*.

5.2.1 Registering Radio Groups

Go to **Administration** (1), **Radio Group** (2) to add/edit/delete Radio Groups in the system.

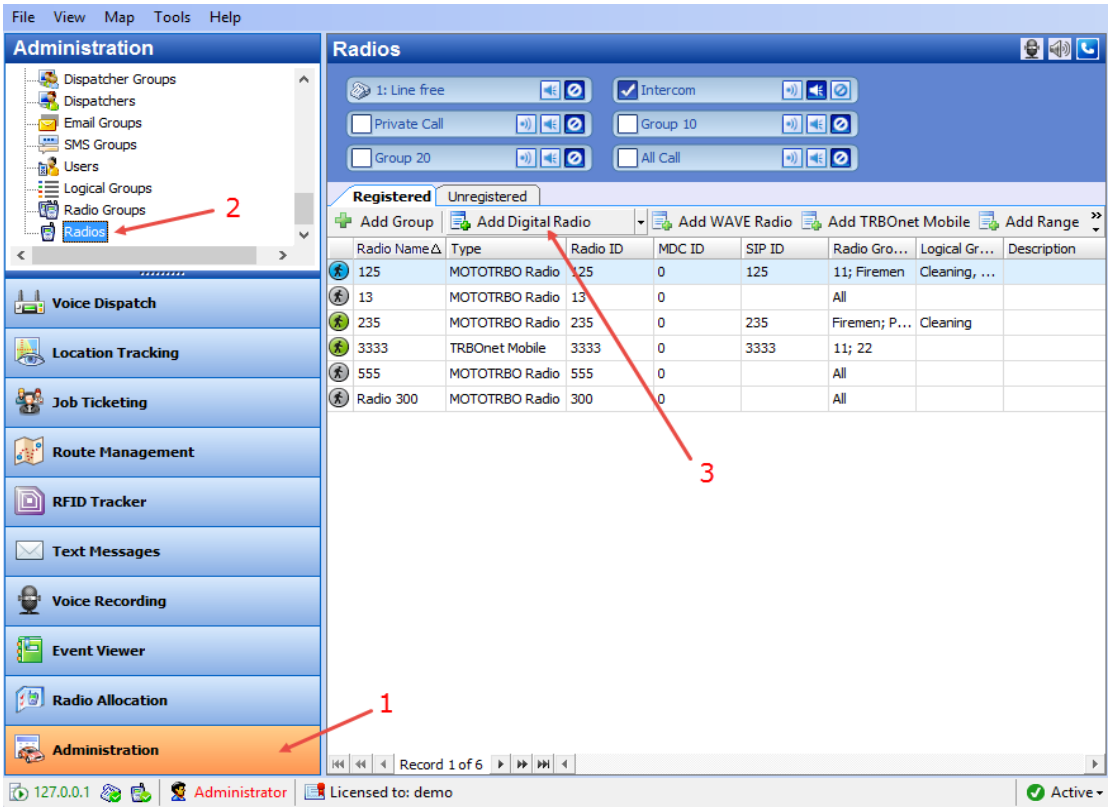


- Click **Add** (3) to add a radio group to the system:
- In the dialog box that appears, specify the **Name** and **Group ID** (Radio ID) of the group you are adding.

Note: Make sure that the radio group(s) created in the Dispatch Console are present in the radio's RX Group List (see section 4.3.4, RX Group Lists). In addition, make sure these radio groups have been added to TRBOnet Server as Audio Paths.

5.2.2 Registering Radios

Go to **Administration** (1), **Radios** (2) to add/edit/delete Radios in the system.

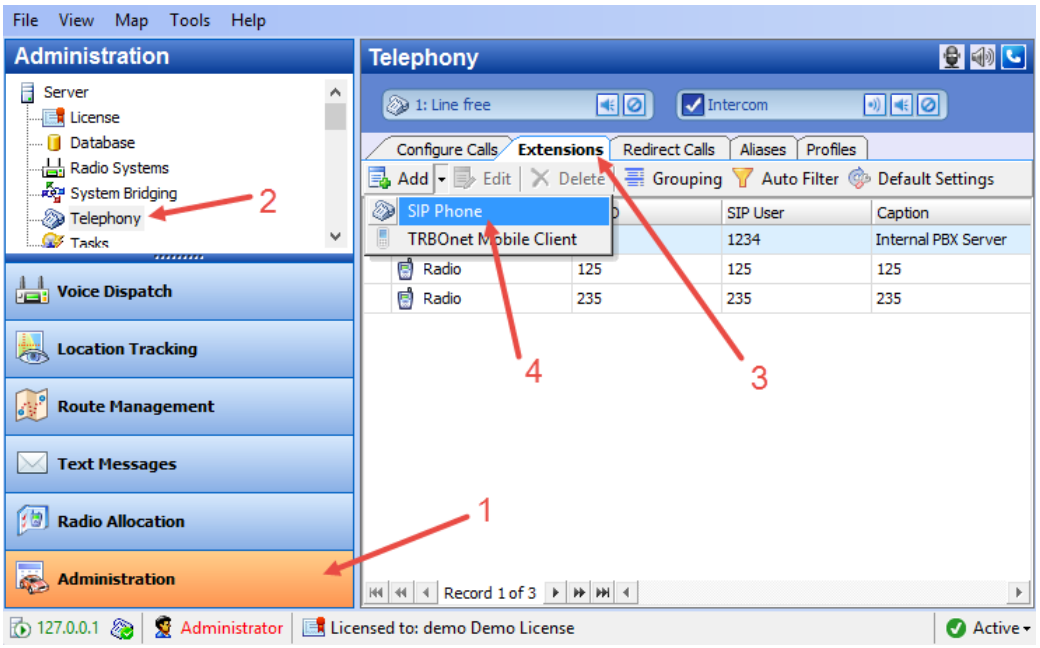


- Click **Add MOTOTRBO Radio** (3) to add a new radio.
- In the dialog box that appears, specify the **Callsign** and **Radio ID**, and **Radio Groups**, to which the radio belongs.

5.2.3 Registering SIP extensions

This section describes how to add SIP extensions to TRBOnet Dispatch Console.

- Go to **Administration** (1), **Telephony** (2).
- In the **Telephone** pane, click the **Extensions** tab (3), and then **Add > SIP Phone** (4).



- In the dialog box that appears, specify the **SIP ID** and **SIP User** of the SIP user you are adding.