System Release 7.17.2
ASTRO® 25
INTEGRATED VOICE AND DATA

MLC 8000
Setup Guide

NOVEMBER 2017

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- Before any software reload.
- To confirm troubleshooting results and analysis before removing and replacing a Field Replaceable Unit (FRU) and Field Replaceable Entity (FRE) to repair the system.

For...	Phone
United States Calls	**800-221-7144**
International Calls	**302-444-9800**

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For...	Phone
Phone Orders	**800-422-4210** (US and Canada Orders) For help identifying an item or part number, select choice 3 from the menu.
	302-444-9842 (International Orders) Includes help for identifying an item or part number and for translation as needed.
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Document History

Version	Description	Date
MN004394A01-A	Original release of the *MLC 8000 Setup Guide*.	November 2017

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About MLC 8000 Setup Guide

This guide provides considerations and sequences for implementing Motorola Solutions MLC 8000s to support voting and comparator functions for various site topologies that include analog channels.

The MLC 8000 is a hardware platform that enables circuit/IP site link combinations for voting and simulcast systems. The MLC 8000 can be configured as an analog comparator or an analog IP gateway.

- The MLC 8000 Analog Comparator provides the 4-wire Tone Remote Control (TRC) connection to the legacy console or MCC 7500 VPM console through the Site Gateway (Conventional Channel Interface). The MLC 8000 Comparator supplies two main functions, voting and simulcast.
- The MLC 8000 Subsite Link Converter provides connectivity for up to four base radios, supporting any combination of GTR 8000, QUANTAR® stations (4-wire/V.24) or traditional TRC base station and receiver equipment. However, in analog IP simulcast, one MLC 8000 Link Converter connects to one base radio only. In analog simulcast systems and non-simulcast voting systems, the MLC 8000 Link Converter connects to the MLC 8000 Analog Comparator.

A previously available Motorola Solutions circuit-based solution employed a GPS-synchronized channel bank and audio distribution equipment to deliver optimal audio quality in the ‘overlap’ zones within a simulcast coverage area. The Motorola Solutions Spectra-TAC and DIGITAC comparator products provided the audio voting, and the Motorola Solutions -designed DSM channel bank card provided the precise transmit audio synchronization.

The MLC 8000’s IP analog simulcast configuration simplifies the audio distribution, while continuing to provide the synchronization technology formerly provided by the Motorola Solutions circuit-based solution.

See Related Information on page 26 for manuals that provide additional details about the systems, sites, equipment, and software indicated in these Quick Guide sequences.

What Is Covered In This Manual

This manual provides information on how to set up the MLC 8000 hardware as an analog voter/comparator or as a link converter for base radios, in a system with analog or mixed mode channels.

- Common Information for MLC 8000 Implementations on page 29 provides information that is common to all MLC 8000 implementations.
- ASTRO 25 Analog-Only Non-Simulcast Voting Subsystem on page 63 provides implementation sequences, system diagram, equipment cabling tables, and troubleshooting information for this subsystem type.
- ASTRO 25 Analog-Only IP-Based Simulcast Subsystem on page 75 provides implementation sequences, system diagram, equipment cabling tables, and troubleshooting information for this subsystem type.
- ASTRO 25 Mixed-Mode Non-Simulcast Voting Subsystem on page 89 provides implementation sequences, system diagram, equipment cabling tables, and troubleshooting information for this subsystem type.
- ASTRO 25 Conventional Mixed-Mode Simulcast Voting Subsystem on page 103provides implementation sequences, system diagram, equipment cabling tables, and troubleshooting information for this subsystem type.
- ASTRO 25 Digital-Only Simulcast Voting Subsystem on page 119 provides implementation sequences, system diagram, equipment cabling tables, and troubleshooting information for this subsystem type.

- ASTRO 25 Circuit-Based Analog-Only Simulcast Voting Subsystem on page 129 provides implementation sequences, system diagram, equipment cabling tables, and troubleshooting information for this subsystem type.
- Circuit-Based Analog-Only Simulcast Voting Subsystem on page 139 provides implementation sequences, system diagram, equipment cabling tables, and troubleshooting information for this subsystem type.
- Analog-Only IP-Based Simulcast Voting Subsystem on page 149 provides implementation sequences, system diagram, equipment cabling tables, and troubleshooting information for this subsystem type.
- MLC 8000 Radio Ports Cabling on page 161 provides figures and tables defining the cables used in the various MLC 8000 implementations.
- Optimization/Calibration for Conventional Simulcast on page 195 provides optimization/calibration procedures for conventional analog circuit-based and IP-based simulcast subsystems.
- Troubleshooting the Optimization/Calibration on page 223 provides troubleshooting information for MLC 8000 implementations.

Helpful Background Information

Motorola Solutions offers various courses designed to assist in learning about the system. For information, go to http://www.motorolasolutions.com/training to view the current course offerings and technology paths.

Related Information

The following table lists the documents that are referenced in this Quick Guide:

Related Information	Purpose
Standards and Guidelines for Communication Sites	Provides standards and guidelines that should be followed when setting up a Motorola Solutions communications site. Also known as R56 manual. This document may be purchased by calling the North America Parts Organization at 800-422-4210 (or the international number: 302-444-9842).
System Overview and Documentation Feature Guide	Provides and overview of the ASTRO® 25 new system features, documentation set, technical illustrations, and system-level disaster recovery that support the ASTRO® 25 radio communication system.
MLC 8000 Configuration Tool User Guide	Provides information about an application used for configuration, analog voting display, and analog voting control of the MLC 8000 device, functioning as an analog conventional comparator for analog IP-based simulcast and non-simulcast voting, and as a subsite link converter for conventional analog, digital, and mixed mode channels.
MLC 8000 Comparator Feature Guide	Provides information required to install, configure, manage and operate the MLC 8000 hardware device which is used as an analog conventional comparator/voter (for analog IP simulcast and non-simulcast voting) and as a subsite link converter. The MLC 8000 facilitates conventional mixed mode conventional channels.
Core CSS Online Help	Describes the Configuration/Service Software (CSS) procedures and parameters to configure and optimize Base Radios for operation in ASTRO® 25 systems.

Table continued…

Related Information	Purpose
QUANTAR® and QUANTRO® Radio Service Software (RSS) Instruction Manual (6881085E35)	Provides descriptions and important information for screens and parameters used with Motorola Solutions base station products and ancillary equipment.
QUANTAR Instruction Manual (6881095E05)	Provides all relating information for the installation and operation of the QUANTAR® for conventional, ASTRO®, 6809 Trunking, and IntelliRepeater systems.
GPS Simulcast Installation (6881098E65)	Describes the configuration, operation, and optimization of equipment unique to analog simulcast systems using Digital Simulcast Modems, second generation (DSM-IIs) (digital transport; Trunked and Conventional systems), ASTRO® simulcast systems (Trunked and Conventional systems), and mixed mode simulcast systems (Trunked systems only).
Provisioning Manager User Guide	Provides a description of the Provisioning Manager application, including information on how to tailor this application for system use and how to provision ASTRO® 25 systems with various system-level, user-level, and device-level configuration parameters.
Configuration Manager for Conventional Systems User Guide	Covers the use of the Configuration Manager application to set up the Conventional system parameters for consoles, channels, user objects, and integrated data services in K Core ASTRO® 25 systems.
L and M Core Conventional Architectures Engineer Guide	Describes the centralized conventional architecture and distributed conventional architecture supported by L or M Core ASTRO® 25 systems.
K Core Conventional Architecture Engineer Guide	Provides a description of the K Core system architecture supporting the Conventional Hub Sites and Conventional Base Radio Sites in ASTRO® 25 Conventional and Integrated Data systems.
MOSCAD Network Fault Management Feature Guide	Provides information required to install, configure, manage, and use the MOSCAD® Network Fault Management (NFM), an optional ASTRO® 25 systems solution that provides tools to configure, monitor, and control auxiliary system devices, such as tower lights or power and environmental equipment, in communication sites.
SDM3000 Site Device Manager User Manual	Describes how to install, configure, operate, and troubleshoot the Site Device Manager (SDM) 3000 web interface to view the status and fault details for the monitored devices.
SDM3000 Builder User Guide	Provides information required to install, configure, manage, and use the SDM3000 Builder software to set up and configure SDM3000 hardware-based devices (SDM3000 RTU and SNT). This documentation is installed with the SDM3000 Builder application on the MOSCAD® NFM Graphical Master Computer (GMC) and on some service laptops.
GMC/GWS for MOSCAD NFM Operator Manual	Provides operational information about the MOSCAD NFM Graphical Master Computer (GMC), which is a PC-based Graphical User Interface (GUI) that provides the display and logging of information received from the SDM3000 RTUs. The MOSCAD NFM Graphical Workstation (GWS) is the remote client of the GMC. The GMC Application (installed on GMC and on GWS) is used to view the Digital Inputs and to use the Digital Outputs to control the connected devices.

Table continued…

Related Information	Purpose
	This documentation is installed on the GMC and on GWS as part of the GMC Application from the *GMC/GWS GUI and SDM3000 Config S/W and Doc for MOSCAD NFM DVD* (F5628A).
MCN Server 8000™ Remote Comparator Display Software for Motorola Solutions IP Comparators manual	Provides information to install and operate the Monitoring and Control Network (MCN) Server 8000 and Client Software. The MCN Server 8000 monitors and controls the operation of IP comparators directly through an IP network. Support is provided for the following Motorola Solutions IP comparators: GCM 8000 Digital Comparator, GRV 8000 Digital Comparator, MLC 8000 Analog Comparator, and Mixed Mode voting systems.
RF Site Technician Guide webhelp	Contains the installation, configuration, operation, maintenance, troubleshooting, recovery, and downgrade procedures for trained technicians and system operators setting up the RF site equipment in ASTRO® 25 conventional and trunking L and M core systems.
RF Site Technician Reference Guide webhelp	Describes the RF site components and tools used in their installation, configuration, and maintenance, and contains referential sections that provide additional information relevant when performing operations described in the *RF Site Technician Guide*, including feature descriptions, diagrams, and lists of parameters.

Chapter 1

Common Information for MLC 8000 Implementations

This chapter provides information that is common to all MLC 8000 implementations. This guide provides considerations and sequences for implementing Motorola Solutions MLC 8000s to support voting and comparator functions for various site topologies that include analog channels.

NOTICE: In this document, the term “Non IP simulcast” implies the “voting unit outbound transmission’ operation. When creating a voting channel cluster configuration with the MLC 8000 Configuration Tool, use the Non IP-Simulcast option. Also use the Non IP-Simulcast option as the channel cluster type if the channel cluster being created is for a circuit-based system or for pre-staging an MLC 8000 device.

NOTICE: Within the MLC 8000 Configuration Tool, the MLC 8000 Analog Comparator is also referred to as VGU, and the MLC 8000 Subsite Link Converter is also referred to as AGU.

1.1 Navigating This Guide

This documentation can be daunting if you try to read the entire guide. This process is designed to help you focus on getting the information that you need for your specific type of installation.

Prerequisites: This process assumes that the site is built and is either functioning or ready to go online. Verify the type of subsystem in which you are installing the MLC 8000 equipment.

When and where to use: This process ensures that you are looking at the correct documentation for the subsystem where you want to install MLC 8000 hardware.

Process:

1 Determine the type of subsystem where MLC 8000 devices are being implemented. See Examples of Subsystems Where MLC 8000s Can Be Used on page 34.

2 Access the appropriate content in this manual to aid in installing the MLC 8000 devices.

If…	Then…
If you want to install the MLC 8000s in an ASTRO® 25 analog-only non-simulcast voting subsystem,	perform the following actions: **a** Read Common Information for MLC 8000 Implementations on page 29. **b** Use ASTRO 25 Analog-Only Non-Simulcast Voting Subsystem on page 63 to install the MLC 8000 hardware. **c** Consult with MLC 8000 Radio Ports Cabling on page 161 for cabling information.
If you want to install the MLC 8000s in an ASTRO® 25 analog-only IP-based simulcast subsystem,	perform the following actions: **a** Read Common Information for MLC 8000 Implementations on page 29. **b** Use ASTRO 25 Analog-Only IP-Based Simulcast Subsystem on page 75 to install the MLC 8000 hardware.

If…	Then…
	c Consult with MLC 8000 Radio Ports Cabling on page 161 for cabling information.
If you want to install the MLC 8000s in an ASTRO® 25 mixed mode non-simulcast voting subsystem	perform the following actions: **a** Read Common Information for MLC 8000 Implementations on page 29. **b** Use ASTRO 25 Mixed-Mode Non-Simulcast Voting Subsystem on page 89to install the MLC 8000 hardware. **c** Consult with MLC 8000 Radio Ports Cabling on page 161 for cabling information.
If you want to install the MLC 8000s in a conventional mixed-mode simulcast voting subsystem,	perform the following actions: **a** Read Common Information for MLC 8000 Implementations on page 29. **b** Use ASTRO 25 Conventional Mixed-Mode Simulcast Voting Subsystem on page 103to install the MLC 8000 hardware. **c** Consult with MLC 8000 Radio Ports Cabling on page 161 for cabling information.
If you want to install the MLC 8000s in an ASTRO® 25 digital-only simulcast voting subsystem,	perform the following actions: **a** Read Common Information for MLC 8000 Implementations on page 29. **b** Use ASTRO 25 Digital-Only Simulcast Voting Subsystem on page 119to install the MLC 8000 hardware. **c** Consult with MLC 8000 Radio Ports Cabling on page 161 for cabling information.
If you want to install the MLC 8000s in an ASTRO® 25 circuit-based analog-only simulcast voting subsystem,	perform the following actions: **a** Read Common Information for MLC 8000 Implementations on page 29. **b** Use ASTRO 25 Circuit-Based Analog-Only Simulcast Voting Subsystem on page 129 to install the MLC 8000 hardware. **c** Consult with MLC 8000 Radio Ports Cabling on page 161 for cabling information.
If you want to install the MLC 8000s in a circuit-based analog-only simulcast voting subsystem,	perform the following actions: **a** Read Common Information for MLC 8000 Implementations on page 29. **b** Use Circuit-Based Analog-Only Simulcast Voting Subsystem on page 139 to install the MLC 8000 hardware. **c** Consult with MLC 8000 Radio Ports Cabling on page 161 for cabling information.
If you want to install the MLC 8000s in an analog-only IP-based simulcast voting substem,	perform the following actions: **a** Read Common Information for MLC 8000 Implementations on page 29. **b** Use Analog-Only IP-Based Simulcast Voting Subsystem on page 149to install the MLC 8000 hardware.

If…	Then…
	c Consult with MLC 8000 Radio Ports Cabling on page 161 for cabling information.

3 Optimize and calibrate the settings for conventional analog circuit-based and IP-based simulcast subsystems. See Optimization/Calibration for Conventional Simulcast on page 195.

NOTICE: If you run into issues with the MLC 8000 implementation, consult with Troubleshooting the Optimization/Calibration on page 223.

4 Determine additional options to implement at the same time, for example:

If…	Then…
MOSCAD NFM	See Setting Up MOSCAD Network Fault Management (NFM) Monitoring on page 37 for more information.
MCN Server 8000™ Remote Comparator Display Software	See Setting Up the MCN Server 8000 Remote Comparator Display Software on page 35 for more information.
Conventional GTR 8000 Base Radios, if replacing QUANTAR® Base Radios	See Replacement of QUANTARs with GTR 8000 Base Radios on page 37 for more information.

1.2 Implementing MLC 8000s

Prerequisites: This expansion plan assumes that the site is built and is either functioning or ready to go online.

When and where to use: This process ensures that you order and confirm receipt of appropriate quantities of equipment, racks/cabinets, and software based on number of sites, subsites, and types of base radio interfaces.

Process:

1 Determine the type of subsystem where MLC 8000 devices are being implemented. See Examples of Subsystems Where MLC 8000s Can Be Used on page 34.

2 Determine additional options to implement at the same time, for example:

If…	Then…
MOSCAD NFM	See Setting Up MOSCAD Network Fault Management (NFM) Monitoring on page 37 for more information.
MCN Server 8000™ Remote Comparator Display Software	See Setting Up the MCN Server 8000 Remote Comparator Display Software on page 35 for more information.
Conventional GTR 8000 Base Radios, if replacing QUANTAR® Base Radios	See Replacement of QUANTARs with GTR 8000 Base Radios on page 37 for more information.

3 Order and confirm receipt of the required number of MLC 8000 Analog Comparators or MLC 8000 Subsite Link Converters.

- The number should correspond to the initial planning of the system.

- Also, when ordering, you have identified which MLC 8000 devices should be configured as MLC 8000 Analog Comparators or as MLC 8000 Subsite Link Converters. See MLC 8000 Devices Per Site Type on page 33.
- MLC 8000s include a grounding cable, with options for MLC 8000 software, external power supplies, and rack mount kits.

4 Order and confirm receipt of appropriate quantities of equipment, racks/cabinets, and software based on number of sites, subsites, and types of base radio interfaces.

If…	Then…
GCM 8000/GRV 8000	Installed at the following site types: • ASTRO 25 Mixed-Mode Non-Simulcast Voting Subsystem • ASTRO 25 Digital-Only Simulcast Voting Subsystem (With QUANTAR® station)
Site Gateway (Conventional Channel Interface), that is, GGM 8000 Gateway hardware platform	Installed at the following site types: • ASTRO 25 Analog-Only Non-Simulcast Voting Subsystem • ASTRO 25 Analog-Only IP-Based Simulcast Subsystem • ASTRO 25 Mixed-Mode Non-Simulcast Voting Subsystem • ASTRO 25 Circuit-Based Analog-Only Simulcast Voting Subsystem For simulcast systems, a Site Gateway (Conventional Channel Interface) can support four channels, with a maximum of three Site Gateways (Conventional Channel Interface) at the prime site.
Simulcast Site Reference devices	Installed at the following site types: • ASTRO 25 Analog-Only IP-Based Simulcast Subsystem • Analog-Only IP-Based Simulcast Voting Subsystem If the Simulcast Site Reference device does not have sufficient capacity, then you may want to install a certified distribution amplifier. See Simulcast Site Reference Considerations on page 50
MCN Server 8000 Remote Comparator Display Software (server/client)	Two PCs required

5 Review bandwidth and other considerations, see Ethernet Bandwidth Considerations for MLC 8000s on page 49.

6 Determine a service window of time for performing the MLC 8000 implementation and communicate this time to radio system subscribers.

CAUTION: The implementation results in down time and outages to the channel/subsystem connected to the MLC 8000 device. An estimate is 2–4 hours, including calibration.

7 Obtain the IP Plan for MLC 8000 expansion following standard policies/procedures.

- Discuss proposed connectivity and transport changes.
- Obtain the pre-expansion IP plan for the system. IP addresses are dynamic, so review the existing plan before adding new devices.

- Obtain the IP plan that includes MLC 8000s and other devices (Site Gateways [Conventional Channel Interface], HP switches, and so on) being added. Determine the number and type of MLC 8000 devices being added.

8 (IP configuration) Obtain configuration files for switches and GGM 8000 gateways from Motorola Solutions.

NOTICE: The configuration files from Motorola Solutions address the new transport requirements.

9 Evaluate and procure transport requirement for the expansion.

NOTICE: The bandwidth consumed over the IP link between the prime site and subsite using G.711 encoding is approximately three times that of G.728 encoding. Configuration files provide new transport requirements. Procure new bandwidth for the site (due to G.711 encoding) and new port capacity for the MLC 8000 devices.

1.2.1
MLC 8000 Devices Per Site Type

Table 1: MLC 8000 Devices Per Site Type

Configuration	MLC 8000 Device	Site Type
Analog Simulcast	One MLC 8000 Analog Comparator is required for each channel at the prime site.	Prime/Hub site
	One MLC 8000 Subsite Link Converter is required for every transmitting base radio.	Base Radio site
Analog Voting (non-Simulcast)	One MLC 8000 Analog Comparator is required for each channel at the prime site.	Prime/Hub site
	One MLC 8000 Subsite Link Converter connects to up to four co-located transmitting base radios. The MLC 8000 Subsite Link Converter can connect to up to four co-located receivers.	Base Radio site
Digital/analog mixed mode voting	One MLC 8000 Analog Comparator and one GCM 8000 comparator are companion devices providing a single mixed mode channel at the prime site.	Prime/Hub site
	One MLC 8000 Subsite Link Converter connects to up to four co-located transmitting base radios. The MLC 8000 Subsite Link Converter can connect to up to four co-located receivers.	Base Radio site
Digital Voting	One MLC 8000 Subsite Link Converter digital-only V.24 gateway can connect up to four co-located transmitting base radios or receivers to a GCM 8000 or GRV 8000 comparator.	Prime/Hub site

NOTICE: In this table, *Hub site* refers to any site in a K-core system where comparators can be located, which does not include the base radio sites. In other systems, sites with comparators are referred to as *prime sites* and the base radio sites are referred to as *subsites*.

1.3
Examples of Subsystems Where MLC 8000s Can Be Used

The following sections explain how to implement the MLC 8000 devices in Conventional Distributed subsystems and Trunked IP Simulcast subsystems.

Table 2: Subsystem Examples

Site type	Implementation Sequence
ASTRO 25 Analog-Only Non-Simulcast Voting Subsystem	See ASTRO 25 Analog-Only Non-Simulcast Voting Subsystem on page 63
ASTRO 25 Analog-Only IP-Based Simulcast Subsystem	See ASTRO 25 Analog-Only IP-Based Simulcast Subsystem on page 75
ASTRO 25 Mixed-Mode Non-Simulcast Voting Subsystem	See ASTRO 25 Mixed-Mode Non-Simulcast Voting Subsystem on page 89
ASTRO 25 Digital-Only Simulcast Voting Subsystem (with QUANTAR® station)	See ASTRO 25 Digital-Only Simulcast Voting Subsystem on page 119
ASTRO 25 Circuit-Based Analog-Only Simulcast Voting Subsystem	See ASTRO 25 Circuit-Based Analog-Only Simulcast Voting Subsystem on page 129
Circuit-Based Analog-Only Simulcast Voting Subsystem	See Circuit-Based Analog-Only Simulcast Voting Subsystem on page 139
Analog-Only IP-Based Simulcast Voting Subsystem	See Analog-Only IP-Based Simulcast Voting Subsystem on page 149

The MLC 8000 Analog Comparator can be installed at:

- Conventional Distributed Subsystem Hub sites (not base radio sites)
- Trunked IP simulcast prime sites (not subsites), when a minimum of one trunked channel has been converted to a conventional channel

The MLC 8000 Subsite Link Converter can be installed at:

- Conventional Distributed Subsystem base radio sites
- Trunked IP Simulcast Subsites, when a minimum of one trunked channel has been converted to a conventional channel
- In some configurations, it can also be installed at: Conventional Distributed Subsystem Hub sites and Trunked IP simulcast prime sites.

For MLC 8000 Subsite Link Converters implemented in ASTRO™ 25 trunked sites, see Examples of Trunking Configurations That Can Share Equipment on page 47.

1.4
MLC 8000 Ports and LEDs

See the *MLC 8000 Comparator Feature Guide* for detailed port information, including port connection tables and LED tables.

1.4.1
MLC 8000 Hardware Views

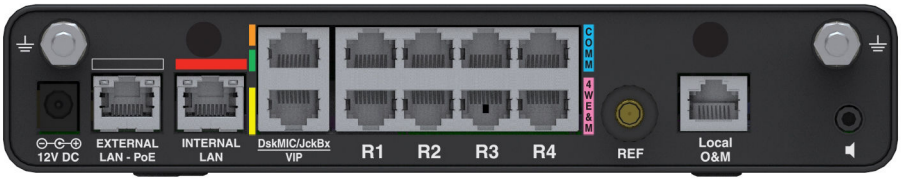
Front and Rear Views of the MLC 8000

NOTICE: The MLC 8000 Analog Comparator and MLC 8000 Link Converter use the same hardware platform and differ only by the application software installed on them.

Figure 1: MLC 8000 Front View

MLC_8000_front

Figure 2: MLC 8000 Rear View



MLC_8000_rear

1.5
MLC 8000 Safety and General Information

See the *MLC 8000 Comparator Feature Guide*.

1.6
MLC 8000 Configuration Tool with Analog Display and Control Set Up

Refer to the *MLC 8000 Configuration Tool User Guide* and online help for instructions on setting up the MLC 8000 Configuration Tool.

1.7
Setting Up the MCN Server 8000 Remote Comparator Display Software

Prerequisites: This process requires the *MCN Server 8000™ Remote Comparator Display Software for Motorola Solutions IP Comparators* manual. Note the following:

- If the MCN Server 8000 and Client Software is implemented in an ASTRO® 25 system, then the ASTRO® 25 PNM Client and ASTRO® 25 console are the only locations permissible for installing the Client Software. (The MCN Server 8000 can be on a standalone PC.)
- If the MCN Server 8000 and Client Software is joined to the ASTRO® 25 domain, then implementation requires locating the *ASTRO 25 Windows Supplemental* media and the instructions for joining a domain, from the *Authentication Services Feature Guide*.

- If the MCN Server 8000 and Client Software is implemented using the HIB-IP device, due to connections to legacy equipment, the level of Information Assurance applied cannot be considered up to the standards for connecting the site to an ASTRO® 25 system.

When and where to use:
MCN Server 8000 and Client Software serves the following function:

- The MCN Server 8000 application receives voting information directly from the GCM 8000 or GRV 8000 digital comparators and MLC 8000 analog comparators. It controls voting for both comparators simultaneously. The server application handles data distribution to distributed client applications.
- The MCN Clients also display and control the voting data.

The MCN Server 8000 and Client Software can monitor and control the operation of following types of IP comparators directly through an IP network:

- GCM 8000 Digital Comparators
- GRV 8000 Digital Comparators
- MLC 8000 Analog Comparators
- Mixed Mode Voting — GCM 8000 or GRV 8000 and MLC 8000 comparators

Process:

1. Determine the PCs where you will install the MCN Server 8000 and Client Software.
   - One PC for the MCN Server 8000 program
   - MCC 7500 VPM dispatch console or a customer-provided PC for the MCN Client

   NOTICE: You cannot install the Motorola Solutions MLC 8000 Configuration Tool with Analog Voting Control and Display or Configuration/Service Software (CSS) on the same PC.
2. Cable the hardware by connecting the PCs to the LAN switch using an RJ45 connector.
3. Install the MCN Server 8000 and Client Software. Refer to the following sections in the *MCN Server 8000™ Remote Comparator Display Software for Motorola Solutions IP Comparators* manual:
   - “Installation Overview” section
   - “Installing MCN Server Software” section
   - “Installing MCN Client Program” section
4. Generate the system configuration files. Refer to the *MCN Server 8000™ Remote Comparator Display Software for Motorola Solutions IP Comparators* manual.

   You must enter specific information, such as the IP address of the comparator, into the MCN Server 8000 system data files.
5. Launch the server or client application from the CTI Products folder on the desktop.

1.8 MLC 8000 Software and Configuration Updates

Refer to the *MLC 8000 Configuration Tool User Guide* and online help for instructions on updating the MLC 8000 software and configuration.

1.9 MLC 8000 Password Setup

Refer to the *MLC 8000 Configuration Tool User Guide* and online help for information on setting up MLC 8000 passwords.

1.10 Considerations for Implementing MLC 8000s to Replace Existing Equipment

If possible, print out or save the programmed values in the equipment that is being replaced before you install the MLC 8000 device.

- For ASTRO-TAC 3000 comparators:
  - Print out the code plug using Radio Service Software (RSS).
  - Power off the ASTRO-TAC 3000 and disconnect the cable connections.
- For DIGITAC comparators:
  - Capture values using the Print command in HyperTerminal (assuming HyperTerminal has been installed).
  - Power off the DIGITAC and disconnect the cable connections.
- For Spectra TAC comparators, as the parameters cannot be printed, power off the Spectra TAC and disconnect the cable connections.

NOTICE: Field names in the MLC 8000 Configuration Tool may differ from the corresponding field names in the configuration tools for the equipment being replaced.

1.11 Replacement of QUANTARs with GTR 8000 Base Radios

The following references provide additional information when QUANTAR® Base Radios are deployed in your system:

- For sites where conventional QUANTAR® Base Radios are replaced with conventional GTR 8000 Base Radios, refer to the *Conventional QUANTAR Replacement Guide*.
- For MLC 8000-related configuration settings required for Analog IP Simulcast GTR 8000s, see ASTRO 25 Analog-Only IP-Based Simulcast Subsystem on page 75.
- For remaining QUANTAR® Base Radios, for information that is applicable to MLC 8000 sites, refer to existing configuration, optimization, and troubleshooting documentation in the *QUANTAR Instruction Manual* (6881095E05).

1.12 Setting Up MOSCAD Network Fault Management (NFM) Monitoring

Prerequisites: For MOSCAD NFM tasks that are required only by specific MLC 8000 sites, see sequences/procedures in the *MLC 8000 Setup Guide*. See also the “GMC Installation” and “GWS Installation” sections in the *MOSCAD Network Fault Management Feature Guide*.

When and where to use: Use these steps to set up MOSCAD NFM monitoring for the sites with MLC 8000 devices. MLC 8000 devices are network fault monitored through generic Digital Inputs (DIs), Digital Outputs (DOs), and Analog Input (AI) of an SDM3000 RTU as configured in 48-DI and 16-DO Device Resources within the SDM3000 Builder configuration software. Indications about MLC 8000 network fault events are sent from the SDM3000 RTU to the GMC through the SDM3000 Network

Translator (SNT). The GMC Application on the GMC (a server) and on the GWS (its clients) presents graphical indications for these events and also allows you to remotely restart the MLC 8000 device.

NOTICE: If the MLC 8000 has already been connected to the SDM3000 RTU, start from step 3.

Process:

1. On the MLC 8000 device, connect an RJ-45 cable from the VIP port to an I/O Wiring Punch Block. For additional information, see:
   - “Connecting I/Os with Punch Blocks” section in the Installation chapter of the *SDM3000 Owner’s Manual*
   - “Pin Assignments” and “Punch Block Terminal Block Contacts” sections in Appendix C of the *SDM3000 Owner’s Manual*
   - “MLC 8000 Ports” in the *MLC 8000 Comparator Feature Guide*.
2. On the SDM3000 RTU, connect RJ-45 cables from the available Digital Input (DI) ports, from an available Digital Output (DO) port, and from an available Analog Input (AI) port to the same I/O Wiring Punch Block used in the previous step.

   See “Cabling MLC 8000 to SDM3000 RTU” in *MLC 8000 Setup Guide*.

   For additional reference about the Punch Block, see:
   - “I/O Connections” section in the Installation chapter of the *SDM3000 Owner’s Manual*
   - “Punch Block Terminal Block Contacts” section in Appendix C of the *SDM3000 Owner’s Manual*
3. Determine if you need to add an extra I/O Expansion Unit (Hardware Resource) to provide an additional 48-DI and 16-DO Device Resources (among others).

   This depends on how many MLC 8000 devices and other items are monitored by a single SDM3000 RTU in the site. See "SDM3000 RTU Capacity" in *MLC 8000 Setup Guide*.
4. Back up the SDM3000 Builder Projects.

   See “Backing Up SDM3000 Builder Projects” in the *MOSCAD Network Fault Management Feature Guide*.
5. Add MLC 8000 devices to the MLC 8000 sites in existing SDM3000 Builder project.

   See Adding MLC 8000 Devices to the MLC 8000 Sites in Existing SDM3000 Builder Project on page 39.
6. Build GMC Configuration and Tags.

   See “Building GMC Configuration and Tags” in the *MOSCAD Network Fault Management Feature Guide*.
7. Configure SDM3000 RTU.

   See “Configuring SDM3000 RTU” in the *MOSCAD Network Fault Management Feature Guide*.

   NOTICE: Set the MOSCAD NFM to generate an alert for AI less than 3 V (960 HEX). The AI is connected to the 5V pin.
8. Start the GMC Application.

   See “Starting the GMC Application” in the *MOSCAD Network Fault Management Feature Guide*.
9. Verify the setup by generating a Site I/O Wiring report for the SDM3000 Builder project.

   See “Generating Reports” in the *SDM3000 Builder User Guide*.

1.12.1

Adding MLC 8000 Devices to the MLC 8000 Sites in Existing SDM3000 Builder Project

When and where to use: For the examples of subsystems where the MLC 8000s can be used, see “Examples of Subsystems Where MLC 8000s Can Be Used” in *MLC 8000 Setup Guide*.

Procedure:

1. Double-click **SDM3000 Builder X.YY** on the desktop.

   The SDM3000 Builder window appears.

2. Navigate to the desired SDM3000 Builder Project with MLC 8000 Site and click **Open**.

   The SDM3000 Builder window appears for the project.

3. Select the desired zone in the project window.

   The Sites list appears in the main window.

4. Navigate to the desired MLC 8000 Site in the **Project** window and click it.

   The Main window displays the Site devices in the Devices tab, and the Resources window displays the optional devices in the Devices tab.

5. From the **Devices** tab in the **Resources** window, drag the 48-DI and 16-DO device resources to the **Devices** tab in the **Main** window.

   NOTICE: The 48-DI and 16-DO device resources can only be added in accordance with the actual number of SDM3000 RTUs and SDM3000 I/O Expansion Units in the site (as already defined in the SDM3000 Builder project).

   To configure MLC 8000 monitoring in a site in the SDM3000 Builder project, see “Defining the Devices in a Site” in the *SDM3000 Builder User Guide*. The MLC 8000 devices are monitored using generic 16-DO and 48-DI Device Resources in the SDM3000 Builder project.

6. If the MLC 8000 device replaces a legacy comparator that is already being network fault monitored by an SDM3000 RTU, remove the corresponding device resource from the Site's Devices pane in the SDM3000 Builder project.

7. If the MLC 8000 device replaces a legacy comparator that is already being network fault monitored by an NFM XC RTU, remove the corresponding network element entry from the Site's list in the Fault Management Site-Builder project, and re-install configuration to the NFM XC RTU and MOSCAD IP Gateway.

8. Change the SDM3000 Builder Mode to **Advanced**:

   a. Click the **View** menu.

      The View menu appears

   b. Click the **Mode** option.

      The Mode menu appears.

   c. Choose **Advanced**.

9. Define which DOs and DIs are monitoring a given MLC 8000 device.

   See “Defining the Objects in a Device” in the *SDM3000 Builder User Guide*.

NOTICE: In particular, it is recommended to manually configure appropriate Description, Name, “On” /“Off” Messages for each of the DIs and for the DO used to monitor a single MLC 8000 device. If desired, other fields such as Severity can be configured as well. See “MOSCAD NFM I/O Monitoring Indications” tables in the *MLC 8000 Setup Guide* or *MLC 8000 Comparator Feature Guide* for recommended Descriptions, Names and “On”/”Off” messages for each type of MLC 8000 device.

To configure I/O object names, see “Configuring I/O Objects Names for UEM and GMC” in the *MOSCAD Network Fault Management Feature Guide*.

10 Repeat step 9 for each DI and for the single DO of each MLC 8000 device.

1.12.2

Cabling MLC 8000 to SDM3000 RTU

The quantity of required MOSCAD NFM cables and I/O Wiring Punch Blocks can be determined from the number of digital inputs and outputs in the following tables:

- MLC 8000 Link Converter and MOSCAD NFM I/O Monitoring Indications (IP Simulcast) on page 41
- MLC 8000 Link Converter MOSCAD NFM I/O Monitoring Indications (Non IP Simulcast) on page 42
- MLC 8000 Analog Comparator and MOSCAD NFM I/O Monitoring Indications (IP Simulcast) on page 43
- MLC 8000 Analog Comparator and MOSCAD NFM I/O Monitoring Indications (Non IP Simulcast) on page 45

SDM3000 RTU Ports

See MLC 8000 Ports and LEDs on page 34 for the MLC 8000 port information.

The following figures show the SDM3000 RTU ports where the MLC 8000 connects using an MLC 8000 to MOSCAD NFM Cable. See MLC 8000 Radio Ports Cabling on page 161.

Figure 3: SDM3000 Advanced Unit – Rear View

Figure 4: SDM3000 I/O Expansion Basic Unit – Rear View

Figure 5: SDM3000 I/O Expansion Advanced Unit – Rear View

Refer to “Punch Block Terminal Block Contacts” in the *SDM3000 Owner’s Manual* for a figure showing the I/O Wiring Punch Block.

1.12.3

MLC 8000 Link Converter and MOSCAD NFM I/O Monitoring Indications (IP Simulcast)

Legend:

- EXS = Existence or presence
- GPN = GPS not synchronized
- L2V = Link to VGU (From AGU)
- L2B = Link to one or more BRs
- BLT = Bad Launch time (AGU)
- RST = Restart
- <xxxxxxxxxxx> are the first eleven (11) characters uniquely identifying the specific MLC 8000 unit (as configured in the SDM3000 Builder project)
- Severity:
  - critical – a problem that affects the entire channel
  - major – one site of the channel is affected at both reception and transmission
  - minor – one site of the channel is affected in one direction (the transmit direction)
  - normal – report of status (only when the user performs the restart from GMC Application)

NOTICE:

- **Name** and **Description** are limited to 15 characters.
- **On** and **Off** messages are limited to 15 characters.

Table 3: MLC 8000 Link Converter and MOSCAD NFM I/O Monitoring Indications (IP Simulcast)

Pin		I/O Wiring Punch Block	SDM3000 Builder						
#	Name	I/O	Object	Name	"On" Message	"Off" Message	Description	Legend	Severity
1	5v	Output	AI	EXS-xxxxxxxxxx	Present	Not Present or VIP cable is disconnected	EXS-xxxxxxxxxx	Unit presence	major
3	VIP 2	Output	DI	GPN-xxxxxxxxxx	Not Synch(GPS)	GPS in synch	GPN-xxxxxxxxxx	Synch with GPS	minor

Table continued…

Pin		I/O Wiring Punch Block	SDM3000 Builder						
#	Name	I/O	Object	Name	"On" Message	"Off" Message	Description	Legend	Severity
4	VIP 3	Output	DI	L2V-xxxxxxxxxx	VGU link failed	VGU link OK	L2V-xxxxxxxxxx	Cmprtr lnk fail	major
5	VIP 4	Output	DI	L2B-xxxxxxxxxx	BR link failed	BR links OK	L2B-xxxxxxxxxx	Link to BR fail	major
6	VIP 5	Output	DI	BLT-xxxxxxxxxx	Bad Launch time	Launch time OK	BLT-xxxxxxxxxx	Bad launch time	minor
7	VIP 6	Input	DO	RST-xxxxxxxxxx	Device restart	RST complete	RST-xxxxxxxxxx	Restart device	normal

1.12.4
MLC 8000 Link Converter MOSCAD NFM I/O Monitoring Indications (Non IP Simulcast)

Legend:

- EXS = Existence or presence
- L2V = Link to VGU (From AGU)
- L2B = Link to one or more BRs
- RST = Restart
- <xxxxxxxxxxx> are the first eleven (11) characters uniquely identifying the specific MLC 8000 unit (as configured in the SDM3000 Builder project)
- Severity:
  - critical – a problem that affects the entire channel
  - major – one site of the channel is affected at both reception and transmission
  - minor – one site of the channel is affected in one direction (the transmit direction)
  - normal – report of status (only when the user performs the restart from GMC Application)

NOTICE:

- **Name** and **Description** are limited to 15 characters.
- **On** and **Off** messages are limited to 15 characters.

Table 4: MLC 8000 Link Converter and MOSCAD NFM I/O Monitoring Indications (Non IP Simulcast)

Pin		I/O Wiring Punch Block	SDM3000 Builder						
#	Name	I/O	Object	Name	"On" Message	"Off" Message	Description	Legend	Severity
1	5v	Output	AI	EXS-xxxxxxxxxx	Present	Not Present or VIP cable is disconnected	EXS-xxxxxxxxxx	Unit presence	major
3	VIP 2	N/A	N/A	Not used					
4	VIP 3	Output	DI	L2V-xxxxxxxxxx	VGU links fail	VGU link(s) OK	L2V-xxxxxxxxxx	Cmprtr lnk fail	major
5	VIP 4	Output	DI	L2B-xxxxxxxxxx	BR links failed	BR link(s) OK	L2B-xxxxxxxxxx	Link to BR fail	major
6	VIP 5	N/A	N/A	Not used					
7	VIP 6	Input	DO	RST-xxxxxxxxxx	Device restart	RST complete	RST-xxxxxxxxxx	Restart device	normal

1.12.5
MLC 8000 Analog Comparator and MOSCAD NFM I/O Monitoring Indications (IP Simulcast)

Legend:

- EXS = Existence or presence
- GPN = Location not synchronized
- L2B = Link to one or more BRs
- LDL = Link delay
- RST = Restart

- <xxxxxxxxxxx> are the first eleven (11) characters uniquely identifying the specific MLC 8000 unit (as configured in the SDM3000 Builder project)
- Severity:
  - critical – a problem that affects the entire channel
  - major – one site of the channel is affected at both reception and transmission
  - minor – one site of the channel is affected in one direction (the transmit direction)
  - normal – report of status (only when the user performs the restart from GMC Application)

NOTICE:

- **Name** and **Description** are limited to 15 characters.
- **On** and **Off** messages are limited to 15 characters.

Table 5: MLC 8000 Analog Comparator and MOSCAD NFM I/O Monitoring Indications (IP Simulcast)

Pin		I/O Wiring Punch Block	SDM3000 Builder						
#	Name	I/O	Object	Name	"On" Message	"Off" Message	Description	Legend	Severity
1	5v	Output	AI	EXS-xxxxxxxxxxx	Present	Not Present or VIP cable is disconnected	EXS-xxxxxxxxxxx	Unit presence	critical
3	VIP2	Output	DI	GPN-xxxxxxxxxxx	Not Synch (Location)	Location in synch	GPN-xxxxxxxxxxx	Synch with Location	critical
4	VIP3	Output	DI	L2B-xxxxxxxxxxx	BR links failed	BR links OK	L2B-xxxxxxxxxxx	Link to BR fail	major
5	VIP4	Output	DI	LDL-xxxxxxxxxxx	Bad link delay or console port's ALC is out of dynamic range	AGUs in synch and console port's ALC is within dynamic range	LDL-xxxxxxxxxxx	Link delay or console port's ALC dynamic range	major

Table continued…

Pin		I/O Wiring Punch Block	SDM3000 Builder						
#	Name	I/O	Object	Name	"On" Message	"Off" Message	Description	Legend	Severity
6	VIP5	N/A	N/A	Not Used					
7	VIP6	Input	DO	RST-xxxxxxxxxxx	Device restart	RST complete	RST-xxxxxxxxxxx	Restart device	normal

1.12.6
MLC 8000 Analog Comparator and MOSCAD NFM I/O Monitoring Indications (Non IP Simulcast)

Legend:

- EXS = Existence or presence
- L2B = Link to one or more BRs
- RST = Restart
- NOS = not synched
- <xxxxxxxxxxx> are the first eleven (11) characters uniquely identifying the specific MLC 8000 unit (as configured in the SDM3000 Builder project)
- Severity:
  - critical – a problem that affects the entire channel
  - major – one site of the channel is affected at both reception and transmission
  - minor – one site of the channel is affected in one direction (the transmit direction)
  - normal – report of status (only when the user performs the restart from GMC Application)

NOTICE:

- **Name** and **Description** are limited to 15 characters.
- **On** and **Off** messages are limited to 15 characters.

Table 6: MLC 8000 Analog Comparator and MOSCAD NFM I/O Monitoring Indications (Non IP Simulcast)

Pin		I/O Wiring Punch Block	SDM3000 Builder					
#	Name	I/O	Object	Name	"On" Message	"Off" Message	Description	Legend	Severity
1	5v	Output	AI	EXS-xxxxxxxxxxx	Present	Not Present or VIP cable is disconnected	EXS-xxxxxxxxxx	Unit presence	critical
3	VIP 2	N/A	N/A	Not used					
4	VIP 3	Output	DI	L2B-xxxxxxxxxxx	BR links failed	BR links OK	L2B-xxxxxxxxxx	Link to BR fail	major
5	VIP 4	Output	DI	NOS-xxxxxxxxxxx	BR not synched or console port's ALC is out of dynamic range	BRs synched and console port's ALC is within dynamic range	NOS-xxxxxxxxxx	BR not synched or console port's ALC is out of dynamic range	major
6	VIP 5	N/A	N/A	Not Used					
7	VIP 6	Input	DO	RST-xxxxxxxxxxx	Device restart	RST complete	RST-xxxxxxxxxx	Restart device	normal

1.13 Optimization/Calibration for Conventional Simulcast

See Optimization/Calibration for Conventional Simulcast on page 195.

1.14 Considerations for Implementing MLC 8000s at Existing Trunking Sites

When adding Analog IP Conventional Simulcast functionality and equipment to an existing ASTRO® 25 trunked site, it is cost-effective to place the Conventional equipment in a way that enables the sharing of the existing transport and timing reference devices at a Trunked subsite. Sharing of these devices can be accommodated using the existing site capacity limits for supported Ethernet switches and Site Routers, Simulcast Site Reference devices and their expansion modules, site link bandwidth capacity, and physical space limitations at the Trunked subsite.

1.14.1 Examples of Trunking Configurations That Can Share Equipment

MLC 8000 Analog Comparators, MLC 8000 Subsite Link Converters, and conventional base radios supporting Ethernet-based digital, analog, or mixed mode channels can be deployed at an ASTRO® 25 trunked site, where the conventional system shares the transport equipment, and timing and frequency reference devices when capacity is available. Trunked RF site (repeater or simulcast) cabinet equipment, as well as transport equipment and timing equipment, can be shared between conventional and trunked channels.

The following site types scenarios are supported:

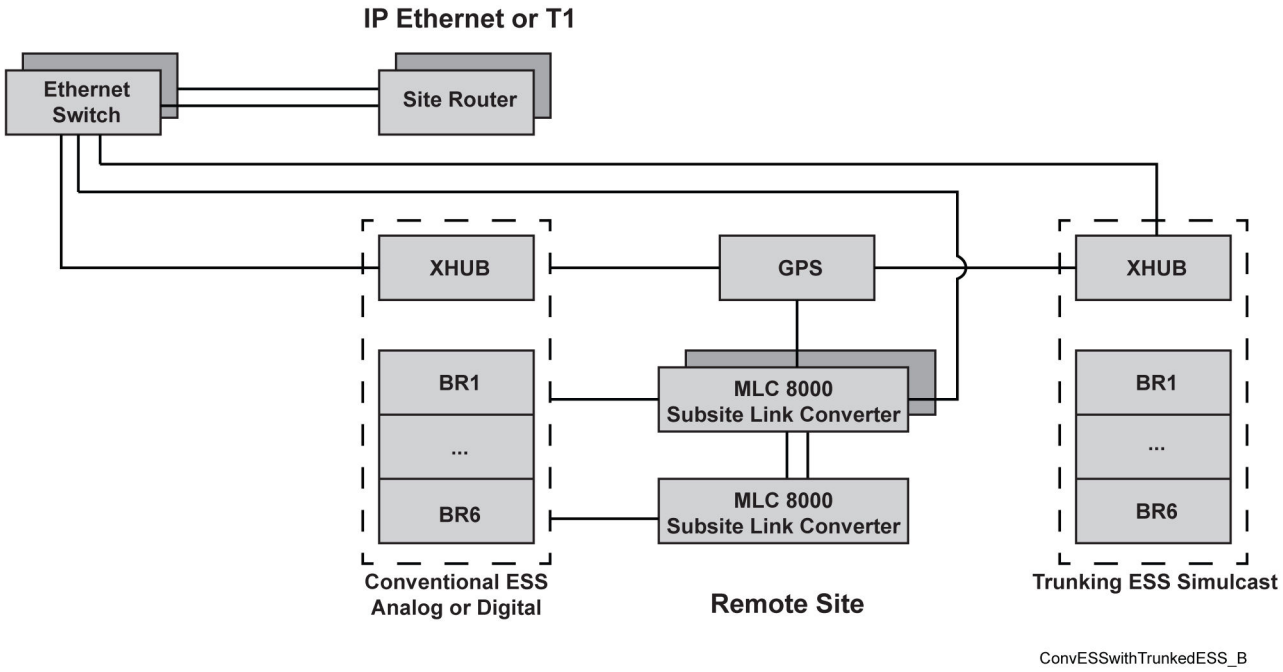
- Sharing of transport equipment that is already installed at a trunked IP Simulcast subsystem by analog conventional channel equipment.
- Sharing of transport equipment that is already installed at a trunked IP Simulcast subsystem by analog conventional channel equipment, plus sharing of site reference/timing equipment that is already installed at a trunked subsite.
- Integration of analog conventional channel equipment into a GTR 8000 Expandable Site Subsystem, plus sharing of transport and site reference/timing equipment that is already installed at a trunked subsite. The Conventional Expandable Site Subsystem can be installed in place of a Conventional Base Radio.

For more information about these configurations, see Channel Capacity Constraints When Conventional Shares Equipment With Trunking on page 49.

For more information about the GTR 8000 cabling, refer to the Wireline & V.24 Subpanel of the GTR 8000 Expandable Site Subsystem junction panel, in the *GTR 8000 Expandable Site Subsystem Feature Guide*.

The following figure illustrates a common system configuration where Conventional IP Simulcast equipment shares existing Trunking subsite equipment. The figure shows that an external Ethernet switch can be used when the existing Ethernet switch port capacity of the Expandable Site Subsystems is insufficient. This configuration requires at least one available Ethernet port on the Expandable Site Subsystem to connect to the external Ethernet switch.

Figure 6: Example Diagram Conventional Expandable Site Subsystem Analog or Digital Co-located with Trunking Expandable Site Subsystem



IMPORTANT: In trunked simulcast subsites, external HP Ethernet switches are already present if the High Availability feature was not implemented. Avoid manually re-configuring the external switch because any manual configuration is lost when the switch is rebooted and the ports return to their defaults. Instead, avoid manual configuration by selecting ports from the Motorola Solutions-provided configuration based on the speeds and duplex required. (The device names associated with the ports in the Motorola Solutions-provided configuration file may not match the device type you are connecting to this external switch.)
For an existing switch, which previously had MAC Port Lockdown enabled, the following must occur if devices are added to the switch:

- Disable MAC Port Lockdown.
- Push the new Motorola Solutions-provided configuration files with the added devices to switches.
- Attach devices to chosen ports.
- Enable MAC Port Lockdown from the core.

NOTICE: Analog IP Simulcast is only supported in an Analog configuration. The connection between the MLC 8000 Subsite Link Converter and base radio is 4-wire only. 2-wires are also OK in a receive only base radio (such as GPW 8000 Receivers). The MLC 8000 Analog Comparator and MLC 8000 Subsite Link Converter require a GPS time reference only if the MLC 8000 Subsite Link Converter is connected to a Tx/Rx or Tx only BR. An Rx only BR does not require the GPS.

NOTICE: Digital IP Simulcast is not supported in an MLC 8000 Mixed Mode configuration. Digital IP Simulcast it is supported through Chapter 5 ASTRO 25 Conventional Mixed-Mode Simulcast Voting Subsystem. The connection between the MLC 8000 Subsite Link Converter and a base radio is 4-wire/V.24. Digital IP Simulcast requires a GPS time reference for the GCM 8000 Comparator or the GRV 8000 Digital Comparator, and the base radio.

NOTICE: Also for Digital IP Simulcast, the connection between MLC 8000 Subsite link converter and base radio is 4-wire/V.24. The digital comparator default setting for launch time delay in Configuration/Service Software (CSS) is set to the default applicable for an IP link. In the Channel window, modify this setting by clicking **Autocalculate Launch Time Delay** to change the **Simulcast Channel Launch Time Delay** field. This change is necessary due to latencies resulting from the MLC 8000 Subsite Link Converter processing and slower links (V.24 compared to IP). Also, refer to the *Flexible Site and InterZone Links Feature Guide* for information about modifying the GCM 8000 and GRV 8000 subsite jitter buffer settings to address audio quality issues.

NOTICE: For Mixed Mode support, the connection between the MLC 8000 Subsite Link Converter and base radio is a hybrid link; 4-wire/V.24. Mixed Mode operation does not support Simulcast.

NOTICE: The Trunking Expandable Site Subsystem can house up to four Conventional base radios, but they must be the same RF band as the Trunking base radios.

NOTICE: The MLC 8000 devices typically installed at the subsite to support analog and digital IP Simulcast are not racked in the Conventional Expandable Site Subsystem, but must be racked separately.

1.14.2
Channel Capacity Constraints When Conventional Shares Equipment With Trunking

Equipment and channel quantities that can be supported are limited to the current system, zone, and site constraints for devices and channels for ASTRO® 25 sites and systems, and by the availability of installed physical equipment and any of their existing interfaces that are unused and can accommodate the device requirements.

Each site type supports specific quantities of Ethernet switches that can provide only a fixed number of Ethernet ports. Site capacity for new channels is limited to the number of Ethernet ports remaining on the Ethernet switches when the maximum number of switches has been installed.

Each IP voted Conventional channel requires two ports to be available on the local Ethernet switching equipment.

NOTICE: For Ethernet ports, evaluate, as part of pre-planning, how many switch ports are available on the Expandable Site Subsystem switch compared to how many are required for the external equipment. If enough Expandable Site Subsystem switch ports are available, then no external switch is required; otherwise, you must obtain and configure an external HP switch. Adding an external HP switch beyond the limit of the trunked IP simulcast subsystem is not supported.

The base radios also have IP port requirements. Either standalone conventional base radio equipment or Conventional GTR 8000 Expandable Site Subsystem can use spare capacity at existing Trunked or Conventional sub-sites.

1.14.3
Ethernet Bandwidth Considerations for MLC 8000s

The Ethernet link between MLC 8000 devices carries G.711 encoded voice. When calculating the bandwidth capacity for links between Hub sites and Base Radio sites, the G.711 traffic must be considered. To ensure optimal analog-only and mixed mode audio performance, each MLC 8000 talkpath vocoded with G.711 should be considered equivalent to three analog conventional talkpaths vocoded with G.728 (approximately three times the bandwidth).

A talk path is defined as a single audio stream. For example, the inbound audio stream from a receiver to a comparator comprises one talk path. The outbound audio stream from a comparator to a base

radio comprises one talk path. A full duplex ‘repeater’ audio stream (from receiver to comparator to base station) is two talk paths.

MLC 8000 bandwidth considerations are as follows:

- For 20 ms audio frames, the packet load is 50 per second and the bandwidth utilization is 81.6 Kbps
- These figures should be multiplied by the number of base radios

Contact your Motorola Solutions representative for bandwidth planning tools and assistance.

Network equipment loading requirements

The MLC 8000 uses G.711 vocoding. When a G.711 channel is added onto a switch, the bandwidth between the Hub/base radio or IP Simulcast Prime/Subsite is adjusted accordingly.

- Router equipment at the Prime Site and at each subsite must provide for the following packet loading capacity: 50 packets per second, multiplied by the number of talk paths (inbound and outbound). As a general rule, the sum of packet loading at each of the Subsite routers is approximately equal to the loading requirement on the router at the Prime Site.
- Remember to budget for additional packet loading capacity due to traffic associated with non-audio operations (file transfer, SNMP, NTP packet activity).

1.14.4 Other Considerations for Implementing MLC 8000s at Trunking Simulcast Sites

Perform a site audit of existing Trunked equipment to determine whether the Ethernet port and IP address capacity is available for the additional equipment required by the Analog IP Conventional Simulcast architecture. Each additional station and MLC 8000 device at the subsite or Base Radio Site requires an IP address and switch port.

Though not explicitly limited by the software or hardware, you should not expect to add more than ten Conventional stations to any single subsite or Base Radio Site as this is considered an uncertified configuration.

Additionally, Conventional base radios can be installed in a Trunking Expandable Site Subsystem if there are at most four open positions (existing functionality).

1.15 Simulcast Site Reference Considerations

The considerations for using a Simulcast Site Reference with the MLC 8000 devices include the following:

- For MLC 8000 devices (and conventional base radios) deployed in the Trunked IP simulcast system, the TRAK 9100 is used. If the TRAK 9100 does not have sufficient capacity, then you may want to install a certified distribution amplifier, adding the TRAK 9200 SSR Digital Distribution Unit (DDU) to expand the number of outputs.
- For MLC 8000 devices deployed in a conventional-only subsystem architecture or in K core systems, a Motorola Solutions-certified TRAK 8835 model is used, as long as the number of devices do not exceed eight (eight MLC 8000 devices and eight conventional base radios in a Hub). The MLC 8000 units are connected in a daisy-chain configuration when connected to the same TRAK. To expand the number of outputs from the TRAK 8835, add additional units or use a TRAK 9100.

Refer to “Installing MLC 8000 REF Input Signals for IP Simulcast System” in the *MLC 8000 Comparator Feature Guide* for instructions on how to cable the MLC 8000 to the Simulcast Site Reference.

For more information about these TRAK devices, refer to the *RF Site Technician Reference Guide* webhelp and the manufacturer’s documentation.

1.16

Jitter Buffer Considerations for Simulcast and Non-Simulcast

The MLC 8000 devices implement jitter buffers used to receive audio transmitted between the MLC 8000 Analog Comparator and the MLC 8000 Subsite Link Converter. The Ethernet link between the two devices carries G.711 encoded audio to and from the RF Site.

- In a Non-Simulcast operation, both devices require that their inbound jitter buffers be configured to compensate for network delay variation.
- In Simulcast operation, jitter buffer is not necessary at the MLC 8000 Subsite Link Converter because it receives a Simulcast Launch Time from the MLC 8000 Analog Comparator that already compensates for the network delay variation.

In Non-Simulcast configurations, the network jitter (IPDV) impacts the MLC 8000 Link Converter jitter buffer per Table 7: MLC 8000 Subsite Link Converter Jitter Buffer Settings on page 51.

The MLC 8000 Analog Comparator jitter buffer is used for Simulcast or Non-Simulcast operation and is shown in Table 8: MLC 8000 Analog Comparator Jitter Buffer Settings on page 51.

In a typical example, use the greatest value observed for the network delay variation, which is 20 ms, to determine the optimal jitter buffer size for the MLC 8000 Analog Comparator and for the MLC 8000 Subsite Link Converter as 40 ms. The jitter buffers on each of the MLC 8000 devices are configured with the same value for their respective jitter buffers.

The MLC 8000 devices can be configured with the settings in the following tables.

Table 7: MLC 8000 Subsite Link Converter Jitter Buffer Settings

MLC 8000 Subsite Link Converter Minimum Jitter Buffer Setting (ms)	Y.1541 IPDV Jitter Protection (ms)	Frame Size (ms)
20 (default)	10	20
40	20	20
50	30	20
70	40	20
90	50	20
100	60	20

Table 8: MLC 8000 Analog Comparator Jitter Buffer Settings

MLC 8000 Analog Comparator Minimum Jitter Buffer Setting (ms)	Y.1541 IPDV Jitter Protection (ms)	Frame Size (ms)
20 (default)	10	20

Table continued…

MLC 8000 Analog Comparator Minimum Jitter Buffer Setting (ms)	Y.1541 IPDV Jitter Protection (ms)	Frame Size (ms)
40	20	20
50	30	20
70	40	20
90	50	20
100	60	20

1.17 Configuring GTR 8000 Base Radios with CSS

Prerequisites: Configuration/Service Software (CSS) is required.

When and where to use: The following provides an overview of how to access CSS for GTR 8000 Base Radios configuration settings that are important to address for MLC 8000 implementations.

Procedure:

1. Connect to the base radio through an Ethernet port link.

   CAUTION: Changing base radio parameters can seriously impact performance. Refer to your custom configuration templates for configuration recommendations provided by your Motorola Solutions representatives when configuring the devices. Do not deviate from specified settings without following the proper change procedures for your organization.

2. Launch the Configuration/Service Software (CSS) application for the conventional base radio.
3. Read the configuration from the base radio by selecting **File**, **Read Configuration From Device**.
4. Click **Site** in the tree to open the Site window and complete the fields.
5. Click **Conventional Configuration** in the tree and then open the necessary windows in the folder. Complete the fields as required for your configuration. The following screens have essential parameters for the MLC 8000 device implementation. All parameters for setting up an RF site are not included.
   - Hardware Configuration
   - Options
   - Infrastructure Interface
   - Repeater Configuration.
   - Channel Configuration
6. Optional: Click on **Network and Security** in the tree to open the **Network Services Configuration** window and complete the fields as required for your configuration.
7. Save the configuration data to a new archive file using **Save As** on the **File** menu or overwrite the existing archive file by using **Save** on the **File** menu.
8. From the **File** menu bar, select **Write Configuration to Device** to write the configuration data to the base radio.
9. Refer to the “Conventional Site - ASTRO 7.12 and Later” section in the *Configuration/Service Software (CSS) Online Help* for detailed information (even when installing Digital only).
10. Close the CSS when you are done.

1.18
GTR 8000 Configuration Settings

Refer to Configuring GTR 8000 Base Radios with CSS on page 52 for the navigation steps to access the configuration windows.

This section describes GTR 8000 configuration settings that are important to address for MLC 8000 devices in an Analog IP Simulcast system or non Simulcast system.

NOTICE: Parameters in CSS include default parameters that provide a baseline that may be suitable for typical base radios. Contact your Motorola Solutions field representative, as necessary, when changing parameters from those shipped with your system to ensure maximum performance.

NOTICE: This section highlights settings that are important to the MLC 8000 implementations. This manual does not cover parameters for the base radio and subscribers that are not specific to the implementation of MLC 8000 devices.

NOTICE: Refer to the CSS for conventional configuration settings for digital and mixed-mode simulcast.

1.18.1
Conventional Configuration Settings for Analog Simulcast

Table 9: Conventional Configuration settings in CSS for Analog Simulcast

Window in CSS	Tab	Field	Value
Hardware Configuration	Hardware Configuration	Station Type	Select **Analog Only**.
		Frequency Reference	Select **External 5 MHz Back Panel** or **External 10 MHz Back Panel** (depending on the available frequency reference source) for the conventional standalone GTR 8000 Base Radio used in simulcast. **NOTICE:** Refer to "Frequency Reference" in the CSS Online Help.
Options	n/a	Wildcard	Select **Basic**.
Infrastructure Interface	Common	Comparator Type	Select **DIGI-TAC or MLC 8000**.
		Fallback In-Cabinet Repeat	The default is **Disabled**.
		Analog Simulcast Reverse Burst	Select **External** for an external source (such as the MLC 8000 Analog Comparator) generating the reverse burst.
		Status Tone	Select **Enabled**. **IMPORTANT:** If Status Tone is not enabled, the MLC 8000 Subsite Link Converter fails to recognize the GTR 8000 Base Radio.
		Tx Notch Filter	Select **Disabled**.

Table continued…

Window in CSS	Tab	Field	Value
		Rx Notch Filter	Select **Enabled**. Notch Filter must be enabled. If not, voice can cause status tone to be detected. **IMPORTANT:** In order for the Rx Notch Filter to do its intended function on the comparator, the status tone frequency should match the guard tone's frequency.
Channel Configuration	RF Parameters	Tx Frequency MHz	According to your GTR 8000 Base Radios.
		Rx Frequency (MHz)	According to your GTR 8000 Base Radios.
	Key Up Control	Analog RX Activation	If **PL** is selected, ensure that the PL selected in the GTR 8000 Base Radio is the same as the PL selected in the subscriber.
	Timeouts	Repeater Timeout Timer	Select **Disabled**.
	Filters and Alarms	Pre-emphasis	Select **Enabled**.
		De-emphasis	Select **Enabled**.
		Compander	Select either **Disabled** or **Enabled**.
	PL/DPL	Rx Squelch Type	Select **PL** (if needed for your system requirements) to match the setting of **PL** in the **PL/DPL** list of the Modify Device Configuration — IP Simulcast tab of the MLC 8000 Configuration Tool with Analog Display and Control.
Repeater Configuration	n/a	Repeater/ Base Operation	Select **Base**.
WildCard Tables	WildCard Tables	n/a	CSS automatically generates a WildCard table for Simulcast using Input 5.

1.18.2
Conventional Configuration Settings for Non Simulcast

Table 10: Conventional Configuration settings in CSS for Non Simulcast

Window in CSS	Tab	Field	Value
Hardware Configuration	Hardware Configuration	Station Type	Select **Analog Only**.
		Frequency Reference	Select **Internal Frequency Reference** for the following configuration: Conventional standalone GTR 8000 Base Radio with Transceiver Option Card (TOC) used in a Non-Simulcast or repeater site.

Table continued…

Window in CSS	Tab	Field	Value
			NOTICE: Refer to "Frequency Reference" in the CSS Online Help.
Options	n/a	Wildcard	Select **Basic**.
Infrastructure Interface	Common	Comparator Type	Select **ASTRO-TAC or GCM 8000/GRV 8000 with MLC 8000**.
		Fallback In-Cabinet Repeat	The default is **Disabled**.
		Status Tone	Select **Enabled**. **IMPORTANT:** If Status Tone is not enabled, the MLC 8000 Subsite Link Converter fails to recognize the GTR 8000 Base Radio.
		Tx Notch Filter	Select **Enabled** when tone remote (TRC) is used.
		Rx Notch Filter	Select **Enabled**. Notch Filter must be enabled. If not, voice can cause status tone to be detected. **IMPORTANT:** In order for the Rx Notch Filter to do its intended function on the comparator, the status tone frequency should match the guard tone's frequency.
Channel Configuration	RF Parameters	Tx Frequency MHz	According to your GTR 8000 Base Radios.
		Rx Frequency (MHz)	According to your GTR 8000 Base Radios.
	Key Up Control	Analog RX Activation	If **PL** is selected, ensure that the PL selected in the GTR 8000 Base Radio is the same as the PL selected in the subscriber.
	Timeouts	Repeater Timeout Timer	Select **Disabled**.
	Filters and Alarms	Pre-emphasis	Select **Enabled**.
		De-emphasis	Select **Enabled**.
		Compander	Select either **Disabled** or **Enabled**.
	PL/DPL	Rx Squelch Type	Select **PL** (if needed for your system requirements) to match the setting of **PL** in the **PL/DPL** list of the Modify Device Configuration — IP Simulcast tab of the MLC 8000 Configuration Tool with Analog Display and Control.
		Tx Squelch Type	Select CSQ only without PL\DPL (if needed by your system requirements).

Table continued…

Window in CSS	Tab	Field	Value
Repeater Configuration	n/a	Repeater/ Base Operation	Select **Base**.
WildCard Tables	WildCard Tables	n/a	CSS automatically generates a WildCard table for Simulcast using Input 5.

1.18.3
Alignment Screen Settings

IMPORTANT: If the Status Tone/ALMT Level Below Peak Audio setting for the GTR 8000 is not coordinated with the Input Level Differential setting for the MLC 8000 Subsite Link Converter, it results in wrong deviation output in repeater mode. In noisy conditions (around 12 dB SINAD and below), this results in audio quality degradation.

Table 11: Alignment Screen settings in CSS for Analog Simulcast

Window in CSS	Tab	Field	Value
Alignment Screen	Rx Wireline Alignment	Status Tone/ALMT Level Below Peak Audio	The result of subtracting this amount from Peak Audio Level should reflect the **Input level Differential (db)** setting for the MLC 8000 Subsite Link Converter. • Input Level Differential = Status Tone/ALMT Level Below Peak Audio + 4.4

NOTICE: See Audio Level Setting on page 232.

1.18.4
MLC 8000 Analog Comparator Parameters

The MLC 8000 Analog Comparator in certain subsystems require settings in the Configuration Tool that correspond to the GTR 8000 parameters in CSS.

This table applies to the following subsystems:

- ASTRO 25 Analog-Only IP-Based Simulcast Subsystem
- ASTRO 25 Circuit-Based Analog-Only Simulcast Voting Subsystems

Table 12: MLC 8000 Analog Comparator Parameters

GTR 8000 parameter in CSS	Corresponding MLC 8000 Analog Comparator parameter in the Configuration Tool	Subscriber must match the GTR 8000 and MLC 8000 parameters?
If Pre-Emphasis is Enabled	n/a — no impact	Yes

Table continued…

GTR 8000 parameter in CSS	Corresponding MLC 8000 Analog Comparator parameter in the Configuration Tool	Subscriber must match the GTR 8000 and MLC 8000 parameters?
If De-Emphasis is Enabled	Select the **Pre-Emphasis** check box in the Modify Device Configuration window for MLC 8000 Analog Comparator (VGU), IP Simulcast tab.	Yes
If Compander is Enabled	If compression* is enabled, select the **Compression** check box in the Modify Device Configuration window for MLC 8000 Analog Comparator (VGU), IP Simulcast tab.	Yes
Rx Squelch Type = PL	In the **PL/DPL** list, select **PL** in the Modify Device Configuration — IP Simulcast tab of the MLC 8000 Configuration Tool with Analog Display and Control.	Yes

NOTICE: *Compression is a technique that can be used to reduce the back ground noise level relative to voice signals. The effectiveness of the technique diminishes as RF wavelength increases. So, more benefit is expected in a 900 MHz system than a UHF-based system. As a consequence of utilizing compression, a listener may hear artificial characteristics in the voice signal that may be deemed unpleasant, but do not disrupt the ability to communicate. The choice of whether to use compression is dictated by the RF band in use and the preference to hear natural analog audio versus the need to reduce background noise.

1.19 Configuration Manager Settings

Another prerequisite is to set up the Conventional Channels (in *Provisioning Manager User Guide* for ASTRO® 25 M series and L series zone core systems, and in Configuration Manager for K cores).

The following are parameters that are especially important for Analog IP Simulcast:

- **Site Type**: Combination GCM 8000 or GRV 8000
- **Co-located Site Type**: Multisite Subsystem
- **CCGW Configuration**: Unique ID number and unique Alias name

CAUTION: Analog Link Monitor Tone (ALMT) is only supported on Conventional Mixed Mode channels with the V.24 interface. It is not supported on Conventional Mixed Mode channels with the Ethernet interface and is not supported on analog conventional channels. Do not configure ALMT for the Site Gateway (Conventional Channel Interface) when using mixed mode channels with an interface type of Ethernet.

For more information, refer to the *Provisioning Manager User Guide* and *Configuration Manager for Conventional Systems User Guide*.

1.20 Installing MLC 8000s with Off-Site Preconfiguration

Prerequisites: Review the following prerequisites:

- See Implementing MLC 8000s on page 31.
- Set up the Conventional Channels (in *Provisioning Manager User Guide* for ASTRO® 25 M series and L series zone core systems, and in Configuration Manager for K cores). See Configuration Manager Settings on page 57.

- For MLC 8000 devices deployed in a conventional-only subsystem architecture or in K core systems, a Motorola Solutions-certified TRAK 8835 model is used. To expand the number of outputs from the TRAK 8835, add additional units or use a TRAK 9100. If the TRAK 9100 does not have sufficient capacity, then you may want to install a certified distribution amplifier, adding the TRAK 9200 SSR Digital Distribution Unit (DDU) to expand the number of outputs.

  NOTICE: For MLC 8000 Subsite Link Converters connected to Rx only BRs, the time reference is not needed.

- If the optional MCN Server 8000 and Client Software are joined to the ASTRO® 25 domain, then implementation requires locating the *ASTRO 25 Windows Supplemental* media and the instructions for joining a domain, from the *Authentication Services Feature Guide*.

When and where to use: Off-site configuration is intended to accomplish as much as possible to minimize the technician time at the RF sites.

Process:

1. If analog configuration, then prestage the MLC 8000 Analog Comparators and MLC 8000 Subsite Link Converters.
   a. Obtain the software and login information:
      - MLC 8000 Configuration Tool
      - Login and password information
   b. Obtain/build necessary cables according to the equipment cabling tables.
      - Grounding wire
      - Cat 5e shielded LAN cable
      - FKN8718, GPS connector for the reference signal
      - FKN3000A, dongle adapter
      - Build all other cables, using the following information:
        - ASTRO 25 Analog-Only Non-Simulcast Voting Subsystem on page 63
        - ASTRO 25 Analog-Only IP-Based Simulcast Subsystem on page 75
        - ASTRO 25 Circuit-Based Analog-Only Simulcast Voting Subsystem on page 129
        - Circuit-Based Analog-Only Simulcast Voting Subsystem on page 139
        - Analog-Only IP-Based Simulcast Voting Subsystem on page 149
        - MLC 8000 Radio Ports Cabling on page 161
   c. Obtain the necessary tools and equipment, including general tools needed to install, optimize, and service equipment.

      See “General Installation/Troubleshooting Tools” in the *MLC 8000 Comparator Feature Guide*.
2. If mixed mode configuration, perform the following steps:

   Prestage the mixed mode comparators: MLC 8000 Mixed Mode Comparators and MLC 8000 Subsite Link Converter.

   a. Obtain the software and login information:
      - MLC 8000 Configuration Tool
      - Login and password information
   b. Obtain/build necessary cables according to the equipment cabling tables.
      - Grounding wire

- Cat 5e shielded LAN cable
- Build all other cables
  - ASTRO 25 Mixed-Mode Non-Simulcast Voting Subsystem on page 89
  - MLC 8000 Radio Ports Cabling on page 161

c Obtain the necessary tools and equipment, including general tools needed to install, optimize, and service equipment.

See “General Installation/Troubleshooting Tools” in the *MLC 8000 Comparator Feature Guide*.

Prestage the mixed mode GCM 8000/GRV 8000 Digital Comparators.

a Obtain the software and login information:

- appropriate cables
- SWDL, CSS, UNC
- Login and password information

See “Pre-Installation Tasks” in the *RF Site Technician Guide* and *RF Site Technician Reference Guide*.

b Obtain the necessary tools and equipment, including general tools needed to install, optimize, and service equipment.

See “General Installation/Troubleshooting Tools” in the the *RF Site Technician Guide* and *RF Site Technician Reference Guide*.

3 If digital configuration, then prestage the MLC 8000 Subsite Link Converters.

a Obtain the software and login information:

- MLC 8000 Configuration Tool
- Login and password information

b Obtain/build necessary cables according to the equipment cabling tables.

- Grounding wire
- Cat 5e shielded LAN cable
- Build all other cables
  - ASTRO 25 Digital-Only Simulcast Voting Subsystem on page 119
  - MLC 8000 Radio Ports Cabling on page 161

c Obtain the necessary tools and equipment, including general tools needed to install, optimize, and service equipment.

See “General Installation/Troubleshooting Tools” in the *MLC 8000 Comparator Feature Guide*.

4 Install the MLC 8000 Configuration Tool with Analog Display and Control application to service laptops.

See “Installing the MLC 8000 Configuration Tool with Analog Display and Control” in the *MLC 8000 Configuration Tool User Guide*. Complete the full process even if individual steps are not called out in this process.

NOTICE: Obtain the installation CD for the MLC 8000 Configuration Tool, or the version of the software you want to install from Motorola Online.

5 Consider the options you have to set up the MLC 8000s:

If…	Then…
Option 1: IF the system is prestaged off-site (not at the RF site), and IP address and channel cluster information is available,	Provision the actual IP address per the IP plan, configure the channel cluster (IP simulcast or Non IP simulcast), and download new software to the device (if available). Continue to step 6
Option 2. IF the system is prestaged off-site (not at the RF site), and IP address and channel cluster information is not available,	Use the default IP address, provision a 'dummy' cluster, and download new software to the device (if available). Continue to step 7
Option 3. IF the system is not prestaged off-site,	Continue to step 8

NOTICE: Download new software to the MLC 8000 device if your Motorola Solutions representative recommends a newer software version. New software is available on the Motorola Online website (http://businessonline.motorolasolutions.com).

6 Option 1: If the system is prestaged off-site (not at the RF site), and IP address and channel cluster information is available, then see the following sections for your system type.

- For ASTRO 25 Analog-Only Non-Simulcast Voting Subsystem, see Configuring MLC 8000 Devices with the MLC 8000 Configuration Tool on page 68
- For ASTRO 25 Analog-Only IP-Based Simulcast Subsystem, see Configuring MLC 8000 Devices with the MLC 8000 Configuration Tool on page 80
- For ASTRO 25 Mixed-Mode Non-Simulcast Voting Subsystem, see Configuring MLC 8000 Devices with the MLC 8000 Configuration Tool on page 94
- For ASTRO 25 Digital-Only Simulcast Voting Subsystem (With QUANTAR®), see Configuring MLC 8000 Devices with the MLC 8000 Configuration Tool on page 122
- For ASTRO 25 Circuit-Based Analog-Only Simulcast Voting Subsystem, see Configuring MLC 8000 Devices with the MLC 8000 Configuration Tool on page 132
- For Circuit-Based Analog-Only Simulcast Voting Subsystem, see Configuring MLC 8000 Devices with the MLC 8000 Configuration Tool on page 141
- For Analog-Only IP-Based Simulcast Voting Subsystem, see Configuring MLC 8000 Devices with the MLC 8000 Configuration Tool on page 153

NOTICE: You can only perform these tasks if you have the necessary configuration information. If not, configuration must be done onsite. The purpose of this option is to perform some of the tasks during prework to save time.

a Follow the directions for the appropriate option.

b Back up the configuration on the same Configuration Tool PC to be loaded to the on-site Configuration Tool PC.

“Backing Up the MLC 8000 System Configuration” in the *MLC 8000 Configuration Tool User Guide*.

7 Option 2: If the system is prestaged off-site (not at the RF site) and IP address and channel cluster information is not available, then use the default IP address, provision a 'dummy' cluster, and download new software to the device.

NOTICE: This option applies to a device from the factory that ships with a particular software version, and your Motorola Solutions representative recommends a newer software version.

a To provision an initial IP address, follow the process to assign the IP addresses for MLC 8000 devices during prestaging.

See “Prestaging IP Addresses for MLC 8000 Devices from the Factory” in the *MLC 8000 Configuration Tool User Guide*.

b To software upgrade a device that just came out of the factory, follow the process for upgrading software during prestaging.

NOTICE: Decide whether it makes sense to perform the software update as part of prework, instead of when building the cluster on-site with all devices networked together.

See “Updating Software during Prestaging for MLC 8000 Devices from the Factory” in the *MLC 8000 Configuration Tool User Guide*.

c To provision an initial IP address and software upgrade a device that just came out of the factory, follow the process to upgrade the software and assign the IP address during prestaging.

“Updating Software and Assigning IP Addresses during Prestaging for MLC 8000 Devices from the Factory” in the *MLC 8000 Configuration Tool User Guide*.

8 Option 3: If the system is not pre-staged off-site, then continue to implementation sequences for your system type.

- ASTRO 25 Analog-Only Non-Simulcast Voting Subsystem on page 63
- ASTRO 25 Analog-Only IP-Based Simulcast Subsystem on page 75
- ASTRO 25 Mixed-Mode Non-Simulcast Voting Subsystem on page 89
- ASTRO 25 Digital-Only Simulcast Voting Subsystem on page 119
- ASTRO 25 Circuit-Based Analog-Only Simulcast Voting Subsystem on page 129
- Circuit-Based Analog-Only Simulcast Voting Subsystem on page 139
- Analog-Only IP-Based Simulcast Voting Subsystem on page 149

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Chapter 2

ASTRO 25 Analog-Only Non-Simulcast Voting Subsystem

This section outlines the installation and configuration procedures required to install MLC 8000s; each process step refers to the appropriate documentation provided with your ASTRO® 25 system for the detailed procedure. A high-level diagram and equipment cabling tables are provided for the subsystem.

2.1 Implementing an ASTRO 25 Analog-Only Non-Simulcast Voting Subsystem

Prerequisites: See Implementing MLC 8000s on page 31.

When and where to use: Follow these sequences when implementing MLC 8000s in an ASTRO® 25 Analog-Only Non-Simulcast Voting subsystem.

Process:

1. Perform the tasks to install equipment at the prime site. See Installing Equipment for Each Channel in the Prime Site on page 63.
2. Perform the tasks to install equipment at subsites. See Installing Equipment For Each Channel in Subsites on page 66.
3. Configure the MLC 8000 devices with the MLC 8000 Configuration Tool. See Configuring MLC 8000 Devices with the MLC 8000 Configuration Tool on page 68.
4. Verify the installation and configuration performed in this implementation. See Verifying the Installation and Configuration on page 70.

2.1.1 Installing Equipment for Each Channel in the Prime Site

When and where to use: Use for Prime Sites for ASTRO® 25 Analog-Only Non-Simulcast Voting Subsystems.

Process:

1. Install a Site Gateway (Conventional Channel Interface) at the prime site if adding G.711 to the existing configuration and the current system does not have a CCGW. Connects to the switch.

   NOTICE: A Site Gateway (Conventional Channel Interface) is also known as a Conventional Channel Gateway (CCGW). A CCGW can support four channels, with a maximum of three CCGWs at the prime site. A Conventional Hub site can support up to 10 LAN-Only CCGWs. Requires one four-wire E&M module (installed in the analog slot).

   See “G-Series Hardware Installation Process” in the *RF Site Technician* webhelp.
2. Configure Site Gateways (Conventional Channel Interface).

   See “GGM 8000 Configuration” in the *GGM 8000 System Gateway Feature Guide*.
3. Install the MLC 8000 Analog Comparator.
   a. Install the MLC 8000 in a rack or cabinet.

See “Installing MLC 8000” in the *MLC 8000 Comparator Feature Guide*.

b Mount the MLC 8000 on a tray.

See “Mounting MLC 8000 on the Tray” in the *MLC 8000 Comparator Feature Guide*.

c Ground the MLC 8000 on a tray.

See “Grounding an MLC 8000 in a Tray” in the *MLC 8000 Comparator Feature Guide*.

d (For rack-mount installation) Install the MLC 8000 tray in a rack.

See “Installing MLC 8000 Tray in Rack” in the *MLC 8000 Comparator Feature Guide*.

e (For cabinet-mount installation) Install the MLC 8000 tray in a cabinet.

See “Installing MLC 8000 Tray in Cabinet” in the *MLC 8000 Comparator Feature Guide*.

4 Ground the MLC 8000 tray installed in the rack or cabinet.

See “Installing MLC 8000” (step 2) in the *MLC 8000 Comparator Feature Guide*.

5 Connect the MLC 8000 to power by connecting the DC cable of the power supply unit to the DC inlet of the MLC 8000.

See “Installing MLC 8000” (step 3) in the *MLC 8000 Comparator Feature Guide*.

6 Is MAC Port Lockdown used on the system? (Disable MAC Port Lockdown if applicable)

If…	Then…
Yes	For core systems, disable MAC Port Lockdown on the site LAN switch. See “Disabling MAC Port Lockdown Using an HP Switch Service Port” in the *MAC Port Lockdown Feature Guide*.
	For M series and L series zone core systems, disable MAC Port Lockdown on the site LAN switch with a Saved Command in UNC. See “Disabling MAC Port Lockdown Using a VoyenceControl Template” in the *MAC Port Lockdown Feature Guide*.
	Determine the switch configuration, to find an unused port. See “HP Switches – Determining Port Connections in ASTRO 25 Systems” in the *System LAN Switches Feature Guide*.
No	For K core systems, enable and configure unused ports on switches. Enable all the ports on the switches. See “Enabling/Disabling Ports on HP Switches Using Local Access” in the *MAC Port Lockdown Feature Guide*.
	For M series and L series zone core systems, enable and configure unused ports on switches. See “Enabling/Disabling Ports on HP Switches Using VoyenceControl” in the *MAC Port Lockdown Feature Guide*.

7 Connect the MLC 8000 Analog Comparator to the switch.

See ASTRO 25 Analog-Only Non-Simulcast Voting Subsystem Equipment Cabling on page 72.

8 Connect the MLC 8000 Analog Comparator to Site Gateways (Conventional Channel Interface). It is a 4-wire connection.

See ASTRO 25 Analog-Only Non-Simulcast Voting Subsystem Equipment Cabling on page 72.

9 Optional: Set up MOSCAD NFM. This task is only applicable if MOSCAD NFM is available.

See Setting Up MOSCAD Network Fault Management (NFM) Monitoring on page 37.

10 Optional: Connect the MLC 8000 Analog Comparator to the SDM3000 RTU. This task is only applicable if MOSCAD NFM is available.

See Cabling MLC 8000 to SDM3000 RTU on page 40.

11 Push new configuration files down to the switches and GGM 8000 gateways.

- For K core systems (distributed conventional architecture), use Configuration Manager to push the configuration files. See “Downloading the Full Configuration to a Device” in the *Configuration Manager for Conventional Systems User Guide*.

  NOTICE: For a K core system, the service PC is used to install the configuration files for the gateways and switches.

- For M series and L series zone core systems, use UNC to push the configuration files. See “Distributing Configurations For Transport Devices through the UNC Wizard” in the *Unified Network Configurator User Guide*.

12 Reboot the gateways. Using a terminal program, type **rb** (ReBoot) and press ENTER.

The switch reboots automatically after pushing the new configuration.

13 Turn on power to the MLC 8000 by connecting the AC cord of the power supply unit to the AC wall-mount power outlet (110-240 VAC, 50/60 Hz).

NOTICE: The AC power outlet should be as near as possible to the equipment and should be accessible. Ensure that the cable is not routed with tension.

See “Installing MLC 8000” (step 6) in the *MLC 8000 Comparator Feature Guide*.

a Verify the MLC 8000 power LED turns RED (which indicates the MLC 8000 is in booting state) and after a while, it turns GREEN.

b (Optional) If the MOSCAD NFM subsystem is available in the system, then you can also verify that the MOSCAD NFM correctly indicates the presence of the MLC 8000 by pin # 1 at the VIP connector (or else the wiring to the SDM3000 RTU may be wrong). Validate that the correct indication of each MLC 8000 power up is shown in the GMC Application, either on the GMC or on the GWS.

14 Install the MLC 8000 Configuration Tool with Analog Display and Control to a service laptop (if you did not do so in the off-site preconfiguration).

See “Installing the MLC 8000 Configuration Tool with Analog Display and Control” in the *MLC 8000 Configuration Tool User Guide*. Complete the full process even if individual steps are not called out.

NOTICE: Obtain the installation CD for the MLC 8000 Configuration Tool, or the version of the software you want to install from Motorola Online. Install the MLC 8000 Configuration Tool on your own laptops in the field.

15 (Optional) Install the MCN Server 8000™ Remote Comparator Display Software. See Setting Up the MCN Server 8000 Remote Comparator Display Software on page 35.

NOTICE: If available, this software can be installed at any time. No configuration at the MLC 8000 is necessary.

16 Change the MLC 8000 factory programmed passwords (if needed).

See “Changing the MLC 8000 Password” in the *MLC 8000 Configuration Tool User Guide*.

17 Define a reset password key if necessary to harden the reset password mechanism.

See “Assigning Reset Password Key” in the *MLC 8000 Configuration Tool User Guide*.

IMPORTANT: Changing the password must occur on-site since passwords are secured and not exposed to Motorola Solutions. The passwords can be changed either locally using the Local O&M port (serial connection) or remotely using the SSH option in PuTTY to connect to the Extranet LAN port. If you change the password, then you must push the same password to all devices (this is mandatory). Use the same password for all the devices of the channel cluster.

Installation of equipment and software for each channel in the prime site is complete.

Postrequisites: See Installing Equipment For Each Channel in Subsites on page 66.

2.1.2
Installing Equipment For Each Channel in Subsites

When and where to use: Use for subsites in an ASTRO® 25 Analog-Only Non-Simulcast Voting subsystem.

Process:

1. Install the MLC 8000 Subsite Link Converter.
   a. Install the MLC 8000 in a rack or cabinet.
      See “Installing MLC 8000” in the *MLC 8000 Comparator Feature Guide*.
   b. Mount the MLC 8000 on a tray.
      See “Mounting MLC 8000 on the Tray” in the *MLC 8000 Comparator Feature Guide*.
   c. Ground the MLC 8000 on a tray.
      See “Grounding an MLC 8000 in a Tray” in the *MLC 8000 Comparator Feature Guide*.
   d. (For rack-mount installation) Install the MLC 8000 tray in a rack.
      See “Installing MLC 8000 Tray in Rack” in the *MLC 8000 Comparator Feature Guide*.
   e. (For cabinet-mount installation) Install the MLC 8000 tray in a cabinet.
      See “Installing MLC 8000 Tray in Cabinet” in the *MLC 8000 Comparator Feature Guide*.
2. Ground the MLC 8000 tray installed in the rack or cabinet.
   See “Installing MLC 8000” (step 2) in the *MLC 8000 Comparator Feature Guide*.
3. Connect the MLC 8000 to power by connecting the DC cable of the power supply unit to the DC inlet of the MLC 8000.
   See “Installing MLC 8000” (step 3) in the *MLC 8000 Comparator Feature Guide*.
4. Is MAC Port Lockdown used on the system? (Disable MAC Port Lockdown if applicable)

If…	Then…
Yes	For K core systems, disable MAC Port Lockdown on the site LAN switch. See “Disabling MAC Port Lockdown Using an HP Switch Service Port” in the *MAC Port Lockdown Feature Guide*.
	For M series and L series zone core systems, disable MAC Port Lockdown on the site LAN switch with a Saved Command in UNC. See “Disabling MAC Port Lockdown Using a VoyenceControl Template” in the *MAC Port Lockdown Feature Guide*.
	Determine the switch configuration, to find an unused port.

If…	Then…
	See “HP Switches – Determining Port Connections in ASTRO 25 Systems” in the *System LAN Switches Feature Guide*.
No	For K core systems, enable and configure unused ports on switches. Enable all the ports on the switches. See “Enabling/Disabling Ports on HP Switches Using Local Access” in the *MAC Port Lockdown Feature Guide*.
	For M series and L series zone core systems, enable and configure unused ports on switches. See “Enabling/Disabling Ports on HP Switches Using VoyenceControl” in the *MAC Port Lockdown Feature Guide*.

5 Connect the MLC 8000 Subsite Link Converter to the switch.

See ASTRO 25 Analog-Only Non-Simulcast Voting Subsystem Equipment Cabling on page 72.

6 Connect the MLC 8000 Subsite Link Converter to a base radio. It is a 4-wire connection, or a 2-wire connection also works when connected to a QUANTAR® Satellite Receiver.

See ASTRO 25 Analog-Only Non-Simulcast Voting Subsystem Equipment Cabling on page 72.

7 Configure the base radios to interface with the MLC 8000 devices.

See Conventional Configuration Settings for Non Simulcast on page 54.

8 (Optional) Set up MOSCAD NFM. This task is only applicable if MOSCAD NFM is available.

See Setting Up MOSCAD Network Fault Management (NFM) Monitoring on page 37.

9 (Optional) Connect the MLC 8000 Analog Comparator to the SDM3000 RTU. This task is only applicable if MOSCAD NFM is available.

See Cabling MLC 8000 to SDM3000 RTU on page 40.

10 Push new configuration files down to the switches and GGM 8000 gateways.

- For K core systems (distributed conventional architecture), use Configuration Manager to push the configuration files. See “Downloading the Full Configuration to a Device” in the *Configuration Manager for Conventional Systems User Guide*.

  NOTICE: For a K core system, the service PC is used to install the configuration files for the gateways and switches.

- For M series and L series zone core systems, use UNC to push the configuration files. See “Distributing Configurations For Transport Devices through the UNC Wizard” in the *Unified Network Configurator User Guide*.

11 Reboot the gateways. Using a terminal program, type **rb** (ReBoot) and press ENTER.

The switch reboots automatically after pushing the new configuration.

12 Turn on power to the MLC 8000 by connecting the AC cord of the power supply unit to the AC wall-mount power outlet (110-240 VAC, 50/60 Hz).

NOTICE: The AC power outlet should be as near as possible to the equipment and should be accessible. Ensure that the cable is not routed with tension.

See “Installing MLC 8000” (step 6) in the *MLC 8000 Comparator Feature Guide*.

a Verify the MLC 8000 power LED turns RED (which indicates the MLC 8000 is in booting state) and after a while, it turns GREEN.

b (Optional) If the MOSCAD NFM subsystem is available in the system, then you can also verify that the MOSCAD NFM correctly indicates the presence of the MLC 8000 by pin # 1 at the VIP connector (or else the wiring to the SDM3000 RTU may be wrong). Validate that the correct indication of each MLC 8000 power up is shown in the GMC Application, either on the GMC or on the GWS.

Installation of equipment for each channel in the subsite is complete.

Postrequisites: See Configuring MLC 8000 Devices with the MLC 8000 Configuration Tool on page 68.

2.1.3
Configuring MLC 8000 Devices with the MLC 8000 Configuration Tool

Prerequisites: Ensure both the MLC 8000 Subsite Link Converters and MLC 8000 Analog Comparators are cabled to switches. So, configuration can only be performed AFTER going to each remote site to cable the MLC 8000 Subsite Link Converters to switches and base radios.

When and where to use: Follow these tasks to configure the MLC 8000 devices using a service laptop with the MLC 8000 Configuration Tool with Analog Display and Control.

Process:

1 Choose one of the following three options to configure the MLC 8000 devices:

If…	Then…
If the system is pre-staged off site (not at the RF site), and the IP address and channel cluster information is available,	When off site, perform the following options:step 2 - step 12. When on site, retrieve the saved configuration, go to step 13 to finish the configuration.
If the system is pre-staged off site (not at the RF site), and IP address and channel cluster information is not available,	On site use these steps to update the configuration and provide the actual IP addresses and channel cluster information, and then set up associations.
If the system is not pre-staged off site,	Perform all the steps here.

2 Configure the MLC 8000 device IP addresses in the MLC 8000 Configuration Tool (if modification is needed).

See “Provisioning the Initial IP Address for an MLC 8000 Device” in the *MLC 8000 Configuration Tool User Guide* .

3 Create and define a channel cluster in the MLC 8000 Configuration Tool.

NOTICE: Prerequisite: IP addresses have been assigned to the MLC 8000 Analog Comparators and MLC 8000 Subsite Link Converters.

See “Creating a Conventional Channel Cluster” in the *MLC 8000 Configuration Tool User Guide*.

4 Define the Site ID and Site Name for the new channel cluster.

See “Entering Site ID and Site Name for a Conventional Channel Cluster” in the *MLC 8000 Configuration Tool User Guide*.

5 Provide the name and type for the channel cluster.

See “Defining a Conventional Channel Cluster” in the *MLC 8000 Configuration Tool User Guide*.

6 Define subsites in the subsite list. The Subsite ID and associated name are required for the system to work.

See “Modifying the Conventional Channel Cluster Subsite List” in the *MLC 8000 Configuration Tool User Guide*.

7 Add the MLC 8000 Analog Comparator (VGU) to the channel cluster.

See “Adding an MLC 8000 Analog or Mixed Mode Comparator to a Conventional Channel Cluster” in the *MLC 8000 Configuration Tool User Guide* manual.

NOTICE: You can complete the configuration now or download the software now, then configure after the software upgrade is complete. In either case, save the changes by clicking **Write to Device**. Result: The device restarts. After the restart, you can upgrade the software if necessary.

8 Optional: Download the MLC 8000 device software if available (if you are unsure that you have the latest version or it was not downloaded in off-site prestaging). Perform this task if your Motorola Solutions representative recommends a newer software version. New software is available at Motorola Online (http://businessonline.motorolasolutions.com).

NOTICE: The software download must be performed separately for each MLC 8000 device in the channel cluster.

See “Downloading a Specific Software Update to an MLC 8000 Device” in the *MLC 8000 Configuration Tool User Guide*.

9 Configure the MLC 8000 Analog Comparator.

See “Configuring an MLC 8000 Analog Comparator for a Non IP Simulcast System” in the *MLC 8000 Configuration Tool User Guide*.

10 Add an MLC 8000 Subsite Link Converter to a conventional channel cluster.

See “Adding an MLC 8000 Subsite Link Converter to a Conventional Channel Cluster” in the *MLC 8000 Configuration Tool User Guide*.

NOTICE: You can complete the configuration now or download the software now, then configure after the software upgrade is complete. In either case, save the changes by clicking **Write to Device**. Result: The device restarts. After the restart, you can upgrade the software if necessary.

11 Optional: Download the MLC 8000 device software if available (if you are unsure that you have the latest version or it was not downloaded in off-site prestaging). Perform this task if your Motorola Solutions representative recommends a newer software version. New software is available at Motorola Online (http://businessonline.motorolasolutions.com).

NOTICE: The software download must be performed separately for each MLC 8000 device in the channel cluster.

See “Downloading a Specific Software Update to an MLC 8000 Device” in the *MLC 8000 Configuration Tool User Guide*.

12 Configure the MLC 8000 Subsite Link Converter (and associated AGU ports).

a Within the procedure to configure the MLC 8000 Subsite Link Converter, you configure the ports associated with the VGU (select the AGU in the Configuration Tool).

See “Configuring an MLC 8000 Subsite Link Converter for a Non IP Simulcast System” in the *MLC 8000 Configuration Tool User Guide*.

NOTICE: When you configure the MLC 8000 Analog Comparator (VGU) ports, you can repeat this step for as many BR locations as your system has.

NOTICE: Base Radio Properties Tab, Link Type = 4 Wire (with TRC or External PTT). This field is enabled for Non IP simulcast systems.

13 Configure the channel (set up associations). Associate base radios with each MLC 8000 Analog Comparator (VGU).

See “Associating a Base Radio with an MLC 8000 Analog Comparator” in the *MLC 8000 Configuration Tool User Guide*.

NOTICE: This loop can be repeated up to four times.

14 Set channel cluster parameters for all MLC 8000s (including G.711, NTP, and timeout parameters).

See “Setting Channel Cluster Parameters” in the *MLC 8000 Configuration Tool User Guide*.

NOTICE: Prerequisite: All devices of the channel cluster have been added and configured, so that MLC 8000 Configuration Tool downloads the channel cluster parameters to all these devices.

15 Optional: Configure the channel transmitters steering associations. Enable and configure transmitter steering and regional voting tables for the MLC 8000 Analog Comparator (VGU). See “Management of the Transmitter Steering Tables for an MLC 8000 Analog Comparator” in the *MLC 8000 Configuration Tool User Guide*.

The MLC 8000 devices are configured.

Postrequisites: See Verifying the Installation and Configuration on page 70.

2.1.4
Verifying the Installation and Configuration

Process:

1 Is MAC Port Lockdown used on the system? Run MAC Port Lockdown if applicable.

If…	Then…
Yes	For K core systems, run MAC Port Lockdown on the switches. See “Locking HP Switch Ports” in the *MAC Port Lockdown Feature Guide*.
	For M series and L series zone core systems, run MAC Port Lockdown on the switches. See “Performing MAC Port Lockdown on HP Switches” in the *MAC Port Lockdown Feature Guide*.
No	For K core systems, disable open (unused) ports on switches. For each of the HP switches, every open port (no device connected) must be disabled. See “Enabling/Disabling Ports on HP Switches Using Local Access” in the *MAC Port Lockdown Feature Guide*.
	For M series and L series zone core systems, disable open (unused) ports on switches. See “Locking HP Switch Ports Using a VoyenceControl Template” in the *MAC Port Lockdown Feature Guide*.

2 Verify connectivity.

a View the channel cluster to verify the links. (Icons for the MLC 8000 Analog Comparator and its MLC 8000 Subsite Link Converters are yellow to indicate connection with the Configuration Tool and the device).

See “Viewing a particular Channel Cluster Tree” in the *MLC 8000 Configuration Tool User Guide*.

b Verify that the MLC 8000 Analog Comparator is voting the base radios by observing at the Analog Display and Control Application. For example, the LED to the left of the base radio should not be gray, the radio state is either **Active** or **No activity**, and the SQM signal strength should not be **N/A**.

See “Opening the Analog Display and Control Application with MLC 8000 Analog Comparator Selected” in the *MLC 8000 Configuration Tool User Guide*.

3 Confirm the status of the links.

Devices		Procedure References
MLC 8000 Analog Comparator to MLC 8000 Subsite Link Converter (IP)		
	Check the COMM LED, which is Red if at least one link connection to the MLC 8000 Link Converter port has failed.	See “MLC 8000 Analog Comparator LEDs” in the *MLC 8000 Comparator User Guide*.
	Use MOSCAD NFM. Only if the MOSCAD NFM subsystem is available in your system.	See “MLC 8000 Analog Comparator — MOSCAD NFM Events Troubleshooting (Non IP Simulcast System)” in the *MLC 8000 Comparator User Guide*.
	Pull a log file of the device for error messages.	See “MLC 8000 Device Logs and Recommended Actions” in the *MLC 8000 Comparator User Guide*.
MLC 8000 Subsite Link Converter to Base Radio (4-wire)		
	Check the Port 1-4 LED. On the MLC 8000, the Port 1-4 LED is Red indicating the link to the base radio failed.	See “MLC 8000 Link Converter LEDs” in the *MLC 8000 Comparator User Guide*.
	Use MOSCAD NFM. Only if the MOSCAD NFM subsystem is available in your system. Check for a VIP 4 event, which indicates a link to a BR has failed. One MLC 8000 Subsite Link Converter connects to four base radios, but it has one VIP to indicate status. So, check each of the four connections.	See “MLC 8000 Link Converter — MOSCAD NFM Events Troubleshooting (Non IP Simulcast System) ” in the *MLC 8000 Comparator User Guide*.
	Pull a log file of the device for error messages.	See “MLC 8000 Device Logs and Recommended Actions” in the *MLC 8000 Comparator User Guide*.
MLC 8000 Analog Comparator to Site Gateways (Conventional Channel Interface) (4-wire)		
	To verify, make a call from the console, and verify that the BR is transmitting.	

4 Verify by making calls. This is a general task to perform.

a Test the operation of the system by making calls from the radios and ensuring call completion and quality.

b Verify that you can make a Console to Radio, Radio to Console, and Radio to Radio analog call.

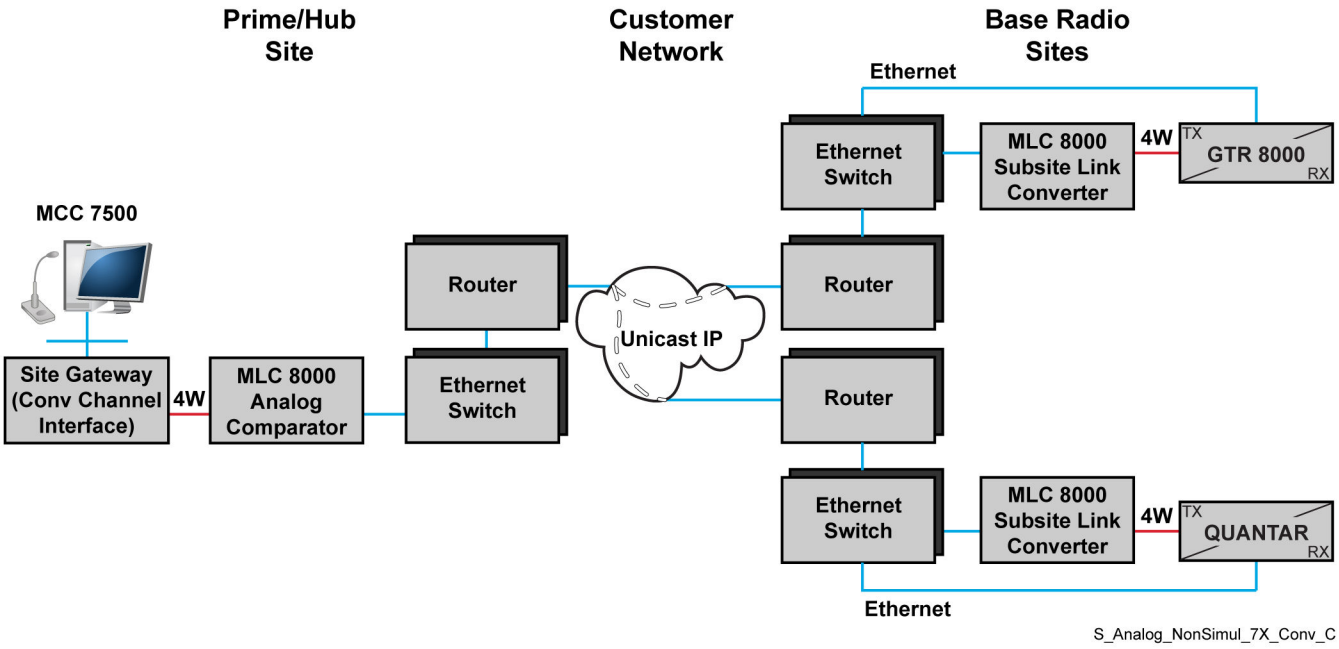
Postrequisites: Calibrate/optimize the Non-Simulcast system after the system is running properly.

- See “Performing Calibration for an MLC 8000 Subsite Link Converter” in the *MLC 8000 Configuration Tool User Guide*.
- See “Performing Calibration for an MLC 8000 Analog Comparator” in the *MLC 8000 Configuration Tool User Guide*.

2.2 ASTRO 25 Analog-Only Non-Simulcast Voting Subsystem Equipment Cabling

This section provides a high-level subsystem diagram and equipment cabling tables from the MLC 8000 device to other system devices. A port description table lists the system devices and refers to the device documentation for more information.

Figure 7: ASTRO 25 Analog-Only Non-Simulcast Voting Subsystem Diagram



IMPORTANT: High-level diagrams are provided as examples only and are not to be used for system planning purposes. SDM3000 RTUs are not shown in the diagram, but would be part of the system if the optional MOSCAD NFM subsystem is available and would be connected to the MLC 8000 devices.

NOTICE: This table provides part numbers for cables that are orderable from Motorola Solutions. Create the remaining cables using the provided pinout tables. See MLC 8000 Radio Ports Cabling on page 161.

Table 13: Equipment Cabling for ASTRO 25 Analog-Only Non-Simulcast Voting Subsystem

From MLC 8000 Analog Comparator (Prime Site)		To Destination device:		
Port	**Connector Type**	**Device**	**Connector Type**	**Cable Description**
External LAN PoE	RJ45	LAN Switch	RJ45	RJ45-to-RJ45 one-to-one cable
VIP	RJ45	SDM3000 RTU	I/O Wiring Punch Block	MLC 8000 to MOSCAD NFM Cable on page 161
R1 4W-E&M	RJ45	Site Gateway (Conventional Channel Interface), 4W E&M (8D…8A)	RJ45	4W MLC 8000 (Analog Comparator) to Site Gateway (Conventional Channel Interface) Cable on page 173
From MLC 8000 Subsite Link Converter (Subsite)		To Destination device:		
Port	Connector Type	Device	Connector Type	Cable Description
External LAN PoE	RJ45	LAN Switch	RJ45	RJ45-to-RJ45 one-to-one cable
VIP	RJ45	SDM3000 RTU	I/O Wiring Punch Block	MLC 8000 to MOSCAD NFM Cable on page 161
R1-4 4W-E&M	RJ45	QUANTAR® Base Radio (or QUANTAR® Satellite Receiver) **NOTICE:** In a QUANTAR® Satellite Receiver, 2-wires are always OK.	Punch Block	4W MLC 8000 to QUANTAR Cable (Non-Simulcast) on page 162
R1-4 4W-E&M	RJ45	GTR 8000 Base Radio or GPW 8000 **NOTICE:** In a GPW Satellite Receiver, 2-wires are always OK.	RJ45 Wireline port	4W MLC 8000 to GTR 8000 Cable (Non-Simulcast) on page 170
R1-4 4W-E&M	RJ45	GTR 8000 Base Radio or GPW 8000, Analog TELCO **NOTICE:** In a GPW Satellite Receiver, 2-wires are always OK.	RJ45 Wireline port	4W MLC 8000 to GTR 8000 Cable (Non-Simulcast) on page 170
			50-pin System Connector, mini SCSI	4W MLC 8000 to GTR 8000 Cable (Non-Simulcast) for T57 DLN6821A Cable Assembly Connection on page 172

NOTICE: Refer to the customized cabling and configuration information provided by Motorola Solutions for port connections specific to your system.

Port Descriptions for ASTRO 25 Analog-Only Non-Simulcast Voting Subsystem

Table 14: Port Descriptions

Device	Manual
MLC 8000	See “MLC 8000 Ports” in the *MLC 8000 Comparator Feature Guide*.
LAN switch	See “HP Switches – Determining Port Connections in ASTRO 25 Systems” in the *System LAN Switches Feature Guide*.
SDM3000 RTU	See the Installation chapter “Connecting I/Os with Punch Blocks” sub-section and Appendix C “Pin Assignments” and “Punch Block Terminal Block Contacts” in the *SDM3000 Owner’s Manual*. Depending on the MLC 8000 device type, up to four I/Os and one output (the 5v) are used to report alarms to MOSCAD NFM, and one I/O is used by MOSCAD NFM to restart the MLC 8000 unit from the GMC Application. See also Setting Up MOSCAD Network Fault Management (NFM) Monitoring on page 37.
Site Gateway (Conventional Channel Interface)	“Making a Physical 4-W Connection on MLC 8000 Analog Comparator to CCGW” in the *GGM 8000 System Gateway Feature Guide*.
QUANTAR® Base Radio	“Backplane Connectors Information” in the *QUANTAR Instruction Manual* (6881095E05). Connects to either the 50–pin Telco System Connector (I) or 8-wire screw terminal connector.
GTR 8000 Base Radio	“Transceiver Ports – Front” and “Analog Simulcast Cable Assembly” in the *RF Site Technician Reference Guide*.

2.3 ASTRO 25 Analog-Only Non-Simulcast Voting Subsystem Troubleshooting

To troubleshoot the initial implementation of MLC 8000s in an ASTRO® 25 Analog-Only Non-Simulcast Voting Subsystem, see Troubleshooting the Transmit (TX) Path for Non-Simulcast Subsystems on page 226.

For general conventional troubleshooting, refer to the *RF Site Technician* webhelp.

Refer to the *MLC 8000 Comparator Feature Guide* for LED indications and the details of the alarms specifically for MLC 8000s, for ongoing monitoring and troubleshooting.

Chapter 3

ASTRO 25 Analog-Only IP-Based Simulcast Subsystem

This chapter outlines the installation and configuration procedures required to install MLC 8000s. Each process step refers to the appropriate documentation provided with your ASTRO® 25 system for the detailed procedure. A high-level diagram and equipment cabling tables are provided for the subsystem.

NOTICE: This chapter is meant for setting up analog-only simulcast system or for setting up the analog operation of a mixed-mode simulcast system. A Mixed-mode simulcast system only supports GEN2 GTR 8000 Base Radios. Analog-only simulcast system supports both QUANTAR® stations and GTR 8000 Base Radios.

3.1
Implementing an ASTRO 25 Analog-Only IP-Based Simulcast Subsystem

Prerequisites: See Implementing MLC 8000s on page 31.

When and where to use: Follow these sequences when implementing MLC 8000s in an ASTRO® 25 Analog-Only IP-Based Simulcast subsystem.

Process:

1. Perform the tasks to install equipment at the prime site. See Installing Equipment for Each Channel in the Prime Site on page 75.
2. Perform the tasks to install equipment at subsites. See Installing Equipment for Each Channel in Subsites on page 78.
3. Configure the MLC 8000 devices with the MLC 8000 Configuration Tool. See Configuring MLC 8000 Devices with the MLC 8000 Configuration Tool on page 80.
4. Verify the installation and configuration performed in this implementation. See Verifying the Installation and Configuration on page 82.

3.1.1
Installing Equipment for Each Channel in the Prime Site

When and where to use: Use for Prime Sites for ASTRO® 25 Analog-Only IP-Based Simulcast Subsystems.

Process:

1. Install a Site Gateway (Conventional Channel Interface) at the prime site if adding G.711 to the existing configuration and the current system does not have a CCGW. Connects to the switch.

   NOTICE: A Site Gateway (Conventional Channel Interface) is also known as a Conventional Channel Gateway (CCGW). A CCGW can support four channels, with a maximum of three CCGWs at the prime site. A Conventional Hub site can support up to 10 LAN-Only CCGWs. Requires one four-wire E&M module (installed in the analog slot).

   See “Installation” in the *GGM 8000 System Gateway Feature Guide*.
2. Configure Site Gateways (Conventional Channel Interface).

See “GGM 8000 Configuration” in the *GGM 8000 System Gateway Feature Guide*.

3 Install the MLC 8000 Analog Comparator.

a Install the MLC 8000 in a rack or cabinet.

See “Installing MLC 8000” in the *MLC 8000 Comparator Feature Guide*.

b Mount the MLC 8000 on a tray.

See “Mounting MLC 8000 on the Tray” in the *MLC 8000 Comparator Feature Guide*.

c Ground the MLC 8000 on a tray.

See “Grounding an MLC 8000 in a Tray” in the *MLC 8000 Comparator Feature Guide*.

d Install the MLC 8000 REF Input Signals to connect the MLC 8000 to the Time Reference (GPS).

See “Installing MLC 8000 REF Input Signals for IP Simulcast System” in the *MLC 8000 Comparator Feature Guide*.

NOTICE: The assumption is that the Simulcast Site Reference device is installed and running, providing a synchronized REF composite signal.

e (For rack-mount installation) Install the MLC 8000 tray in a rack.

See “Installing MLC 8000 Tray in Rack” in the *MLC 8000 Comparator Feature Guide*.

f (For cabinet-mount installation) Install the MLC 8000 tray in a cabinet.

See “Installing MLC 8000 Tray in Cabinet” in the *MLC 8000 Comparator Feature Guide*.

4 Ground the MLC 8000 tray installed in the rack or cabinet.

See “Installing MLC 8000” (step 2) in the *MLC 8000 Comparator Feature Guide*.

5 Connect the MLC 8000 to power by connecting the DC cable of the power supply unit to the DC inlet of the MLC 8000.

See “Installing MLC 8000” (step 3) in the *MLC 8000 Comparator Feature Guide*.

6 Is MAC Port Lockdown used on the system? (Disable MAC Port Lockdown if applicable)

If…	Then…
Yes	For K core systems, disable MAC Port Lockdown on the site LAN switch. See “Disabling MAC Port Lockdown Using an HP Switch Service Port” in the *MAC Port Lockdown Feature Guide*.
	For M series and L series zone core systems, disable MAC Port Lockdown on the site LAN switch with a Saved Command in UNC. See “Disabling MAC Port Lockdown Using a VoyenceControl Template” in the *MAC Port Lockdown Feature Guide*.
	Determine the switch configuration, to find an unused port. See “HP Switches – Determining Port Connections in ASTRO 25 Systems” in the *System LAN Switches Feature Guide*.
No	For K core systems, enable and configure unused ports on switches. Enable all the ports on the switches. See “Enabling/Disabling Ports on HP Switches Using Local Access” in the *MAC Port Lockdown Feature Guide*.
	For M series and L series zone core systems, enable and configure unused ports on switches.

If…	Then…
	See “Enabling/Disabling Ports on HP Switches Using VoyenceControl” in the *MAC Port Lockdown Feature Guide*.

7 Connect the MLC 8000 Analog Comparator to the switch.

See ASTRO 25 Analog-Only IP-Based Simulcast Subsystem Equipment Cabling on page 84.

8 Connect the MLC 8000 Analog Comparator to Site Gateways (Conventional Channel Interface). It is a 4-wire connection.

See ASTRO 25 Analog-Only IP-Based Simulcast Subsystem Equipment Cabling on page 84.

9 Optional: Set up MOSCAD NFM. This task is only applicable if MOSCAD NFM is available.

See Setting Up MOSCAD Network Fault Management (NFM) Monitoring on page 37.

10 Optional: Connect the MLC 8000 Analog Comparator to the SDM3000 RTU. This task is only applicable if MOSCAD NFM is available.

See Cabling MLC 8000 to SDM3000 RTU on page 40.

11 Push new configuration files down to the switches and GGM 8000 gateways.

- For K core systems (distributed conventional architecture), use Configuration Manager to push the configuration files. See “Downloading the Full Configuration to a Device” in the *Configuration Manager for Conventional Systems User Guide*.

  NOTICE: For a K Core system, the service PC is used to install the configuration files for the gateways and switches.

- For M series and L series zone core systems, use UNC to push the configuration files. See “Distributing Configurations For Transport Devices through the UNC Wizard” in the *Unified Network Configurator User Guide*.

12 Reboot the gateways. Using a terminal program, type **rb** (ReBoot) and press ENTER.

The switch reboots automatically after pushing the new configuration.

13 Turn on power to the MLC 8000 by connecting the AC cord of the power supply unit to the AC wall-mount power outlet (110-240 VAC, 50/60 Hz).

NOTICE: The AC power outlet should be as near as possible to the equipment and should be accessible. Ensure that the cable is not routed with tension.

See “Installing MLC 8000” (step 6) in the *MLC 8000 Comparator Feature Guide*.

a Verify the MLC 8000 power LED turns RED (which indicates the MLC 8000 is in booting state) and after a while, it turns GREEN.

b Optional: If the MOSCAD NFM subsystem is available in the system, then you can also verify that the MOSCAD NFM correctly indicates the presence of the MLC 8000 by pin # 1 at the VIP connector (or else the wiring to the SDM3000 RTU may be wrong). Validate that the correct indication of each MLC 8000 power up is shown in the GMC Application, either on the GMC or on the GWS.

14 Install the MLC 8000 Configuration Tool with Analog Display and Control to a service laptop (if you did not do so in the off-site preconfiguration).

See “Installing the MLC 8000 Configuration Tool with Analog Display and Control” in the *MLC 8000 Configuration Tool User Guide*. Complete the full process even if individual steps are not called out.

NOTICE: Obtain the installation CD for the MLC 8000 Configuration Tool, or the version of the software you want to install from Motorola Online. Install the MLC 8000 Configuration Tool on your own laptops in the field.

15 Optional: Install the MCN Server 8000™ Remote Comparator Display Software. See Setting Up the MCN Server 8000 Remote Comparator Display Software on page 35.

NOTICE: If available, this software can be installed at any time. No configuration at the MLC 8000 is necessary.

16 Change the MLC 8000 factory programmed passwords (if needed).

See “Changing the MLC 8000 Password” in the *MLC 8000 Configuration Tool User Guide*.

17 Define a reset password key if necessary to harden the reset password mechanism.

See “Assigning Reset Password Key” in the *MLC 8000 Configuration Tool User Guide*.

IMPORTANT: Changing the password must occur on-site since passwords are secured and not exposed to Motorola Solutions. The passwords can be changed either locally using the Local O&M port (serial connection) or remotely using the SSH option in PuTTY to connect to the Extranet LAN port. If you change the password, then you must push the same password to all devices (this is mandatory). Use the same password for all the devices of the channel cluster.

Installation of equipment and software for each channel in the prime site is complete.

Postrequisites: See Installing Equipment for Each Channel in Subsites on page 78.

3.1.2
Installing Equipment for Each Channel in Subsites

When and where to use: Use for subsites for ASTRO® 25 Analog-Only IP-Based Simulcast Subsystem.

Process:

1 Install the MLC 8000 Subsite Link Converter.

a Install the MLC 8000 in a rack or cabinet.

See “Installing MLC 8000” in the *MLC 8000 Comparator Feature Guide*.

b Mount the MLC 8000 on a tray.

See “Mounting MLC 8000 on the Tray” in the *MLC 8000 Comparator Feature Guide*.

c Ground the MLC 8000 on a tray.

See “Grounding an MLC 8000 in a Tray” in the *MLC 8000 Comparator Feature Guide*.

d Install the MLC 8000 REF Input Signals to connect the MLC 8000 to the Time Reference (GPS).

See “Installing MLC 8000 REF Input Signals for IP Simulcast System” in the *MLC 8000 Comparator Feature Guide*.

NOTICE: The assumption is that the Simulcast Site Reference device is installed and running, providing a synchronized REF composite signal. The Time Reference (GPS) is not needed if the MLC 8000 Subsite Link Converter is connected to an Rx only BR.

e (For rack-mount installation) Install the MLC 8000 tray in a rack.

See “Installing MLC 8000 Tray in Rack” in the *MLC 8000 Comparator Feature Guide*.

f (For cabinet-mount installation) Install the MLC 8000 tray in a cabinet.

See “Installing MLC 8000 Tray in Cabinet” in the *MLC 8000 Comparator Feature Guide*.

2 Ground the MLC 8000 tray installed in the rack or cabinet.

See “Installing MLC 8000” (step 2) in the *MLC 8000 Comparator Feature Guide*.

3 Connect the MLC 8000 to power by connecting the DC cable of the power supply unit to the DC inlet of the MLC 8000.

See “Installing MLC 8000” (step 3) in the *MLC 8000 Comparator Feature Guide*.

4 Is MAC Port Lockdown used on the system? (Disable MAC Port Lockdown if applicable)

If…	Then…
Yes	For K core systems, disable MAC Port Lockdown on the site LAN switch. See “Disabling MAC Port Lockdown Using an HP Switch Service Port” in the *MAC Port Lockdown Feature Guide*.
	For M series and L series zone core systems, disable MAC Port Lockdown on the site LAN switch with a Saved Command in UNC. See “Disabling MAC Port Lockdown Using a VoyenceControl Template” in the *MAC Port Lockdown Feature Guide*.
	Determine the switch configuration, to find an unused port. See “HP Switches – Determining Port Connections in ASTRO 25 Systems” in the *System LAN Switches Feature Guide*.
No	For K core systems, enable and configure unused ports on switches. Enable all the ports on the switches. See “Enabling/Disabling Ports on HP Switches Using Local Access” in the *MAC Port Lockdown Feature Guide*.
	For M series and L series zone core systems, enable and configure unused ports on switches. See “Enabling/Disabling Ports on HP Switches Using VoyenceControl” in the *MAC Port Lockdown Feature Guide*.

5 Connect the MLC 8000 Subsite Link Converter to the switch.

See ASTRO 25 Analog-Only IP-Based Simulcast Subsystem Equipment Cabling on page 84.

6 Connect the MLC 8000 Subsite Link Converter to a base radio. It is a 4-wire connection, or a 2-wire connection also works when connected to a QUANTAR® Satellite Receiver.

See ASTRO 25 Analog-Only IP-Based Simulcast Subsystem Equipment Cabling on page 84.

NOTICE: For analog Simulcast channels, all base radios on the same channel must be of the same type on all the subsites (for example, all GTR 8000s or all QUANTARs®).

7 Configure the base radios to interface with the MLC 8000 devices.

See Conventional Configuration Settings for Analog Simulcast on page 53.

8 Optional: Set up MOSCAD NFM. This task is only applicable if MOSCAD NFM is available.

See Setting Up MOSCAD Network Fault Management (NFM) Monitoring on page 37.

9 Optional: Connect the MLC 8000 Analog Comparator to the SDM3000 RTU. This task is only applicable if MOSCAD NFM is available.

See Cabling MLC 8000 to SDM3000 RTU on page 40.

10 Push new configuration files down to the switches and GGM 8000 gateways.

- For K core systems (distributed conventional architecture), use Configuration Manager to push the configuration files. See “Downloading the Full Configuration to a Device” in the *Configuration Manager for Conventional Systems User Guide*.

NOTICE: For a K core system, the service PC is used to install the configuration files for the gateways and switches.

- For M series and L series zone core systems, use UNC to push the configuration files. See “Distributing Configurations For Transport Devices through the UNC Wizard” in the *Unified Network Configurator User Guide*.

11 Reboot the gateways. Using a terminal program, type **rb** (ReBoot) and press ENTER.

The switch reboots automatically after pushing the new configuration.

12 Turn on power to the MLC 8000 by connecting the AC cord of the power supply unit to the AC wall-mount power outlet (110-240 VAC, 50/60 Hz).

NOTICE: The AC power outlet should be as near as possible to the equipment and should be accessible. Ensure that the cable is not routed with tension.

See “Installing MLC 8000” (step 6) in the *MLC 8000 Comparator Feature Guide*.

a Verify the MLC 8000 power LED turns RED (which indicates the MLC 8000 is in booting state) and after a while, it turns GREEN.

b Optional: If the MOSCAD NFM subsystem is available in the system, then you can also verify that the MOSCAD NFM correctly indicates the presence of the MLC 8000 by pin # 1 at the VIP connector (or else the wiring to the SDM3000 RTU may be wrong). Validate that the correct indication of each MLC 8000 power up is shown in the GMC Application, either on the GMC or on the GWS.

Installation of equipment for each channel in the subsite is complete.

Postrequisites: See Configuring MLC 8000 Devices with the MLC 8000 Configuration Tool on page 80.

3.1.3
Configuring MLC 8000 Devices with the MLC 8000 Configuration Tool

Prerequisites: Ensure both the MLC 8000 Subsite Link Converters and MLC 8000 Analog Comparators are cabled to switches. So, configuration can only be performed AFTER going to each remote site to cable the MLC 8000 Subsite Link Converters to switches and base radios.

When and where to use: Follow these tasks to configure the MLC 8000 devices using a service laptop with the MLC 8000 Configuration Tool User Guide.

Process:

1 You have three options to configure the MLC 8000s:

If…	Then…
Option 1: IF the system is prestaged off-site (not at the RF site), and IP address and channel cluster information is available	When off-site perform step 2- step 12 When onsite, retrieve the saved configuration, skip to step 13 and finish the configuration.
Option 2: IF the system is prestaged off-site (not at the RF site), and IP address and channel cluster information is not available	On site, use these steps to update the configuration and provide the actual IP addresses and channel cluster information, and then set up associations.

If…	Then…
Option 3: IF the system is not prestaged off-site	Perform all the steps here.

2 Configure the MLC 8000 device IP addresses in the MLC 8000 Configuration Tool (if modification is needed).

See “Provisioning the Initial IP Address for an MLC 8000 Device” in the *MLC 8000 Configuration Tool User Guide*.

3 Create and define a channel cluster in the MLC 8000 Configuration Tool.

NOTICE: Prerequisite: IP addresses have been assigned to the MLC 8000 Analog Comparators and MLC 8000 Subsite Link Converters.

See “Creating a Conventional Channel Cluster” in the *MLC 8000 Configuration Tool User Guide*.

4 Define the Site ID and Site Name for the new channel cluster.

See “Entering Site ID and Site Name for a Conventional Channel Cluster” in the *MLC 8000 Configuration Tool User Guide*.

5 Provide the name and type for the channel cluster.

See “Defining a Conventional Channel Cluster” in the *MLC 8000 Configuration Tool User Guide*.

6 Define subsites in the subsite list. The Subsite ID and associated name are required for the system to work.

See “Modifying the Conventional Channel Cluster Subsite List” in the *MLC 8000 Configuration Tool User Guide*.

7 Add the MLC 8000 Analog Comparator (VGU) to the channel cluster.

See “Adding an MLC 8000 Analog or Mixed Mode Comparator to a Conventional Channel Cluster” in the *MLC 8000 Configuration Tool User Guide*.

NOTICE: You can complete the configuration now or download the software now, then configure after the software upgrade is complete. In either case, save the changes by clicking **Write to Device**. Result: The device restarts. After the restart, you can upgrade the software if necessary.

8 Optional: Download the MLC 8000 device software if available (if you are unsure that you have the latest version or it was not downloaded in off-site prestaging). Perform this task if your Motorola Solutions representative recommends a newer software version. New software is available at Motorola Online (http://businessonline.motorolasolutions.com).

NOTICE: The software download must be performed separately for each MLC 8000 device in the channel cluster.

See “Downloading a Specific Software Update to an MLC 8000 Device” in the *MLC 8000 Configuration Tool User Guide*.

9 Configure the MLC 8000 Analog Comparator.

NOTICE: If manual steering is used and tables of related TRC codes are already defined, select the **No Steering** option.

See “Configuring an MLC 8000 Analog Comparator for an IP Simulcast System” in the *MLC 8000 Configuration Tool User Guide*.

10 Add an MLC 8000 Subsite Link Converter to a conventional channel cluster.

See “Adding an MLC 8000 Subsite Link Converter to a Conventional Channel Cluster” in the *MLC 8000 Configuration Tool User Guide*.

NOTICE: You can complete the configuration now or download the software now, then configure after the software upgrade is complete. In either case, save the changes by clicking **Write to Device**. Result: The device restarts. After the restart, you can upgrade the software if necessary.

11 Optional: Download the MLC 8000 device software if available (if you are unsure that you have the latest version or it was not downloaded in off-site prestaging). Perform this task if your Motorola Solutions representative recommends a newer software version. New software is available at Motorola Online (http://businessonline.motorolasolutions.com).

NOTICE: The software download must be performed separately for each MLC 8000 device in the channel cluster.

See “Downloading a Specific Software Update to an MLC 8000 Device” in the *MLC 8000 Configuration Tool User Guide*.

12 Configure the MLC 8000 Subsite Link Converter (and associated AGU ports).

a Within the procedure to configure the MLC 8000 Subsite Link Converter, you configure the ports associated with the VGU (select the AGU in the Configuration Tool).

See “Configuring an MLC 8000 Subsite Link Converter for an IP Simulcast System” in the *MLC 8000 Configuration Tool User Guide*.

NOTICE: When you configure the MLC 8000 Analog Comparator (VGU) ports, you can repeat this step for as many BR locations as your system has.

13 Configure the channel (set up associations). Associate base radios with each MLC 8000 Analog Comparator (VGU).

See “Associating a Base Radio with an MLC 8000 Analog Comparator” in the *MLC 8000 Configuration Tool User Guide*.

NOTICE: This loop can be repeated up to four times.

14 Set channel cluster parameters for all MLC 8000s (including G.711, NTP, and timeout parameters).

See “Setting Channel Cluster Parameters” in the *MLC 8000 Configuration Tool User Guide*.

NOTICE: Prerequisite: All devices of the channel cluster have been added and configured, so that MLC 8000 Configuration Tool downloads the channel cluster parameters to all these devices.

15 Optional: Configure the channel transmitters steering associations. Enable and configure transmitter steering and regional voting tables for the MLC 8000 Analog Comparator (VGU). See “Management of the Transmitter Steering Tables for an MLC 8000 Analog Comparator” in the *MLC 8000 Configuration Tool User Guide*.

The MLC 8000 devices are configured.

Postrequisites: See Verifying the Installation and Configuration on page 82.

3.1.4
Verifying the Installation and Configuration

Process:

1 Is MAC Port Lockdown used on the system? Run MAC Port Lockdown, if applicable.

If…	Then…
Yes	For K core systems, run MAC Port Lockdown on the switches.

If…	Then…
	See “Locking HP Switch Ports” in the *MAC Port Lockdown Feature Guide*.
	For M series and L series zone core systems, run MAC Port Lockdown on the switches. See “Performing MAC Port Lockdown on HP Switches” in the *MAC Port Lockdown Feature Guide*.
No	For K core systems, disable open (unused) ports on switches. For each of the HP switches, every open port (no device connected) must be disabled. See “Enabling/Disabling Ports on HP Switches Using Local Access” in the *MAC Port Lockdown Feature Guide*.
	For M series and L series zone core systems, disable open (unused) ports on switches. See “Locking HP Switch Ports Using a VoyenceControl Template” in the *MAC Port Lockdown Featuer Guide*.

2 Verify connectivity.

a View the channel cluster to verify the links. (Icons for the MLC 8000 Analog Comparator and its MLC 8000 Subsite Link Converters are yellow to indicate connection with the Configuration Tool and the device).

See “Viewing a particular Channel Cluster Tree” in the *MLC 8000 Configuration Tool User Guide*.

b Verify that the MLC 8000 Analog Comparator is voting the base radios by observing at the Analog Display and Control Application. For example, the LED to the left of the base radio should not be gray, the radio state is either **Active** or **No activity**, and the SQM signal strength should not be **N/A**.

See “Opening the Analog Display and Control Application with MLC 8000 Analog Comparator Selected” in the *MLC 8000 Configuration Tool User Guide*.

3 Confirm the status of the links.

Devices		Procedure References
MLC 8000 Analog Comparator to MLC 8000 Subsite Link Converter (IP)		
	Check the COMM LED, which is Red if at least one link connection to the MLC 8000 Link Converter port has failed.	See “MLC 8000 Analog Comparator LEDs” in the *MLC 8000 Comparator Feature Guide*.
	Use MOSCAD NFM. Only if the MOSCAD NFM subsystem is available in your system.	See “MLC 8000 Analog Comparator — MOSCAD NFM Events Troubleshooting (IP Simulcast System)” in the *MLC 8000 Comparator Feature Guide*.
	Pull a log file of the device for error messages.	See “MLC 8000 Device Logs and Recommended Actions” in the *MLC 8000 Comparator Feature Guide*.
MLC 8000 Subsite Link Converter to Base Radio (4-wire)		

Table continued…

Devices		Procedure References
	Check the Port 1-4 LED. On the MLC 8000, the Port 1-4 LED is Red indicating the link to the base radio failed.	See “MLC 8000 Link Converter LEDs” in the *MLC 8000 Comparator Feature Guide*.
	Use MOSCAD NFM. Only if the MOSCAD NFM subsystem is available in your system. Check for a VIP 4 event, which indicates a link to a BR has failed. One MLC 8000 Subsite Link Converter connects to four base radios, but it has one VIP to indicate status. So, check each of the four connections.	See “MLC 8000 Link Converter — MOSCAD NFM Events Troubleshooting (IP Simulcast System)” in the *MLC 8000 Comparator Feature Guide*.
	Pull a log file of the device for error messages.	See “MLC 8000 Device Logs and Recommended Actions” in the *MLC 8000 Comparator Feature Guide*.
MLC 8000 Analog Comparator to Site Gateways (Conventional Channel Interface) (4-wire)		
	To verify, make a call from the console, and verify that the BR is transmitting.	

4 Verify by making calls. This is a general task to perform.

a Test the operation of the system by making calls from the radios and ensuring call completion and quality.

b Verify that you can make a Console to Radio, Radio to Console, and Radio to Radio analog call.

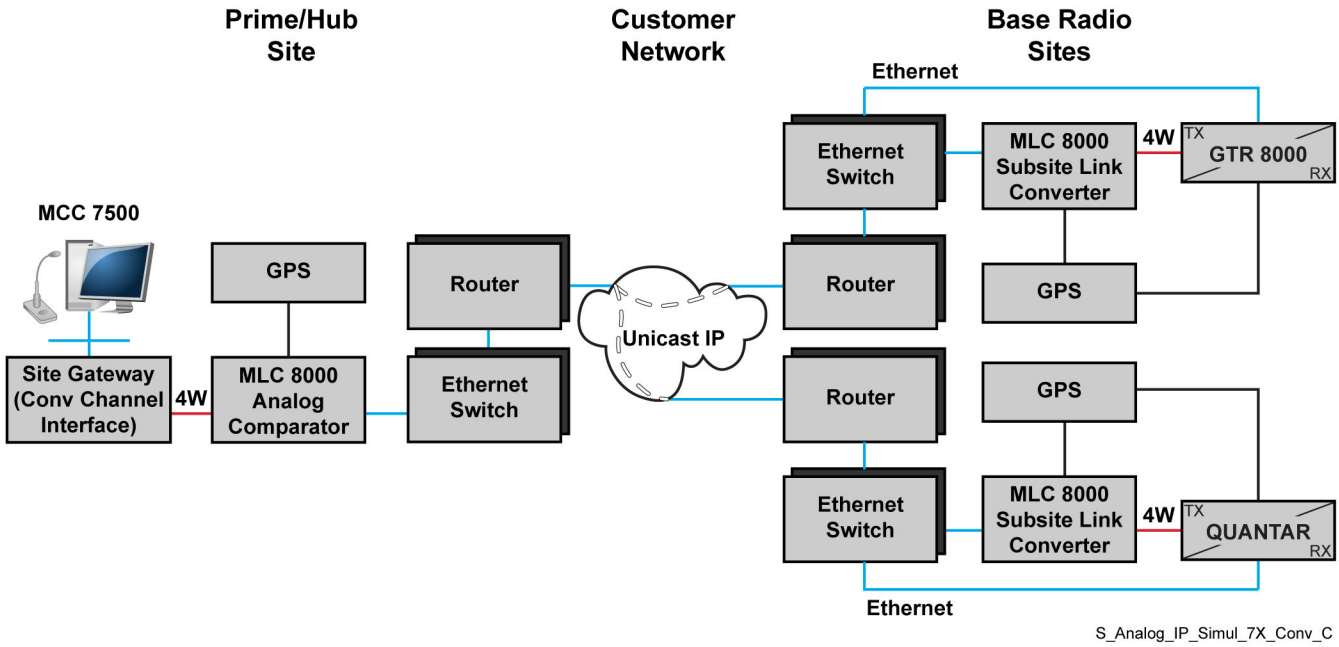
Postrequisites: Calibrate/optimize the IP Simulcast system after the system is running properly.

- See “Performing Calibration for an MLC 8000 Subsite Link Converter” in the *MLC 8000 Configuration Tool User Guide*.
- See “Performing Calibration for an MLC 8000 Analog Comparator” in the *MLC 8000 Configuration Tool User Guide*.
- Continue to Optimization/Calibration for Conventional Simulcast on page 195.

3.2 ASTRO 25 Analog-Only IP-Based Simulcast Subsystem Equipment Cabling

This section provides a high-level subsystem diagram and equipment cabling tables from the MLC 8000 device to other system devices. A port description table lists the system devices and refers to the device documentation for more information.

Figure 8: ASTRO 25 Analog-Only IP-Based Simulcast Subsystem Diagram



IMPORTANT: High-level diagrams are provided as examples only and are not to be used for system planning purposes. “GPS” in the diagram refers to a Simulcast Site Reference device. SDM3000 RTUs are not shown in the diagram, but would be part of the system if the optional MOSCAD NFM subsystem is available and would be connected to the MLC 8000 devices. The GPS should be connected to the MLC 8000 Subsite Link Converter only if is connected to an Rx/Tx or Tx only BR.

NOTICE: This table provides part numbers for cables that are orderable from Motorola Solutions. Create the remaining cables using the provided pinout tables. See MLC 8000 Radio Ports Cabling on page 161.

Table 15: Equipment Cabling for ASTRO 25 Analog-Only IP-Based Simulcast Subsystem

From MLC 8000 Analog Comparator (Prime Site)		To Destination device:		
Port	**Connector Type**	**Device**	**Connector Type**	**Description**
REF	QMA	Simulcast Site Reference device	BNC	GPS connector for the reference signal. REF signal cable (FKN8718) T-BNC BNC-to-BNC COAX cable
External LAN PoE	RJ45	LAN Switch	RJ45	RJ45-to-RJ45 one-to-one cable
VIP	RJ45	SDM3000 RTU	I/O Wiring Punch Block	MLC 8000 to MOSCAD NFM Cable on page 161
R1 4W-E&M	RJ45	Site Gateway (Conventional Channel Inter-	RJ45	4W MLC 8000 (Analog Comparator) to Site Gateway (Con-

Table continued…

From MLC 8000 Analog Comparator (Prime Site)		To Destination device:		
Port	**Connector Type**	**Device**	**Connector Type**	**Description**
		face), 4W E&M (8D… 8A)		ventional Channel Interface) Cable on page 173
From MLC 8000 Subsite Link Converter (Subsite)		To Destination device:		
Port	Connector Type	Device	Connector Type	Description
REF	QMA	Simulcast Site Reference device	BNC	GPS connector for the reference signal. REF signal cable (FKN8718) T-BNC BNC-to-BNC COAX cable
External LAN PoE	RJ45	LAN Switch	RJ45	RJ45-to-RJ45 one-to-one cable
R4 4W-E&M	RJ45	QUANTAR® Base Radio (or QUANTAR® Satellite Receiver), TELCO **NOTICE:** In a QUANTAR® Satellite Receiver, 2-wires are always OK.	50 Pin Connector	4W MLC 8000 to QUANTAR Cable (IP Simulcast) on page 167
R4 4W-E&M	RJ45	GTR 8000 Base Radio or GPW 8000 **NOTICE:** In a GPW Satellite Receiver, 2-wires are always OK.	RJ45 Punch Block	4W MLC 8000 to GTR 8000 Cable (IP Simulcast) on page 165

NOTICE: The GPS should be connected to the MLC 8000 Subsite Link Converter only if is connected to an Rx/Tx or Tx only BR.

Port Descriptions for ASTRO 25 Analog-Only IP-Based Simulcast Subsystem

Table 16: Port Descriptions

Device	Manual
MLC 8000	See “MLC 8000 Ports” in the *MLC 8000 Comparator Feature Guide*.
Simulcast Site Reference device	See “Cabling the TRAK 9100 SSR” in the *RF Site Technician Guide* webhelp.

Table continued…

Device	Manual
LAN switch	See “HP Switches – Determining Port Connections in ASTRO 25 Systems” in the *System LAN Switches Feature Guide*.
SDM3000 RTU	See the Installation chapter “Connecting I/Os with Punch Blocks” sub-section and Appendix C “Pin Assignments” and “Punch Block Terminal Block Contacts” in the *SDM3000 Owner’s Manual*. Depending on the MLC 8000 device type, up to four I/Os and one output (the 5v) are used to report alarms to MOSCAD NFM, and one I/O is used by MOSCAD NFM to restart the MLC 8000 unit from the GMC Application. See also Setting Up MOSCAD Network Fault Management (NFM) Monitoring on page 37.
Site Gateway (Conventional Channel Interface)	“Making a Physical 4-W Connection on MLC 8000 Analog Comparator to CCGW” in the *GGM 8000 System Gateway Feature Guide*.
QUANTAR® Base Radio	“Backplane Connectors Information” in the *QUANTAR Instruction Manual* (6881095E05). Connects to either a punch block to the 50–pin Telco System Connector (I) or the 8-wire screw terminal connector.
GTR 8000 Base Radio	“Transceiver Ports – Front” and “Analog Simulcast Cable Assembly” in the *RF Site Technician Guide* webhelp

NOTICE: The GPS should be connected to the MLC 8000 Subsite Link Converter only if is connected to an Rx/Tx or Tx only BR.

3.3 ASTRO 25 Analog-Only IP-Based Simulcast Subsystem Troubleshooting

To troubleshoot echo issues or to reduce delay, see Reducing Delay for Analog Simulcast on page 236.

To troubleshoot the initial implementation of MLC 8000s in an ASTRO 25 Analog-Only IP-Based Simulcast Subsystem, see Troubleshooting the Transmit (TX) Path for Simulcast Subsystems on page 223.

For general conventional troubleshooting, refer to the *RF Site Technician* webhelp.

Refer to the *MLC 8000 Comparator Feature Guide* for LED indications and the details of the alarms specifically for MLC 8000s, for ongoing monitoring and troubleshooting.

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Chapter 4

ASTRO 25 Mixed-Mode Non-Simulcast Voting Subsystem

This section outlines the installation and configuration procedures required to install MLC 8000s; each process step refers to the appropriate documentation provided with your ASTRO® 25 system for the detailed procedure. A high-level diagram and equipment cabling tables are provided for the subsystem.

4.1

Implementing an ASTRO 25 Mixed-Mode Non-Simulcast Voting Subsystem

Prerequisites: See Implementing MLC 8000s on page 31.

NOTICE: A digital voice call has priority over an analog voice call, and a voice call (digital or analog) has priority over a data call.

When and where to use: Follow these sequences when implementing MLC 8000s in an ASTRO® 25 Mixed-Mode Non-Simulcast Voting subsystem.

Process:

1. Perform the tasks to install equipment at the prime site. See Installing Equipment for Each Channel in the Prime Site on page 89.
2. Perform the tasks to install equipment at subsites. See Installing Equipment for Each Channel in Subsites on page 92.
3. Perform the tasks to install equipment at subsites. See Configuring MLC 8000 Devices with the MLC 8000 Configuration Tool on page 94.
4. Verify the installation and configuration performed in this implementation. See Verifying the Installation and Configuration on page 96.

4.1.1

Installing Equipment for Each Channel in the Prime Site

When and where to use: Use for Prime Sites for ASTRO® 25 Mixed-Mode Non-Simulcast Voting Subsystems..

Process:

1. Install a Site Gateway (Conventional Channel Interface) at the prime site if adding G.711 to the existing configuration and the current system does not have a CCGW. Connects to the switch.

   NOTICE: A Site Gateway (Conventional Channel Interface) is also known as a Conventional Channel Gateway (CCGW). A CCGW can support four channels, with a maximum of three CCGWs at the prime site. A Conventional Hub site can support up to 10 LAN-Only CCGWs. Requires one four-wire E&M module (installed in the analog slot).

   See “Installation” in the *GGM 8000 System Gateway Feature Guide*.
2. Configure Site Gateways (Conventional Channel Interface).

   See “GGM 8000 Configuration” in the *GGM 8000 System Gateway Feature Guide*.

NOTICE: Analog Link Monitor Tone (ALMT) is only supported on Conventional Mixed Mode channels with the V.24 interface. It is not supported on Conventional Mixed Mode channels with the Ethernet interface and is not supported on analog conventional channels. Do not configure ALMT for the Site Gateway (Conventional Channel Interface) when using mixed mode channels with an interface type of Ethernet.

3 Install the MLC 8000 Analog Comparator.

a Install the MLC 8000 in a rack or cabinet.

See “Installing MLC 8000” in the *MLC 8000 Comparator Feature Guide*.

b Mount the MLC 8000 on a tray.

See “Mounting MLC 8000 on the Tray” in the *MLC 8000 Comparator Feature Guide*.

c Ground the MLC 8000 on a tray.

See “Grounding an MLC 8000 in a Tray” in the *MLC 8000 ComparatorFeature Guide*.

d (For rack-mount installation) Install the MLC 8000 tray in a rack.

See “Installing MLC 8000 Tray in Rack” in the *MLC 8000 Comparator Feature Guide*.

e (For cabinet-mount installation) Install the MLC 8000 tray in a cabinet.

See “Installing MLC 8000 Tray in Cabinet” in the *MLC 8000 Comparator Feature Guide*.

4 Ground the MLC 8000 tray installed in the rack or cabinet.

See “Installing MLC 8000” (step 2) in the *MLC 8000 Comparator Feature Guide*.

5 Connect the MLC 8000 to power by connecting the DC cable of the power supply unit to the DC inlet of the MLC 8000.

See “Installing MLC 8000” (step 3) in the *MLC 8000 Comparator Feature Guide*.

6 Install the GCM 8000 or GRV 8000 Digital Comparator.

See the *RF Site Technician Guide* and *RF Site Technician Reference Guide* webhelp.

7 Is MAC Port Lockdown used on the system? (Disable MAC Port Lockdown, if applicable)

If…	Then…
Yes	For K core systems, disable MAC Port Lockdown on the site LAN switch. See “Disabling MAC Port Lockdown Using an HP Switch Service Port” in the *MAC Port Lockdown Feature Guide*.
	For M series and L series zone core systems, disable MAC Port Lockdown on the site LAN switch with a Saved Command in UNC. See “Disabling MAC Port Lockdown Using a VoyenceControl Template” in the *MAC Port Lockdown Feature Guide*.
	Determine the switch configuration, to find an unused port. See “HP Switches – Determining Port Connections in ASTRO 25 Systems” in the *System LAN Switches Feature Guide*.
No	For K core systems, enable and configure unused ports on switches. Enable all the ports on the switches. See “Enabling/Disabling Ports on HP Switches Using Local Access” in the *MAC Port Lockdown Feature Guide*.
	For M series and L series zone core systems, enable and configure unused ports on switches.

If…	Then…
	See “Enabling/Disabling Ports on HP Switches Using VoyenceControl” in the *MAC Port Lockdown Feature Guide*.

8 Connect the MLC 8000 Analog Comparator to the switch.

See ASTRO 25 Mixed-Mode Non-Simulcast Voting Subsystem Equipment Cabling on page 98.

9 Connect the digital comparator to the switch.

See “Cabling” in the the *RF Site Technician Guide* and *RF Site Technician Reference Guide* webhelp.

10 Connect the MLC 8000 Analog Comparator to Site Gateways (Conventional Channel Interface). It is a 4-wire connection.

See ASTRO 25 Mixed-Mode Non-Simulcast Voting Subsystem Equipment Cabling on page 98.

11 (Optional) Set up MOSCAD NFM. This task is only applicable if MOSCAD NFM is available.

See Setting Up MOSCAD Network Fault Management (NFM) Monitoring on page 37.

12 (Optional) Connect the MLC 8000 Analog Comparator to the SDM3000 RTU. This task is only applicable if MOSCAD NFM is available.

See Cabling MLC 8000 to SDM3000 RTU on page 40.

13 Push new configuration files down to the switches and GGM 8000 gateways.

- For K core systems (distributed conventional architecture), use Configuration Manager to push the configuration files. See “Downloading the Full Configuration to a Device” in the *Configuration Manager for Conventional Systems User Guide*.

  NOTICE: For a K core system, the service PC is used to install the configuration files for the gateways and switches.

- For M series and L series zone core systems, use UNC to push the configuration files. See “Distributing Configurations For Transport Devices through the UNC Wizard” in the *Unified Network Configurator User Guide*.

14 Reboot the gateways. Using a terminal program, type **rb** (ReBoot) and press ENTER.

The switch reboots automatically after pushing the new configuration.

15 Turn the comparator ON.

See the *RF Site Technician Guide* and *RF Site Technician Reference Guide* webhelp.

16 In IP Mixed Mode configurations, disable Simulcast operation on the GCM 8000 or GRV 8000 in CSS.

See “Site Configuration” in the *CSS Online Help*.

17 Turn on power to the MLC 8000 by connecting the AC cord of the power supply unit to the AC wall-mount power outlet (110-240 VAC, 50/60 Hz).

NOTICE: The AC power outlet should be as near as possible to the equipment and should be accessible. Ensure that the cable is not routed with tension.

See “Installing MLC 8000” (step 6) in the *MLC 8000 Comparator Feature Guide*.

a Verify the MLC 8000 power LED turns RED (which indicates the MLC 8000 is in booting state) and after a while, it turns GREEN.

b (Optional) If the MOSCAD NFM subsystem is available in the system, then you can also verify that the MOSCAD NFM correctly indicates the presence of the MLC 8000 by pin # 1 at the VIP connector (or else the wiring to the SDM3000 RTU may be wrong). Validate that the

correct indication of each MLC 8000 power up is shown in the GMC Application, either on the GMC or on the GWS.

18 Install the MLC 8000 Configuration Tool with Analog Display and Control to a service laptop (if you did not do so in the off-site preconfiguration).

See “Installing the MLC 8000 Configuration Tool with Analog Display and Control” in the *MLC 8000 Configuration Tool User Guide*. Complete the full process even if individual steps are not called out.

NOTICE: Obtain the installation CD for the MLC 8000 Configuration Tool, or the version of the software you want to install from Motorola Online. Install the MLC 8000 Configuration Tool on your own laptops in the field.

19 (Optional) Install the MCN Server 8000™ Remote Comparator Display Software. See Setting Up the MCN Server 8000 Remote Comparator Display Software on page 35.

NOTICE: If available, this software can be installed at any time. No configuration at the MLC 8000 is necessary.

20 Change the MLC 8000 factory programmed passwords (if needed).

See “Changing the MLC 8000 Password” in the *MLC 8000 Configuration Tool User Guide*.

21 Define a reset password key if necessary to harden the reset password mechanism.

See “Assigning Reset Password Key” in the *MLC 8000 Configuration Tool User Guide*.

IMPORTANT: Changing the password must occur on-site since passwords are secured and not exposed to Motorola Solutions. The passwords can be changed either locally using the Local O&M port (serial connection) or remotely using the SSH option in PuTTY to connect to the Extranet LAN port. If you change the password, then push the same password to all devices (this is mandatory). Use the same password for all the devices of the channel cluster.

Installation of equipment and software for each channel in the prime site is complete.

Postrequisites: See Installing Equipment for Each Channel in Subsites on page 92.

4.1.2
Installing Equipment for Each Channel in Subsites

When and where to use: Use for subsites for ASTRO® 25 Mixed-Mode Non-Simulcast Voting Subsystems.

Process:

1 Install the MLC 8000 Subsite Link Converter.

a Install the MLC 8000 in a rack or cabinet.

See “Installing MLC 8000” in the *MLC 8000 Comparator Feature Guide*.

b Mount the MLC 8000 on a tray.

See “Mounting MLC 8000 on the Tray” in the *MLC 8000 Comparator Feature Guide*.

c Ground the MLC 8000 on a tray.

See “Grounding an MLC 8000 in a Tray” in the *MLC 8000 Comparator Feature Guide*.

d (For rack-mount installation) Install the MLC 8000 tray in a rack.

See “Installing MLC 8000 Tray in Rack” in the *MLC 8000 Comparator Feature Guide*.

e (For cabinet-mount installation) Install the MLC 8000 tray in a cabinet.

See “Installing MLC 8000 Tray in Cabinet” in the *MLC 8000 Comparator Feature Guide*.

2 Ground the MLC 8000 tray installed in the rack or cabinet.

See “Installing MLC 8000” (step 2) in the *MLC 8000 Comparator Feature Guide*.

3 Connect the MLC 8000 to power by connecting the DC cable of the power supply unit to the DC inlet of the MLC 8000.

See “Installing MLC 8000” (step 3) in the *MLC 8000 Comparator Feature Guide*.

4 Is MAC Port Lockdown used on the system? (Disable MAC Port Lockdown, if applicable)

If…	Then…
Yes	For K core systems, disable MAC Port Lockdown on the site LAN switch. See “Disabling MAC Port Lockdown Using an HP Switch Service Port” in the *MAC Port Lockdown Feature Guide*.
	For M series and L series zone core systems, disable MAC Port Lockdown on the site LAN switch with a Saved Command in UNC. See “Disabling MAC Port Lockdown Using a VoyenceControl Template” in the *MAC Port Lockdown Feature Guide*.
	Determine the switch configuration, to find an unused port. See “HP Switches – Determining Port Connections in ASTRO 25 Systems” in the *System LAN Switches Feature Guide*.
No	For K core systems, enable and configure unused ports on switches. Enable all the ports on the switches. See “Enabling/Disabling Ports on HP Switches Using Local Access” in the *MAC Port Lockdown Feature Guide*.
	For M series and L series zone core systems, enable and configure unused ports on switches. See “Enabling/Disabling Ports on HP Switches Using VoyenceControl” in the *MAC Port Lockdown Feature Guide*.

5 Connect the MLC 8000 Subsite Link Converter to the switch.

See ASTRO 25 Mixed-Mode Non-Simulcast Voting Subsystem Equipment Cabling on page 98.

6 Connect the MLC 8000 Subsite Link Converter to a base radio. It is a 4-wire connection, or a 2-wire connection also works when connected to a QUANTAR® Satellite Receiver.

See ASTRO 25 Mixed-Mode Non-Simulcast Voting Subsystem Equipment Cabling on page 98.

7 Configure the base radios to interface with the MLC 8000 devices.

See Conventional Configuration Settings for Non Simulcast on page 54.

8 (Optional) Set up MOSCAD NFM. This task is only applicable if MOSCAD NFM is available.

See Setting Up MOSCAD Network Fault Management (NFM) Monitoring on page 37.

9 (Optional) Connect the MLC 8000 Analog Comparator to the SDM3000 RTU. This task is only applicable if MOSCAD NFM is available.

See Cabling MLC 8000 to SDM3000 RTU on page 40.

10 Push new configuration files down to the switches and GGM 8000 gateways.

- For K core systems (distributed conventional architecture), use Configuration Manager to push the configuration files. See “Downloading the Full Configuration to a Device” in the *Configuration Manager for Conventional Systems User Guide*.

NOTICE: For a K core system, the service PC is used to install the configuration files for the gateways and switches.

- For M series and L series zone core systems, use UNC to push the configuration files. See “Distributing Configurations For Transport Devices through the UNC Wizard” in the *Unified Network Configurator User Guide*.

11 Reboot the gateways. Using a terminal program, type **rb** (ReBoot) and press ENTER.

The switch reboots automatically after pushing the new configuration.

12 Turn on power to the MLC 8000 by connecting the AC cord of the power supply unit to the AC wall-mount power outlet (110-240 VAC, 50/60 Hz).

NOTICE: The AC power outlet should be as near as possible to the equipment and should be accessible. Ensure that the cable is not routed with tension.

See “Installing MLC 8000” (step 6) in the *MLC 8000 Comparator Feature Guide*.

a Verify the MLC 8000 power LED turns RED (which indicates the MLC 8000 is in booting state) and after a while, it turns GREEN.

b (Optional) If the MOSCAD NFM subsystem is available in the system, then you can also verify that the MOSCAD NFM correctly indicates the presence of the MLC 8000 by pin # 1 at the VIP connector (or else the wiring to the SDM3000 RTU may be wrong). Validate that the correct indication of each MLC 8000 power up is shown in the GMC Application, either on the GMC or on the GWS.

Installation of equipment for each channel in the subsite is complete.

Postrequisites: See Configuring MLC 8000 Devices with the MLC 8000 Configuration Tool on page 94.

4.1.3
Configuring MLC 8000 Devices with the MLC 8000 Configuration Tool

Prerequisites: Ensure both the MLC 8000 Subsite Link Converters and MLC 8000 Analog Comparators are cabled to switches. So, configuration can only be performed AFTER going to each remote site to cable the MLC 8000 Subsite Link Converters to switches and base radios.

When and where to use: Follow these tasks to configure the MLC 8000 devices using a service laptop with the MLC 8000 Configuration Tool with Analog Display and Control.

Process:

1 You have three options to configure the MLC 8000s:

If…	Then…
Option 1: IF the system is prestaged off-site (not at the RF site), and IP address and channel cluster information is available	When off-site perform step 2- step 12 When on site, retrieve the saved configuration, skip to step 13 and finish the configuration.
Option 2: IF the system is prestaged off-site (not at the RF site), and IP address and channel cluster information is not available	On site, use these steps to update the configuration and provide the actual IP addresses and channel cluster information, and then set up associations.

If…	Then…
Option 3: IF the system is not prestaged off-site	Perform all the steps here.

2 Configure the MLC 8000 device IP addresses in the MLC 8000 Configuration Tool (if modification is needed).

See “Provisioning the Initial IP Address for an MLC 8000 Device” in the *MLC 8000 Configuration Tool User Guide*.

3 Create and define a channel cluster in the MLC 8000 Configuration Tool.

NOTICE: Prerequisite: IP addresses have been assigned to the MLC 8000 Analog Comparators and MLC 8000 Subsite Link Converters.

See “Creating a Conventional Channel Cluster” in the *MLC 8000 Configuration Tool User Guide*.

4 Define the Site ID and Site Name for the new channel cluster.

See “Entering Site ID and Site Name for a Conventional Channel Cluster” in the *MLC 8000 Configuration Tool User Guide*.

5 Provide the name and type for the channel cluster.

See “Defining a Conventional Channel Cluster” in the *MLC 8000 Configuration Tool User Guide*.

6 Define subsites in the subsite list. The Subsite ID and associated name are required for the system to work.

See “Modifying the Conventional Channel Cluster Subsite List” in the *MLC 8000 Configuration Tool User Guide*.

7 Add the Mixed Mode MLC 8000 Comparator (VGU) to the channel cluster.

See “Adding an MLC 8000 Analog or Mixed Mode Comparator to a Conventional Channel Cluster” in the *MLC 8000 Configuration Tool User Guide*.

NOTICE: You can complete the configuration now or download the software now, then configure after the software upgrade is complete. In either case, save the changes by clicking **Write to Device**. **Result:** The device restarts. After the restart, you can upgrade the software if necessary.

8 (Optional) Download the MLC 8000 device software if available (if you are unsure that you have the latest version or it was not downloaded in off-site prestaging). Perform this task if your Motorola Solutions representative recommends a newer software version. New software is available at Motorola Online (http://businessonline.motorolasolutions.com).

NOTICE: The software download must be performed separately for each MLC 8000 device in the channel cluster.

See “Downloading a Specific Software Update to an MLC 8000 Device” in the *MLC 8000 Configuration Tool User Guide*.

9 Configure the Mixed Mode MLC 8000 Comparator (VGU).

See “Configuring an MLC 8000 Analog Comparator for Mixed Mode Non IP Simulcast Voting” in the *MLC 8000 Configuration Tool User Guide*.

10 Add an MLC 8000 Subsite Link Converter to a conventional channel cluster.

See “Adding an MLC 8000 Subsite Link Converter to a Conventional Channel Cluster” in the *MLC 8000 Configuration Tool User Guide*.

NOTICE: You can complete the configuration now or download the software now, then configure after the software upgrade is complete. In either case, save the changes by clicking **Write to Device**. Result: The device restarts. After the restart, you can upgrade the software if necessary.

11 (Optional) Download the MLC 8000 device software if available (if you are unsure that you have the latest version or it was not downloaded in off-site prestaging). Perform this task if your Motorola Solutions representative recommends a newer software version. New software is available at Motorola Online (http://businessonline.motorola.com).

NOTICE: The software download must be performed separately for each MLC 8000 device in the channel cluster.

See “Downloading a Specific Software Update to an MLC 8000 Device” in the *MLC 8000 Configuration Tool User Guide*.

12 Configure the MLC 8000 Subsite Link Converter (and associated AGU ports).

a Within the procedure to configure the MLC 8000 Subsite Link Converter, you configure the ports associated with the VGU (select the AGU in the Configuration Tool).

See “Configuring an MLC 8000 Subsite Link Converter for a Non IP Simulcast System” in the *MLC 8000 Configuration Tool User Guide*.

NOTICE: When you configure the MLC 8000 Analog Comparator (VGU) ports, you can repeat this step for as many BR locations as your system has.

NOTICE: Base Radio Properties Tab, Link Type = Hybrid Link (internal or external TX clock). This field is enabled for Non IP simulcast systems.

13 Configure the channel (set up associations). Associate base radios with each MLC 8000 Analog Comparator (VGU).

See “Associating a Base Radio with an MLC 8000 Analog Comparator” in the *MLC 8000 Configuration Tool User Guide*.

NOTICE: This loop can be repeated up to four times.

14 Set channel cluster parameters for all MLC 8000s (including G.711, NTP, and timeout parameters).

See “Setting Channel Cluster Parameters” in the *MLC 8000 Configuration Tool User Guide*.

NOTICE: Prerequisite: All devices of the channel cluster have been added and configured, so that MLC 8000 Configuration Tool downloads the channel cluster parameters to all these devices.

The MLC 8000 devices are configured.

Postrequisites: See Verifying the Installation and Configuration on page 96.

4.1.4
Verifying the Installation and Configuration

When and where to use: Follow this process to verify the installation and configuration.

Process:

1 Is MAC Port Lockdown used on the system? Run MAC Port Lockdown, if applicable.

If…	Then…
Yes	For K core systems, run MAC Port Lockdown on the switches. See “Locking HP Switch Ports” in the *MAC Port Lockdown Feature Guide*.
	For M series and L series zone core systems, run MAC Port Lockdown on the switches.

If…	Then…
	See “Performing MAC Port Lockdown on HP Switches” in the *MAC Port Lockdown Feature Guide*.
No	For K core systems, disable open (unused) ports on switches. For each of the HP switches, every open port (no device connected) must be disabled. See “Enabling/Disabling Ports on HP Switches Using Local Access” in the *MAC Port Lockdown Feature Guide*.
	For M series and L series zone core systems, disable open (unused) ports on switches. See “Locking HP Switch Ports Using a VoyenceControl Template” in the *MAC Port Lockdown Feature Guide*.

2 Verify connectivity.

a View the channel cluster to verify the links. (Icons for the MLC 8000 Analog Comparator and its MLC 8000 Subsite Link Converters are yellow to indicate connection with the Configuration Tool and the device).

See “Viewing a particular Channel Cluster Tree” in the *MLC 8000 Configuration Tool User Guide*.

b Verify that the MLC 8000 Analog Comparator is voting the base radios by observing at the Analog Display and Control Application. For example, the LED to the left of the base radio should not be gray, the radio state is either **Active** or **No activity**, and the SQM signal strength should not be **N/A**.

See “Opening the Analog Display and Control Application with MLC 8000 Analog Comparator Selected” in the *MLC 8000 Configuration Tool User Guide*.

3 Confirm the status of the links.

Devices		Procedure References
MLC 8000 Analog Comparator to MLC 8000 Subsite Link Converter (IP)		
	Check the COMM LED, which is Red if at least one link connection to the MLC 8000 Link Converter port has failed.	See “MLC 8000 Analog Comparator LEDs” in the *MLC 8000 Comparator Feature Guide*.
	Use MOSCAD NFM. Only if the MOSCAD NFM subsystem is available in your system.	See “MLC 8000 Analog Comparator — MOSCAD NFM Events Troubleshooting (Non IP Simulcast System)” in the *MLC 8000 Comparator Feature Guide*.
	Pull a log file of the device for error messages.	See “MLC 8000 Device Logs and Recommended Actions” in the *MLC 8000 Comparator Feature Guide*.
GCM 8000/GRV 8000 Digital Comparator to MLC 8000 Subsite Link Converter (IP)		
	Check the COMM LED.	See “MLC 8000 Link Converter LEDs” in the *MLC 8000 Comparator Feature Guide*.

Table continued…

Devices		Procedure References
	Use MOSCAD NFM. Only if the MOSCAD NFM subsystem is available in your system. Check for a VIP 3 event, which indicates the comparator link failed.	See “MLC 8000 Link Converter — MOSCAD NFM Events Troubleshooting (IP Simulcast System)” in the *MLC 8000 Comparator Feature Guide*.
MLC 8000 Subsite Link Converter to Base Radio (4-wire)		
	Check the Port 1-4 LED. On the MLC 8000, the Port 1-4 LED is Red indicating the link to the base radio failed.	See “MLC 8000 Link Converter LEDs” in the *MLC 8000 Comparator Feature Guide*.
	Use MOSCAD NFM. Only if the MOSCAD NFM subsystem is available in your system. Check for a VIP 4 event, which indicates a link to a BR has failed. One MLC 8000 Subsite Link Converter connects to four base radios, but it has one VIP to indicate status. So, check each of the four connections.	See “MLC 8000 Link Converter — MOSCAD NFM Events Troubleshooting (Non IP Simulcast System)” in the *MLC 8000 Comparator Feature Guide*.
	Pull a log file of the device for error messages.	See “MLC 8000 Device Logs and Recommended Actions” in the *MLC 8000 Comparator Feature Guide*.
MLC 8000 Analog Comparator to Site Gateways (Conventional Channel Interface) (4-wire)		
	To verify, make a call from the console, and verify that the BR is transmitting.	

4 Verify by making calls. This is a general task to perform.

   a Test the operation of the system by making calls from the radios and ensuring call completion and quality.

   b Verify that you can make a Console to Radio, Radio to Console, and Radio to Radio analog call.

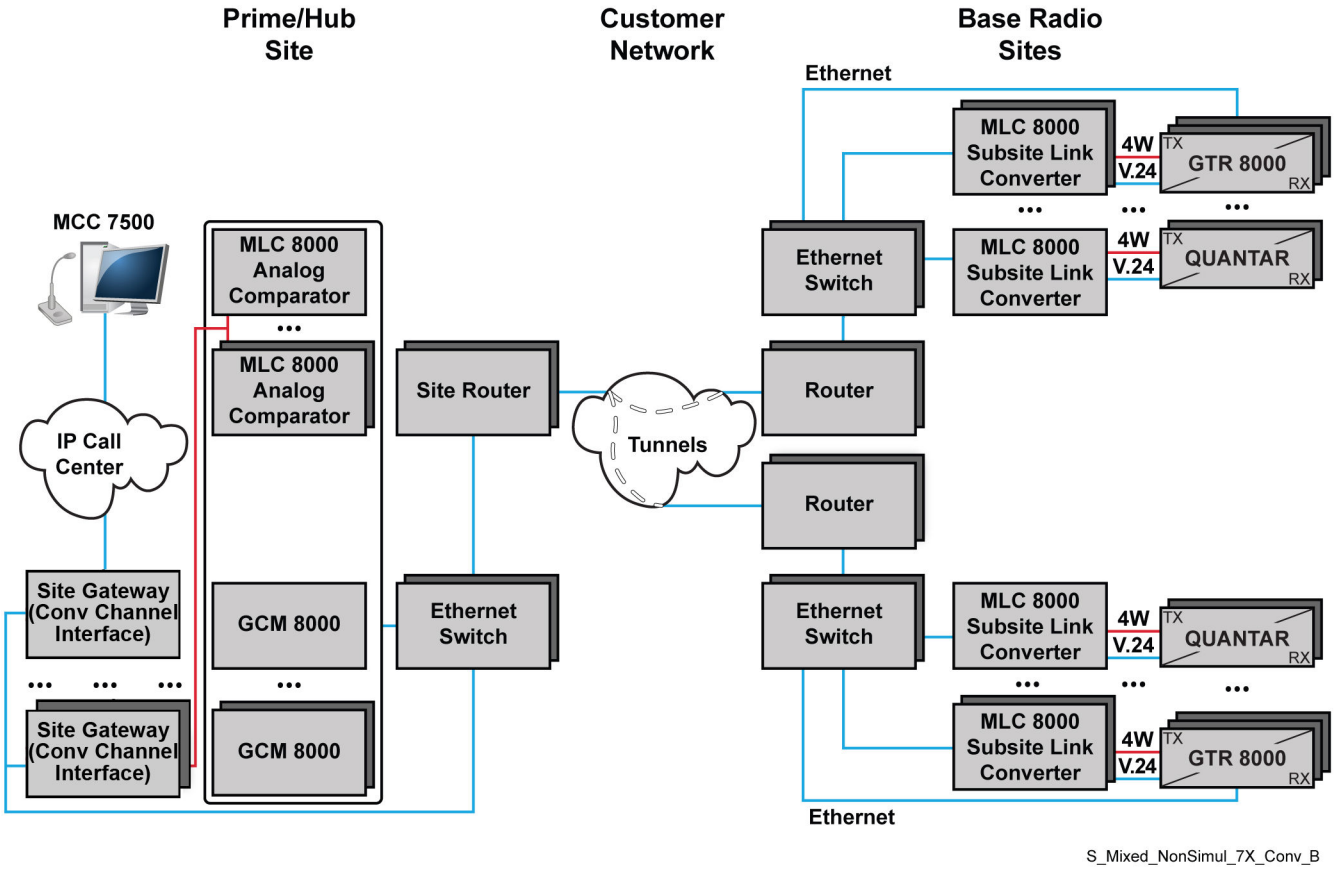
Postrequisites: Calibrate/optimize the Non Simulcast system after the system is running properly.

- See “Performing Calibration for an MLC 8000 Subsite Link Converter” in the *MLC 8000 Configuration Tool User Guide*.
- See “Performing Calibration for an MLC 8000 Analog Comparator” in the *MLC 8000 Configuration Tool User Guide*.

4.2 ASTRO 25 Mixed-Mode Non-Simulcast Voting Subsystem Equipment Cabling

This section provides a high-level subsystem diagram and equipment cabling tables from the MLC 8000 device to other system devices. A port description table lists the system devices and refers to the device documentation for more information.

Figure 9: ASTRO 25 Mixed-Mode Non-Simulcast Voting Subsystem Diagram



IMPORTANT: High-level diagrams are provided as examples only and are not to be used for system planning purposes. SDM3000 RTUs are not shown in the diagram, but would be part of the system if the optional MOSCAD NFM subsystem is available and would be connected to the MLC 8000 devices.

NOTICE: This table provides part numbers for cables that are orderable from Motorola Solutions. Create the remaining cables using the provided pinout tables. See MLC 8000 Radio Ports Cabling on page 161.

Table 17: Equipment Cabling for ASTRO 25 Mixed-Mode Non-Simulcast Voting Subsystem

From MLC 8000 Analog Comparator (Prime Site)		To Destination device:		
Port	**Connector Type**	**Device**	**Connector Type**	**Description**
External LAN PoE	RJ45	LAN Switch	RJ45	RJ45-to-RJ45 one-to-one cable
VIP	RJ45	SDM3000 RTU	I/O Wiring Punch Block	MLC 8000 to MOSCAD NFM Cable on page 161
R1 4W-E&M	RJ45	Site Gateway (Conventional Channel Interface), 4W E&M (8D…8A)	RJ45	4W MLC 8000 (Analog Comparator) to Site Gateway (Conventional Channel Interface) Cable on page 173

Table continued…

From MLC 8000 Analog Comparator (Prime Site)		To Destination device:		
Port	**Connector Type**	**Device**	**Connector Type**	**Description**
From MLC 8000 Subsite Link Converter (Subsite)		To Destination device:		
Port	Connector Type	Device	Connector Type	Description
External LAN PoE	RJ45	LAN Switch	RJ45	RJ45-to-RJ45 one-to-one cable
VIP	RJ45	SDM3000 RTU	I/O Wiring Punch Block	MLC 8000 to MOSCAD NFM Cable on page 161
R1-4 4W-E&M	RJ45	QUANTAR® Base Radio	Punch Block	4W MLC 8000 to QUANTAR Cable (Non-Simulcast) on page 162
R1-4 4W-E&M	RJ45	GTR 8000 Base Radio	RJ45 Wireline port	4W MLC 8000 to GTR 8000 Cable (Non-Simulcast) on page 170
R1-4 4W-E&M	RJ45	GTR 8000 Base Radio, Analog TELCO	RJ45	4W MLC 8000 to GTR 8000 Cable (Non-Simulcast) on page 170
			50-pin System Connector, mini SCSI	4W MLC 8000 to GTR 8000 Cable (Non-Simulcast) for T57 DLN6821A Cable Assembly Connection on page 172
R1-4 COMM	RJ45	GTR 8000 Base Radio QUANTAR® Base Radio	RJ45 RJ45	V.24 MLC 8000 to GTR 8000/ QUANTAR Cable on page 191

Port Descriptions for ASTRO 25 Mixed-Mode Non-Simulcast Voting Subsystem

Table 18: Port Descriptions

Device	Manual
MLC 8000	See “MLC 8000 Ports” in the *MLC 8000 Comparator Feature Guide*.
LAN switch	See “HP Switches – Determining Port Connections in ASTRO 25 Systems” in the *System LAN Switches Feature Guide*.
SDM3000 RTU	See the Installation chapter “Connecting I/Os with Punch Blocks” sub-section and Appendix C “Pin Assignments” and “Punch Block Terminal Block Contacts” in the *SDM3000 Owner’s Manual*. Depending on the MLC 8000 device type, up to four I/Os and one output (the 5v) are used to report alarms to MOSCAD NFM, and one I/O is used by MOSCAD NFM to restart the MLC 8000 unit from the GMC Application.

Table continued…

Device	Manual
	See also Setting Up MOSCAD Network Fault Management (NFM) Monitoring on page 37.
Site Gateway (Conventional Channel Interface)	“Making a Physical 4-W Connection on MLC 8000 Analog Comparator to CCGW” in the *GGM 8000 System Gateway Feature Guide*.
QUANTAR® Base Radio	“Backplane Connectors Information” in the *QUANTAR Instruction Manual* (6881095E05). Connects to either a punch block to the 50–pin Telco System Connector (I) or the 8-wire screw terminal connector.
GTR 8000 Base Radio	“Transceiver Ports – Front” in the *RF Site Technician Guide* webhelp

4.3 ASTRO 25 Mixed-Mode Non-Simulcast Voting Subsystem Troubleshooting

To troubleshoot the initial implementation of MLC 8000s in an ASTRO® 25 Mixed-Mode Non-Simulcast Voting Subsystem, see Troubleshooting the Transmit (TX) Path for Non-Simulcast Subsystems on page 226.

For general conventional troubleshooting, refer to the *RF Site Technician* webhelp.

Refer to the *MLC 8000 Comparator Feature Guide* for LED indications and the details of the alarms specifically for MLC 8000s, for ongoing monitoring and troubleshooting.

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Chapter 5

ASTRO 25 Conventional Mixed-Mode Simulcast Voting Subsystem

The MLC 8000 Implementation for an ASTRO® 25 Conventional Mixed-Mode Simulcast Voting Subsystem is divided into two separate and independent setups; Analog-Only and Digital-Only.

For Analog-Only implementation, see Chapter 3 “ASTRO 25 Analog-Only IP-Based Simulcast Subsystem”.

For Digital-Only set-up, see to Chapter 6 “ASTRO 25 Digital-Only Simulcast Voting Subsystem”.

NOTICE: A Mixed-Mode Simulcast Voting System is supported only with GEN 2 GTR 8000 Base Radios.

A high-level diagram and equipment cabling tables are also provided for the subsystem. See ASTRO 25 Conventional Mixed-Mode Simulcast Voting Subsystem Equipment Cabling on page 113.

5.1 Implementing an ASTRO 25 Conventional Mixed-Mode Simulcast Voting Subsystem

Prerequisites: See Implementing MLC 8000s on page 31.

NOTICE: A digital voice call has priority over an analog voice call, and a voice call (digital or analog) has priority over a data call.

When and where to use: Follow these sequences when implementing MLC 8000s in an ASTRO® 25 Conventional Mixed-Mode Simulcast Voting subsystem.

Process:

1. Perform the tasks to install equipment at the prime site. See Installing Equipment for Each Channel in the Prime Site on page 103.
2. Perform the tasks to install equipment at subsites. See Installing Equipment for Each Channel in Subsites on page 106.
3. Perform the tasks to install equipment at subsites. See “Configuring an MLC 8000 Analog Comparator for an IP Simulcast System” in the *MLC 8000 Configuration Tool User Guide*.
4. Verify the installation and configuration performed in this implementation. See Verifying the Installation and Configuration on page 111.

5.1.1 Installing Equipment for Each Channel in the Prime Site

When and where to use: Use for Prime Sites for ASTRO® 25 Conventional Mixed-Mode Voting Subsystems.

Process:

1. Install a Site Gateway (Conventional Channel Interface) at the prime site if adding G.711 to the existing configuration and the current system does not have a CCGW. Connects to the switch.

NOTICE: A Site Gateway (Conventional Channel Interface) is also known as a Conventional Channel Gateway (CCGW). A CCGW can support four channels, with a maximum of three CCGWs at the prime site. A Conventional Hub site can support up to 10 LAN-Only CCGWs. Requires one four-wire E&M module (installed in the analog slot).

See “Installation” in the *GGM 8000 System Gateway Feature Guide*.

2 Configure Site Gateways (Conventional Channel Interface).

See “GGM 8000 Configuration” in the *GGM 8000 System Gateway Feature Guide*.

NOTICE: Analog Link Monitor Tone (ALMT) is only supported on Conventional Mixed Mode channels with the V.24 interface. It is not supported on Conventional Mixed Mode channels with the Ethernet interface and is not supported on analog conventional channels. Do not configure ALMT for the Site Gateway (Conventional Channel Interface) when using mixed mode channels with an interface type of Ethernet.

3 Install the MLC 8000 Analog Comparator.

a Install the MLC 8000 in a rack or cabinet.

See “Installing MLC 8000” in the *MLC 8000 Comparator Feature Guide*.

b Mount the MLC 8000 on a tray.

See “Mounting MLC 8000 on the Tray” in the *MLC 8000 Comparator Feature Guide*.

c Ground the MLC 8000 on a tray.

See “Grounding an MLC 8000 in a Tray” in the *MLC 8000 Comparator Feature Guide*.

d (For rack-mount installation) Install the MLC 8000 tray in a rack.

See “Installing MLC 8000 Tray in Rack” in the *MLC 8000 Comparator Feature Guide*.

e (For cabinet-mount installation) Install the MLC 8000 tray in a cabinet.

See “Installing MLC 8000 Tray in Cabinet” in the *MLC 8000 Comparator Feature Guide*.

4 Ground the MLC 8000 tray installed in the rack or cabinet.

See “Installing MLC 8000” (step 2) in the *MLC 8000 Comparator Feature Guide*.

5 Connect the MLC 8000 to power by connecting the DC cable of the power supply unit to the DC inlet of the MLC 8000.

See “Installing MLC 8000” (step 3) in the *MLC 8000 Comparator Feature Guide*.

6 Install the GCM 8000 or GRV 8000 Digital Comparator.

See the *RF Site Technician Guide* and *RF Site Technician Reference Guide* webhelp.

7 Is MAC Port Lockdown used on the system? (Disable MAC Port Lockdown if applicable)

If…	Then…
Yes	For K core systems, disable MAC Port Lockdown on the site LAN switch. See “Disabling MAC Port Lockdown Using an HP Switch Service Port” in the *MAC Port Lockdown Feature Guide*.
	For M series and L series zone core systems, disable MAC Port Lockdown on the site LAN switch with a Saved Command in UNC. See “Disabling MAC Port Lockdown Using a VoyenceControl Template” in the *MAC Port Lockdown Feature Guide*.
	Determine the switch configuration, to find an unused port. See “HP Switches – Determining Port Connections in ASTRO 25 Systems” in the *System LAN Switches Feature Guide*.

If…	Then…
No	For K core systems, enable and configure unused ports on switches. Enable all the ports on the switches. See “Enabling/Disabling Ports on HP Switches Using Local Access” in the *MAC Port Lockdown Feature Guide*.
	For M series and L series zone core systems, enable and configure unused ports on switches. See “Enabling/Disabling Ports on HP Switches Using VoyenceControl” in the *MAC Port Lockdown Feature Guide*.

8 Connect the MLC 8000 Analog Comparator to the switch.

See ASTRO 25 Conventional Mixed-Mode Simulcast Voting Subsystem Equipment Cabling on page 113.

9 Connect the digital comparator to the switch.

See “Cabling” in the *RF Site Technician Guide* and *RF Site Technician Reference Guide* webhelp.

10 Connect the MLC 8000 Analog Comparator to Site Gateways (Conventional Channel Interface). It is a 4-wire connection.

See ASTRO 25 Conventional Mixed-Mode Simulcast Voting Subsystem Equipment Cabling on page 113.

11 Optional: Set up MOSCAD NFM. This task is only applicable if MOSCAD NFM is available.

See Setting Up MOSCAD Network Fault Management (NFM) Monitoring on page 37.

12 Optional: Connect the MLC 8000 Analog Comparator to the SDM3000 RTU. This task is only applicable if MOSCAD NFM is available.

See Cabling MLC 8000 to SDM3000 RTU on page 40.

13 Push new configuration files down to the switches and GGM 8000 gateways.

- For K core systems (distributed conventional architecture), use Configuration Manager to push the configuration files. See “Downloading the Full Configuration to a Device” in the *Configuration Manager for Conventional Systems User Guide*.

  NOTICE: For a K core system, the service PC is used to install the configuration files for the gateways and switches.

- For M series and L series zone core systems, use UNC to push the configuration files. See “Distributing Configurations For Transport Devices through the UNC Wizard” in the *Unified Network Configurator User Guide*.

14 Reboot the gateways. Using a terminal program, type **rb** (ReBoot) and press ENTER.

The switch reboots automatically after pushing the new configuration.

15 Turn the digital comparator ON.

See the *RF Site Technician Guide* and *RF Site Technician Reference Guide*.

16 For Mixed Mode Non Simulcast Voting Subsystem configurations, use CSS to disable Simulcast operation on the GCM 8000 or GRV 8000. Otherwise, for the Conventional Mixed-Mode Simulcast Voting Subsystem configurations, use CSS to enable Simulcast operation on the GCM 8000 or GRV 8000.

See “Site Configuration” in the *CSS Online Help*.

17 Turn on power to the MLC 8000 by connecting the AC cord of the power supply unit to the AC wall-mount power outlet (110-240 VAC, 50/60 Hz).

NOTICE: The AC power outlet should be as near as possible to the equipment and should be accessible. Ensure that the cable is not routed with tension.

See “Installing MLC 8000” (step 6) in the *MLC 8000 Comparator Feature Guide*.

a Verify the MLC 8000 power LED turns RED (which indicates the MLC 8000 is in booting state) and after a while, it turns GREEN.

b Optional: If the MOSCAD NFM subsystem is available in the system, then you can also verify that the MOSCAD NFM correctly indicates the presence of the MLC 8000 by pin # 1 at the VIP connector (or else the wiring to the SDM3000 RTU may be wrong). Validate that the correct indication of each MLC 8000 power up is shown in the GMC Application, either on the GMC or on the GWS.

18 Install the MLC 8000 Configuration Tool with Analog Display and Control to a service laptop (if you did not do so in the off-site preconfiguration).

See “Installing the MLC 8000 Configuration Tool with Analog Display and Control” in the *MLC 8000 Configuration Tool User Guide*. Complete the full process even if individual steps are not called out.

NOTICE: Obtain the installation CD for the MLC 8000 Configuration Tool, or the version of the software you want to install from Motorola Online. Install the MLC 8000 Configuration Tool on your own laptops in the field.

19 Optional: Install the MCN Server 8000™ Remote Comparator Display Software. See Setting Up the MCN Server 8000 Remote Comparator Display Software on page 35.

NOTICE: If available, this software can be installed at any time. No configuration at the MLC 8000 is necessary.

20 Change the MLC 8000 factory programmed passwords (if needed).

See “Changing the MLC 8000 Password” in the *MLC 8000 Configuration Tool User Guide*.

21 Define a reset password key if necessary to harden the reset password mechanism.

See “Assigning Reset Password Key” in the *MLC 8000 Configuration Tool User Guide*.

IMPORTANT: Changing the password must occur on-site since passwords are secured and not exposed to Motorola Solutions. The passwords can be changed either locally using the Local O&M port (serial connection) or remotely using the SSH option in PuTTY to connect to the Extranet LAN port. If you change the password, then push the same password to all devices (this is mandatory). Use the same password for all the devices of the channel cluster.

Installation of equipment and software for each channel in the prime site is complete.

Postrequisites: See Installing Equipment for Each Channel in Subsites on page 106.

5.1.2
Installing Equipment for Each Channel in Subsites

When and where to use: Use for subsites for ASTRO® 25 Conventional Mixed-Mode Simulcast Voting Subsystems.

Process:

1 Install the MLC 8000 Subsite Link Converter.

a Install the MLC 8000 in a rack or cabinet.

See “Installing MLC 8000” in the *MLC 8000 Comparator Feature Guide*.

b Mount the MLC 8000 on a tray.

See “Mounting MLC 8000 on the Tray” in the *MLC 8000 Comparator Feature Guide*.

c Ground the MLC 8000 on a tray.

See “Grounding an MLC 8000 in a Tray” in the *MLC 8000 Comparator Feature Guide*.

d Install the MLC 8000 REF Input Signals to connect the MLC 8000 to the Time Reference (GPS). See “Installing MLC 8000 REF Input Signals for IP Simulcast System” in the *MLC 8000 Comparator Feature Guide*.

NOTICE: The assumption is that the Simulcast Site Reference device is installed and running, providing a synchronized REF composite signal. The Time Reference (GPS) is not needed if the MLC 8000 Subsite Link Converter is connected to an Rx only BR

e (For rack-mount installation) Install the MLC 8000 tray in a rack.

See “Installing MLC 8000 Tray in Rack” in the *MLC 8000 Comparator Feature Guide*.

f (For cabinet-mount installation) Install the MLC 8000 tray in a cabinet.

See “Installing MLC 8000 Tray in Cabinet” in the *MLC 8000 Comparator Feature Guide*.

2 Ground the MLC 8000 tray installed in the rack or cabinet.

See “Installing MLC 8000” (step 2) in the *MLC 8000 Comparator Feature Guide*.

3 Connect the MLC 8000 to power by connecting the DC cable of the power supply unit to the DC inlet of the MLC 8000.

See “Installing MLC 8000” (step 3) in the *MLC 8000 Comparator Feature Guide*.

4 Is MAC Port Lockdown used on the system? (Disable MAC Port Lockdown if applicable)

If…	Then…
Yes	For K core systems, disable MAC Port Lockdown on the site LAN switch. See “Disabling MAC Port Lockdown Using an HP Switch Service Port” in the *MAC Port Lockdown Feature Guide*.
	For M series and L series zone core systems, disable MAC Port Lockdown on the site LAN switch with a Saved Command in UNC. See “Disabling MAC Port Lockdown Using a VoyenceControl Template” in the *MAC Port Lockdown Feature Guide*.
	Determine the switch configuration, to find an unused port. See “HP Switches – Determining Port Connections in ASTRO 25 Systems” in the *System LAN Switches Feature Guide*.
No	For K core systems, enable and configure unused ports on switches. Enable all the ports on the switches. See “Enabling/Disabling Ports on HP Switches Using Local Access” in the *MAC Port Lockdown Feature Guide*.
	For M series and L series zone core systems, enable and configure unused ports on switches. See “Enabling/Disabling Ports on HP Switches Using VoyenceControl” in the *MAC Port Lockdown Feature Guide*.

5 Connect the MLC 8000 Subsite Link Converter to the switch.

See ASTRO 25 Conventional Mixed-Mode Simulcast Voting Subsystem Equipment Cabling on page 113.

6 Connect the MLC 8000 Subsite Link Converter to the base radio.

NOTICE: For Conventional Mixed-Mode Voting Simulcast, all base radios must be G-Series Generation 2. See “GTR 8000 Base Radio FRU Procedures, Transceiver Hardware Generations” in the *RF Site Technician Reference Guide* webhelp.

7 Configure the base radios to interface with the MLC 8000 devices.

See GTR 8000 Configuration Settings on page 53.

8 Optional: Set up MOSCAD NFM. This task is only applicable if MOSCAD NFM is available.

See Setting Up MOSCAD Network Fault Management (NFM) Monitoring on page 37.

9 Optional: Connect the MLC 8000 Analog Comparator to the SDM3000 RTU. This task is only applicable if MOSCAD NFM is available.

See Cabling MLC 8000 to SDM3000 RTU on page 40.

10 Push new configuration files down to the switches and GGM 8000 gateways.

- For K core systems (distributed conventional architecture), use Configuration Manager to push the configuration files. See “Downloading the Full Configuration to a Device” in the *Configuration Manager for Conventional Systems User Guide*.

  NOTICE: For a K core system, the service PC is used to install the configuration files for the gateways and switches.

- For M series and L series zone core systems, use UNC to push the configuration files. See “Distributing Configurations For Transport Devices through the UNC Wizard” in the *Unified Network Configurator User Guide*.

11 Reboot the gateways. Using a terminal program, type **rb** (ReBoot) and press ENTER.

The switch reboots automatically after pushing the new configuration.

12 Turn on power to the MLC 8000 by connecting the AC cord of the power supply unit to the AC wall-mount power outlet (110-240 VAC, 50/60 Hz).

NOTICE: The AC power outlet should be as near as possible to the equipment and should be accessible. Ensure that the cable is not routed with tension.

See “Installing MLC 8000” (step 6) in the *MLC 8000 Comparator Feature Guide*.

a Verify the MLC 8000 power LED turns RED (which indicates the MLC 8000 is in booting state) and after a while, it turns GREEN.

b Optional: If the MOSCAD NFM subsystem is available in the system, then you can also verify that the MOSCAD NFM correctly indicates the presence of the MLC 8000 by pin # 1 at the VIP connector (or else the wiring to the SDM3000 RTU may be wrong). Validate that the correct indication of each MLC 8000 power up is shown in the GMC application, either on the GMC or on the GWS.

Installation of equipment for each channel in the subsite is complete.

Postrequisites: See Configuring MLC 8000 Devices with the MLC 8000 Configuration Tool on page 94.

5.1.3
Configuring MLC 8000 Devices with the MLC 8000 Configuration Tool

Prerequisites: Ensure both the MLC 8000 Subsite Link Converters and MLC 8000 Analog Comparators are cabled to switches. So, configuration can only be performed AFTER going to each remote site to cable the MLC 8000 Subsite Link Converters to switches and base radios.

When and where to use: Follow these tasks to configure the MLC 8000 devices using a service laptop with the MLC 8000 Configuration Tool with Analog Display and Control.

Process:

1 You have three options to configure the MLC 8000s:

If…	Then…
Option 1: IF the system is prestaged off-site (not at the RF site), and IP address and channel cluster information is available	When off-site perform step 2- step 12 When on site, retrieve the saved configuration, skip to step 13 and finish the configuration.
Option 2: IF the system is prestaged off-site (not at the RF site), and IP address and channel cluster information is not available	On site, use these steps to update the configuration and provide the actual IP addresses and channel cluster information, and then set up associations.
Option 3: IF the system is not prestaged off-site	Perform all the steps here.

2 Configure the MLC 8000 device IP addresses in the MLC 8000 Configuration Tool (if modification is needed).

See “Provisioning the Initial IP Address for an MLC 8000 Device” in the *MLC 8000 Configuration Tool User Guide*.

3 Create and define a channel cluster in the MLC 8000 Configuration Tool.

NOTICE: Prerequisite: IP addresses have been assigned to the MLC 8000 Analog Comparators and MLC 8000 Subsite Link Converters.

See “Creating a Conventional Channel Cluster” in the *MLC 8000 Configuration Tool User Guide*.

4 Define the Site ID and Site Name for the new channel cluster.

See “Entering Site ID and Site Name for a Conventional Channel Cluster” in the *MLC 8000 Configuration Tool User Guide*.

5 Provide the name and type for the channel cluster.

See “Defining a Conventional Channel Cluster” in the *MLC 8000 Configuration Tool User Guide*.

6 Define subsites in the subsite list. The Subsite ID and associated name are required for the system to work.

See “Modifying the Conventional Channel Cluster Subsite List” in the *MLC 8000 Configuration Tool User Guide*.

7 Add digital comparators to the channel cluster. See “Adding a Digital Comparator to a Conventional Channel Cluster” in the *MLC 8000 Configuration Tool User Guide*.

8 Add the Mixed Mode MLC 8000 Comparator (VGU) to the channel cluster.

See “Adding an MLC 8000 Analog or Mixed Mode Comparator to a Conventional Channel Cluster” in the *MLC 8000 Configuration Tool User Guide*.

NOTICE: You can complete the configuration now or download the software now, then configure after the software upgrade is complete. In either case, save the changes by clicking **Write to Device**. Result: The device restarts. After the restart, you can upgrade the software if necessary.

9 (Optional) Download the MLC 8000 device software if available (if you are unsure that you have the latest version or it was not downloaded in off-site prestaging). Perform this task if your

Motorola Solutions representative recommends a newer software version. New software is available at Motorola Online (http://businessonline.motorolasolutions.com).

NOTICE: The software download must be performed separately for each MLC 8000 device in the channel cluster.

See “Downloading a Specific Software Update to an MLC 8000 Device” in the *MLC 8000 Configuration Tool User Guide*.

10 Configure the Mixed Mode MLC 8000 Comparator (VGU).

See “Configuring an MLC 8000 Analog Comparator for an IP Simulcast System” in the *MLC 8000 Configuration Tool User Guide* and refer to the CSS for GGM 8000 digital and mixed-mode simulcast configuration.

11 Add an MLC 8000 Subsite Link Converter to a conventional channel cluster.

See “Adding an MLC 8000 Subsite Link Converter to a Conventional Channel Cluster” in the *MLC 8000 Configuration Tool User Guide*.

NOTICE: You can complete the configuration now or download the software now, then configure after the software upgrade is complete. In either case, save the changes by clicking **Write to Device**. Result: The device restarts. After the restart, you can upgrade the software if necessary.

12 (Optional) Download the MLC 8000 device software if available (if you are unsure that you have the latest version or it was not downloaded in off-site prestaging). Perform this task if your Motorola Solutions representative recommends a newer software version. New software is available at Motorola Online (http://businessonline.motorola.com).

NOTICE: The software download must be performed separately for each MLC 8000 device in the channel cluster.

See “Downloading a Specific Software Update to an MLC 8000 Device” in the *MLC 8000 Configuration Tool User Guide*.

13 Configure the MLC 8000 Subsite Link Converter (and associated AGU ports).

a Within the procedure to configure the MLC 8000 Subsite Link Converter, you configure the ports associated with the VGU (select the AGU in the Configuration Tool).

See “Configuring an MLC 8000 Subsite Link Converter for an IP Simulcast System” in the *MLC 8000 Configuration Tool User Guide*.

NOTICE: When you configure the MLC 8000 Analog Comparator (VGU) ports, you can repeat this step for as many BR locations as your system has.

NOTICE: Base Radio Properties Tab, Link Type = Hybrid Link (internal or external TX clock).

14 Configure the channel (set up associations). Associate base radios with each MLC 8000 Analog Comparator (VGU).

See “Associating a Base Radio with an MLC 8000 Analog Comparator” in the *MLC 8000 Configuration Tool User Guide*.

NOTICE: This loop can be repeated up to four times.

15 Set channel cluster parameters for all MLC 8000s (including G.711, NTP, and timeout parameters).

See “Setting Channel Cluster Parameters” in the *MLC 8000 Configuration Tool User Guide*.

NOTICE: Prerequisite: All devices of the channel cluster have been added and configured, so that MLC 8000 Configuration Tool downloads the channel cluster parameters to all these devices.

The MLC 8000 devices are configured.

Postrequisites: See Verifying the Installation and Configuration on page 111.

5.1.4
Verifying the Installation and Configuration

When and where to use: Follow this process to verify the installation and configuration.

Process:

1 Is MAC Port Lockdown used on the system? Run MAC Port Lockdown if applicable.

If…	Then…
Yes	For K core systems, run MAC Port Lockdown on the switches. See “Locking HP Switch Ports” in the *MAC Port Lockdown Feature Guide*.
	For M series and L series zone core systems, run MAC Port Lockdown on the switches. See “Performing MAC Port Lockdown on HP Switches” in the *MAC Port Lockdown Feature Guide*.
No	For K core systems, disable open (unused) ports on switches. For each of the HP switches, every open port (no device connected) must be disabled. See “Enabling/Disabling Ports on HP Switches Using Local Access” in the *MAC Port Lockdown Feature Guide*.
	For M series and L series zone core systems, disable open (unused) ports on switches. See “Locking HP Switch Ports Using a VoyenceControl Template” in the *MAC Port Lockdown Feature Guide*.

2 Verify connectivity.

a View the channel cluster to verify the links. (Icons for the MLC 8000 Analog Comparator and its MLC 8000 Subsite Link Converters are yellow to indicate connection with the Configuration Tool and the device).

See “Viewing a particular Channel Cluster Tree” in the *MLC 8000 Configuration Tool User Guide*.

b Verify that the MLC 8000 Analog Comparator is voting the base radios by observing at the Analog Display and Control Application. For example, the LED to the left of the base radio should not be gray, the radio state is either **Active** or **No activity**, and the SQM signal strength should not be **N/A**.

See “Opening the Analog Display and Control Application with MLC 8000 Analog Comparator Selected” in the *MLC 8000 Configuration Tool User Guide*.

3 Confirm the status of the links.

Devices		Procedure References
MLC 8000 Analog Comparator to MLC 8000 Subsite Link Converter (IP)		
	Check the COMM LED, which is Red if at least one link connection to the MLC 8000 Link Converter port has failed.	See “MLC 8000 Analog Comparator LEDs” in the *MLC 8000 Comparator Feature Guide*.
	Use MOSCAD NFM. Only if the MOSCAD NFM subsystem is available in your system.	See “MLC 8000 Analog Comparator — MOSCAD NFM Events Troubleshooting (Non IP Simulcast System)” in the *MLC 8000 Comparator Feature Guide*.
	Pull a log file of the device for error messages.	See “MLC 8000 Device Logs and Recommended Actions” in the *MLC 8000 Comparator Feature Guide*.
GCM 8000/GRV 8000 Digital Comparator to MLC 8000 Subsite Link Converter (IP)		
	Check the COMM LED.	See “MLC 8000 Link Converter LEDs” in the *MLC 8000 Comparator Feature Guide*.
	Use MOSCAD NFM. Only if the MOSCAD NFM subsystem is available in your system. Check for a VIP 3 event, which indicates the comparator link failed.	See “MLC 8000 Link Converter — MOSCAD NFM Events Troubleshooting (IP Simulcast System)” in the *MLC 8000 Comparator Feature Guide*.
MLC 8000 Subsite Link Converter to Base Radio (4-wire)		
	Check the Port 1-4 LED. On the MLC 8000, the Port 1-4 LED is Red indicating the link to the base radio failed.	See “MLC 8000 Link Converter LEDs” in the *MLC 8000 Comparator Feature Guide*.
	Use MOSCAD NFM. Only if the MOSCAD NFM subsystem is available in your system. Check for a VIP 4 event, which indicates a link to a BR has failed. One MLC 8000 Subsite Link Converter connects to four base radios, but it has one VIP to indicate status. So, check each of the four connections.	See “MLC 8000 Link Converter — MOSCAD NFM Events Troubleshooting (IP Simulcast System)” in the *MLC 8000 Comparator Feature Guide*.
	Pull a log file of the device for error messages.	See “MLC 8000 Device Logs and Recommended Actions” in the *MLC 8000 Comparator Feature Guide*.
MLC 8000 Analog Comparator to Site Gateways (Conventional Channel Interface) (4-wire)		
	To verify, make a call from the console, and verify that the BR is transmitting.	

4 Verify by making calls. This is a general task to perform.

a Test the operation of the system by making calls from the radios and ensuring call completion and quality.

b Verify that you can make a Console to Radio, Radio to Console, and Radio to Radio analog call.

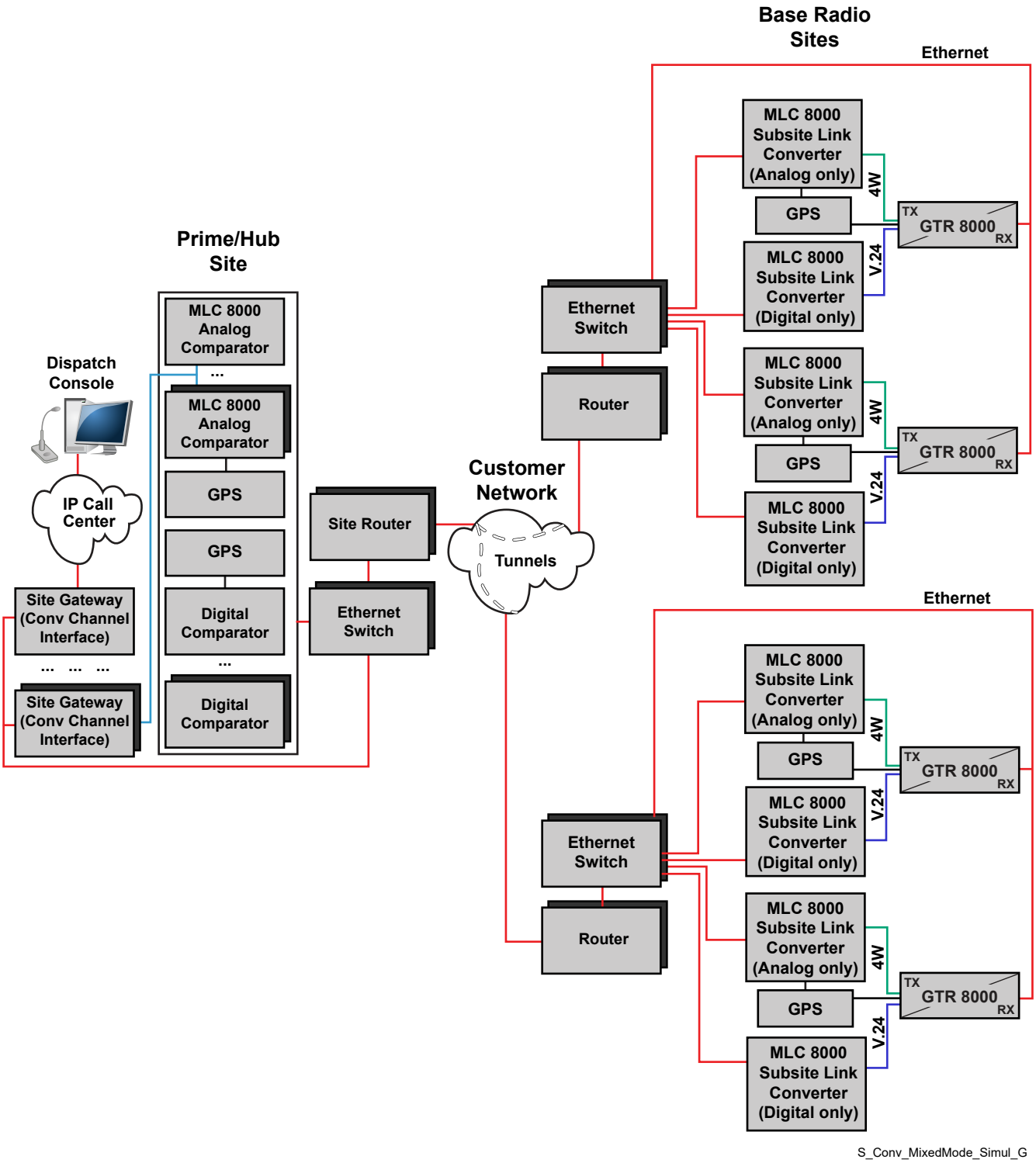
Postrequisites: Calibrate/optimize the system after the system is running properly.

- See “Performing Calibration for an MLC 8000 Subsite Link Converter” in the *MLC 8000 Configuration Tool User Guide*.
- See “Performing Calibration for an MLC 8000 Analog Comparator” in the *MLC 8000 Configuration Tool User Guide*.

5.2 ASTRO 25 Conventional Mixed-Mode Simulcast Voting Subsystem Equipment Cabling

This section provides a high-level subsystem diagram and equipment cabling tables from the MLC 8000 device to other system devices. A port description table lists the system devices and refers to the device documentation for more information.

Figure 10: ASTRO 25 Conventional Mixed-Mode Simulcast Voting Subsystem Diagram



IMPORTANT: High-level diagrams are provided as examples only and are not to be used for system planning purposes. “GPS” in the diagram refers to a Simulcast Site Reference device. This service is now called Global Navigation Satellite System (GNSS). SDM3000 RTUs are not shown in the diagram, but would be part of the system if the optional MOSCAD NFM subsystem is available and would be connected to the MLC 8000 devices.

NOTICE: This table provides part numbers for cables that are orderable from Motorola Solutions. Create the remaining cables using the provided pinout tables. See MLC 8000 Radio Ports Cabling on page 161.

Table 19: Equipment Cabling for ASTRO 25 Conventional Mixed-Mode Simulcast Voting Subsystem

From MLC 8000 Analog Comparator (Prime Site)		**To Destination device:**		
Port	**Connector Type**	**Device**	**Connector Type**	**Description**
REF .	QMA	Simulcast Site Reference device	BNC	GPS connector for the reference signal REF signal cable (FKN8718) T-BNC BNC-to-BNC COAX cable
External LAN PoE	RJ45	LAN Switch	RJ45	RJ45-to-RJ45 one-to-one cable
VIP	RJ45	SDM3000 RTU	I/O Wiring Punch Block	MLC 8000 to MOSCAD NFM Cable on page 161
R1 4W-E&M	RJ45	Site Gateway (Conventional Channel Interface), 4W E&M (8D…8A)	RJ45	4W MLC 8000 (Analog Comparator) to Site Gateway (Conventional Channel Interface) Cable on page 173
From MLC 8000 Subsite Link Converter (Subsite)		**To Destination device:**		
Port	Connector Type	Device	Connector Type	Description
REF .	QMA	Simulcast Site Reference device	BNC	GPS connector for the reference signal REF signal cable (FKN8718) T-BNC BNC-to-BNC COAX cable
External LAN PoE	RJ45	LAN Switch	RJ45	RJ45-to-RJ45 one-to-one cable
VIP	RJ45	SDM3000 RTU	I/O Wiring Punch Block	MLC 8000 to MOSCAD NFM Cable on page 161
R1-4 4W-E&M	RJ45	GTR 8000 Base Radio	RJ45 Wireline port	4W MLC 8000 to GTR 8000 Cable (IP Simulcast) on page 165
R1-4 4W-E&M	RJ45	GTR 8000 Base Radio, Analog TELCO	RJ45	4W MLC 8000 to GTR 8000 Cable (IP Simulcast) on page 165
			50-pin System Connector, mini SCSI	4W MLC 8000 to GTR 8000 Cable (IP Simulcast) on page 165
R1-4 COMM	RJ45	GTR 8000 Base Radio	RJ45 RJ45	V.24 MLC 8000 to GTR 8000/ QUANTAR Cable on page 191

From MLC 8000 Analog Comparator (Prime Site)		To Destination device:		
Port	**Connector Type**	**Device**	**Connector Type**	**Description**
				NOTICE: For Conventional Mixed-Mode Voting Simulcast, all base radios must be G-Series Generation 2.

NOTICE: The Global Navigation Satellite System (GNSS) should be connected to the MLC 8000 Subsite Link Converter only if GNSS is connected to an Rx/Tx or Tx only BR.

Port Descriptions for ASTRO 25 Conventional Mixed-Mode Simulcast Voting Subsystem

Table 20: Port Descriptions

Device	Manual
MLC 8000	See “MLC 8000 Ports” in the *MLC 8000 Comparator Feature Guide*.
Simulcast Site Reference device	See “Cabling the TRAK 9100 SSR” in the *RF Site Technician Guide* webhelp.
LAN switch	See “HP Switches – Determining Port Connections in ASTRO 25 Systems” in the *System LAN Switches Feature Guide*.
SDM3000 RTU	See the Installation chapter “Connecting I/Os with Punch Blocks” sub-section and Appendix C “Pin Assignments” and “Punch Block Terminal Block Contacts” in the *SDM3000 Owner’s Manual*. Depending on the MLC 8000 device type, up to four I/Os and one output (the 5v) are used to report alarms to MOSCAD NFM, and one I/O is used by MOSCAD NFM to restart the MLC 8000 unit from the GMC Application. See also Setting Up MOSCAD Network Fault Management (NFM) Monitoring on page 37.
Site Gateway (Conventional Channel Interface)	“Making a Physical 4-W Connection on MLC 8000 Analog Comparator to CCGW” in the *GGM 8000 System Gateway Feature Guide*.
GTR 8000 Base Radio	“Transceiver Ports – Front” in the *RF Site Technician Guide* webhelp

NOTICE: The Global Navigation Satellite System (GNSS) should be connected to the MLC 8000 Subsite Link Converter only if it is connected to an Rx/Tx or Tx only BR.

5.3

ASTRO 25 Conventional Mixed-Mode Simulcast Voting Subsystem Troubleshooting

To troubleshoot the initial implementation of MLC 8000s in an ASTRO® 25 Conventional Mixed-Mode Simulcast Voting Subsystem, see Troubleshooting the Transmit (TX) Path for Simulcast Subsystems on page 223.

For general conventional troubleshooting, refer to the *RF Site Technician* webhelp.

Refer to the *MLC 8000 Comparator Feature Guide* for LED indications and the details of the alarms specifically for MLC 8000s, for ongoing monitoring and troubleshooting.

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Chapter 6

ASTRO 25 Digital-Only Simulcast Voting Subsystem

This section outlines the installation and configuration procedures required to install MLC 8000s; each process step refers to the appropriate documentation provided with your ASTRO® 25 system for the detailed procedure. A high-level diagram and equipment cabling tables are provided for the subsystem.

NOTICE: This chapter is meant for setting up a digital-only simulcast system or for setting up the digital operation of a mixed-mode simulcast system. A mixed-mode simulcast system only supports GEN2 GTR 8000 Base Radios. Digital-only simulcast system supports QUANTAR® stations and GTR 8000 Base Radios

6.1 Implementing an ASTRO 25 Digital-Only Simulcast Voting Subsystem

Prerequisites: See Implementing MLC 8000s on page 31.

When and where to use: Follow these sequences when implementing MLC 8000s in an ASTRO® 25 Digital-Only Simulcast Voting subsystem.

Process:

1. Perform the tasks to install equipment at subsites. See Installing Equipment for Each Channel in Subsites on page 119.
2. Configure the MLC 8000 devices with the MLC 8000 Configuration Tool. See Configuring MLC 8000 Devices with the MLC 8000 Configuration Tool on page 122.
3. Verify the installation and configuration performed in this implementation. See Verifying the Installation and Configuration on page 123.

6.1.1 Installing Equipment for Each Channel in Subsites

When and where to use: Use for subsites for ASTRO® 25 Digital-Only Simulcast Voting Subsystem.

Process:

1. Install the MLC 8000 Subsite Link Converter.
   a. Install the MLC 8000 in a rack or cabinet.
      See “Installing MLC 8000” in the *MLC 8000 Comparator Feature Guide*.
   b. Mount the MLC 8000 on a tray.
      See “Mounting MLC 8000 on the Tray” in the *MLC 8000 Comparator Feature Guide*.
   c. Ground the MLC 8000 on a tray.
      See “Grounding an MLC 8000 in a Tray” in the *MLC 8000 Comparator Feature Guide*.
   d. (For rack-mount installation) Install the MLC 8000 tray in a rack.
      See “Installing MLC 8000 Tray in Rack” in the *MLC 8000 Comparator Feature Guide*.

e (For cabinet-mount installation) Install the MLC 8000 tray in a cabinet.

See “Installing MLC 8000 Tray in Cabinet” in the *MLC 8000 Comparator Feature Guide*.

2 Ground the MLC 8000 tray installed in the rack or cabinet.

See “Installing MLC 8000” (step 2) in the *MLC 8000 Comparator Feature Guide*.

3 Connect the MLC 8000 to power by connecting the DC cable of the power supply unit to the DC inlet of the MLC 8000. Ensure that the cable is not routed with tension.

See “Installing MLC 8000” (step 3) in the *MLC 8000 Comparator Feature Guide*.

4 Is MAC Port Lockdown used on the system? (Disable MAC Port Lockdown if applicable)

If…	Then…
Yes	For K core systems, disable MAC Port Lockdown on the site LAN switch. See “Disabling MAC Port Lockdown Using an HP Switch Service Port” in the *MAC Port Lockdown Featuer Guide*.
	For M series and L series zone core systems, disable MAC Port Lockdown on the site LAN switch with a Saved Command in UNC. See “Disabling MAC Port Lockdown Using a VoyenceControl Template” in the *MAC Port Lockdown Feature Guide*.
	Determine the switch configuration, to find an unused port. See “HP Switches – Determining Port Connections in ASTRO 25 Systems” in the *System LAN Switches Feature Guide*.
No	For K core systems, enable and configure unused ports on switches. Enable all the ports on the switches. See “Enabling/Disabling Ports on HP Switches Using Local Access” in the *MAC Port Lockdown Feature Guide*.
	For M series and L series zone core systems, enable and configure unused ports on switches. See “Enabling/Disabling Ports on HP Switches Using VoyenceControl” in the *MAC Port Lockdown Feature Guide*.

5 Connect the MLC 8000 Subsite Link Converter to the switch.

See ASTRO 25 Digital-Only Simulcast Voting Subsystem Equipment Cabling on page 125.

6 Connect the MLC 8000 Subsite Link Converter to a base radio. It is V.24 connection.

See ASTRO 25 Digital-Only Simulcast Voting Subsystem Equipment Cabling on page 125.

7 Configure the base radios to interface with the MLC 8000 devices.

See Conventional Configuration Settings for Analog Simulcast on page 53.

8 (Optional) Set up MOSCAD NFM. This task is only applicable if MOSCAD NFM is available.

See Setting Up MOSCAD Network Fault Management (NFM) Monitoring on page 37.

9 (Optional) Connect the MLC 8000 Subsite Link Converter to SDM3000 RTU. This task is only applicable if MOSCAD NFM is available.

See Cabling MLC 8000 to SDM3000 RTU on page 40.

10 Push new configuration files down to the switches and GGM 8000 gateways.

- For K core systems (distributed conventional architecture), use Configuration Manager to push the configuration files. See “Downloading the Full Configuration to a Device” in the *Configuration Manager for Conventional Systems User Guide*.

  NOTICE: For a K core system, the service PC is used to install the configuration files for the gateways and switches.

- For M series and L series zone core systems, use UNC to push the configuration files. See “Distributing Configurations For Transport Devices through the UNC Wizard” in the *Unified Network Configurator User Guide*.

11 Reboot the gateways. Using a terminal program, type **rb** (ReBoot) and press ENTER.

The switch reboots automatically after pushing the new configuration.

12 Turn on power to the MLC 8000 by connecting the AC cord of the power supply unit to the AC wall-mount power outlet (110-240 VAC, 50/60 Hz).

NOTICE: The AC power outlet should be as near as possible to the equipment and should be accessible. Ensure that the cable is not routed with tension.

See “Installing MLC 8000” (step 6) in the *MLC 8000 Comparator Feature Guide*.

a Verify the MLC 8000 power LED turns RED (which indicates the MLC 8000 is in booting state) and after a while, it turns GREEN.

b (Optional) If the MOSCAD NFM subsystem is available in the system, then you can also verify that the MOSCAD NFM correctly indicates the presence of the MLC 8000 by pin # 1 at the VIP connector (or else the wiring to the SDM3000 RTU may be wrong). Validate that the correct indication of each MLC 8000 power up is shown in the GMC Application, either on the GMC or on the GWS.

13 Install the MLC 8000 Configuration Tool with Analog Display and Control to a service laptop (if you did not do so in the off-site preconfiguration).

See “Installing the MLC 8000 Configuration Tool with Analog Display and Control” in the *MLC 8000 Configuration Tool User Guide*. Complete the full process even if individual steps are not called out.

NOTICE: Obtain the installation CD for the MLC 8000 Configuration Tool, or the version of the software you want to install from Motorola Online. Install the MLC 8000 Configuration Tool on your own laptops in the field.

14 (Optional) Install the MCN Server 8000™ Remote Comparator Display Software. See Setting Up the MCN Server 8000 Remote Comparator Display Software on page 35.

NOTICE: If available, this software can be installed at any time. No configuration at the MLC 8000 is necessary.

15 Change the MLC 8000 factory programmed passwords (if needed).

See “Changing the MLC 8000 Password” in the *MLC 8000 Configuration Tool User Guide*.

16 Define a reset password key if necessary to harden the reset password mechanism.

See “Assigning Reset Password Key” in the *MLC 8000 Configuration Tool User Guide*.

IMPORTANT: Changing the password must occur on-site since passwords are secured and not exposed to Motorola Solutions. The passwords can be changed either locally using the Local O&M port (serial connection) or remotely using the SSH option in PuTTY to connect to the Extranet LAN port. If you change the password, then push the same password to all devices (this is mandatory). Use the same password for all the devices of the channel cluster.

Installation of equipment for each channel in the subsite is complete.

Postrequisites: See Configuring MLC 8000 Devices with the MLC 8000 Configuration Tool on page 122.

6.1.2
Configuring MLC 8000 Devices with the MLC 8000 Configuration Tool

When and where to use: Follow these tasks to configure the MLC 8000 devices using a service laptop with the MLC 8000 Configuration Tool with Analog Display and Control.

Process:

1 You have three options to configure the MLC 8000s:

If…	Then…
Option 1: IF the system is prestaged off-site (not at the RF site), and IP address and channel cluster information is available	When off-site perform step 2- step 11 When on site, retrieve the saved configuration, skip to step 12 and finish the configuration.
Option 2: IF the system is prestaged off-site (not at the RF site), and IP address and channel cluster information is not available	On site, use these steps to update the configuration and provide the actual IP addresses and channel cluster information, and then set up associations.
Option 3: IF the system is not prestaged off-site	Perform all the steps here.

2 Configure the MLC 8000 device IP addresses in the MLC 8000 Configuration Tool (if modification is needed).

See “Provisioning the Initial IP Address for an MLC 8000 Device” in the *MLC 8000 Configuration Tool User Guide*.

3 Create and define a channel cluster in the MLC 8000 Configuration Tool.

NOTICE: Prerequisite: IP addresses have been assigned to the MLC 8000 Subsite Link Converters.

See “Creating a Conventional Channel Cluster” in the *MLC 8000 Configuration Tool User Guide*.

4 Define the Site ID and Site Name for the new channel cluster.

See “Entering Site ID and Site Name for a Conventional Channel Cluster” in the *MLC 8000 Configuration Tool User Guide*.

5 Provide the name and type for the channel cluster.

See “Defining a Conventional Channel Cluster” in the *MLC 8000 Configuration Tool User Guide*.

6 Define subsites in the subsite list. The Subsite ID and associated name are required for the system to work.

See “Modifying the Conventional Channel Cluster Subsite List” in the *MLC 8000 Configuration Tool User Guide*.

7 Add digital comparators to the channel cluster.

See “Adding a Digital Comparator to a Conventional Channel Cluster” in the *MLC 8000 Configuration Tool User Guide*.

8 Configure the Mixed Mode MLC 8000 Comparator (VGU).

See “Configuring an MLC 8000 Analog Comparator for Mixed Mode Non IP Simulcast Voting” in the *MLC 8000 Configuration Tool User guide*.

9 Add an MLC 8000 Subsite Link Converter to a conventional channel cluster.

See “Adding an MLC 8000 Subsite Link Converter to a Conventional Channel Cluster” in the *MLC 8000 Configuration Tool User Guide*.

NOTICE: You can complete the configuration now or download the software now, then configure after the software upgrade is complete. In either case, save the changes by clicking **Write to Device**. Result: The device restarts. After the restart, you can upgrade the software if necessary.

10 (Optional) Download the MLC 8000 device software if available (if you are unsure that you have the latest version or it was not downloaded in off-site prestaging). Perform this task if your Motorola Solutions representative recommends a newer software version. New software is available at Motorola Online (http://businessonline.motorolasolutions.com).

NOTICE: The software download must be performed separately for each MLC 8000 device in the channel cluster.

See “Downloading a Specific Software Update to an MLC 8000 Device” in the *MLC 8000 Configuration Tool User Guidel*.

11 Configure the MLC 8000 Subsite Link Converter (and associated AGU ports).

a Within the procedure to configure the MLC 8000 Subsite Link Converter, you configure the ports associated with the VGU (select the AGU in the Configuration Tool).

See “Configuring an MLC 8000 Subsite Link Converter for an IP Simulcast System” in the *MLC 8000 Configuration Tool User Guide*.

NOTICE: When you configure the MLC 8000 Analog Comparator (VGU) ports, you can repeat this step for as many BR locations as your system has.

12 Set channel cluster parameters for all MLC 8000s (including G.711, NTP, and timeout parameters).

See “Setting Channel Cluster Parameters” in the *MLC 8000 Configuration Tool User Guide*.

NOTICE: Prerequisite: All devices of the channel cluster have been added and configured, so that MLC 8000 Configuration Tool downloads the channel cluster parameters to all these devices.

The MLC 8000 devices are configured.

Postrequisites: See Verifying the Installation and Configuration on page 123.

6.1.3
Verifying the Installation and Configuration

Process:

1 Is MAC Port Lockdown used on the system? Run MAC Port Lockdown if applicable.

If…	Then…
Yes	For Kc ore systems, run MAC Port Lockdown on the switches. See “Locking HP Switch Ports” in the *MAC Port Lockdown Feature Guide*.
	For M series and L series zone core systems, run MAC Port Lockdown on the switches.

If…	Then…
	See “Performing MAC Port Lockdown on HP Switches” in the *MAC Port Lockdown Feature Guide*.
No	For K core systems, disable open (unused) ports on switches. For each of the HP switches, every open port (no device connected) must be disabled. See “Enabling/Disabling Ports on HP Switches Using Local Access” in the *MAC Port Lockdown Feature Guide*.
	For M series and L series zone core systems, disable open (unused) ports on switches. See “Locking HP Switch Ports Using a VoyenceControl Template” in the *MAC Port Lockdown Feature Guide*.

2 Verify connectivity.

a View the channel cluster to verify the links. (Icons for the MLC 8000 Analog Comparator and its MLC 8000 Subsite Link Converters are yellow to indicate connection with the Configuration Tool and the device).

See “Viewing a particular Channel Cluster Tree” in the *MLC 8000 Configuration Tool User Guide*.

b Verify that the MLC 8000 Analog Comparator is voting the base radios by observing at the Analog Display and Control Application. For example, the LED to the left of the base radio should not be gray, the radio state is either **Active** or **No activity**, and the SQM signal strength should not be **N/A**.

See “Opening the Analog Display and Control Application with MLC 8000 Analog Comparator Selected” in the *MLC 8000 Configuration Tool User Guide* .

3 Confirm the status of the links.

Devices		Procedure References
GCM 8000/GRV 8000 Digital Comparator to MLC 8000 Subsite Link Converter (IP)		
	Check the COMM LED.	See “MLC 8000 Link Converter LEDs” in the *MLC 8000 Comparator Feature Guide*.
	Use MOSCAD NFM. Only if the MOSCAD NFM subsystem is available in your system. Check for a VIP 3 event, which indicates the comparator link failed.	See “MLC 8000 Link Converter — MOSCAD NFM Events Troubleshooting (IP Simulcast System)” in the *MLC 8000 Comparator Feature Guide*.
MLC 8000 Subsite Link Converter to Base Radio (V.24)		
	Check the Port 1-4 LED. On the MLC 8000, the Port 1-4 LED is Red indicating the link to the base radio failed.	See “MLC 8000 Link Converter LEDs” in the *MLC 8000 Comparator Feature Guide*.
	Use MOSCAD NFM. Only if the MOSCAD NFM subsystem is available in your system.	See “MLC 8000 Link Converter — MOSCAD NFM Events Troubleshooting

Table continued…

Devices		Procedure References
	Check for a VIP 4 event, which indicates a link to a BR has failed. One MLC 8000 Subsite Link Converter connects to four base radios, but it has one VIP to indicate status. So, check each of the four connections.	(IP Simulcast System)" in the *MLC 8000 Comparator Feature Guide*.
	Pull a log file of the device for error messages.	See "MLC 8000 Device Logs and Recommended Actions" in the *MLC 8000 Comparator Feature Guide*.

4 Verify by making calls. This is a general task to perform.

a Test the operation of the system by making calls from the radios and ensuring call completion and quality.

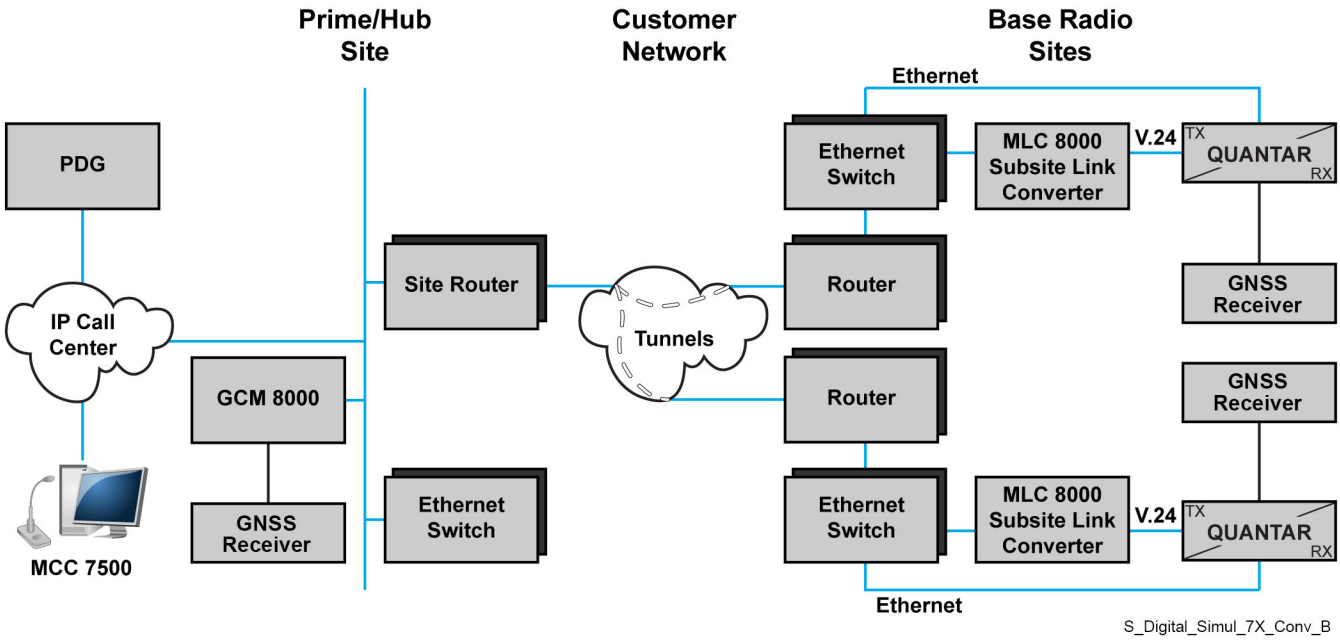
b Verify that you can make a Console to Radio, Radio to Console, and Radio to Radio digital call.

Postrequisites: No calibration is required for digital-only systems.

6.2 ASTRO 25 Digital-Only Simulcast Voting Subsystem Equipment Cabling

This section provides a high-level subsystem diagram and equipment cabling tables from the MLC 8000 device to other system devices. A port description table lists the system devices and refers to the device documentation for more information.

Figure 11: Equipment Cabling for ASTRO 25 Digital-Only Simulcast Voting Subsystem Diagram



IMPORTANT: High-level diagrams are provided as examples only and are not to be used for system planning purposes. “GPS” in the diagram refers to a Simulcast Site Reference device. This service is now called Global Navigational Satellite System (GNSS). SDM3000 RTUs are not shown in the diagram, but would be part of the system if the optional MOSCAD NFM subsystem is available and would be connected to the MLC 8000 devices.

NOTICE: The following table provides part numbers for cables that are orderable from Motorola Solutions. Create the remaining cables using the provided pinout tables. See MLC 8000 Radio Ports Cabling on page 161.

Table 21: Equipment Cabling for ASTRO 25 Digital-Only Simulcast Voting Subsystem

From MLC 8000 Subsite Link Converter (Subsite)		To Destination Device:		
Port	**Connector Type**	**Device**	**Connector Type**	**Description**
External LAN PoE	RJ-45	LAN Switch	RJ-45	RJ-45–to-R-J45 one-to-one cable
VIP	RJ-45	SDM3000 RTU	I/O Wiring Punch Block	MLC 8000 to MOSCAD NFM Cable on page 161
R1-4 COMM	RJ-45	GTR 8000 Base Radio QUANTAR® Station	RJ-45	V.24 MLC 8000 to GTR 8000/ QUANTAR Cable on page 191

Port Descriptions for ASTRO 25 Digital-Only Simulcast Voting Subsystem

Table 22: Port Descriptions

Device	Manual
MLC 8000	See “MLC 8000 Ports” in the *MLC 8000 Comparator Feature Guide*.
LAN switch	See “HP Switches – Determining Port Connections in ASTRO 25 Systems” in the *System LAN Switches Feature Guide*.
SDM3000 RTU	See the Installation chapter “Connecting I/Os with Punch Blocks” sub-section and Appendix C “Pin Assignments” and “Punch Block Terminal Block Contacts” in the *SDM3000 Owner’s Manual*. Depending on the MLC 8000 device type, up to four I/Os and one output (the 5v) are used to report alarms to MOSCAD NFM, and one I/O is used by MOSCAD NFM to restart the MLC 8000 unit from the GMC Application. See also Setting Up MOSCAD Network Fault Management (NFM) Monitoring on page 37.
QUANTAR® Station	“Backplane Connectors Information” in the *QUANTAR Instruction Manual* (6881095E05). Connects to either a punch block to the 50–pin Telco System Connector (I) or the 8-wire screw terminal connector.

Table continued…

Device	Manual
GTR 8000 Base Radio	“Transceiver Ports – Front” in the *RF Site Technician Guide* web-help

6.3

ASTRO 25 Digital-Only Simulcast Voting Subsystem Troubleshooting

To troubleshoot the initial implementation of MLC 8000s in an ASTRO® 25 Digital-Only Simulcast Voting Subsystem (With QUANTAR® station), see Troubleshooting the Transmit (TX) Path for Simulcast Subsystems on page 223.

For general conventional troubleshooting, refer to the *RF Site Technician* webhelp.

See the *MLC 8000 Comparator Feature Guide* for LED indications and the details of the alarms specifically for MLC 8000s, for ongoing monitoring and troubleshooting.

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Chapter 7

ASTRO 25 Circuit-Based Analog-Only Simulcast Voting Subsystem

This section outlines the installation and configuration procedures required to install MLC 8000s; each process step refers to the appropriate documentation provided with your ASTRO® 25 system for the detailed procedure. A high-level diagram and equipment cabling tables are provided for the subsystem.

NOTICE: This chapter is applicable when replacing a legacy comparator with an MLC 8000 Analog Comparator.

7.1 Implementing an ASTRO 25 Circuit-Based Analog-Only Simulcast Voting Subsystem

Prerequisites: See Implementing MLC 8000s on page 31.

When and where to use: Follow these sequences when implementing MLC 8000s in an ASTRO® 25 Circuit-Based Analog-Only Simulcast Voting subsystem.

Process:

1. Perform the tasks to install equipment at the prime site. See Installing Equipment for Each Channel in the Prime Site on page 129.
2. Configure the MLC 8000 devices with the MLC 8000 Configuration Tool. See Configuring MLC 8000 Devices with the MLC 8000 Configuration Tool on page 132.
3. Verify the installation and configuration performed in this implementation. See Verifying the Installation and Configuration on page 134.

7.1.1 Installing Equipment for Each Channel in the Prime Site

When and where to use: Use for Prime Sites for ASTRO® 25 Circuit-Based Analog-Only Simulcast Voting Subsystem.

Process:

1. Install a Site Gateway (Conventional Channel Interface) at the prime site if adding G.711 to the existing configuration and the current system does not have a CCGW. Connects to the switch.

   NOTICE: A Site Gateway (Conventional Channel Interface) is also known as a Conventional Channel Gateway (CCGW). A CCGW can support four channels, with a maximum of three CCGWs at the prime site. A Conventional Hub site can support up to 10 LAN-Only CCGWs. Requires one four-wire E&M module (installed in the analog slot).

   See “Installation” in the *GGM 8000 System Gateway Feature Guide*.
2. Configure Site Gateways (Conventional Channel Interface).

   See “GGM 8000 Configuration” in the *GGM 8000 System Gateway Feature Guide*.
3. Install the MLC 8000 Analog Comparator.
   a. Install the MLC 8000 in a rack or cabinet.

See “Installing MLC 8000” in the *MLC 8000 Comparator Feature Guide*.

b Mount the MLC 8000 on a tray.

See “Mounting MLC 8000 on the Tray” in the *MLC 8000 Comparator Feature Guide*.

c Ground the MLC 8000 on a tray.

See “Grounding an MLC 8000 in a Tray” in the *MLC 8000 Comparator Feature Guide*.

d (For rack-mount installation) Install the MLC 8000 tray in a rack.

See “Installing MLC 8000 Tray in Rack” in the *MLC 8000 Comparator Feature Guide*.

e (For cabinet-mount installation) Install the MLC 8000 tray in a cabinet.

See “Installing MLC 8000 Tray in Cabinet” in the *MLC 8000 Comparator Feature Guide*.

4 Ground the MLC 8000 tray installed in the rack or cabinet.

See “Installing MLC 8000” (step 2) in the *MLC 8000 Comparator Feature Guide*.

5 Connect the MLC 8000 to power by connecting the DC cable of the power supply unit to the DC inlet of the MLC 8000.

See “Installing MLC 8000” (step 3) in the *MLC 8000 Comparator Feature Guide*.

6 Install the MLC 8000 Subsite Link Converter.

a Install the MLC 8000 in a rack or cabinet.

See “Installing MLC 8000” in the *MLC 8000 Comparator Feature Guide*.

b Mount the MLC 8000 on a tray.

See “Mounting MLC 8000 on the Tray” in the *MLC 8000 Comparator Feature Guide*.

c Ground the MLC 8000 on a tray.

See “Grounding an MLC 8000 in a Tray” in the *MLC 8000 Comparator Feature Guide*.

d (For rack-mount installation) Install the MLC 8000 tray in a rack.

See “Installing MLC 8000 Tray in Rack” in the *MLC 8000 Comparator Feature Guide*.

e (For cabinet-mount installation) Install the MLC 8000 tray in a cabinet.

See “Installing MLC 8000 Tray in Cabinet” in the *MLC 8000 Comparator Feature Guide*.

7 Ground the MLC 8000 tray installed in the rack or cabinet.

See “Installing MLC 8000” (step 2) in the *MLC 8000 Comparator Feature Guide*.

8 Connect the MLC 8000 to power by connecting the DC cable of the power supply unit to the DC inlet of the MLC 8000.

See “Installing MLC 8000” (step 3) in the *MLC 8000 Comparator Feature Guide*.

9 Connect the MLC 8000 Analog Comparator to a switch that connects to the MLC 8000 Subsite Link Converter.

See ASTRO 25 Circuit-Based Analog-Only Simulcast Voting Subsystem Equipment Cabling on page 135.

10 Connect the MLC 8000 Analog Comparator to Site Gateways (Conventional Channel Interface). It is a 4-wire connection.

See ASTRO 25 Circuit-Based Analog-Only Simulcast Voting Subsystem Equipment Cabling on page 135.

11 Connect the MLC 8000 Subsite Link Converter to the Conventional Simulcast Controller Interface (CSCI).

See ASTRO 25 Circuit-Based Analog-Only Simulcast Voting Subsystem Equipment Cabling on page 135.

12 Connect the MLC 8000 Subsite Link Converter to the channel bank.

See ASTRO 25 Circuit-Based Analog-Only Simulcast Voting Subsystem Equipment Cabling on page 135.

13 Optional: Set up MOSCAD NFM. This task is only applicable if MOSCAD NFM is available.

See Setting Up MOSCAD Network Fault Management (NFM) Monitoring on page 37.

14 Optional: Connect the MLC 8000 Analog Comparator to the SDM3000 RTU. This task is only applicable if MOSCAD NFM is available.

See Cabling MLC 8000 to SDM3000 RTU on page 40.

15 Optional: Connect the MLC 8000 Subsite Link Converter to the SDM3000 RTU.

See Cabling MLC 8000 to SDM3000 RTU on page 40.

16 Turn on power to the MLC 8000 by connecting the AC cord of the power supply unit to the AC wall-mount power outlet (110-240 VAC, 50/60 Hz).

NOTICE: The AC power outlet should be as near as possible to the equipment and should be accessible. Ensure that the cable is not routed with tension.

See “Installing MLC 8000” (step 6) in the *MLC 8000 Comparator Feature Guide*.

a Verify the MLC 8000 power LED turns RED (which indicates the MLC 8000 is in booting state) and after a while, it turns GREEN.

b Optional: If the MOSCAD NFM subsystem is available in the system, then you can also verify that the MOSCAD NFM correctly indicates the presence of the MLC 8000 by pin # 1 at the VIP connector (or else the wiring to the SDM3000 RTU may be wrong). Validate that the correct indication of each MLC 8000 power up is shown in the GMC Application, either on the GMC or on the GWS.

17 Install the MLC 8000 Configuration Tool with Analog Display and Control to a service laptop (if you did not do so in the off-site preconfiguration).

See “Installing the MLC 8000 Configuration Tool with Analog Display and Control” in the *MLC 8000 Configuration Tool User Guide*. Complete the full process even if individual steps are not called out.

NOTICE: Obtain the installation CD for the MLC 8000 Configuration Tool, or the version of the software you want to install from Motorola Online. Install the MLC 8000 Configuration Tool on your own laptops in the field.

18 Optional: Install the MCN Server 8000™ Remote Comparator Display Software. See Setting Up the MCN Server 8000 Remote Comparator Display Software on page 35.

NOTICE: If available, this software can be installed at any time. No configuration at the MLC 8000 is necessary.

19 Change the MLC 8000 factory programmed passwords (if needed).

See “Changing the MLC 8000 Password” in the *MLC 8000 Configuration Tool User Guide*.

20 Define a reset password key if necessary to harden the reset password mechanism.

See “Assigning Reset Password Key” in the *MLC 8000 Configuration Tool User Guide*.

IMPORTANT: Changing the password must occur on-site since passwords are secured and not exposed to Motorola. The passwords can be changed either locally using the Local O&M port (serial connection) or remotely using the SSH option in PuTTY to connect to the Extranet LAN port. If you change the password, then push the same password to all devices (this is mandatory). Use the same password for all the devices of the channel cluster.

Installation of equipment and software for each channel in the prime site is complete.

Postrequisites: See Configuring MLC 8000 Devices with the MLC 8000 Configuration Tool on page 132.

7.1.2
Configuring MLC 8000 Devices with the MLC 8000 Configuration Tool

When and where to use: Follow these tasks to configure the MLC 8000 devices using a service laptop with the MLC 8000 Configuration Tool with Analog Display and Control.

Process:

1 You have three options to configure the MLC 8000s:

If…	Then…
Option 1: IF the system is prestaged off-site (not at the RF site), and IP address and channel cluster information is available	When off-site, perform step 2-step 12 When on site, retrieve the saved configuration, skip to step 13 and finish the configuration.
Option 2: IF the system is prestaged off-site (not at the RF site), and IP address and channel cluster information is not available	On site, use these steps to update the configuration and provide the actual IP addresses and channel cluster information, and then set up associations.
Option 3: IF the system is not prestaged off-site	Perform all the steps here.

2 Configure the MLC 8000 device IP addresses in the MLC 8000 Configuration Tool (if modification is needed).

See “Provisioning the Initial IP Address for an MLC 8000 Device” in the *MLC 8000 Configuration Tool User Guide*.

3 Create and define a channel cluster in the MLC 8000 Configuration Tool.

NOTICE: Prerequisite: IP addresses have been assigned to the MLC 8000 Analog Comparators and MLC 8000 Subsite Link Converters.

See “Creating a Conventional Channel Cluster” in the *MLC 8000 Configuration Tool User Guide*.

4 Define the Site ID and Site Name for the new channel cluster.

See “Entering Site ID and Site Name for a Conventional Channel Cluster” in the *MLC 8000 Configuration Tool User Guide*.

5 Provide the name and type for the channel cluster.

See “Defining a Conventional Channel Cluster” in the *MLC 8000 Configuration Tool User Guide*.

6 Define subsites in the subsite list. The Subsite ID and associated name are required for the system to work.

See “Modifying the Conventional Channel Cluster Subsite List” in the *MLC 8000 Configuration Tool User Guide*.

7 Add the MLC 8000 Analog Comparator (VGU) to the channel cluster.

See “Adding an MLC 8000 Analog or Mixed Mode Comparator to a Conventional Channel Cluster” in the *MLC 8000 Configuration Tool User Guide*.

NOTICE: You can complete the configuration now or download the software now, then configure after the software upgrade is complete. In either case, save the changes by clicking **Write to Device**. Result: The device restarts. After the restart, you can upgrade the software if necessary.

8 Optional: Download the MLC 8000 device software if available (if you are unsure that you have the latest version or it was not downloaded in off-site prestaging). Perform this task if your Motorola Solutions representative recommends a newer software version. New software is available at Motorola Online (http://businessonline.motorolasolutions.com).

NOTICE: The software download must be performed separately for each MLC 8000 device in the channel cluster.

See “Downloading a Specific Software Update to an MLC 8000 Device” in the *MLC 8000 Configuration Tool User Guide*.

9 Configure the MLC 8000 Analog Comparator.

NOTICE: If manual steering is used and tables of related TRC codes are already defined, select the **No Steering** option.

See “Configuring an MLC 8000 Analog Comparator for an IP Simulcast System” in the *MLC 8000 Configuration Tool User Guide*.

10 Add an MLC 8000 Subsite Link Converter to a conventional channel cluster.

See “Adding an MLC 8000 Subsite Link Converter to a Conventional Channel Cluster” in the *MLC 8000 Configuration Tool User Guide*.

NOTICE: You can complete the configuration now or download the software now, then configure after the software upgrade is complete. In either case, save the changes by clicking **Write to Device**. **Result:** The device restarts. After the restart, you can upgrade the software if necessary.

11 Optional: Download the MLC 8000 device software if available (if you are unsure that you have the latest version or it was not downloaded in off-site prestaging). Perform this task if your Motorola Solutions representative recommends a newer software version. New software is available at Motorola Online (http://businessonline.motorolasolutions.com).

NOTICE: The software download must be performed separately for each MLC 8000 device in the channel cluster.

See “Downloading a Specific Software Update to an MLC 8000 Device” in the *MLC 8000 Configuration Tool User Guide*.

12 Configure the MLC 8000 Subsite Link Converter (and associated AGU ports) and ensure the **Link Type** field is set to **4 Wire External PTT (circuit)**.

a Within the procedure to configure the MLC 8000 Subsite Link Converter, you configure the ports associated with the VGU (select the AGU in the Configuration Tool).

See “Configuring an MLC 8000 Subsite Link Converter for a Non IP Simulcast System ” in the *MLC 8000 Configuration Tool User Guide*.

NOTICE: When you configure the MLC 8000 Analog Comparator (VGU) ports, you can repeat this step for as many BR locations as your system has.

13 Set channel cluster parameters for all MLC 8000s (including G.711, NTP, and timeout parameters).

See “Setting Channel Cluster Parameters” in the *MLC 8000 Configuration Tool User Guide*.

NOTICE: Prerequisite: All devices of the channel cluster have been added and configured, so that MLC 8000 Configuration Tool downloads the channel cluster parameters to all these devices.

The MLC 8000 devices are configured.

Postrequisites: See Verifying the Installation and Configuration on page 134.

7.1.3
Verifying the Installation and Configuration

Process:

1 Verify connectivity.

a View the channel cluster to verify the links. (Icons for the MLC 8000 Analog Comparator and its MLC 8000 Subsite Link Converters are yellow to indicate connection with the Configuration Tool and the device).

See “Viewing a particular Channel Cluster Tree” in the *MLC 8000 Configuration Tool User Guide*.

b Verify that the MLC 8000 Analog Comparator is voting the base radios by observing at the Analog Display and Control Application. For example, the LED to the left of the base radio should not be gray, the radio state is either **Active** or **No activity**, and the SQM signal strength should not be **N/A**.

See “Opening the Analog Display and Control Application with MLC 8000 Analog Comparator Selected” in the *MLC 8000 Configuration Tool User Guide*.

2 Confirm the status of the links.

Devices		Procedure References
MLC 8000 Analog Comparator to MLC 8000 Subsite Link Converter (IP)		
	Check the COMM LED, which is Red if at least one link connection to the MLC 8000 Link Converter port has failed.	See “MLC 8000 Analog Comparator LEDs” in the *MLC 8000 Comparator Feature Guide*.
	Use MOSCAD NFM. Only if the MOSCAD NFM subsystem is available in your system.	See “MLC 8000 Analog Comparator — MOSCAD NFM Events Troubleshooting (IP Simulcast System)” in the *MLC 8000 Comparator Feature Guide*.
	Pull a log file of the device for error messages.	See “MLC 8000 Device Logs and Recommended Actions” in the *MLC 8000 Comparator Feature Guide*.
MLC 8000 Analog Comparator to Site Gateways (Conventional Channel Interface) (4-wire)		
	To verify, make a call from the console, and verify that the BR is transmitting.	

3 Verify by making calls. This is a general task to perform.

a Test the operation of the system by making calls from the radios and ensuring call completion and quality.

b Verify that you can make a Console to Radio, Radio to Console, and Radio to Radio analog call.

Postrequisites: Calibrate/optimize the Simulcast system after the system is running properly.

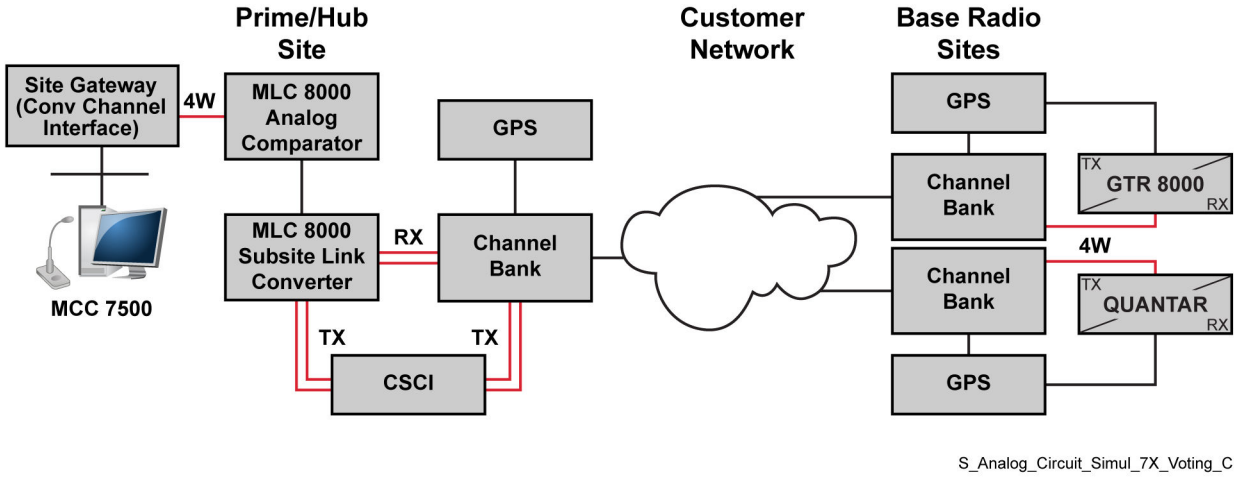
- See “Performing Calibration for an MLC 8000 Subsite Link Converter” in the *MLC 8000 Configuration Tool User Guide*.
- See “Performing Calibration for an MLC 8000 Analog Comparator” in the *MLC 8000 Configuration Tool User Guide*.
- Continue to Optimization/Calibration for Conventional Simulcast on page 195.

7.2

ASTRO 25 Circuit-Based Analog-Only Simulcast Voting Subsystem Equipment Cabling

This section provides a high-level subsystem diagram and equipment cabling tables from the MLC 8000 device to other system devices. A port description table lists the system devices and refers to the device documentation for more information.

Figure 12: ASTRO 25 Circuit-Based Analog-Only Simulcast Voting Subsystem Diagram



IMPORTANT: High-level diagrams are provided as examples only and are not to be used for system planning purposes. “GPS” in the diagram refers to a Simulcast Site Reference device. SDM3000 RTUs are not shown in the diagram, but would be part of the system if the optional MOSCAD NFM subsystem is available and would be connected to the MLC 8000 devices. The GPS should be connected to the MLC 8000 Subsite Link Converter only if it is connected to an Rx/Tx or Tx only BR.

NOTICE: This table provides part numbers for cables that are orderable from Motorola. Create the remaining cables using the provided pinout tables. See MLC 8000 Radio Ports Cabling on page 161.

Table 23: Equipment Cabling for ASTRO 25 Circuit-Based Analog-Only Simulcast Voting Subsystem

From MLC 8000 Analog Comparator (Prime Site)		To Destination device:		
Port	**Connector Type**	**Device**	**Connector Type**	**Description**
External LAN PoE	RJ45	LAN Switch	RJ45	RJ45-to-RJ45 one-to-one cable

Table continued…

From MLC 8000 Analog Comparator (Prime Site)		To Destination device:		
Port	**Connector Type**	**Device**	**Connector Type**	**Description**
VIP	RJ45	SDM3000 RTU	I/O Wiring Punch Block	MLC 8000 to MOSCAD NFM Cable on page 161
R1 4W-E&M	RJ45	Site Gateway (Conventional Channel Interface), 4W E&M (8D…8A)	RJ45	4W MLC 8000 (Analog Comparator) to Site Gateway (Conventional Channel Interface) Cable on page 173
From MLC 8000 Subsite Link Converter (Prime Site)		To Destination device:		
Port	Connector Type	Device	Connector Type	Description
External LAN PoE	RJ45	LAN Switch	RJ45	RJ45-to-RJ45 one-to-one cable
R1-4 4W-E&M	RJ45	CSCI	Punch Block	CENTRACOM to MLC 8000 through CTI on page 179
R1-4 COMM	RJ45	Channel Bank	SRU card	V.24 MLC 8000 to Channel Bank SRU Card Cable on page 189
VIP	RJ45	SDM3000 RTU	I/O Wiring Punch Block	MLC 8000 to MOSCAD NFM Cable on page 161

Port Descriptions for ASTRO 25 Circuit-Based Analog-Only Simulcast Voting Subsystem

Table 24: Port Descriptions

Device	Manual
MLC 8000	See “MLC 8000 Ports” in the *MLC 8000 Comparator Feature Guide*.
LAN switch	See “HP Switches – Determining Port Connections in ASTRO 25 Systems” in the *System LAN Switches Feature Guide*.
SDM3000 RTU	See the Installation chapter “Connecting I/Os with Punch Blocks” sub-section and Appendix C “Pin Assignments” and “Punch Block Terminal Block Contacts” in the *SDM3000 Owner’s Manual*. Depending on the MLC 8000 device type, up to four I/Os and one output (the 5v) are used to report alarms to MOSCAD NFM, and one I/O is used by MOSCAD NFM to restart the MLC 8000 unit from the GMC Application. See also Setting Up MOSCAD Network Fault Management (NFM) Monitoring on page 37.
Site Gateway (Conventional Channel Interface)	See “Making a Physical 4-W Connection on MLC 8000 Analog Comparator to CCGW” in the *GGM 8000 System Gateway Feature Guide*.

Table continued…

Device	Manual
CSCI	See “CSCI-to-Punchblock Cabling” in the *GPS Simulcast Installation* manual (6881098E65). Refers to a legacy comparator, but this is applicable to the MLC 8000.
Channel Bank	See the *GPS Simulcast Installation* manual (6881098E65).

7.3 ASTRO 25 Circuit-Based Analog-Only Simulcast Voting Subsystem Troubleshooting

To troubleshoot the initial implementation of MLC 8000s in an ASTRO® 25 Circuit-Based Analog-Only Simulcast Voting Subsystem, refer to Troubleshooting the Transmit (TX) Path for Simulcast Subsystems on page 223.

For general conventional troubleshooting, refer to the *RF Site Technician* webhelp.

Refer to the *MLC 8000 Comparator Feature Guide* for LED indications and the details of the alarms specifically for MLC 8000s, for ongoing monitoring and troubleshooting.

Refer to the *GPS Simulcast Installation* manual for information about the ASTRO-TAC and CSCI.

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Chapter 8

Circuit-Based Analog-Only Simulcast Voting Subsystem

This section outlines the installation and configuration procedures required to install MLC 8000s; each process step refers to the appropriate documentation provided with your ASTRO® 25 system for the detailed procedure. A high-level diagram and equipment cabling tables are provided for the subsystem.

8.1 Implementing a Circuit-Based Analog-Only Simulcast Voting Subsystem

Prerequisites: See Implementing MLC 8000s on page 31.

When and where to use: Follow these sequences when implementing MLC 8000s in a Circuit-Based Analog-Only Simulcast Voting subsystem.

Process:

1. Perform the tasks to install equipment at the prime site. See Installing Equipment for Each Channel in the Prime Site on page 139.
2. Configure the MLC 8000 devices with the MLC 8000 Configuration Tool. See Configuring MLC 8000 Devices with the MLC 8000 Configuration Tool on page 141.
3. Verify the installation and configuration performed in this implementation. See Verifying the Installation and Configuration on page 143.

8.1.1 Installing Equipment for Each Channel in the Prime Site

When and where to use: Use for Prime Sites for Circuit-Based Analog-Only Simulcast Voting Subsystem.

Process:

1. Install the MLC 8000 Analog Comparator.
   - **a** Install the MLC 8000 in a rack or cabinet.

     See “Installing MLC 8000” in the *MLC 8000 Comparator Feature Guide*.
   - **b** Mount the MLC 8000 on a tray.

     See “Mounting MLC 8000 on the Tray” in the *MLC 8000 Comparator Feature Guide*.
   - **c** Ground the MLC 8000 on a tray.

     See “Grounding an MLC 8000 in a Tray” in the *MLC 8000 Comparator Feature Guide*.
   - **d** (For rack-mount installation) Install the MLC 8000 tray in a rack.

     See “Installing MLC 8000 Tray in Rack” in the *MLC 8000 Comparator Feature Guide*.
   - **e** (For cabinet-mount installation) Install the MLC 8000 tray in a cabinet.

     See “Installing MLC 8000 Tray in Cabinet” in the *MLC 8000 Comparator Feature Guide*
2. Ground the MLC 8000 tray installed in the rack or cabinet.

See “Installing MLC 8000” (step 2) in the *MLC 8000 Comparator Feature Guide*.

3 Connect the MLC 8000 to power by connecting the DC cable of the power supply unit to the DC inlet of the MLC 8000.

See “Installing MLC 8000” (step 3) in the *MLC 8000 Comparator Feature Guide*.

4 Install the MLC 8000 Subsite Link Converter n a rack or cabinet.

See “Installing MLC 8000” in the *MLC 8000 Comparator Feature Guide*.

5 Mount the MLC 8000 on a tray.

See “Mounting MLC 8000 on the Tray” in the *MLC 8000 Comparator Feature Guide*.

6 Ground the MLC 8000 on a tray.

See “Grounding an MLC 8000 in a Tray” in the *MLC 8000 Comparator Feature Guide*.

7 (For rack-mount installation) Install the MLC 8000 tray in a rack.

See “Installing MLC 8000 Tray in Rack” in the *MLC 8000 Comparator Feature*.

8 (For cabinet-mount installation) Install the MLC 8000 tray in a cabinet.

See “Installing MLC 8000 Tray in Cabinet” in the *MLC 8000 Comparator Feature Guide*.

9 Ground the MLC 8000 tray installed in the rack or cabinet.

See “Installing MLC 8000” (step 2) in the *MLC 8000 Comparator Feature Guide*.

10 Connect the MLC 8000 to power by connecting the DC cable of the power supply unit to the DC inlet of the MLC 8000.

See “Installing MLC 8000” (step 3) in the *MLC 8000 Comparator Feature Guide*.

11 Connect the MLC 8000 Analog Comparator to a switch that connects to the MLC 8000 Subsite Link Converter.

See Circuit-Based Analog-Only Simulcast Voting Subsystem Equipment Cabling on page 145.

12 Connect the MLC 8000 Analog Comparator to the analog console.

See Circuit-Based Analog-Only Simulcast Voting Subsystem Equipment Cabling on page 145.

13 Connect the MLC 8000 Subsite Link Converter to the Conventional Simulcast Controller Interface (CSCI).

See Circuit-Based Analog-Only Simulcast Voting Subsystem Equipment Cabling on page 145.

14 Connect the MLC 8000 Subsite Link Converter to the channel bank.

See Circuit-Based Analog-Only Simulcast Voting Subsystem Equipment Cabling on page 145.

15 Optional: Set up MOSCAD NFM. This task is only applicable if MOSCAD NFM is available.

See Setting Up MOSCAD Network Fault Management (NFM) Monitoring on page 37.

16 Optional: Connect the MLC 8000 Analog Comparator to the SDM3000 RTU. This task is only applicable if MOSCAD NFM is available.

See Cabling MLC 8000 to SDM3000 RTU on page 40.

17 Optional: Connect the MLC 8000 Subsite Link Converter to the SDM3000 RTU. This task is only applicable if MOSCAD NFM is available.

See Cabling MLC 8000 to SDM3000 RTU on page 40.

18 Turn on power to the MLC 8000 by connecting the AC cord of the power supply unit to the AC wall-mount power outlet (110-240 VAC, 50/60 Hz).

NOTICE: The AC power outlet should be as near as possible to the equipment and should be accessible. Ensure that the cable is not routed with tension.

See “Installing MLC 8000” (step 6) in the *MLC 8000 Comparator Feature Guide*.

a Verify the MLC 8000 power LED turns RED (which indicates the MLC 8000 is in booting state) and after a while, it turns GREEN.

b Optional: If the MOSCAD NFM subsystem is available in the system, then you can also verify that the MOSCAD NFM correctly indicates the presence of the MLC 8000 by pin # 1 at the VIP connector (or else the wiring to the SDM3000 RTU may be wrong). Validate that the correct indication of each MLC 8000 power up is shown in the GMC Application, either on the GMC or on the GWS.

19 Install the MLC 8000 Configuration Tool with Analog Display and Control to a service laptop (if you did not do so in the off-site preconfiguration).

See “Installing the MLC 8000 Configuration Tool with Analog Display and Control” in the *MLC 8000 Configuration Tool User Guide*. Complete the full process even if individual steps are not called out.

NOTICE: Obtain the installation CD for the MLC 8000 Configuration Tool, or the version of the software you want to install from Motorola Online. Install the MLC 8000 Configuration Tool on your own laptops in the field.

20 Optional: Install the MCN Server 8000™ Remote Comparator Display Software. See Setting Up the MCN Server 8000 Remote Comparator Display Software on page 35.

NOTICE: If available, this software can be installed at any time. No configuration at the MLC 8000 is necessary.

21 Change the MLC 8000 factory programmed passwords (if needed).

See “Changing the MLC 8000 Password” in the *MLC 8000 Configuration Tool User Guide*.

22 Define a reset password key if necessary to harden the reset password mechanism.

See “Assigning Reset Password Key” in the *MLC 8000 Configuration Tool User Guide*.

IMPORTANT: Changing the password must occur on-site since passwords are secured and not exposed to Motorola Solutions. The passwords can be changed either locally using the Local O&M port (serial connection) or remotely using the SSH option in PuTTY to connect to the Extranet LAN port. If you change the password, then push the same password to all devices (this is mandatory). Use the same password for all the devices of the channel cluster.

Installation of equipment and software for each channel in the prime site is complete.

Postrequisites: See Configuring MLC 8000 Devices with the MLC 8000 Configuration Tool on page 141.

8.1.2
Configuring MLC 8000 Devices with the MLC 8000 Configuration Tool

When and where to use: Follow these tasks to configure the MLC 8000 devices using a service laptop with the MLC 8000 Configuration Tool with Analog Display and Control.

Process:

1 You have three options to configure the MLC 8000s:

If…	Then…
Option 1: IF the system is prestaged off-site (not at the RF site), and IP address	When off-site, perform step 2- step 12 When on site, retrieve the saved configuration, skip to step 13 and finish the configuration.

If…	Then…
and channel cluster information is available	
Option 2: IF the system is prestaged off-site (not at the RF site), and IP address and channel cluster information is not available	On site, use these steps to update the configuration and provide the actual IP addresses and channel cluster information, and then set up associations.
Option 3: IF the system is not prestaged off-site	Perform all the steps here.

2 Configure the MLC 8000 device IP addresses in the MLC 8000 Configuration Tool (if modification is needed).

See “Provisioning the Initial IP Address for an MLC 8000 Device” in the *MLC 8000 Configuration Tool User Guide*.

3 Create and define a channel cluster in the MLC 8000 Configuration Tool.

NOTICE: Prerequisite: IP addresses have been assigned to the MLC 8000 Analog Comparators and MLC 8000 Subsite Link Converters.

See “Creating a Conventional Channel Cluster” in the *MLC 8000 Configuration Tool User Guide*.

4 Define the Site ID and Site Name for the new channel cluster.

See “Entering Site ID and Site Name for a Conventional Channel Cluster” in the *MLC 8000 Configuration Tool User Guide*.

5 Provide the name and type for the channel cluster.

See “Defining a Conventional Channel Cluster” in the *MLC 8000 Configuration Tool User Guide*.

6 Define subsites in the subsite list. The Subsite ID and associated name are required for the system to work.

See “Modifying the Conventional Channel Cluster Subsite List” in the *MLC 8000 Configuration Tool User Guide*.

7 Add the MLC 8000 Analog Comparator (VGU) to the channel cluster.

See “Adding an MLC 8000 Analog or Mixed Mode Comparator to a Conventional Channel Cluster” in the *MLC 8000 Configuration Tool User Guide*.

NOTICE: You can complete the configuration now or download the software now, then configure after the software upgrade is complete. In either case, save the changes by clicking **Write to Device**. Result: The device restarts. After the restart, you can upgrade the software if necessary.

8 (Optional) Download the MLC 8000 device software if available (if you are unsure that you have the latest version or it was not downloaded in off-site prestaging). Perform this task if your Motorola representative recommends a newer software version. New software is available at Motorola Online (http://businessonline.motorolasolutions.com).

NOTICE: The software download must be performed separately for each MLC 8000 device in the channel cluster.

See “Downloading a Specific Software Update to an MLC 8000 Device” in the *MLC 8000 Configuration Tool User Guide*.

9 Configure the MLC 8000 Analog Comparator.

NOTICE: If manual steering is used and tables of related TRC codes are already defined, select the **No Steering** option.

See “Configuring an MLC 8000 Analog Comparator for a Non IP Simulcast System” in the *MLC 8000 Configuration Tool User Guide*.

10 Add an MLC 8000 Subsite Link Converter to a conventional channel cluster.

See “Adding an MLC 8000 Subsite Link Converter to a Conventional Channel Cluster” in the *MLC 8000 Configuration Tool User Guide*.

NOTICE: You can complete the configuration now or download the software now, then configure after the software upgrade is complete. In either case, save the changes by clicking **Write to Device**. **Result:** The device restarts. After the restart, you can upgrade the software if necessary.

11 (Optional) Download the MLC 8000 device software if available (if you are unsure that you have the latest version or it was not downloaded in off-site prestaging). Perform this task if your Motorola Solutions representative recommends a newer software version. New software is available at Motorola Online (http://businessonline.motorolasolutions.com).

NOTICE: The software download must be performed separately for each MLC 8000 device in the channel cluster.

See “Downloading a Specific Software Update to an MLC 8000 Device” in the *MLC 8000 Configuration Tool User Guide*.

12 Configure the MLC 8000 Subsite Link Converter (and associated AGU ports) and ensure the **Link Type** field is set to **4 Wire External PTT (circuit)**.

a Within the procedure to configure the MLC 8000 Subsite Link Converter, you configure the ports associated with the VGU (select the AGU in the Configuration Tool).

See “Configuring an MLC 8000 Subsite Link Converter for a Non IP Simulcast System ” in the *MLC 8000 Configuration Tool User Guide*.

NOTICE: When you configure the MLC 8000 Analog Comparator (VGU) ports, you can repeat this step for as many BR locations as your system has.

13 Set channel cluster parameters for all MLC 8000s (including G.711, NTP, and timeout parameters).

See “Setting Channel Cluster Parameters” in the *MLC 8000 Configuration Tool User Guide*.

NOTICE: Prerequisite: All devices of the channel cluster have been added and configured, so that MLC 8000 Configuration Tool downloads the channel cluster parameters to all these devices.

14 Optional: Configure the channel transmitters steering associations. Enable and configure transmitter steering and regional voting tables for the MLC 8000 Analog Comparator (VGU). See “Management of the Transmitter Steering Tables for an MLC 8000 Analog Comparator” in the *MLC 8000 Configuration Tool User Guide*.

The MLC 8000 devices are configured.

Postrequisites: See Verifying the Installation and Configuration on page 143.

8.1.3
Verifying the Installation and Configuration

Process:

1 Verify connectivity.

a View the channel cluster to verify the links. (Icons for the MLC 8000 Analog Comparator and its MLC 8000 Subsite Link Converters are yellow to indicate connection with the Configuration Tool and the device).

See “Viewing a particular Channel Cluster Tree” in the *MLC 8000 Configuration Tool User Guide*.

b Verify that the MLC 8000 Analog Comparator is voting the base radios by observing at the Analog Display and Control Application. For example, the LED to the left of the base radio should not be gray, the radio state is either **Active** or **No activity**, and the SQM signal strength should not be **N/A**.

See “Opening the Analog Display and Control Application with MLC 8000 Analog Comparator Selected” in the *MLC 8000 Configuration Tool User Guide*.

2 Confirm the status of the links.

Devices		Procedure References
MLC 8000 Analog Comparator to MLC 8000 Subsite Link Converter (IP)		
	Check the COMM LED, which is Red if at least one link connection to the MLC 8000 Link Converter port has failed.	See “MLC 8000 Analog Comparator LEDs” in the *MLC 8000 Comparator Feature Guide*.
	Use MOSCAD NFM. Only if the MOSCAD NFM subsystem is available in your system.	See “MLC 8000 Analog Comparator — MOSCAD NFM Events Troubleshooting (IP Simulcast System)” in the *MLC 8000 Comparator Feature Guide*.
	Pull a log file of the device for error messages.	See “MLC 8000 Device Logs and Recommended Actions” in the *MLC 8000 Comparator Feature Guide*.
MLC 8000 Analog Comparator to Analog Console (4-wire)		
	Link status is verified by audio monitoring or by transmitting voice from the console and observing audio is transmitted out (not by LED or MOSCAD NFM).	

3 Verify by making calls. This is a general task to perform.

a Test the operation of the system by making calls from the radios and ensuring call completion and quality.

b Verify that you can make a Console to Radio, Radio to Console, and Radio to Radio analog call.

Postrequisites: Calibrate/optimize the Circuit-Based Simulcast after the system is running properly.

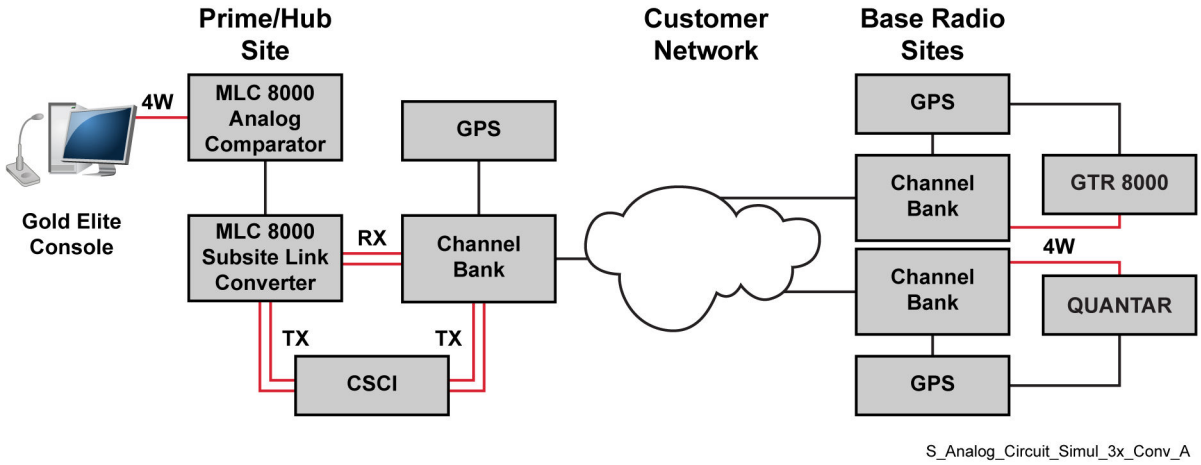
- See “Performing Calibration for an MLC 8000 Subsite Link Converter” in the *MLC 8000 Configuration Tool User Guide*.
- See “Performing Calibration for an MLC 8000 Analog Comparator” in the *MLC 8000 Configuration Tool User Guide*.
- Continue to Optimization/Calibration for Conventional Simulcast on page 195.

8.2

Circuit-Based Analog-Only Simulcast Voting Subsystem Equipment Cabling

This section provides a high-level subsystem diagram and equipment cabling tables from the MLC 8000 device to other system devices. A port description table lists the system devices and refers to the device documentation for more information.

Figure 13: Circuit-Based Conventional Analog-Only Simulcast Voting Subsystem Diagram



IMPORTANT: High-level diagrams are provided as examples only and are not to be used for system planning purposes. “GPS” in the diagram refers to a Simulcast Site Reference device. SDM3000 RTUs are not shown in the diagram, but would be part of the system if the optional MOSCAD NFM subsystem is available and would be connected to the MLC 8000 devices.

NOTICE: This table provides part numbers for cables that are orderable from Motorola Solutions. Create the remaining cables using the provided pinout tables. See MLC 8000 Radio Ports Cabling on page 161.

Table 25: Equipment Cabling for Circuit-Based Conventional Analog-Only Simulcast Voting Subsystem

From MLC 8000 Analog Comparator (Prime Site)		To Destination device:		
Port	**Connector Type**	**Device**	**Connector Type**	**Description**
External LAN PoE	RJ45	Ethernet Switch (not shown, connects to the MLC 8000 Subsite Link Converter)	RJ45	RJ45-to-RJ45 one-to-one cable
R1 4W-E&M	RJ45	MC2500	DB25	4-Wire MLC 8000 to MC2500 Analog Console Cable on page 176
VIP	RJ45	SDM3000 RTU	I/O Wiring Punch Block	MLC 8000 to MOSCAD NFM Cable on page 161
From MLC 8000 Subsite Link Converter (Prime Site)		To Destination device:		

Table continued…

From MLC 8000 Analog Comparator (Prime Site)		To Destination device:		
Port	**Connector Type**	**Device**	**Connector Type**	**Description**
Port	Connector Type	Device	Connector Type	Description
External LAN PoE	RJ45	Ethernet Switch (not shown, connects to the MLC 8000 Analog Comparator)	RJ45	RJ45-to-RJ45 one-to-one cable
R1-4 4W-E&M	RJ45	CSCI	Punch Block	CENTRACOM to MLC 8000 through CTI on page 179
VIP	RJ45	SDM3000 RTU	I/O Wiring Punch Block	MLC 8000 to MOSCAD NFM Cable on page 161
R1-4 COMM	RJ45	Channel Bank	RJ45	4W MLC 8000 to Channel Bank DSM-II Card Cable (Circuit-Based Simulcast) on page 188

Port Descriptions for Circuit-Based Conventional Analog-Only Simulcast Voting Subsystem

Table 26: Port Descriptions

Device	Manual
MLC 8000	See “MLC 8000 Ports” in the *MLC 8000 Comparator Feature Guide*.
Ethernet Switch	See the manufacturer’s manual.
MC2500 analog console	See the *MC2500™ Multi-channel Deskset L3217 Operator and Installation Manual* (6880309L14).
SDM3000 RTU	See the Installation chapter “Connecting I/Os with Punch Blocks” sub-section and Appendix C “Pin Assignments” and “Punch Block Terminal Block Contacts” in the *SDM3000 Owner’s Manual*. Depending on the MLC 8000 device type, up to four I/Os and one output (the 5v) are used to report alarms to MOSCAD NFM, and one I/O is used by MOSCAD NFM to restart the MLC 8000 unit from the GMC Application. See also Setting Up MOSCAD Network Fault Management (NFM) Monitoring on page 37.
CSCI	See “CSCI-to-Punchblock Cabling” in the *GPS Simulcast Installation* manual (6881098E65). Refers to a legacy comparator, but this is applicable to the MLC 8000.
Channel Bank	See “DSM-II Pinouts” in the *GPS Simulcast Installation* manual (6881098E65).

8.3

Circuit-Based Analog-Only Simulcast Voting Subsystem Troubleshooting

To troubleshoot the initial implementation of MLC 8000s in a Circuit-Based Analog-Only Simulcast Voting Subsystem, refer to Troubleshooting the Transmit (TX) Path for Simulcast Subsystems on page 223.

For general conventional troubleshooting, refer to the *RF Site Technician* webhelp.

Refer to the *MLC 8000 Comparator Feature Guide* for LED indications and the details of the alarms specifically for MLC 8000s, for ongoing monitoring and troubleshooting.

Refer to the *GPS Simulcast Installation* manual (68P81098E65) for information about ASTRO-TAC and CSCI.

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Chapter 9

Analog-Only IP-Based Simulcast Voting Subsystem

This section outlines the installation and configuration procedures required to install MLC 8000s; each process step refers to the appropriate documentation provided with your ASTRO® 25 system for the detailed procedure. A high-level diagram and equipment cabling tables are provided for the subsystem.

9.1 Implementing an Analog-Only IP-Based Simulcast Voting Subsystem

Prerequisites: See Implementing MLC 8000s on page 31.

When and where to use: Follow these sequences when implementing MLC 8000s in an Analog-Only IP-Based Simulcast Voting subsystem.

Process:

1. Perform the tasks to install equipment at the prime site. See Installing Equipment for Each Channel in the Prime Site on page 149.
2. Perform the tasks to install equipment at subsites. See Installing Equipment for Each Channel in Subsites on page 151.
3. Configure the MLC 8000 devices with the MLC 8000 Configuration Tool. See Configuring MLC 8000 Devices with the MLC 8000 Configuration Tool on page 153
4. Verify the installation and configuration performed in this implementation. See Verifying the Installation and Configuration on page 156.

9.1.1 Installing Equipment for Each Channel in the Prime Site

When and where to use: Use for prime sites for an Analog-Only IP-Based Simulcast Voting Subsystem.

Process:

1. Install the MLC 8000 Analog Comparator.
   - **a** Install the MLC 8000 in a rack or cabinet.

     See “Installing MLC 8000” in the *MLC 8000 Comparator Feature Guide*.
   - **b** Mount the MLC 8000 on a tray.

     See “Mounting MLC 8000 on the Tray” in the *MLC 8000 Comparator Feature Guide*.
   - **c** Ground the MLC 8000 on a tray.

     See “Grounding an MLC 8000 in a Tray” in the *MLC 8000 Comparator Feature Guide*.
   - **d** Install the MLC 8000 REF Input Signals to connect the MLC 8000 to the Time Reference (GPS).

     See “Installing MLC 8000 REF Input Signals for IP Simulcast System” in the *MLC 8000 Comparator Feature Guide*.

NOTICE: The assumption is that the Simulcast Site Reference device is installed and running, providing a synchronized REF composite signal.

e (For rack-mount installation) Install the MLC 8000 tray in a rack.

See “Installing MLC 8000 Tray in Rack” in the *MLC 8000 Comparator Feature Guide*.

f (For cabinet-mount installation) Install the MLC 8000 tray in a cabinet.

See “Installing MLC 8000 Tray in Cabinet” in the *MLC 8000 Comparator Feature Guide*.

2 Ground the MLC 8000 tray installed in the rack or cabinet.

See “Installing MLC 8000” (step 2) in the *MLC 8000 Comparator Feature Guide*.

3 Connect the MLC 8000 to power by connecting the DC cable of the power supply unit to the DC inlet of the MLC 8000. Ensure that the cable is not routed with tension.

See “Installing MLC 8000” (step 3) in the *MLC 8000 Comparator Feature Guide*.

4 Is MAC Port Lockdown used on the system? (Disable MAC Port Lockdown if applicable)

If…	Then…
Yes	For K core systems, disable MAC Port Lockdown on the site LAN switch. See “Disabling MAC Port Lockdown Using an HP Switch Service Port” in the *MAC Port Lockdown Feature Guide*.
	For M series and L series zone core systems, disable MAC Port Lockdown on the site LAN switch with a Saved Command in UNC. See “Disabling MAC Port Lockdown Using a VoyenceControl Template” in the *MAC Port Lockdown Feature Guide*.
	Determine the switch configuration, to find an unused port. See “HP Switches – Determining Port Connections in ASTRO 25 Systems” in the *System LAN Switches Feature Guide*.
No	For K core systems, enable and configure unused ports on switches. Enable all the ports on the switches. See “Enabling/Disabling Ports on HP Switches Using Local Access” in the *MAC Port Lockdown Feature Guide*.
	For M series and L series zone core systems, enable and configure unused ports on switches. See “Enabling/Disabling Ports on HP Switches Using VoyenceControl” in the *MAC Port Lockdown Feature Guide*.

5 Connect the MLC 8000 Analog Comparator to the switch.

See Analog-Only IP-Based Simulcast Voting Subsystem Equipment Cabling on page 158.

6 Connect the MLC 8000 Analog Comparator to an analog console.

See Analog-Only IP-Based Simulcast Voting Subsystem Equipment Cabling on page 158.

7 Optional: Set up MOSCAD NFM. This task is only applicable if MOSCAD NFM is available.

See Setting Up MOSCAD Network Fault Management (NFM) Monitoring on page 37.

8 Optional: Connect the MLC 8000 Analog Comparator to the SDM3000 RTU. This task is only applicable if MOSCAD NFM is available.

See Cabling MLC 8000 to SDM3000 RTU on page 40.

9 Turn on power to the MLC 8000 by connecting the AC cord of the power supply unit to the AC wall-mount power outlet (110-240 VAC, 50/60 Hz).

NOTICE: The AC power outlet should be as near as possible to the equipment and should be accessible. Ensure that the cable is not routed with tension.

See “Installing MLC 8000” (step 6) in the *MLC 8000 Comparator Feature Guide*.

a Verify the MLC 8000 power LED turns RED (which indicates the MLC 8000 is in booting state) and after a while, it turns GREEN.

b Optional: If the MOSCAD NFM subsystem is available in the system, then you can also verify that the MOSCAD NFM correctly indicates the presence of the MLC 8000 by pin # 1 at the VIP connector (or else the wiring to the SDM3000 RTU may be wrong). Validate that the correct indication of each MLC 8000 power up is shown in the GMC Application, either on the GMC or on the GWS.

10 Install the MLC 8000 Configuration Tool with Analog Display and Control to a service laptop (if you did not do so in the off-site preconfiguration).

See “Installing the MLC 8000 Configuration Tool with Analog Display and Control” in the *MLC 8000 Configuration Tool User Guide*. Complete the full process even if individual steps are not called out.

NOTICE: Obtain the installation CD for the MLC 8000 Configuration Tool, or the version of the software you want to install from Motorola Online. Install the MLC 8000 Configuration Tool on your own laptops in the field.

11 Optional: Install the MCN Server 8000™ Remote Comparator Display Software. See Setting Up the MCN Server 8000 Remote Comparator Display Software on page 35.

NOTICE: If available, this software can be installed at any time. No configuration at the MLC 8000 is necessary.

12 Change the MLC 8000 factory programmed passwords (if needed).

See “Changing the MLC 8000 Password” in the *MLC 8000 Configuration Tool User Guide*.

13 Define a reset password key if necessary to harden the reset password mechanism.

See “Assigning Reset Password Key” in the *MLC 8000 Configuration Tool User Guide*.

IMPORTANT: Changing the password must occur on-site since passwords are secured and not exposed to Motorola Solutions. The passwords can be changed either locally using the Local O&M port (serial connection) or remotely using the SSH option in PuTTY to connect to the Extranet LAN port. If you change the password, then push the same password to all devices (this is mandatory). Use the same password for all the devices of the channel cluster.

Installation of equipment and software for each channel in the prime site is complete.

Postrequisites: See Installing Equipment for Each Channel in Subsites on page 151.

9.1.2
Installing Equipment for Each Channel in Subsites

When and where to use: Use for subsites for Analog-Only IP-Based Simulcast Voting Subsystems.

Process:

1 Install the MLC 8000 Subsite Link Converter (AGU).

a Install the MLC 8000 in a rack or cabinet.

See “Installing MLC 8000” in the *MLC 8000 Comparator Feature Guide*.

b Mount the MLC 8000 on a tray.

See “Mounting MLC 8000 on the Tray” in the *MLC 8000 Comparator Feature Guide*.

c Ground the MLC 8000 on a tray.

See “Grounding an MLC 8000 in a Tray” in the *MLC 8000 Comparator Feature Guide*.

d Install the MLC 8000 REF Input Signals to connect the MLC 8000 to the Time Reference (GPS).

IMPORTANT: The Time Reference (GPS) is not needed if the MLC 8000 Subsite Link Converter is connected to an Rx only BR.

See “Installing MLC 8000 REF Input Signals for IP Simulcast System” in the *MLC 8000 Comparator Feature Guide*.

NOTICE: The assumption is that the Simulcast Site Reference device is installed and running, providing a synchronized REF composite signal.

e (For rack-mount installation) Install the MLC 8000 tray in a rack.

See “Installing MLC 8000 Tray in Rack” in the *MLC 8000 Comparator Feature Guide*.

f (For cabinet-mount installation) Install the MLC 8000 tray in a cabinet.

See “Installing MLC 8000 Tray in Cabinet” in the *MLC 8000 Comparator Feature Guide*.

2 Ground the MLC 8000 tray installed in the rack or cabinet.

See “Installing MLC 8000” (step 2) in the *MLC 8000 Comparator Feature Guide*.

3 Connect the MLC 8000 to power by connecting the DC cable of the power supply unit to the DC inlet of the MLC 8000.

See “Installing MLC 8000” (step 3) in the *MLC 8000 Comparator Feature Guide*.

4 Is MAC Port Lockdown used on the system? (Disable MAC Port Lockdown if applicable)

If…	Then…
Yes	For K core systems, disable MAC Port Lockdown on the site LAN switch. See “Disabling MAC Port Lockdown Using an HP Switch Service Port” in the *MAC Port Lockdown Feature Guide*.
	For M series and L series zone core systems, disable MAC Port Lockdown on the site LAN switch with a Saved Command in UNC. See “Disabling MAC Port Lockdown Using a VoyenceControl Template” in the *MAC Port Lockdown Feature Guide*.
	Determine the switch configuration, to find an unused port. See “HP Switches – Determining Port Connections in ASTRO 25 Systems” in the *System LAN Switches Feature Guide*.
No	For K core systems, enable and configure unused ports on switches. Enable all the ports on the switches. See “Enabling/Disabling Ports on HP Switches Using Local Access” in the *MAC Port Lockdown Feature Guide*.
	For M series and L series zone core systems, enable and configure unused ports on switches. See “Enabling/Disabling Ports on HP Switches Using VoyenceControl” in the *MAC Port Lockdown Feature Guide*.

5 Connect the MLC 8000 Subsite Link Converter to the switch.

See Analog-Only IP-Based Simulcast Voting Subsystem Equipment Cabling on page 158.

6 Connect the MLC 8000 Subsite Link Converter to a base radio. It is a 4-wire connection, or a 2-wire connection can also work when connected to a QUANTAR® Satellite Receiver.

See Analog-Only IP-Based Simulcast Voting Subsystem Equipment Cabling on page 158.

NOTICE: For analog Simulcast channels, all base radios on the same channel must be of the same type on all the subsites (for example, all GTR 8000s or all QUANTARs®).

7 Configure the base radios to interface with the MLC 8000 devices.

See Conventional Configuration Settings for Analog Simulcast on page 53.

8 Optional: Set up MOSCAD NFM. This task is only applicable if MOSCAD NFM is available.

See Setting Up MOSCAD Network Fault Management (NFM) Monitoring on page 37.

9 Optional: Connect the MLC 8000 Subsite Link Converter to the SDM3000 RTU. This task is only applicable if MOSCAD NFM is available.

See Cabling MLC 8000 to SDM3000 RTU on page 40.

10 Turn on power to the MLC 8000 by connecting the AC cord of the power supply unit to the AC wall-mount power outlet (110-240 VAC, 50/60 Hz).

NOTICE: The AC power outlet should be as near as possible to the equipment and should be accessible. Ensure that the cable is not routed with tension.

See “Installing MLC 8000” (step 6) in the *MLC 8000 Comparator Feature Guide*.

a Verify the MLC 8000 power LED turns RED (which indicates the MLC 8000 is in booting state) and after a while, it turns GREEN.

b Optional: If the MOSCAD NFM subsystem is available in the system, then you can also verify that the MOSCAD NFM correctly indicates the presence of the MLC 8000 by pin # 1 at the VIP connector (or else the wiring to the SDM3000 RTU may be wrong). Validate that the correct indication of each MLC 8000 power up is shown in the GMC Application, either on the GMC or on the GWS.

Installation of equipment for each channel in the subsite is complete.

Postrequisites: See Configuring MLC 8000 Devices with the MLC 8000 Configuration Tool on page 153.

9.1.3
Configuring MLC 8000 Devices with the MLC 8000 Configuration Tool

Prerequisites: Ensure both the MLC 8000 Subsite Link Converters and MLC 8000 Analog Comparators are cabled to switches. So, configuration can only be performed AFTER going to each remote site to cable the MLC 8000 Subsite Link Converters to switches and base radios.

When and where to use: Follow these tasks to configure the MLC 8000 devices using a service laptop with the MLC 8000 Configuration Tool with Analog Display and Control.

Process:

1 You have three options to configure the MLC 8000s:

If…	Then…
Option 1: IF the system is prestaged off-site (not at the RF site), and IP address and channel cluster information is available	When off-site, perform step 2- step 12 When on site, retrieve the saved configuration, skip to step 13 and finish the configuration.

If…	Then…
Option 2: IF the system is prestaged off-site (not at the RF site), and IP address and channel cluster information is not available	On site, use these steps to update the configuration and provide the actual IP addresses and channel cluster information, and then set up associations.
Option 3: IF the system is not prestaged off-site	Perform all the steps here.

2 Configure the MLC 8000 device IP addresses in the MLC 8000 Configuration Tool (if modification is needed).

See “Provisioning the Initial IP Address for an MLC 8000 Device” in the *MLC 8000 Configuration Tool User Guide*.

3 Create and define a channel cluster in the MLC 8000 Configuration Tool.

NOTICE: Prerequisite: IP addresses have been assigned to the MLC 8000 Analog Comparators and MLC 8000 Subsite Link Converters.

See “Creating a Conventional Channel Cluster” in the *MLC 8000 Configuration Tool User Guide*.

4 Define the Site ID and Site Name for the new channel cluster.

See “Entering Site ID and Site Name for a Conventional Channel Cluster” in the *MLC 8000 Configuration Tool User Guide*.

5 Provide the name and type for the channel cluster.

See “Defining a Conventional Channel Cluster” in the *MLC 8000 Configuration Tool User Guide*.

6 Define subsites in the subsite list. The Subsite ID and associated name are required for the system to work.

See “Modifying the Conventional Channel Cluster Subsite List” in the *MLC 8000 Configuration Tool User Guide*.

7 Add the MLC 8000 Analog Comparator (VGU) to the channel cluster.

See “Adding an MLC 8000 Analog or Mixed Mode Comparator to a Conventional Channel Cluster” in the *MLC 8000 Configuration Tool User Guide*.

NOTICE: You can complete the configuration now or download the software now, then configure after the software upgrade is complete. In either case, save the changes by clicking **Write to Device**. Result: The device restarts. After the restart, you can upgrade the software if necessary.

8 (Optional) Download the MLC 8000 device software if available (if you are unsure that you have the latest version or it was not downloaded in off-site prestaging). Perform this task if your Motorola Solutions representative recommends a newer software version. New software is available at Motorola Online (http://businessonline.motorolasolutions.com).

NOTICE: The software download must be performed separately for each MLC 8000 device in the channel cluster.

See “Downloading a Specific Software Update to an MLC 8000 Device” in the *MLC 8000 Configuration Tool User Guide*.

9 Configure the MLC 8000 Analog Comparator.

NOTICE: If manual steering is used and tables of related TRC codes are already defined, select the **No Steering** option.

See “Configuring an MLC 8000 Analog Comparator for an IP Simulcast System” in the *MLC 8000 Configuration Tool User Guide*.

10 Add an MLC 8000 Subsite Link Converter to a conventional channel cluster.

See “Adding an MLC 8000 Subsite Link Converter to a Conventional Channel Cluster” in the *MLC 8000 Configuration Tool User Guide*.

NOTICE: You can complete the configuration now or download the software now, then configure after the software upgrade is complete. In either case, save the changes by clicking **Write to Device**. Result: The device restarts. After the restart, you can upgrade the software if necessary.

11 (Optional) Download the MLC 8000 device software if available (if you are unsure that you have the latest version or it was not downloaded in off-site prestaging). Perform this task if your Motorola Solutions representative recommends a newer software version. New software is available at Motorola Online (http://businessonline.motorolasolutions.com).

NOTICE: The software download must be performed separately for each MLC 8000 device in the channel cluster.

See “Downloading a Specific Software Update to an MLC 8000 Device” in the *MLC 8000 Configuration Tool User Guide*.

12 Configure the MLC 8000 Subsite Link Converter (and associated AGU ports).

a Within the procedure to configure the MLC 8000 Subsite Link Converter, you configure the ports associated with the VGU (select the AGU in the Configuration Tool).

See “Configuring an MLC 8000 Subsite Link Converter for an IP Simulcast System ” in the *MLC 8000 Configuration Tool User Guide*.

NOTICE: When you configure the MLC 8000 Analog Comparator (VGU) ports, you can repeat this step for as many BR locations as your system has.

NOTICE: Base Radio Properties Tab, Link Type = 4 Wire (with TRC or External PTT). This field is enabled for Non IP simulcast systems.

13 Configure the channel (set up associations). Associate base radios with each MLC 8000 Analog Comparator (VGU).

See “Associating a Base Radio with an MLC 8000 Analog Comparator” in the *MLC 8000 Configuration Tool User Guide*.

NOTICE: This loop can be repeated up to four times.

14 Set channel cluster parameters for all MLC 8000s (including G.711, NTP, and timeout parameters).

See “Setting Channel Cluster Parameters” in the *MLC 8000 Configuration Tool User Guide*.

NOTICE: Prerequisite: All devices of the channel cluster have been added and configured, so that MLC 8000 Configuration Tool downloads the channel cluster parameters to all these devices.

15 Optional: Configure the channel transmitters steering associations. Enable and configure transmitter steering and regional voting tables for the MLC 8000 Analog Comparator (VGU). See “Management of the Transmitter Steering Tables for an MLC 8000 Analog Comparator” in the *MLC 8000 Configuration Tool User Guide*.

The MLC 8000 devices are configured.

Postrequisites: See Verifying the Installation and Configuration on page 156.

9.1.4
Verifying the Installation and Configuration

Process:

1 Is MAC Port Lockdown used on the system? Run MAC Port Lockdown, if applicable.

If…	Then…
Yes	For K core systems, run MAC Port Lockdown on the switches. See “Locking HP Switch Ports” in the *MAC Port Lockdown Feature Guide*.
	For M series and L series zone core systems, run MAC Port Lockdown on the switches. See “Performing MAC Port Lockdown on HP Switches” in the *MAC Port Lockdown Feature Guide*.
No	For K core systems, disable open (unused) ports on switches. For each of the HP switches, every open port (no device connected) must be disabled. See “Enabling/Disabling Ports on HP Switches Using Local Access” in the *MAC Port Lockdown Feature Guide*.
	For M series and L series zone core systems, disable open (unused) ports on switches. See “Locking HP Switch Ports Using a VoyenceControl Template” in the *MAC Port Lockdown Feature Guide*.

2 Verify connectivity.

a View the channel cluster to verify the links. (Icons for the MLC 8000 Analog Comparator and its MLC 8000 Subsite Link Converters are yellow to indicate connection with the Configuration Tool and the device).

See “Viewing a particular Channel Cluster Tree” in the *MLC 8000 Configuration Tool User Guide*.

b Verify that the MLC 8000 Analog Comparator is voting the base radios by observing at the Analog Display and Control Application. For example, the LED to the left of the base radio should not be gray, the radio state is either **Active** or **No activity**, and the SQM signal strength should not be **N/A**.

See “Opening the Analog Display and Control Application with MLC 8000 Analog Comparator Selected” in the *MLC 8000 Configuration Tool User Guide*.

3 Confirm the status of the links.

Devices		Procedure References
MLC 8000 Analog Comparator to MLC 8000 Subsite Link Converter (IP)		
	Check the COMM LED, which is Red if at least one link connection to the MLC 8000 Link Converter port has failed.	See “MLC 8000 Analog Comparator LEDs” in the *MLC 8000 Comparator Feature Guide*.
	Use MOSCAD NFM. Only if the MOSCAD NFM subsystem is available in your system.	See “MLC 8000 Analog Comparator — MOSCAD NFM Events Troubleshoot-

Table continued…

Devices		Procedure References
		ing (IP Simulcast System)" in the *MLC 8000 Comparator Feature Guide*.
	Pull a log file of the device for error messages.	See "MLC 8000 Device Logs and Recommended Actions" in the *MLC 8000 Comparator Feature Guide*.
MLC 8000 Subsite Link Converter to Base Radio (4-wire)		
	Check the Port 1-4 LED. On the MLC 8000, the Port 1-4 LED is Red indicating the link to the base radio failed.	See "MLC 8000 Link Converter LEDs" in the *MLC 8000 Comparator Feature Guide*.
	Use MOSCAD NFM. Only if the MOSCAD NFM subsystem is available in your system. Check for a VIP 4 event, which indicates a link to a BR has failed. One MLC 8000 Subsite Link Converter connects to four base radios, but it has one VIP to indicate status. So, check each of the four connections.	See "MLC 8000 Link Converter — MOSCAD NFM Events Troubleshooting (IP Simulcast System)" in the *MLC 8000 Comparator Feature Guide*.
	Pull a log file of the device for error messages.	See "MLC 8000 Device Logs and Recommended Actions" in the *MLC 8000 Comparator Feature Guide*.
MLC 8000 Analog Comparator to Analog Console (4–w)		
	Link status is verified by audio monitoring or by transmitting voice from the console and observing audio is transmitted out (not by LED or MOSCAD NFM).	

4 Verify by making calls. This is a general task to perform.

a Test the operation of the system by making calls from the radios and ensuring call completion and quality.

b Verify that you can make a Console to Radio, Radio to Console, and Radio to Radio analog call.

Postrequisites: Calibrate/optimize the Simulcast system after the system is running properly.

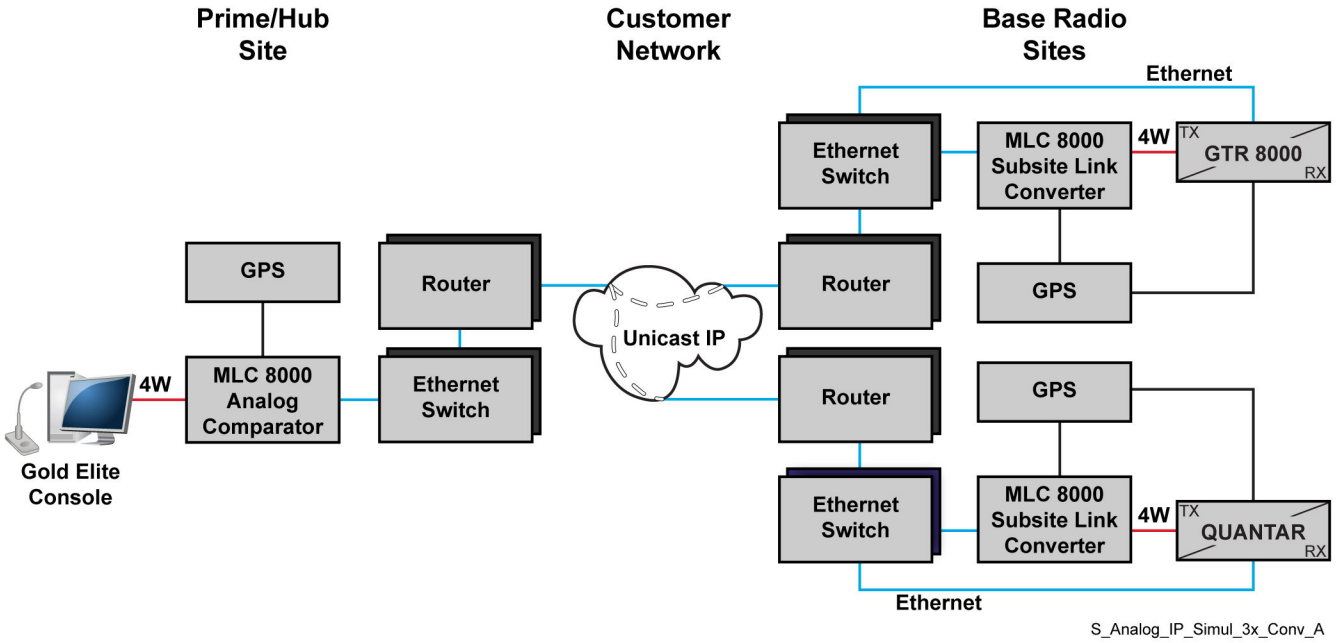
- See "Performing Calibration for an MLC 8000 Subsite Link Converter" in the *MLC 8000 Configuration Tool User Guide*.
- See "Performing Calibration for an MLC 8000 Analog Comparator" in the *MLC 8000 Configuration Tool User Guide*.
- Continue to Optimization/Calibration for Conventional Simulcast on page 195.

9.2

Analog-Only IP-Based Simulcast Voting Subsystem Equipment Cabling

This section provides a high-level subsystem diagram and equipment cabling tables from the MLC 8000 device to other system devices. A port description table lists the system devices and refers to the device documentation for more information.

Figure 14: Analog-Only IP-Based Simulcast Voting Subsystem Diagram



IMPORTANT: High-level diagrams are provided as examples only and are not to be used for system planning purposes. “GPS” in the diagram refers to a Simulcast Site Reference device. SDM3000 RTUs are not shown in the diagram, but would be part of the system if the optional MOSCAD NFM subsystem is available and would be connected to the MLC 8000 devices. The GPS should be connected to the MLC 8000 Subsite Link Converter only if it is connected to an Rx/Tx or Tx only BR.

NOTICE: This table provides part numbers for cables that are orderable from Motorola Solutions. Create the remaining cables using the provided pinout tables. See MLC 8000 Radio Ports Cabling on page 161.

Table 27: Equipment Cabling for Analog-Only IP-Based Simulcast Voting Subsystem

From MLC 8000 Analog Comparator		To Destination device:		
Port	**Connector Type**	**Device**	**Connector Type**	**Description**
REF	QMA	Simulcast Site Reference device	BNC	GPS connector for the reference signal. REF signal cable (FKN8718) T-BNC BNC-to-BNC COAX cable

Table continued…

From MLC 8000 Analog Comparator		To Destination device:		
Port	**Connector Type**	**Device**	**Connector Type**	**Description**
External LAN PoE	RJ45	LAN Switch	RJ45	RJ45-to-RJ45 one-to-one cable
VIP	RJ45	SDM3000 RTU	I/O Wiring Punch Block	MLC 8000 to MOSCAD NFM Cable on page 161
R1 4W-E&M	RJ45	MC2500	DB25	4-Wire MLC 8000 to MC2500 Analog Console Cable on page 176
From MLC 8000 Subsite Link Converter (Subsite)		To Destination device:		
Port	Connector Type	Device	Connector Type	Description
REF	QMA	Simulcast Site Reference device	BNC	GPS connector for the reference signal. REF signal cable (FKN8718) T-BNC BNC-to-BNC COAX cable
External LAN PoE	RJ45	LAN Switch	RJ45	RJ45-to-RJ45 one-to-one cable
VIP	RJ45	SDM3000 RTU	I/O Wiring Punch Block	MLC 8000 to MOSCAD NFM Cable on page 161
R1 4W-E&M	RJ45	QUANTAR® Base Radio (or QUANTAR® Satellite Receiver), TELCO **NOTICE:** In a QUANTAR® Satellite Receiver, 2–wires are always OK.	50 Pin Connector	4W MLC 8000 to QUANTAR Cable (IP Simulcast) on page 167
R14W-E&M	RJ45	GTR 8000 Base Radio or GPW 8000, 4W Gen-Tx **NOTICE:** In a GPW Satellite Receiver, 2–wires are always OK.	RJ45 Punch Block	4W MLC 8000 to GTR 8000 Cable (IP Simulcast) on page 165

NOTICE: The GPS should be connected to the MLC 8000 Subsite Link Converter only if it is connected to an Rx/Tx or Tx only BR.

Port Descriptions for Analog-Only IP-Based Simulcast Voting Subsystem

Table 28: Port Descriptions

Device	Manual
MLC 8000	See “MLC 8000 Ports” in the *MLC 8000 Comparator Feature Guide*.
Simulcast Site Reference device	See the manufacturer’s manual.
Ethernet Switch	See the manufacturer’s manual.
MC2500 analog console	See the *MC2500™ Multi-channel Deskset L3217 Operator and Installation Manual* (6880309L14).
SDM3000 RTU	See the Installation chapter “Connecting I/Os with Punch Blocks” sub-section and Appendix C “Pin Assignments” and “Punch Block Terminal Block Contacts” in the *SDM3000 Owner’s Manual*. Depending on the MLC 8000 device type, up to four I/Os and one output (the 5v) are used to report alarms to MOSCAD NFM, and one I/O is used by MOSCAD NFM to restart the MLC 8000 unit from the GMC Application. See also Setting Up MOSCAD Network Fault Management (NFM) Monitoring on page 37.
QUANTAR® Base Radio	See “Backplane Connectors Information” in the *QUANTAR Instruction Manual* (6881095E05). Connects to either a punch block to the 50–pin Telco System Connector (I) or the 8-wire screw terminal connector.
GTR 8000 Base Radio	See “Transceiver Ports – Front” in the *RF Site Technician Reference Guide* webhelp

9.3 Analog-Only IP-Based Simulcast Voting Subsystem Troubleshooting

To troubleshoot the initial implementation of MLC 8000s in an Analog-Only IP-Based Simulcast Voting Subsystem, refer to Troubleshooting the Transmit (TX) Path for Simulcast Subsystems on page 223.

For general conventional troubleshooting, refer to the *RF Site Technician Guide* webhelp.

Refer to the *MLC 8000 Comparator Feature Guide* for LED indications and the details of the alarms specifically for MLC 8000s, for ongoing monitoring and troubleshooting.

Chapter 10

MLC 8000 Radio Ports Cabling

This chapter provides figures and tables defining the cables and adapters used in various MLC 8000 implementations.

In this chapter:

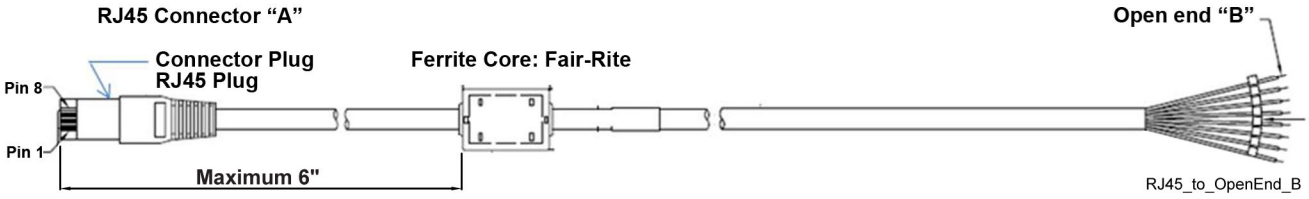
- Pinouts are provided for these cables, so that you can build them.
- Pre-wired adapters listed here with part numbers 58009260001 and 58009256011 can be ordered from Motorola Solutions.
- Adapter 58009256017 is not pre-wired by Motorola Solutions. You can customize Motorola RJ45-to-Telco adapter 58009256017 for many different applications, including using the pinouts listed in RJ45-to-T57 Telco Adapter for QUANTAR Analog Conventional Voting on page 164 for 4-wire MLC 8000 connections to GTR 8000s.

Please contact Motorola Solutions System Support Center for information about adapters which you can order.

10.1 MLC 8000 to MOSCAD NFM Cable

This cable has a ferrite core, Fair-Rite® (part number: FHN9045A).

Figure 15: MLC 8000 to MOSCAD NFM Cable



NOTICE: Use the open-ended cable with the punch block.

Table 29: MLC 8000 to MOSCAD NFM Cable

End A, MLC 8000 (RJ45)				End B, MOSCAD NFM
Pin No.	**Signal**	**Definition**	**I/O**	**Signal**
1	5V	Unit Present	Output	Analog Input
2	VIP1	N/A	Output	Digital Input 1
3	VIP2	GPS in Simul-cast mode	Output	Digital Input 2
4	VIP3	Communication	Output	Digital Input 3
5	VIP4	Ports	Output	Digital Input 4

Table continued…

End A, MLC 8000 (RJ45)				End B, MOSCAD NFM
Pin No.	Signal	Definition	I/O	Signal
6	VIP5	Launch time in Simulcast mode	Output	Digital Input 5
7	VIP6	Reset	Input	Digital Output
8	GND			

10.2
4W MLC 8000 to QUANTAR Cable (Non-Simulcast)

Three options are available to connect the 4W MLC 8000 to QUANTAR® Base Radios in Non-Simulcast systems. See the following for details:

- 4W MLC 8000 to QUANTAR (Non-Simulcast) — Option A (8-Wire Screw Terminal) on page 162
- 4W MLC 8000 to QUANTAR (Non-Simulcast) — Option B (8-Wire Screw Terminal Adapter) on page 163
- 4W MLC 8000 to QUANTAR (Non-Simulcast) — Option C (RJ45-to-RJ45 Cable with RJ45-to-T57 Telco Adapter) on page 164

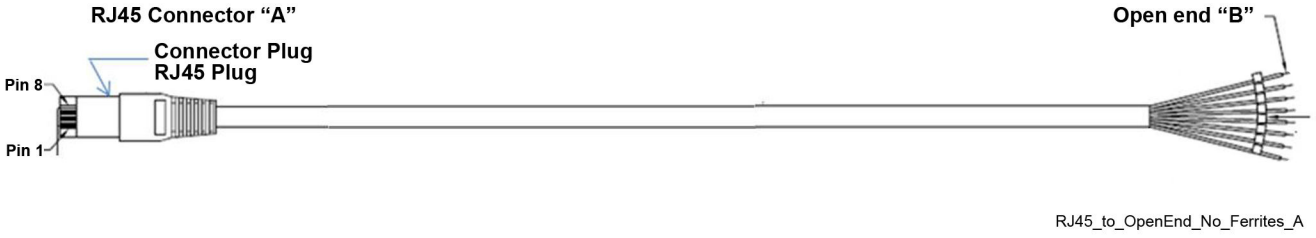
NOTICE:

1 QUANTAR® can also be a QUANTAR® satellite receiver.

2 When connected to a receive-only BR, a full 4–wire connection is not required. The two wires of the Audio In are sufficient.

10.2.1
4W MLC 8000 to QUANTAR (Non-Simulcast) — Option A (8-Wire Screw Terminal)

Figure 16: 4W MLC 8000 to QUANTAR (Non-Simulcast) — Option A, RJ45 to Open End Cable



NOTICE: Use the open-ended cable with the 8-wire screw terminal on the QUANTAR® Base Radio.

Table 30: 4W MLC 8000 to QUANTAR Cable (Non-Simulcast) — Option A (8-Wire Screw Terminal)

End A, MLC 8000 (RJ45)			End B, QUANTAR 8-wire screw terminal	
Pin No.	Signal (4W)	Wire Color	Pin No.	Signal
1	Audio Out+	White/Orange	1	LINE 1 +

Table continued…

End A, MLC 8000 (RJ45)			End B, QUANTAR 8-wire screw terminal	
Pin No.	Signal (4W)	Wire Color	Pin No.	Signal
2	Audio Out-	Orange	2	LINE 1 -
3	Audio In +	White/Blue	3	LINE 2 +
4	Audio In -	Blue	4	LINE 2 -
5	PTT	White/Green	Not Connected	LINE 3 +
6	COR	Brown	Not Connected	LINE 3 -
7	5V	Green	Not Connected	LINE 4 +
8	VGND	White/Brown	Not Connected	LINE 4 -

10.2.2
4W MLC 8000 to QUANTAR (Non-Simulcast) — Option B (8-Wire Screw Terminal Adapter)

Figure 17: 4W MLC 8000 to QUANTAR Cable (Non-Simulcast) — Option B RJ45-to-RJ45 Cable

Option B uses an RJ45 to 8-wire screw terminal connector adapter (Motorola part number: 58009260001). Attach the cable to the L1/L2 connector at the adapter.

Table 31: 4W MLC 8000 to QUANTAR Cable (Non-Simulcast) — Option B (8-Wire Screw Terminal Adapter)

End A, MLC 8000 (RJ45)			End B, QUANTAR 8-Wire Screw Terminal Adapter (RJ45)	
Pin No.	Signal (4W)	Wire Color	Pin No.	Signal
1	Audio Out+	White/Orange	5	LINE 1 +
2	Audio Out-	Orange	4	LINE 1 -
3	Audio In +	White/Blue	1	LINE 2 +
4	Audio In -	Blue	2	LINE 2 -
5	PTT	White/Green	Not Connected	LINE 3 +
6	COR	Brown	Not Connected	LINE 3 -
7	5V	Green	Not Connected	LINE 4 +
8	VGND	White/Brown	Not Connected	LINE 4 -

10.2.3
4W MLC 8000 to QUANTAR (Non-Simulcast) — Option C (RJ45-to-RJ45 Cable with RJ45-to-T57 Telco Adapter)

Figure 18: 4W MLC 8000 to QUANTAR Cable (Non-Simulcast) — Option C (RJ45-to-RJ45 Cable)

Option C uses an RJ45-to-RJ45 cable with an RJ45 to 50-pin Telco connector adapter that you can build by customizing Motorola Part Number 58009256017 using the pinout table in section RJ45-to-T57 Telco Adapter for QUANTAR Analog Conventional Voting on page 164.

Table 32: 4W MLC 8000 to QUANTAR Cable (Non-Simulcast) — Option C (RJ45-to-RJ45 Cable with RJ45-to-T57 Telco Adapter)

End A, MLC 8000 (RJ45)			End B, QUANTAR (RJ45)	
Pin No.	**Signal (4W)**	**Wire Color**	**Pin No.**	**Signal**
1	Audio Out+	White/Orange	1	LINE 1 +
2	Audio Out-	Orange	2	LINE 1 -
3	Audio In +	White/Blue	5	LINE 2 +
4	Audio In -	Blue	4	LINE 2 -
5	PTT	White/Green	3	External PTT
6	COR	Brown	Not Connected	Not Connected
7	5V	Green	Not Connected	Not Connected
8	VGND	White/Brown	7	logic GND

10.2.3.1
RJ45-to-T57 Telco Adapter for QUANTAR Analog Conventional Voting

The following wiring applies to the Motorola RJ45-to-T57 Telco Adapter 58009256017.

Table 33: RJ45-to-T57 Telco Adapter for QUANTAR Analog Conventional Voting

Function	MLC 8000 (RJ45M) Side	QUANTAR (T57M) Side	
	Adapter Pin No.	**Adapter Pin No.**	**Notes**
EXT. PTT	3	15	
Logic Ground	7	32	
Line 1 (-)	2	26	
Line 1 (+)	1	1	

Table continued…

Function	MLC 8000 (RJ45M) Side	QUANTAR (T57M) Side	
	Adapter Pin No.	Adapter Pin No.	Notes
Line 2 Rx(+)	4	2	
Line 2 Rx(-)	5	27	
		22	Pin 22 and Pin 8: direct connection
		8	

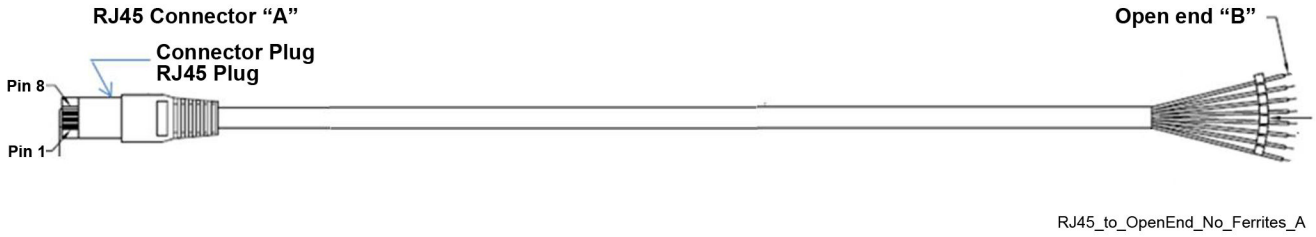
10.3
4W MLC 8000 to GTR 8000 Cable (IP Simulcast)

Two options are available to connect the 4W MLC 8000 to the GTR 8000 Base Radio in IP simulcast systems. See the following for details:

- 4W MLC 8000 to GTR 8000 Cable (IP Simulcast) for Punch Block to 50-Pin Telco and RJ45 Connectors on page 165
- 4W MLC 8000 to GTR 8000 Cable (IP Simulcast) for DLN6821A Cable Assembly Connection on page 166

10.3.1
4W MLC 8000 to GTR 8000 Cable (IP Simulcast) for Punch Block to 50-Pin Telco and RJ45 Connectors

Figure 19: 4W MLC 8000 to GTR 8000 Cable (IP Simulcast), RJ45 to Open End Cable



NOTICE: Use the open-ended cable with the punch block.

Table 34: 4W MLC 8000 to GTR 8000 Cable (IP Simulcast) for Punch Block to 50-Pin Telco and RJ45 Connectors

End A,			End B,		End B,	
MLC 8000 (RJ45)			GTR 8000 Standard 50-Pin Telco Connector		GTR 8000 4W RJ45	
Pin No.	Description	Wire Color	Pin No.	Description	Pin No.	Description
1	Audio Out+	White/ Orange	50	Gen TX+	Not Connected	Not Connected
2	Audio Out-	Orange	25	Gen TX-	Not Connected	Not Connected

Table continued…

End A,			End B,		End B,	
MLC 8000 (RJ45)			GTR 8000 Standard 50-Pin Telco Connector		GTR 8000 4W RJ45	
Pin No.	Description	Wire Color	Pin No.	Description	Pin No.	Description
3	Audio In +	White/ Blue	Not Connected	Not Connected	JC-1	RX+
4	Audio In -	Blue	Not Connected	Not Connected	JC-2	RX-
5	PTT	White/ Green	28	PTT, Aux In 5	Not Connected	Not Connected
6	COR	Brown	Not Connected	Not Connected	Not Connected	Not Connected
7	5V	Green	Not Connected	Not Connected	Not Connected	Not Connected
8	VGND	White/ Brown	43,44,34,46,48	GND	Not Connected	Not Connected

10.3.2

4W MLC 8000 to GTR 8000 Cable (IP Simulcast) for DLN6821A Cable Assembly Connection

Figure 20: 4W MLC 8000 to GTR 8000 Cable (IP Simulcast)

Table 35: 4W MLC 8000 to GTR 8000 Cable (IP Simulcast) for DLN6821A Cable Assembly Connection

End A, MLC 8000 Side of RJ45 Cable			End B, RJ45 on GTR 8000 Side (Connects to DLN6821A Using Adapter 58009256017)	
Pin No.	Signal	Wire Color	Pin No.	Signal
1	Audio Out+	White/Orange	1	Gen TX Data +
2	Audio Out-	Orange	2	Gen TX Data -
3	Audio In +	White/Blue	5	Line 2+
4	Audio In -	Blue	4	Line 2-
5	PTT	White/Green	3	Aux In 5 (Ext PTT-)
6	COR	Brown	Not Connected	Not Connected
7	5V	Green	Not Connected	Not Connected

Table continued…

End A, MLC 8000 Side of RJ45 Cable			End B, RJ45 on GTR 8000 Side (Connects to DLN6821A Using Adapter 58009256017)	
Pin No.	**Signal**	**Wire Color**	**Pin No.**	**Signal**
8	VGND	White/Brown	7	GND Station Ground

10.3.2.1

RJ45-to-T57 Telco Adapter for DLN6812A GTR 8000 Cable Assembly Connection (IP Simulcast)

The following wiring should be applied to Motorola RJ45-to-T57 Telco Adapter 58009256017.

Table 36: RJ45-to-T57 Telco Adapter for DLN6812A GTR 8000 Cable Assembly Connection (IP Simulcast)

Function	T57 Side	RJ45 Side
	Adapter Pin No.	**Adapter Pin No.**
External PTT	15	3
Logic Ground	32	7
GEN TX (-)	9	2
GEN TX (+)	34	1
Line 2 Rx (-)	27	4
Line 2 Rx (+)	2	5

10.4

4W MLC 8000 to QUANTAR Cable (IP Simulcast)

Two options are available to connect the 4W MLC 8000 to the QUANTAR® Base Radio in IP simulcast systems. See the following for details:

- 4W MLC 8000 to QUANTAR Cable (IP Simulcast) for Punch Block to 50-Pin Telco Connector on page 168
- 4W MLC 8000 to QUANTAR Cable (IP Simulcast) (RJ45-to-RJ45 Cable with RJ45 Adapter to 50-Pin Telco) on page 168

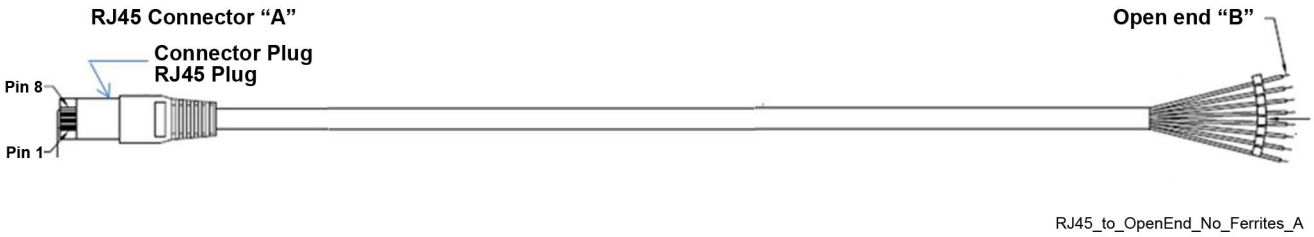
NOTICE:

1. QUANTAR® can also be a QUANTAR® satellite receiver.
2. When connected to a receive-only BR, a full 4 wire connection is not required. The two wires of the Audio In are sufficient.

10.4.1

4W MLC 8000 to QUANTAR Cable (IP Simulcast) for Punch Block to 50-Pin Telco Connector

Figure 21: 4W MLC 8000 to QUANTAR Cable (IP Simulcast), RJ45 to Open End Cable



NOTICE: Use the open-ended cable with the punch block.

Table 37: 4W MLC 8000 to QUANTAR Cable (IP Simulcast) for Punch Block to 50-Pin Telco Connector

End A,			End B,		
MLC 8000 (RJ45)			QUANTAR Standard 50-Pin Telco Connector		
Pin No.	Signal	Wire Color	Pin No.	Signal	Notes
1	Audio Out+	White/Orange	34	Gen TX Data +	
2	Audio Out-	Orange	9	Gen TX Data -	
3	Audio In +	White/Blue	2	Line 2+	RX+
4	Audio In -	Blue	27	Line 2-	RX-
5	PTT	White/Green	47	Aux In 9 (Ext PTT-)	
6	COR	Brown	Not Connected	Not Connected	
7	5V	Green	Not Connected	Not Connected	
8	VGND	White/Brown	7,32	GND Station Ground	
			22	Aux In 9 (Ext PTT+)	Pin 22 and Pin 8: direct connection
			8	5 VDC Out	

10.4.2

4W MLC 8000 to QUANTAR Cable (IP Simulcast) (RJ45-to-RJ45 Cable with RJ45 Adapter to 50-Pin Telco)

NOTICE: This option is an RJ45-to-RJ45 cable with an RJ45 adapter to 50-pin Telco connector (Motorola Part Number: 58009256011).

Figure 22: 4W MLC 8000 to QUANTAR Cable (IP Simulcast) — RJ45-to-RJ45 Cable

Table 38: 4W MLC 8000 to QUANTAR Cable (IP Simulcast) — RJ45-to-RJ45 Cable with RJ45 Adapter to 50-Pin Telco

End A,			End B,	
MLC 8000 (RJ45)			RJ45 on QUANTAR Side (Connects to Adapter 58009256011)	
Pin No.	Signal	Wire Color	Pin No.	Signal
1	Audio Out+	White/Orange	1	Gen TX Data +
2	Audio Out-	Orange	2	Gen TX Data -
3	Audio In +	White/Blue	5	Line 2+
4	Audio In -	Blue	4	Line 2-
5	PTT	White/Green	3	Aux In 9 (Ext PTT-)
6	COR	Brown	Not Connected	Not Connected
7	5V	Green	Not Connected	Not Connected
8	VGND	White/Brown	7	GND Station Ground

10.4.2.1

RJ45-to-T57 Telco Adapter for QUANTAR (IP Simulcast)

The following wiring should be applied to Motorola RJ45-to-T57 Telco Adapter (58009256011).

Table 39: RJ45-to-T57 Telco Adapter for QUANTAR (IP Simulcast)

Function	T57 Side	RJ45 Side
	Adapter Pin No.	Adapter Pin No.
Gen TX Data +	34	1
Gen TX Data -	9	2
Ext PTT	47	3
Line 2-	27	4
Line 2+	2	5
Not Connected	6	6
Logic ground	7	7
Rx Code Detect	37	8
N/C Jumper 5V	8 to 22	N/A

10.5
4W MLC 8000 to GTR 8000 Cable (Non-Simulcast)

The following options are available to connect the 4W MLC 8000 to the GTR 8000 Base Radio in Non-Simulcast systems.

- 4W MLC 8000 to GTR 8000 Cable (Non-Simulcast) TRC on page 170
- 4W MLC 8000 to GTR 8000 Cable (Non-Simulcast) Open End on page 171
- 4W MLC 8000 to GTR 8000 Cable (Non-Simulcast) for T57 DLN6821A Cable Assembly Connection on page 172

10.5.1
4W MLC 8000 to GTR 8000 Cable (Non-Simulcast) TRC

Figure 23: 4W MLC 8000 to GTR 8000 Cable (Non-Simulcast) TRC RJ45-to-RJ45 Cable

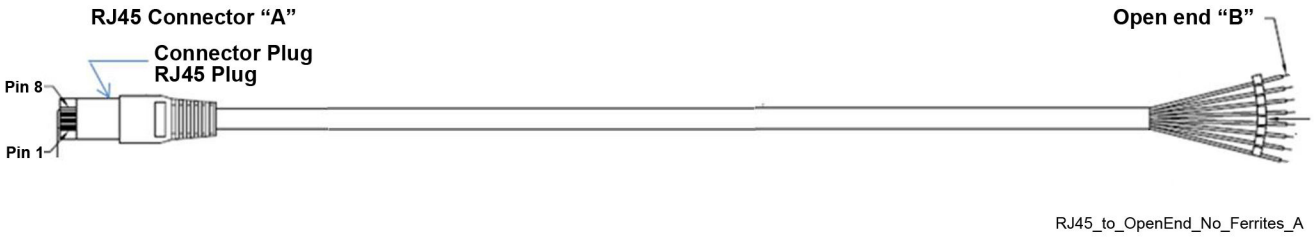
Table 40: 4W MLC 8000 to GTR 8000 Cable (Non-Simulcast) TRC

End A,			End B,	
MLC 8000 (RJ45)			GTR 8000 Base Radio	
Pin No.	Signal	Wire Color	Pin No.	Signal
1	Audio Out+	White/Orange	5	Line 1+
2	Audio Out-	Orange	4	Line 1-
3	Audio In +	White/Blue	1	Line 2+
4	Audio In -	Blue	2	Line 2-
5	PTT	White/Green	Not connected	Line 3+
6	COR	Brown	Not connected	Line 3-
7	5V	Green	Not connected	Line 4+
8	VGND	White/Brown	Not connected	Line 4-

10.5.2

4W MLC 8000 to GTR 8000 Cable (Non-Simulcast) Open End

Figure 24: 4W MLC 8000 to GTR 8000 Cable (Non-Simulcast), RJ45 to Open End Cable



NOTICE: Use the open-ended cable with the punch block.

Table 41: 4W MLC 8000 to GTR 8000 Cable (Non-Simulcast) Open End

End A,						
MLC 8000 (RJ45)			GTR System Connector	GTR Wireline Connector		
Pin No.	Signal	Wire Color	Pin No.	Pin No.	Signal	Notes
1	Audio Out+	White/ Orange	Not Connected	5	Line 1+	TX+
2	Audio Out-	Orange	Not Connected	4	Line 1-	TX-
3	Audio In +	White/Blue	Not Connected	1	Line 2+	RX+
4	Audio In -	Blue	Not Connected	2	Line 2-	RX-
5	PTT	White/ Green	28	Not Connected	Aux In 5 (Ext PTT)	
6	COR	Brown	Not Connected	Not Connected		
7	5V	Green	Not Connected	Not Connected		
8	VGND	White/ Brown	34, 43, 44, 48	Not Connected	Station Ground	

10.5.3

4W MLC 8000 to GTR 8000 Cable (Non-Simulcast) for T57 DLN6821A Cable Assembly Connection

This section provides information for connecting the MLC 8000 RJ45 cable to a T57 Telco connector that is part of a cable assembly for mounting on a bracket at the rear of a GTR 8000 Base Radio.

The cable assembly includes one cable that connects to both the 50-pin System Connector and the RJ45 wireline port on the front of the GTR 8000 Base Radio. The cable assembly including bracket can be ordered using the FRU number DLN6821A.

Figure 25: 4W MLC 8000 to GTR 8000 Cable (Non-Simulcast) RJ45-to-RJ45 Cable

This RJ45-to-RJ45 cable connects to an RJ45–to–50-pin Telco connector adapter that you can build by customizing Motorola Part Number 58009256017 using the pinout table in RJ45-to-T57 Telco Adapter for GTR 8000 T57 DLN6821A Cable Assembly Connection (Non-Simulcast) on page 173.

Table 42: 4W MLC 8000 to GTR 8000 Cable (Non-Simulcast) for T57 DLN6821A Cable Assembly Connection

End A,			End B,	
(RJ45 on MLC 8000 side)			RJ45 on GTR 8000 side (Connects to DLN6821A Using Adapter 58009256017)	
Pin No.	Signal	Wire Color	Pin No.	Signal
1	Audio Out+	White/Orange	1	Line 1 Tx(+)
2	Audio Out-	Orange	2	Line 1 Tx(-)
3	Audio In +	White/Blue	5	EXT. PTT
4	Audio In -	Blue	4	Line 2 Rx(-)
5	PTT	White/Green	3	Line 2 Rx(+)
6	COR	Brown	Not Connected	Spare
7	5V	Green	Not Connected	Login Ground
8	VGND	White/Brown	7	Rx Code Detect

10.5.3.1

RJ45-to-T57 Telco Adapter for GTR 8000 T57 DLN6821A Cable Assembly Connection (Non-Simulcast)

The following wiring should be applied to Motorola RJ45-to-T57 Telco Adapter 58009256017.

Table 43: RJ45-to-T57 Telco Adapter for GTR 8000 T57 DLN6821A Cable Assembly Connection (Non-Simulcast)

Function	T57 Side	RJ45 Side
	Adapter Pin No.	Adapter Pin No.
Line 1 Tx(+)	1	1
Line 1 Tx(-)	26	2
EXT. PTT	47	3
Line 2 Rx(-)	27	4
Line 2 Rx(+)	2	5
Spare	6	6
Logic Ground	7	7
Rx Code Detect	37	8

10.6

4W MLC 8000 (Analog Comparator) to Site Gateway (Conventional Channel Interface) Cable

This section provides information for connecting the MLC 8000 RJ45 cable to a Site Gateway (Conventional Channel Interface).

Figure 26: 4W MLC 8000 (Analog Comparator) to Site Gateway (CCGW) RJ45-to-RJ45 Cable

Table 44: 4W MLC 8000 (Analog Comparator) to Site Gateway (CCGW) Cable

End A,			End B,	
MLC 8000 (Analog Comparator)			Site Gateway (CCGW)	
Pin No.	Signal	Wire Color	Pin No.	Signal
1	Audio Out+	White/Orange	1	TIP2
2	Audio Out-	Orange	2	RING2
3	Audio In +	White/Blue	5	TIP1

Table continued…

End A,			End B,	
MLC 8000 (Analog Comparator)			Site Gateway (CCGW)	
Pin No.	Signal	Wire Color	Pin No.	Signal
4	Audio In -	Blue	4	RING1
5*	Channel Active	White/Green	Not connected	Not connected
6	PTT from Console	Brown	Not connected	Not connected
7	5V	Green	Not connected	Not connected
8	VGND	White/Brown	Not connected	Not connected

IMPORTANT: *If you connect the CCGW (Site Gateway) to a console that uses Channel Active indication (or both Channel Active indication and VOX). The connections should be as shown in Table 45: MLC 8000 Analog Comparator to Site Gateway (CCGW) with CTI on page 175 or Table 46: CTI GPIO to CCGW on page 176.

NOTICE: Currently PTT signal in the console is not in use. This is PIN 6 in End A. This will be implemented in a future release.

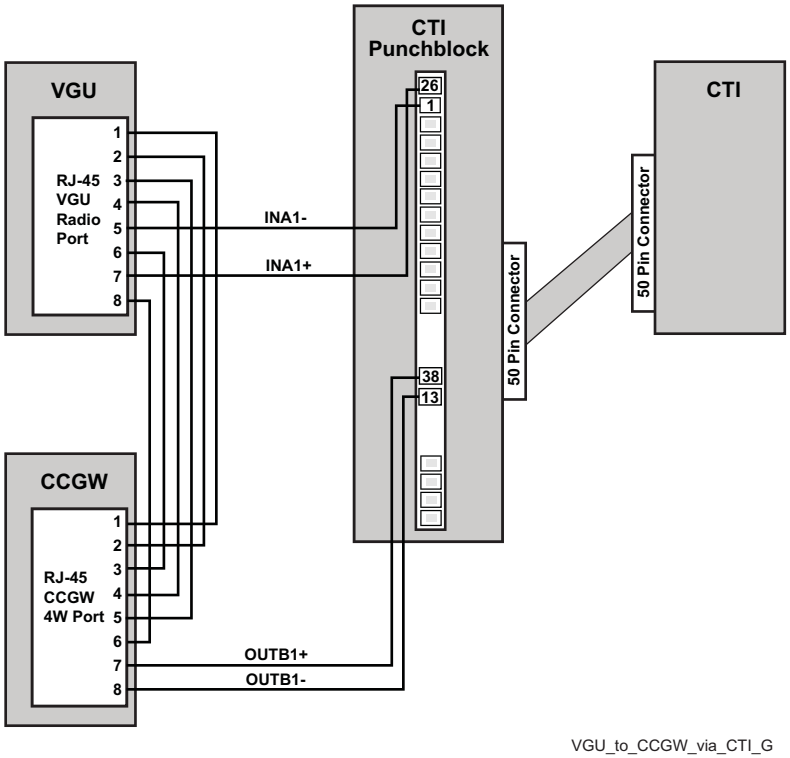
10.6.1

CCGW Wiring Requirements for Receiving the Channel Active Indication from the MLC 8000 Analog Comparator

This section provides information for connecting the MLC 8000 RJ45 cable to a Site Gateway (CCGW) for the case where the CCGW will receive channel active indication from the MLC 8000 analog comparator. The following figure describes the connection between MLC 8000 Analog Comparator (VGU) and the CCGW with CTI. This connection requires additional CTI logic converter hardware to transfer the voltage properly between the MLC and the CCGW.

NOTICE: The CTI part number is S2-61418. The Motorola drop-ship part number is DSS261418.

Figure 27: MLC 8000 Analog Comparator to CCGW Connections with CTI



NOTICE: All connections shown are made through the punchblock.

Table 45: MLC 8000 Analog Comparator to Site Gateway (CCGW) with CTI

VGU			CCGW		CTI Punchblock	
Pin No.	**Signal**	**Wire Color**	**Pin No.**	**Signal**	**Pin No.**	**Signal**
1	Audio Out +	White/ Orange	1	TIP2		
2	Audio Out-	Orange	2	RING2		
3	Audio In+	White/Blue	5	TIP1		
4	Audio In-	Blue	4	RING1		
5	Channel Active	White/ Green			1	In A1-
6	PTT from Console	Brown	3			
7	5V	Green			26	In A1+

Table continued…

VGU			CCGW		CTI Punchblock	
Pin No.	Signal	Wire Color	Pin No.	Signal	Pin No.	Signal
8	VGND	White/ Brown	6			

Table 46: CTI GPIO to CCGW

CTI GPIO			CCGW	
Pin No.	Signal	Wire Color	Pin No.	Signal
38	Out B1+	White/Orange	7	
13	Out B1-	Orange	8	

10.7
4-Wire MLC 8000 to MC2500 Analog Console Cable

This section covers two different cabling options for the 4-Wire MLC 8000 to MC2500 Analog Console. The first is cabling for a console that detects audio received from the comparator using VOX detection. The second option is cabling for a console that detects audio from the comparator using COR.

10.7.1
Cable Requirements for a Console that Detects Audio Received from the Comparator through VOX Detection

The following figure shows the cable from the MLC 8000 to the MC2500 analog console. This cable has a ferrite core, Fair-Rite® (part number: FHN9045A).

Figure 28: 4W MLC 8000 (Analog Comparator) to MC2500 Analog Console Cable

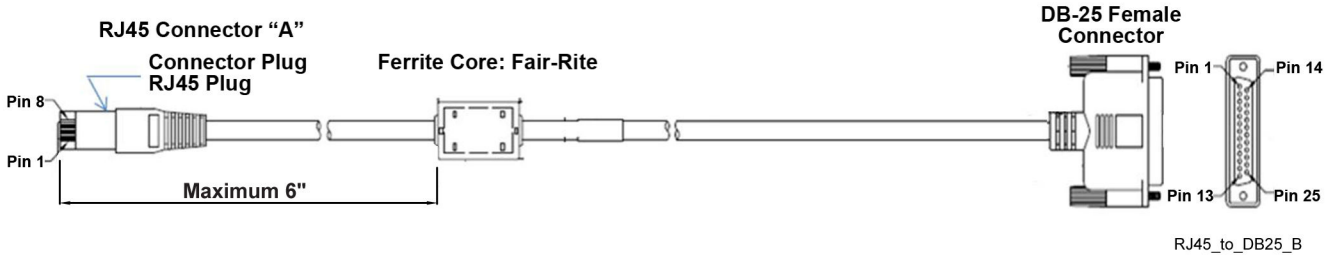


Table 47: 4W MLC 8000 Port 1 to MC2500 P1 Audio/Accessory 25-PIN Analog Connector – TRC

VGU			MC2500-P1	
Pin No.	Signal	Wire Color	Pin No.	Signal
1	Audio Out+	White/Orange	12	+RX_Port1
2	Audio Out-	Orange	25	-RX_Port1
3	Audio In +	White/Blue	11	+TX_Port1
4	Audio In -	Blue	24	-TX_Port1

Table continued…

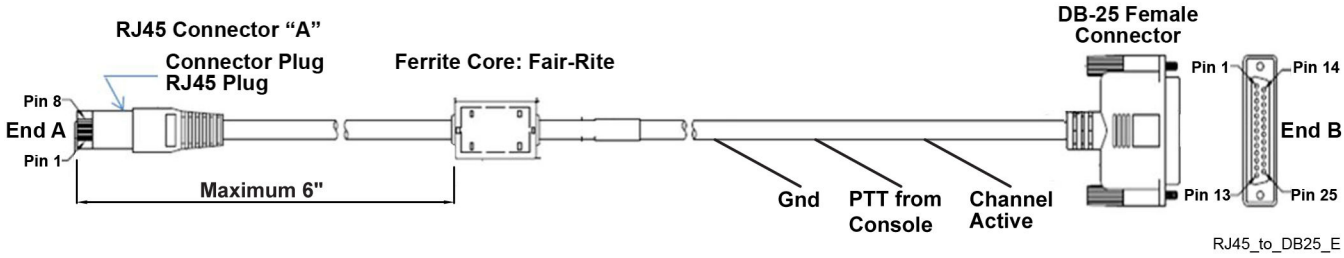
VGU			MC2500-P1	
Pin No.	Signal	Wire Color	Pin No.	Signal
5	Channel Active	White/Green	Not Connected	Not Connected
6	PTT from Console	Brown	Not Connected	Not Connected
7	5V	Green	Not Connected	Not Connected
8	VGND	White/Brown	Not Connected	Not Connected

10.7.2

Cable Requirements for a Console that Detects Audio from the Comparator through Channel Active Indication

The following figure shows the cable from the 4W MLC 8000 VGU to the MC2500 analog console. This cable has a ferrite core, Fair-Rite® (part number: FHN9045A).

Figure 29: 4W MLC 8000 VGU to MC2500 Analog Console Cable



The following table provides additional information for the cable from the 4W MLC 8000 VGU to the MC2500 console.

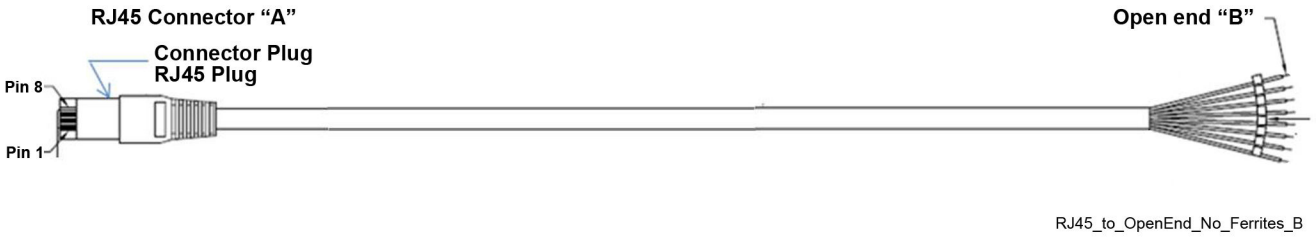
Table 48: 4W MLC 8000 VGU Port 1 to MC 2500 Analog Console Cable

VGU Port 1			MC2500-P1		Plug-P2		Plug-P4	
Pin No.	Signal	Wire Color	Pin No.	Signal	Pin No.	Signal	Pin No.	Signal
1	Audio Out+	White/ Orange	12	+RX_Port 1				
2	Audio Out-	Orange	25	-RX_Port1				
3	Audio In +	White/ Blue	11	+TX_Port 1				
4	Audio In -	Blue	24	-TX_Port1				
5	Channel Active	White/ Green			1	E1 of OPTO cou-		

Table continued…

VGU Port 1			MC2500-P1		Plug-P2		Plug-P4	
Pin No.	Signal	Wire Color	Pin No.	Signal	Pin No.	Signal	Pin No.	Signal
						pler U2		
6	PTT from Console	Brown					3	I/O Relay 1 NO Normally Open
7	5V	Green	Not connected	Not connected				
8	VGND	White/ Brown	13	GND			1	I/O Relay 1_common

Figure 30: MC2500 Repeat On/Off Cable



NOTICE: All four inputs and all four outputs on the MC2500 are configurable using the RSS/CPS software.

Table 49: 4W MLC 8000 Port 2 to MC2500 (Non-Simulcast) Open End

VGU Port 2				Plug-P3		
Pin No.	Signal	Wire Color		Pin No.	Signal	Notes
1	Audio Out +	White/ Orange	Not Connected			
2	Audio Out-	Orange	Not Connected			
3	Audio In+	White/Blue	Not Connected			
4	Audio In-	Blue	Not Connected			
5	Channel Active	White/ Green	Not Connected			

Table continued…

VGU Port 2				Plug-P3		
Pin No.	Signal	Wire Color		Pin No.	Signal	Notes
6	REPEAT_ON/OFF	Brown		3	Takeover1_NO Normally Open	Repeat On/Off
7	5V	Green	Not Connected			
8	VGND	White/Brown		1	Takeover1-Common	

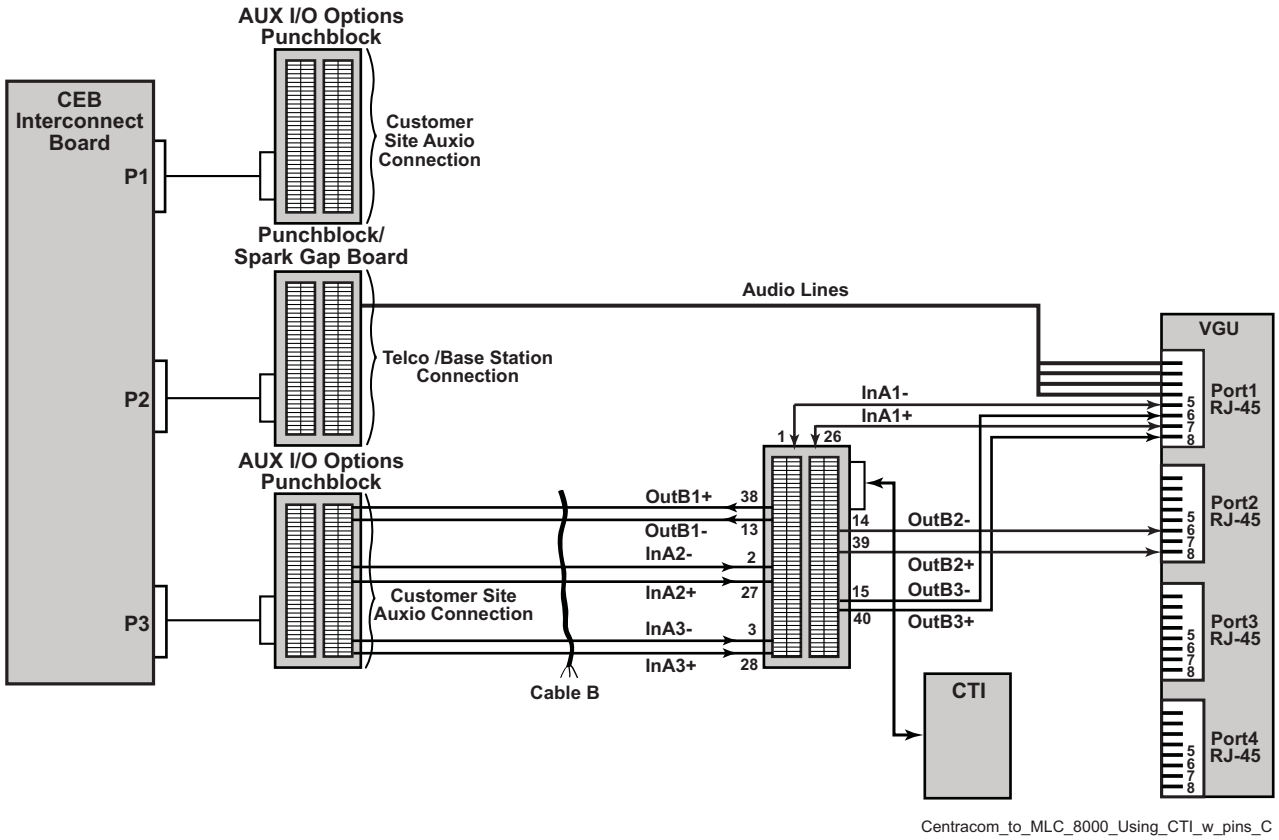
10.8

CENTRACOM to MLC 8000 through CTI

The following scheme describes the connection of CENTRACOM to MLC 8000 when CENTRACOM receives Channel Activation indication. This connection requires additional CTI logic converter hardware to transfer the voltage properly between the MLC and the console.

NOTICE: The CTI part number is S2-61418. The Motorola drop-ship part number is DSS261418.

Figure 31: 4-Wire MLC 8000 to CEB Cabling Including CTI E&M

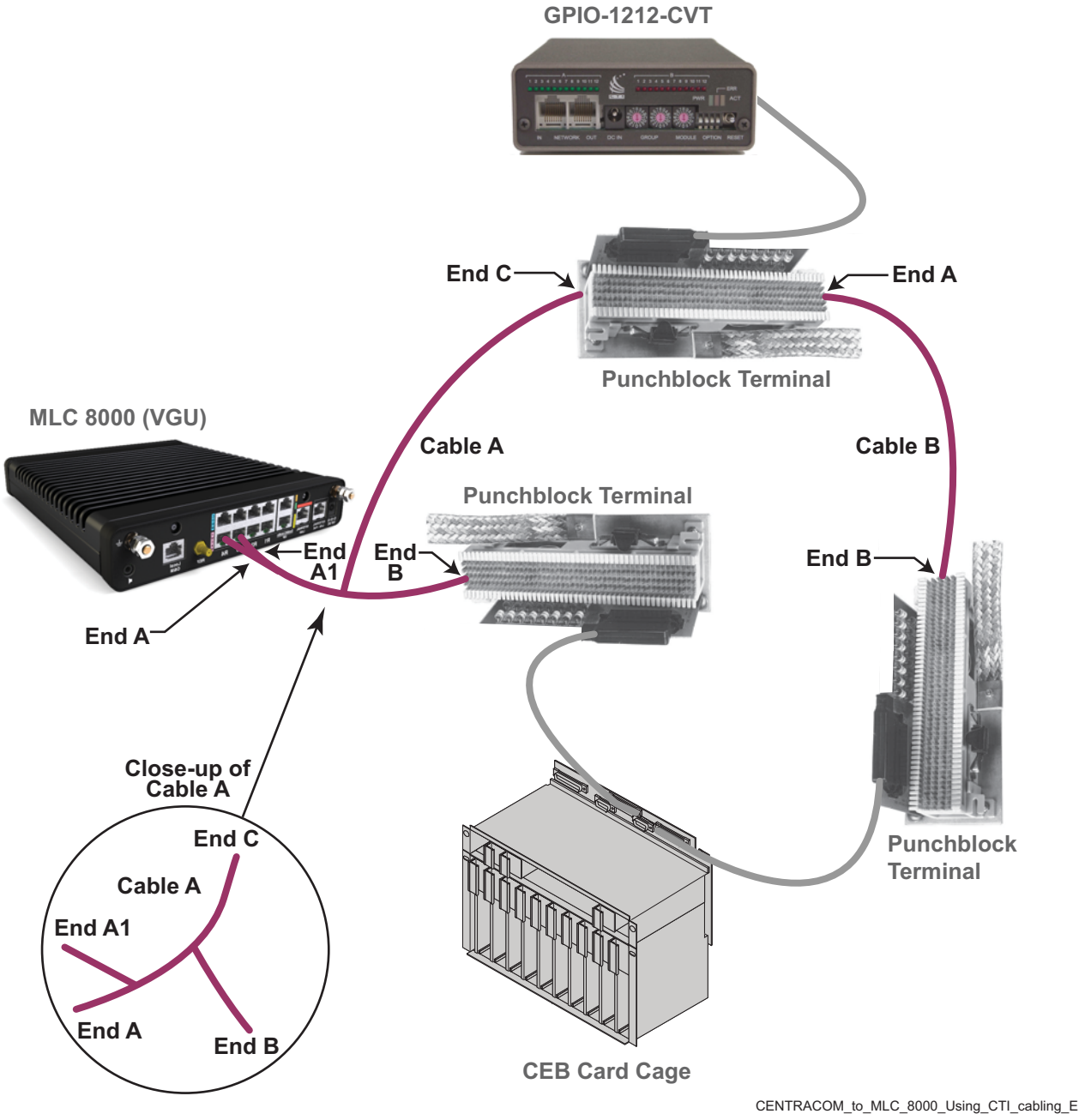


NOTICE: For Repeat On/Off and PTT from console, the connections through the punchblock are optional. For distances beyond 200 feet or in another building, the CTI is required.

NOTICE: See the following tables for more information about the customer site auxio connection.

The following is an example of a CENTRACOM to MLC 8000 with CTI connection. Note the punch blocks and the cabling.

Figure 32: CENTRACOM to MLC 8000 with CTI Sample Connection



NOTICE: For Cable A, use the open-ended cable with the punch block. In the previous figure, the CTI is connected to P3, but this can be P1 as well, based on the card cage connection.

End A and End C:

Cable A:
The following table provides additional information for the connection of Cable A.

Table 50: 4-Wire MLC 8000 VGU to CENTRACOM through CTI Cabling E&M

End A,	VGU Port 1		End B,		End C,	
Pin No.	Signal	Wire Color	Pin No.	Signal	Pin No.	Signal
1	Audio Out+	White/ Orange	(*)	4-Wire As input		
2	Audio Out-	Orange	(*)	4-Wire As input		
3	Audio In+	White/Blue	(*)	2-Wire As output		
4	Audio In-	Blue	(*)	2-Wire As output		
5	Channel Active	White/ Brown			1	In A1-
6	PTT from Console	White/ Green			15	Out B3-
7	5V	Brown			26	In A1+
8	VGND	Green			40	Out B3+

NOTICE: (*) Pin numbers are dependent upon the cardcage slot in which the BIM card is installed. See Table 53: BIM Audio Connections on page 183 through Table 56: PTT from Console Connections to BIM on page 185 for the correct PIN numbers.

IMPORTANT: Note that the 4-wire has two pairs. You configure each pair to be either the output or the input audio. This configuration is done at the CENTRACOM.

NOTICE: (*) From the *CENTRACOM Gold Series Installation* Manual (part number 6881097E45-B).

The following table provides additional information on the connection for Repeat On/Off.

NOTICE: Port 2 of the VGU is connected with the CTI punch block by Cable A side End A1 and End C.

Table 51: MLC 8000 Analog Comparator to Site Gateway (CCGW) with CTI Repeat On/Off

End A1,			End C,		
VGU Port 2			CTI Punchblock		
Pin No.	Signal	Wire Color	Pin No.	Signal	Notes
1	Audio Out +	White/ Orange	Not Connected		
2	Audio Out -	Orange	Not Connected		

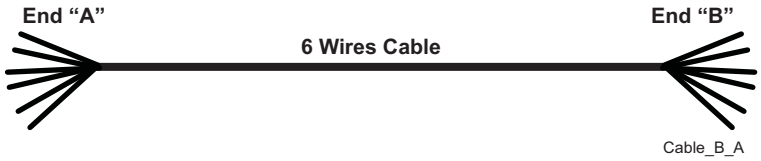
Table continued…

End A1,			End C,		
VGU Port 2			CTI Punchblock		
Pin No.	Signal	Wire Color	Pin No.	Signal	Notes
3	Audio In +	White/Blue	Not Connected		
4	Audio In -	Blue	Not Connected		
5	Channel Active	White/Green	Not Connected		
6	REPEAT_ON/OFF	Brown	14	Out B2+	REPEAT_ON/OFF
7	5V	Green	Not Connected		
8	VGND	White/Brown	39	Out B2-	

Cable B: (As shown in Figure 31: 4-Wire MLC 8000 to CEB Cabling Including CTI E&M on page 179)

Use the open-ended cable with the punch block.

Figure 33: CTI GPIO to CEB Cabling



The following table applies to Figure 31: 4-Wire MLC 8000 to CEB Cabling Including CTI E&M on page 179.

Table 52: CTI to CENTRACOM Connection

VGU		VGU		END A,		END B,	
PORT 1		PORT 2		CTI GPIO Punch Block		CEB Interconnect Board Plug P3 Line Connector	
Pin No.	Signal	Pin No.	Signal	Pin No.	Signal	Pin No.	Signal
7	5V			26	In A1+		
5	Channel Active			1	In A1-		
				27	In A2+	(*)	
				2	In A2-	(*)	
				28	In A3+	(*)	
				3	In A3-	(*)	
				38	Out B1+	(*)	
				13	Out B1-	(*)	

Table continued…

VGU		VGU		END A,		END B,	
PORT 1		PORT 2		CTI GPIO Punch Block		CEB Interconnect Board Plug P3 Line Connector	
Pin No.	Signal	Pin No.	Signal	Pin No.	Signal	Pin No.	Signal
		8	VGND	39	Out B2+	(*)	
		6	RE-PEAT_ON/OFF	14	Out B2-	(*)	
8	VGND			40	Out B3+	(*)	
6	PTT from Console			15	Out B3-	(*)	

NOTICE: (*) PIN number is dependent on the slot in the card cage where the BIM is inserted. See the following tables in this section for the correct PIN numbers.

Table 53: BIM Audio Connections

Slot 1 Function	P2	Slot 7 Function	P2
4-Wire	24	4-Wire	11
4-Wire	49	4-Wire	36
2-Wire	23	2-Wire	12
2-Wire	48	2-Wire	37
Slot 2 Function	**P2**	**Slot 8 Function**	**P2**
4-Wire	21	4-Wire	8
4-Wire	46	4-Wire	33
2-Wire	20	2-Wire	9
2-Wire	45	2-Wire	34
Slot 3 Function	**P2**	**Slot 9 Function**	**P2**
4-Wire	18	4-Wire	5
4-Wire	43	4-Wire	30
2-Wire	17	2-Wire	6
2-Wire	42	2-Wire	31
Slot 4 Function	**P2**	**Slot 10 Function**	**P2**
4-Wire	15	4-Wire	2
4-Wire	40	4-Wire	27
2-Wire	14	2-Wire	3
2-Wire	39	2-Wire	28

Table 54: Channel Active Indication Connections to BIM

BIM in Cardcage Slot	Punch Block	Punch Block PIN Number
1	P1	44
1	P1	19
2	P1	43
2	P1	18
3	P1	37
3	P1	12
4	P1	31
4	P1	6
7	P3	44
7	P3	19
8	P3	43
8	P3	18
9	P3	37
9	P3	12
10	P3	31
10	P3	6

NOTICE:

1 BIMS cannot be installed into slots 5 and 6 in the cardcage.

2 This table assumes that the Aux 1 board (BLN6664) is jumpered for aux 4 to be Channel Active Indication input.

See the *CENTRACOM Gold Series Installation* manual for jumpering tables for the Aux 1 board.

Table 55: Repeat On/Off Connections to BIM

BIM in Cardcage Slot	Punch Block	Punch Block PIN Number
1	P1	20
1	P1	23
2	P1	17
2	P1	14
3	P1	11
3	P1	8
4	P1	5
4	P1	2
7	P3	20
7	P3	23
8	P3	17

Table continued…

BIM in Cardcage Slot	Punch Block	Punch Block PIN Number
8	P3	14
9	P3	11
9	P3	8
10	P3	5
10	P3	2

NOTICE:

1 BIMS cannot be installed into slots 5 and 6 in the cardcage.

2 This table assumes that the Aux 1 board (BLN6664) is jumpered for aux 4 to be Channel Active Indication input.

See the *CENTRACOM Gold Series Installation* manual for jumpering tables for the Aux 1 board.

Table 56: PTT from Console Connections to BIM

BIM in Cardcage Slot	Punch Block	Punch Block PIN Number
1	P1	49
1	P1	24
2	P1	38
2	P1	13
3	P1	32
3	P1	7
4	P1	26
4	P1	1
7	P3	49
7	P3	24
8	P3	38
8	P3	13
9	P3	32
9	P3	7
10	P3	26
10	P3	1

NOTICE:

1 BIMS cannot be installed into slots 5 and 6 in the cardcage.

2 This table assumes that the Aux 1 board (BLN6664) is jumpered for aux 4 to be Channel Active Indication input.

See the *CENTRACOM Gold Series Installation* manual for jumpering tables for the Aux 1 board.

10.9

4W MLC 8000 to Channel Bank 4W-E&M Voice Card Cable TRC Only (Circuit-Based Non-Simulcast Voting)

Two options are available to connect the 4W MLC 8000 to the 4W-E&M voice card in the Channel Bank for Tone Remote Control (TRC) only in circuit-based Non-Simulcast voting. See the following for details:

- 4W MLC 8000 to Channel Bank 4W-E&M Voice Card Cable for TRC Only (Circuit-Based Non-Simulcast Voting) on page 186
- 4W MLC 8000 to Channel Bank 4W-E&M Voice Card Cable Open End for External PTT (Circuit-Based Non-Simulcast Voting) on page 187

10.9.1

4W MLC 8000 to Channel Bank 4W-E&M Voice Card Cable for TRC Only (Circuit-Based Non-Simulcast Voting)

Figure 34: 4W MLC 8000 to Channel Bank Cable (Circuit-Based Non-Simulcast Voting) RJ45-to-RJ45 Cable

NOTICE: This cable is a direct connection, only supporting TRC connection, not E&M signaling.

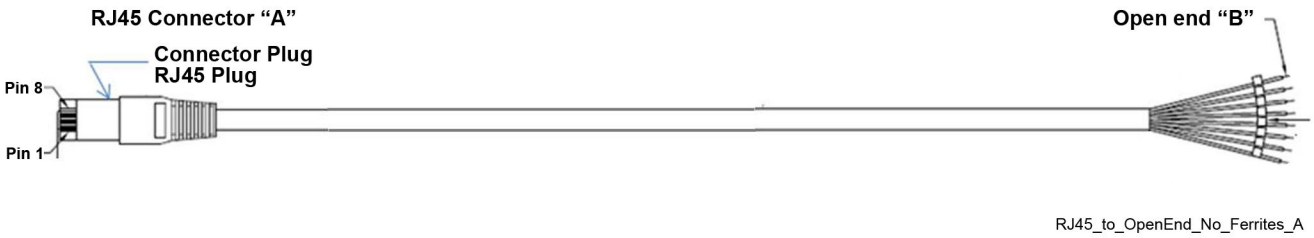
Table 57: 4W MLC 8000 to Channel Bank 4W-E&M Voice Card Cable for TRC Only (Circuit-Based Non-Simulcast Voting)

End A,			End B,	
MLC 8000			Channel Bank	
Pin No.	Signal	Wire Color	Pin No.	Signal
1	Audio Out +	White/Orange	5	Audio In +
2	Audio Out -	Orange	4	Audio In -
3	Audio In +	White/Blue	1	Audio Out +
4	Audio IN -	Blue	2	Audio Out -
5	Channel Active	White/Brown	Not connected	Not connected
6	PTT from Console	White/Green	Not connected	Not connected
7	5V	Brown	Not connected	Not connected
8	VGND	Green	Not connected	Not connected

10.9.2

4W MLC 8000 to Channel Bank 4W-E&M Voice Card Cable Open End for External PTT (Circuit-Based Non-Simulcast Voting)

Figure 35: 4W MLC 8000 to Channel Bank Cable (Circuit-Based Non-Simulcast Voting), RJ45 to Open End Cable



NOTICE: Use the open-ended cable with the punch block.

Table 58: 4W MLC 8000 to Channel Bank 4W-E&M Voice Card Cable Open End for External PTT (Circuit-Based Non-Simulcast Voting)

End A,			End B,			
MLC 8000			TeNSr punch block	CTI GP I/O Converter J1		
Pin No.	Signal	Wire Color	Pin No.	Pin No.	Signal	Notes
1	Audio Out +	White/Orange	26	Not Connected	TX Audio+	CB TX+
2	Audio Out -	Orange	1	Not Connected	TX Audio-	CB TX-
3	Audio In +	White/Blue	27	Not Connected	RX Audio+	CB RX+
4	Audio IN -	Blue	2	Not Connected	RX Audio-	CB RX-
5	Channel Active	White/Brown	Not Connected	1*	In A1-	
6	PTT from Console	White/Green	Not Connected	Not Connected		
7	5V	Brown	Not Connected	26*	In A1+	
8	VGND	Green	Not Connected	Not Connected		
			3	38*	Out B1+	M-Lead
			28	13*	Out B1-	Signal Battery

NOTICE: *Pin numbers indicated are for the first port of the CTI (In A1/Out B1); may differ if other ports are used. If other ports are used, see the CTI GP I/O manufacturer’s manual.

10.10

4W MLC 8000 to Channel Bank DSM-II Card Cable (Circuit-Based Simulcast)

Two options are available to connect the 4W MLC 8000 to the DSM-II card in the Channel Bank in circuit-based simulcast voting systems. See the following for details:

- 4W MLC 8000 to Channel Bank DSM-II Card Cable (Circuit-Based Simulcast) on page 188
- 4W MLC 8000 to Channel Bank DSM-II Card Cable Open End (Circuit-Based Simulcast) on page 189

10.10.1

4W MLC 8000 to Channel Bank DSM-II Card Cable (Circuit-Based Simulcast)

Figure 36: 4W MLC 8000 to Channel Bank Cable (Circuit-Based Simulcast) RJ45-to-RJ45 Cable

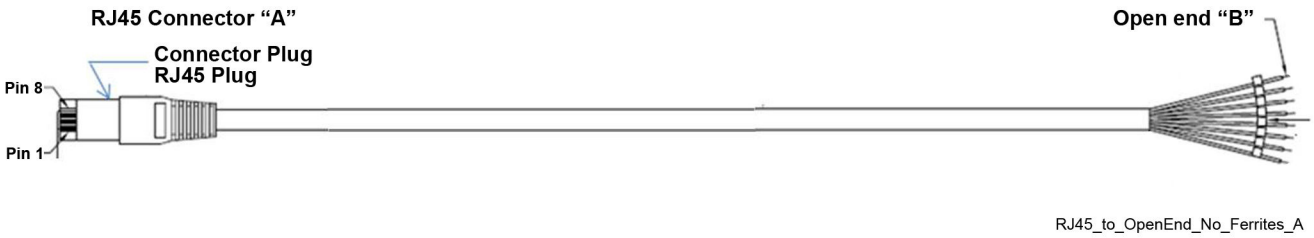
Table 59: 4W MLC 8000 to Channel Bank DSM-II Card Cable (Circuit-Based Simulcast)

End A,			End B,	
MLC 8000 (RJ45)			Channel Bank	
Pin No.	Signal	Wire Color	Pin No.	Signal
1	Audio Out +	White/Orange	5	Audio In +
2	Audio Out -	Orange	4	Audio In -
3	Audio In +	White/Blue	1	Audio Out +
4	Audio IN -	Blue	2	Audio Out -
5	Channel Active	White/Brown	7	M1 Input
6	PTT from Console	White/Green	Not connected	Not connected
7	5V	Brown	Not connected	Not connected
8	VGND	Green	6	E2 (N.O.)

10.10.2

4W MLC 8000 to Channel Bank DSM-II Card Cable Open End (Circuit-Based Simulcast)

Figure 37: 4W MLC 8000 to Channel Bank Cable (Circuit-Based Simulcast), RJ45 to Open End Cable



NOTICE: Use the open-ended cable with the punch block.

Table 60: 4W MLC 8000 to Channel Bank DSM-II Card Cable Open End (Circuit-Based Simulcast)

End A,			End B,		
MLC 8000 (RJ45)			TeNSr punch block		
Pin No.	Signal	Wire Color	Pin No.	Signal	Notes
1	Audio Out +	White/Orange	Not Connected	TX Audio+	CB TX+
2	Audio Out -	Orange	Not Connected	TX Audio-	CB TX-
3	Audio In +	White/Blue	27*	RX Audio+	CB RX+
4	Audio IN -	Blue	2*	RX Audio-	CB RX-
5	Channel Active	White/Brown	Not Connected	M2 Input	
6	PTT from Console	White/Green	Not Connected		
7	5V	Brown	Not Connected		
8	VGND	Green	Not Connected	M1 Input	

NOTICE: *Pin numbers indicated are for the first port of the device; may differ if other ports are used. See the channel bank manufacturer's documentation.

10.11

V.24 MLC 8000 to Channel Bank SRU Card Cable

This cable has a ferrite core, Fair-Rite® (part number: FHN9045A).

Figure 38: V.24 MLC 8000 to Channel Bank SRU Card Cable

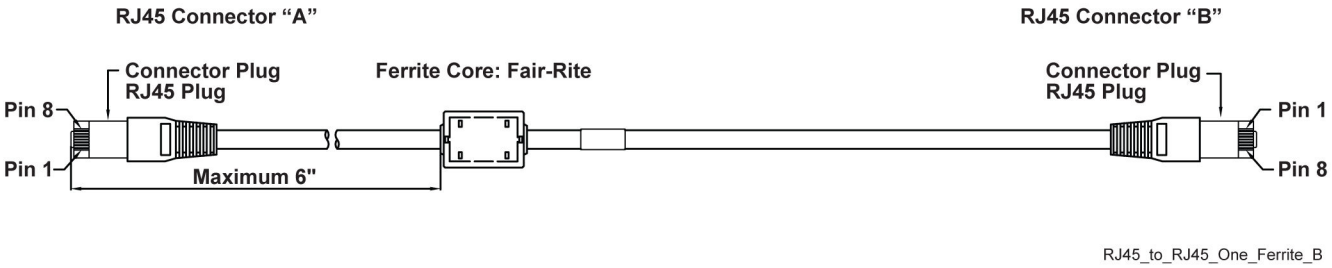


Table 61: V.24 MLC 8000 to Channel Bank SRU Card Cable

End A,			End B,	
MLC 8000			Channel Bank	
Pin No.	Signal	Wire Color	Pin No.	Signal
1	DATA_TX	White/Orange	6	Tx Data
2	DATA_RX	Orange	5	Rx Data
3	RTS	White/Green	8	RTS
4	CTS	Blue	7	CTS
5	+5V	White/Blue	Not Con-nected	Not Connected
6	RXCLK	Green	1	RCLK
7	TXCLK	White/Brown	3	TCLK
8	DGND	Brown	4	GND

10.12 V.24 MLC 8000 to MODEM with External Clock Connection Cable

This cable has a ferrite core, Fair-Rite® (part number: FHN9045A).

Figure 39: V.24 MLC 8000 to MODEM with External Clock Connection

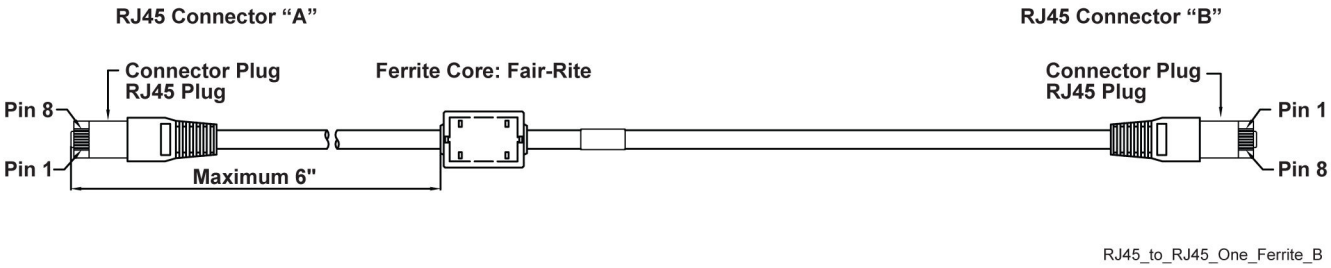


Table 62: V.24 MLC 8000 to MODEM with External Clock Connection

End A,			End B,	
MLC 8000			Channel Bank	
Pin No.	Signal	Wire Color	Pin No.	Signal
1	DATA_TX	White/Orange	6	Tx Data
2	DATA_RX	Orange	5	Rx Data
3	RTS	White/Green	8	RTS
4	CTS	Blue	7	CTS
5	+5V	White/Blue	Not Con-nected	Not Connected
6	RXCLK	Green	1	RCLK
7	TXCLK	White/Brown	Not Con-nected	Not Connected
8	DGND	Brown	4	GND

NOTICE: This cable should be used only if the Tx clock is sourced by the pairing device.

NOTICE: When using this cable, the **Modify Device Configuration - Link Type** field in the MLC 8000 Configuration Tool should be set to **V.24 Link - EXTERNAL TX CLOCK** or **Hybrid Link - EXTERNAL TX CLOCK**.

10.13 V.24 MLC 8000 to GTR 8000/QUANTAR Cable

This cable has a ferrite core, Fair-Rite® (part number: FHN9045A).

Figure 40: V.24 MLC 8000 to GTR 8000/QUANTAR Cable RJ45-to-RJ45 with Ferrite Core

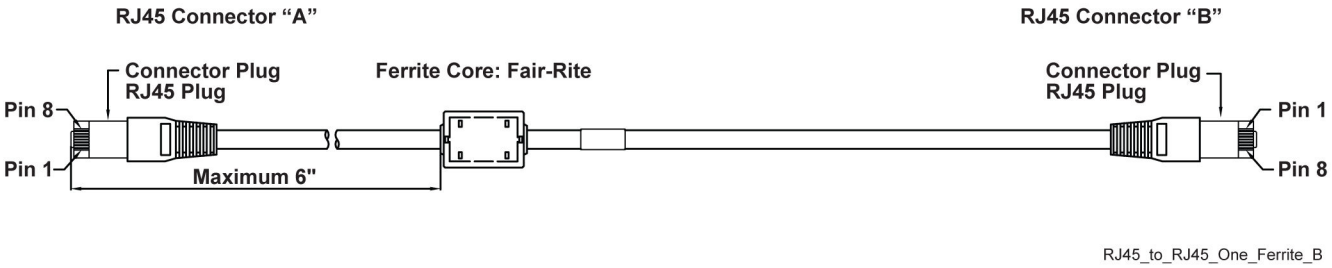


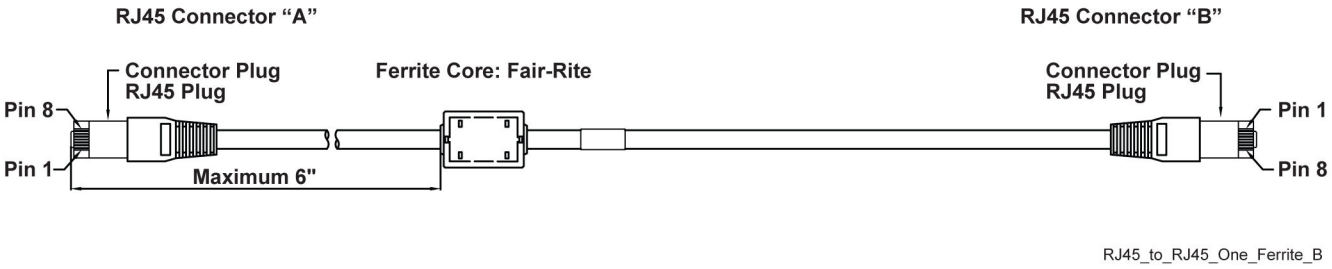
Table 63: V.24 MLC 8000 to GTR 8000 Cable

End A,			End B,	
MLC 8000			GTR 8000 Base Radio V.24–Front	
Pin No.	Signal 4W	Wire Color	Pin No.	Signal
1	DATA_TX	White/Orange	5	RXD
2	DATA_RX	Orange	6	TXD
3	RTS	White/Blue	2	CD
4	CTS	Blue	Not connected	Not connected
5	+5V	White/Green	Not connected	Not connected
6	RXCLK	Brown	3	TCLK
7	TXCLK	Green	1	RCLK
8	DGND	White/Brown	4	GND

10.14
MLC 8000 Local O&M to RS232 (PC) DB9 Cable

This cable has a ferrite core, Fair-Rite® (part number: FHN9045A).

Figure 41: MLC 8000 Local O&M to RS232 (PC) DB9 Cable



The RJ45-to-RJ45 cable with ferrite core and a DB9 Female adapter must be used (UPC Code: 820799019102, RJ45 to DB9-F Adapter). See “MLC 8000 Local O&M Connection” in the *MLC 8000 Comparator Feature Guide* for the procedure.

Table 64: MLC 8000 Local O&M to RS232 (PC) DB9 Cable

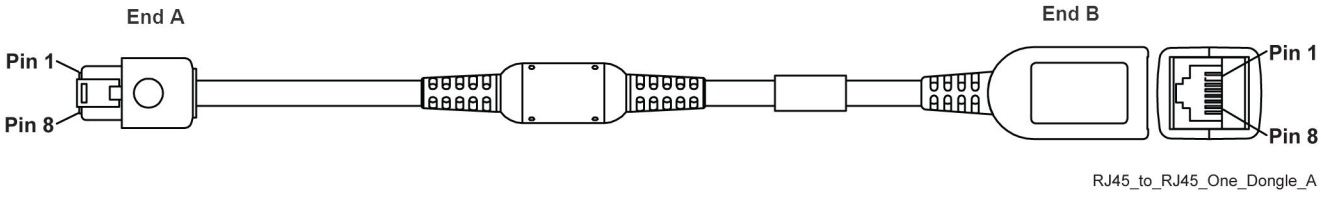
End A,			End B,				
MLC 8000			RJ45 to DB9 adapter connector		Adapter		
Pin No.	Signal	Wire Color	Pin No. (Standard RS232 on PC)	Signal	DB9-F connector	Signal	Wire Color
1	KVL Sense	White/ Orange	1	Not connected	Not connected	Not connected	
2	5v OUT	Orange	2	Not connected	Not connected	Not connected	
3	Cable sense	White/Blue	3	Not connected	Not connected	Not connected	
4	GND	Blue	4	GND	5	GND	Red
5	RX	White/ Green	5	TX	3	TX	Green
6	TX	Green	6	RX	2	RX	Yellow
7	CTS	White/ Brown	7	Not connected	Not connected	Not connected	
8	RTS	Brown	8	Not connected	Not connected	Not connected	

10.15

4W MLC 8000 to GTR 8000/QUANTAR FKN3000A Cable (Simulcast)

FKN3000A is a “Dongle” cable (RJ45 male to RJ45 female). It is used only for Simulcast configurations.

Figure 42: 4W MLC 8000 to GTR 8000/QUANTAR FKN3000A Cable (Simulcast)



NOTICE: The FKN3000A cable must be installed in the MLC 8000 Subsite Link Converter radio port #4 for all 4W simulcast configurations.

Table 65: 4W MLC 8000 to GTR 8000/QUANTAR FKN3000A Cable (Simulcast)

End A,			End B,
MLC 8000 Radio port #4 (RJ45)			RJ45 on Base Radio side
Pin No.	Signal	Wire Color	Pin No.
1	Audio Out+	Red	1
2	Audio Out-	Black	2
3	Audio In +	Green	3
4	Audio In -	White	4
5	PTT	Blue	5
6	Channel Active Indication	Purple	6
7	5V	Brown	7
8	VGND	Orange	8

For connection to the QUANTAR® Base Radios, use adapter 58009256011, see RJ45-to-T57 Telco Adapter for QUANTAR (IP Simulcast) on page 169.

For connection to GTR 8000 Base Radios, use adapter 58009256017 and the wiring shown in RJ45-to-T57 Telco Adapter for DLN6812A GTR 8000 Cable Assembly Connection (IP Simulcast) on page 167.

Appendix A

Optimization/Calibration for Conventional Simulcast

This appendix provides optimization/calibration procedures for simulcast subsystems.

A.1 Overview of Simulcast Optimization

The following subsystems require optimization/calibration:

- Conventional analog **circuit-based** simulcast
- Conventional analog **IP-based** simulcast

Simulcast subsystems require precise control of outbound timing and modulation levels. The components that make up your system are carefully selected to have the appropriate specifications for stability and accuracy. Timing control in Motorola Solutions systems is automatic and no routine alignments for timing are required. Once your system is configured to accommodate the longest link delay, it does not require further adjustments or alignment for timing.

For analog modulated simulcast operation, it is required to carefully adjust the deviation from each individual base radio to tightly controlled levels. Also, the frequency response of each base radio should be verified so that there are minimum variations in modulation levels with frequency. For proper operation, analog modulation levels must be held to ± 0.15 dB or within a total range of variability of 0.3 dB. Achieving this level of accuracy requires the use of different techniques than used with non-simulcast systems.

The traditional FM deviation meter responds to the peak deviation level. This is used to ensure that deviation does not exceed the emission mask requirements. However, a disadvantage of the peak measurement is that any noise introduced in the measurement shows up as a high deviation reading. It takes little noise to exceed the ± 0.15 dB level tolerance. Noise is often an issue due to the requirements of performing the fine level check.

The fine level check works best when **all** the same test equipment is used throughout the system. This check helps to ensure that different test equipment does not cause variations. Controlling and performing adjustments of the simulcast subsystem is easiest to achieve at the simulcast prime site. The general nature of the test equipment required is:

- Service Monitor
- Optimization Receiver
- Dynamic Signal Analyzer

The best and most efficient method for performing the fine level check is to use an optimization receiver located at the simulcast prime site. The other simulcast sites need to produce usable signal strength levels for the optimization receiver at the prime site. An external antenna mounted on a tower or high location should be used. If enough signal strength is present, you may be able to use a service monitor as the optimization receiver. The service monitor is typically 20 dB to 30 dB less sensitive than a subscriber and can be influenced by other carriers or signals as it has virtually no RF selectivity. If a sufficient RF level cannot be obtained to use a service monitor, then use a consolette or mobile in a tray subscriber radio connected to the external antenna. Occasionally, to obtain sufficient RF levels, a Yagi antenna on a rotator needs to be used. In extreme situations, an optimization receiver may have to be located elsewhere. In this case, the optimization receiver audio must be made available at the

prime site. This is due to the need to be at the prime site for control of the system while performing the fine level check.

Since the optimization receiver is receiving RF signals over the air and it is likely that the RF levels produce different quieting in the optimization receiver, it is nearly impossible to use the FM deviation meter in the service monitor for the fine level check. This leads to the need for a different level meter.

By far the best solution for simulcast optimization is to use a Dynamic Signal Analyzer. The DSA is an audio spectrum analyzer and displays level versus frequency. The DSA can improve immunity to noise in our demodulated simulcast audio by upwards of 50 dB over the peak FM meter, which helps to ensure that the final system level requirement of ± 0.15 dB can be met.

A.2 Test Equipment

The following categories of test equipment are required. The list contains equipment that is known to work for these procedures. Other equipment may work but have not been tested or verified to be adequate for these procedures.

NOTICE: You must gather equipment that performs the functions of a service monitor, optimization receiver, or dynamic signal analyzer. You can use legacy equipment that is available or the latest models of equipment. You are not required to obtain all models listed under each category; one model is sufficient.

- **Service Monitor**
  - Aeroflex 2975
  - Aeroflex 3901, 3902, 3920
  - GDI 2600 series
- **Optimization Receiver**
  - CDM1250 Mobile Radio
  - MCS2000 Mobile Radio
  - Spectra Mobile Radio (NOT ASTRO Spectra)
  - Syntor Mobile Radio
  - Service Monitor (no RF selectivity and poorer sensitivity)
- **Dynamic Signal Analyzer**
  - RF Test Solutions Audio Communications Test Set
  - Agilent 35670A
  - HP 35665A
  - HP 3561A

A.3 Setting up Test Equipment

Prerequisites: Knowledge of test equipment is required.

NOTICE: The specific steps to access the parameters described are not covered in this manual. Please see the operating manual for your specific instrument for assistance with setting it up.

When and where to use: These generic settings are sufficient to achieve the necessary baseline. The following information can be applied to any of the test equipment mentioned in Test Equipment on page 196.

Procedure:

1 Begin the service monitor setup by setting the following parameters:
- **Analyzer Input Port**: Set to **Antenna**.
- **RF Preamp**: Off Initially
- **Modulation Type**: Set to **FM**.
- **IF Bandwidth**: must match the transmitter bandwidth of 12.5 kHz or 25 kHz

  NOTICE: The GDI 2600 series does not have a 12.5 kHz bandwidth setting. For a 12.5 kHz system, the result is higher noise for both cabled and over-the-air measurements.
- **Audio Filtering**: 15 kHz or 5 kHz Low Pass Filter

2 Begin the Dynamic Signal Analyzer (DSA) set up by setting the following parameters:
- **Preset**: If the instrument has a preset, press it for a known starting state.
- **Inst Mode**: FFT Analysis
- **Channel**: Ch 1
- **Active Trace**: A and B
- **Display Format**: Upper/Lower
- **Meas Data**: Upper Trace CH1 Time, Lower Trace CH1 Power
- **Freq**: Start 0 kHz, Stop 2 kHz initially

A.4 Calibrating the DSA to Measure FM Deviation

When and where to use: The Bessel Null technique is **only** applicable to sine waves used for testing and calibration. The DSA cannot be used to measure peak deviation with anything other than a sine wave. In other words, this cannot be used with voice to check the deviation. This procedure should be performed before starting to optimize/calibrate the simulcast system.

NOTICE: The RF Analyzer, RF Generator, and Channel Analyzer referenced in the steps are part of the service monitor.

Procedure:

1 Connect the Service Monitor demod output to the DSA input.

2 Set up the service monitor to generate an RF signal into the RF Analyzer (loopback operation).

NOTICE: Some service monitors, such as the GDI 2600 series, must be placed in Duplex Generate mode to support loopback.

3 Set the RF Generator modulation source frequency and FM deviation to the values in the table below depending upon your system channel bandwidth:

Table 66: Bessel Null Calibration Setup

System Bandwidth	Modulation Frequency	FM Deviation
12.5 kHz	1039.6 Hz	2.500 kHz

Table continued…

System Bandwidth	Modulation Frequency	FM Deviation
25 kHz	905.8 Hz	5.000 kHz

4 Set the Channel Analyzer display for a Span of 10 kHz.

NOTICE: The GDI 2600 series does not support a spectrum analyzer span small enough to see the carrier null. You can use an external spectrum analyzer to set the deviation using the Bessel null. If a suitable spectrum analyzer is not available, set the GDI generator modulation 5% low (2.375 kHz or 4.75 kHz) and calibrate the DSA to this level.

5 Vary the RF Generator Deviation (not the Modulation Frequency) to obtain the minimum level of the carrier frequency (null). The RF Generator is now generating an FM signal with exactly the FM Deviation in the table above.

6 Note the level of the Modulation Frequency signal on the DSA. This level is the Service Monitor demod output level that equals the maximum peak deviation allowed (100% system deviation). The 60% system deviation level is -4.44 dB lower than the level noted above.

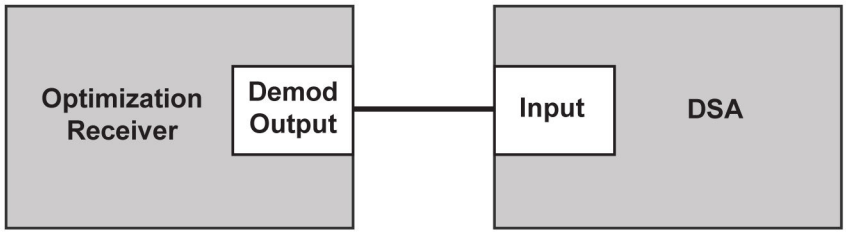
7 Turn off the RF Generator.

A.5 Test Connections

The specific connectors and cables needed vary depending upon your test equipment and the optimization receiver being used. The information is generic and can be used as a guideline for the needed connections.

Set up the test equipment as shown in the figure, which represents the relationship between the various test equipment. Connect the test antenna to the RF input of the optimization receiver. The audio output of the optimization receiver is connected to the DSA input.

Figure 43: Amplitude Optimization Test Setup



A.6 Checking RF Signal Quality

When and where to use: This check must be performed with one channel at each site. The objective is to document received signal quality. By keying up a channel at each site with a 1 kHz test tone and checking the SINAD, you determine if the test antenna and optimization receiver are adequate for performing the simulcast subsystem optimization.

Procedure:

1 Configure the Service Monitor to make SINAD measurements.

- If using a service monitor as the optimization receiver, set the SINAD meter input to the demodulated signal. Set the service monitor so that external audio is the source for the SINAD meter.

- If not using the service monitor as the optimization receiver, temporarily connect the optimization receiver audio output to the audio input of the service monitor.

2 Using either the TenSr channel bank or the MLC 8000 Configuration Tool, key-up a channel at the site nearest the optimization receiver (may be co-located) with a 1 kHz tone. (See Performing Fine Amplitude Adjustment on page 208 for circuit-based systems or Performing Fine Amplitude Adjustment on page 218 for IP-based systems for instructions on how to key-up).

3 If using the service monitor as the optimization receiver, check the Analyzer RF level. If it is greater than 0 dBm, de-key the transmitter (click the Stop button) and insert enough attenuation so the level is less than **0 dBm** and then re-key (click the Start button). If the RF Level is below ~-60 dBm, turn on the RF pre-amp if one is available.

4 Use the SINAD meter on the Service Monitor to evaluate the quality of the received signal. A minimum SINAD of **10 dB** is required with a DSA to produce stable tone levels.

5 De-key the channel under test and key-up the same channel at each of the different sites, one at a time.

6 Check the Service Monitor for better than 10 dB SINAD.

7 At the end of this process, you should have an acceptable SINAD for each site.

8 If you cannot obtain an acceptable SINAD, **do not** proceed with the optimization. Identify the issues preventing acceptable readings and correct them.

Postrequisites: Perform either the **circuit-based** or the **IP-based** procedure that follows depending upon your system configuration.

- Optimizing/Calibrating Conventional Analog Circuit-Based Simulcast on page 199
- Optimizing/Calibrating Conventional Analog IP-Based Simulcast on page 212

A.7 Optimizing/Calibrating Conventional Analog Circuit-Based Simulcast

This section provides the circuit-based procedures for optimizing/calibrating Conventional analog circuit-based simulcast.

A.7.1 Calibrating and Optimizing Circuit-Based Simulcast

Prerequisites: This process has the following prerequisites:

- Obtain the following:
  - Radio Service Software (RSS) or Configuration/Service Software (CSS)
  - Test Equipment (see Test Equipment on page 196)
- The following tasks must be completed:
  - “Performing Calibration for an MLC 8000 Subsite Link Converter” in the *MLC 8000 Configuration Tool User Guide*.
  - “Performing Calibration for an MLC 8000 Analog Comparator” in the *MLC 8000 Configuration Tool User Guide*.

When and where to use: This process covers optimization/calibration for conventional analog **circuit-based** simulcast systems. This process must be performed upon initial system installation and

annually (recommended) to maintain the audio quality of your simulcast system. If audio issues develop in overlap coverage areas, this procedure should be performed.

Process:

1 Start the calibration/optimization.

If…	Then…
QUANTAR® Base Radios	**a** Perform base radio alignment. See Aligning the QUANTAR Base Radio on page 200. **b** Perform the procedures for modulation compensation. See Modulation Compensation (QUANTAR) on page 202.
GTR 8000 Base Radios	Perform the “Rx Wireline Alignment Procedure” in the *CSS Online Help*. This procedure is required for circuit-based systems only.

2 Set up test equipment. See Setting up Test Equipment on page 196.

3 Perform coarse level adjustment for the transmit audio path. See Performing Coarse Level Adjustment (Transmit Audio Path 1 kHz) on page 205.

4 Perform a coarse level PL/DPL adjustment. See Performing Coarse Level Adjustment (Conventional Systems PL/ DPL Adjustment) on page 207.

5 Perform fine amplitude adjustment. See Performing Fine Amplitude Adjustment on page 208.

6 Repeat step 4; the PL/DPL level should be verified after all adjustments as the level can change with other adjustments.

7 Perform a final system level check. See Performing a Final System-Level Check on page 210.

Optimization/calibration is complete.

8 Repeat step 4; the PL/DPL level should be verified after all adjustments as the level can change with other adjustments.

A.7.2
Aligning the QUANTAR Base Radio

Prerequisites: Radio Service Software (RSS) is required for this procedure.

When and where to use: Perform this procedure for each QUANTAR® Base Radio in the system.

Procedure:

1 Read the QUANTAR® Base Radio’s code plug using the Radio Service Software (RSS).

2 Enter Service Mode on RSS.

3 From the service alignment menu, press **F4** to access station disable.

4 Perform base radio checks and adjustments in accordance with Table 67: Base Station Alignment Characteristics on page 201.

A.7.2.1

Base Station Alignment Characteristics

Table 67: Base Station Alignment Characteristics

Characteristic	Procedure
Reference Oscillator	Verify that the QUANTAR® Base Radio internal reference oscillator is netted to 5 MHz input from GPS rubidium frequency standard. **NOTICE:** This alignment takes a minimum of 5 minutes per station. If the station control board is changed, the autonet alignment must be performed again. **NOTICE:** You can use the manual procedure in place of the autonet procedure to save time. The Reference Oscillator alignment is required, even for a system using the external frequency reference, however the manual procedure is sufficiently accurate for this adjustment.
TX Power Output	Verify output power; adjust if required. **NOTICE:** TX power output is typically pre-aligned at the factory.
Squelch	Set squelch according to system design (for example, portable coverage or mobile coverage) to ensure proper voting operation.
Receive Wireline	• Verify that receive wireline is set to produce a 1 kHz tone @ –10 dBm when a 1 kHz tone @ 60% system deviation on the channel carrier is present. • Verify that the status tone level is set to –18.6 dBm. **NOTICE:** The status tone is based on the peak audio level. For a –10 dBm output level, the peak audio is set to –5.6 dBm. Therefore, the number entered for the Status Tone field in the RSS is –13. (–5.6 + (–13)= –18.6)
TX Deviation Gain Adjustment	Verify that the base radio is set for 60% system deviation. **NOTICE:** TX deviation is aligned at the factory to a higher accuracy than can be achieved using a typical service monitor. It is not necessary to change the factory settings unless the station exciter or station control board has been serviced in the field.
Reference Modulation Compensation	Verify that the modulation compensation (MOD COMP) is adjusted by going through appropriate procedure. If MOD COMP is properly adjusted, then make no changes. **NOTICE:** This adjustment has no room for error. Error of only one step off causes audio degradation in non-capture/ overlap areas. For procedure information about setting MODCOMP, see Modulation Compensation (QUANTAR) on page 202.

NOTICE: The GPS should be connected to the MLC 8000 Subsite Link Converter only if it is connected to an Rx/Tx or Tx only BR.

For a detailed base radio alignment procedure, refer to the *QUANTAR® and QUANTRO® Radio Service Software (RSS) Instruction Manual* (6881085E35).

A.7.3
Modulation Compensation (QUANTAR)

The goal is to adjust the modulation compensation to achieve a flat response and to close the gap between the frequency response curves for the QUANTAR® Base Radio involved.

The information describing how to adjust modulation compensation includes the following topics:

- Rough Setting on page 202
- Simulcast Setting on page 202
- Fine-Tuning Modulation Compensation on page 203

NOTICE: Modulation compensation does not apply to GTR 8000 Base Radios.

A.7.3.1
Rough Setting

When adjusting the modulation compensation, use the procedure found in the *QUANTAR® and QUANTRO® Radio Service Software (RSS) Instruction Manual* (6881085E35), the Communications System Analyzer (CSA) must have the low pass and high pass filters set properly.

CSA Filter Setup:

The CSA **High Pass** filter should be set for **5 Hz** and the CSA **Low Pass** filter should be set for **300 Hz**.

When the Mod Comp rough setting is completed, reset the CSA filters per Setting up Test Equipment on page 196 and proceed to review Simulcast Setting on page 202 and Fine-Tuning Modulation Compensation on page 203.

A.7.3.2
Simulcast Setting

Modulation compensation is critical to overall system optimization. Since the goal is to achieve less than a 0.3 dB difference in amplitude response between sites, the shape of the low frequency end of the Frequency response curve is important. The modulation compensation adjustment determines this shape.

The procedure for aligning Reference Modulation Compensation in the *QUANTAR® and QUANTRO® Radio Service Software (RSS) Instruction Manual* (6881085E35) results in an alignment that is accurate for most purposes, but not accurate enough for simulcast. Additional fine-tuning of the modulation compensation adjustment is required. Use a Dynamic Signal Analyzer (DSA) to verify that the frequency response curve is as flat as possible.

When using the DSA to view the frequency response, it becomes apparent that the step size of the modulation compensation adjustment on some base radios may not be fine enough to achieve a flat frequency response. On these stations, you can flatten the frequency response by adjusting the transmitter deviation (see Fine-Tuning Modulation Compensation on page 203 for the technique).

Due to the simulcast equipment configuration, this additional fine-tuning step is easier to perform as part of the Fine Amplitude Adjustment procedure. If the DSA and the optimization receiver are available when aligning the modulation compensation, it is also possible to adjust during initial base radio alignment.

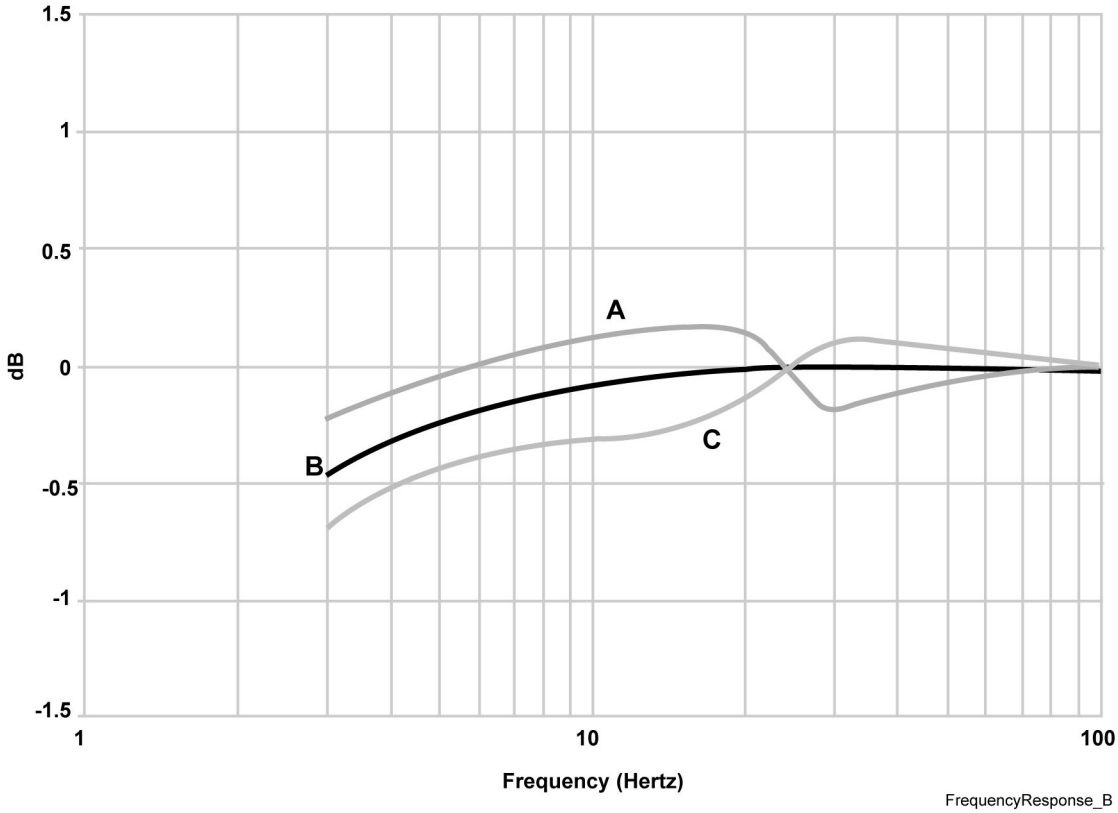
A.7.3.3

Fine-Tuning Modulation Compensation

The purpose of the modulation compensation (mod comp) adjustment is to flatten the frequency response of the base radio at low frequencies by adjusting the gain at low frequencies. A DSA is required to display the frequency response from 1 Hz to 100 Hz when setting the modulation compensation.

This figure shows the frequency response of the base radio from 1 Hz to 100 Hz at several different mod comp settings. The response curves are arbitrarily referenced to zero at 100 Hz.

Figure 44: Frequency Response



The goal is to adjust the modulation compensation to achieve a flat response, as shown by trace B. If the modulation compensation is set high, the frequency response looks like trace A. If the modulation compensation is low, the response looks like trace C. Ideally the response depicted by trace B should be attainable by the adjustment of the modulation compensation. However, sometimes this is not possible because of the step size of the modulation compensation adjustment. In Figure 44: Frequency Response on page 203, trace A and trace C are about 0.4 dB apart. This is the nominal step size of the modulation compensation adjustment on some base radios. Therefore, trace A and C represent the worst case where one setting is too high and the next lower setting is too low.

When this situation occurs, it still is possible to obtain a flat frequency response (trace B) by making a small adjustment in the gain at high frequencies. This is possible because the step size in the adjustment of the high frequency audio gain is about 0.1 dB. Trace B can be obtained by selecting the modulation compensation setting that gave you trace A and increasing the deviation slightly to boost the high frequency levels, flattening the frequency response. To adjust the high frequency level, increase the deviation by modifying the TX Deviation Adjustment using the RSS.

If you lower the numbers that you entered in the TX Deviation Gain Adjust window when you did the initial station alignment, the deviation becomes higher. Lowering the entered deviation values by about

40 Hz should result in a 0.1 dB increase in deviation. Due to variations in the stations, a 40 Hz change may not always be sufficient. If a change does not occur, increase the value slightly.

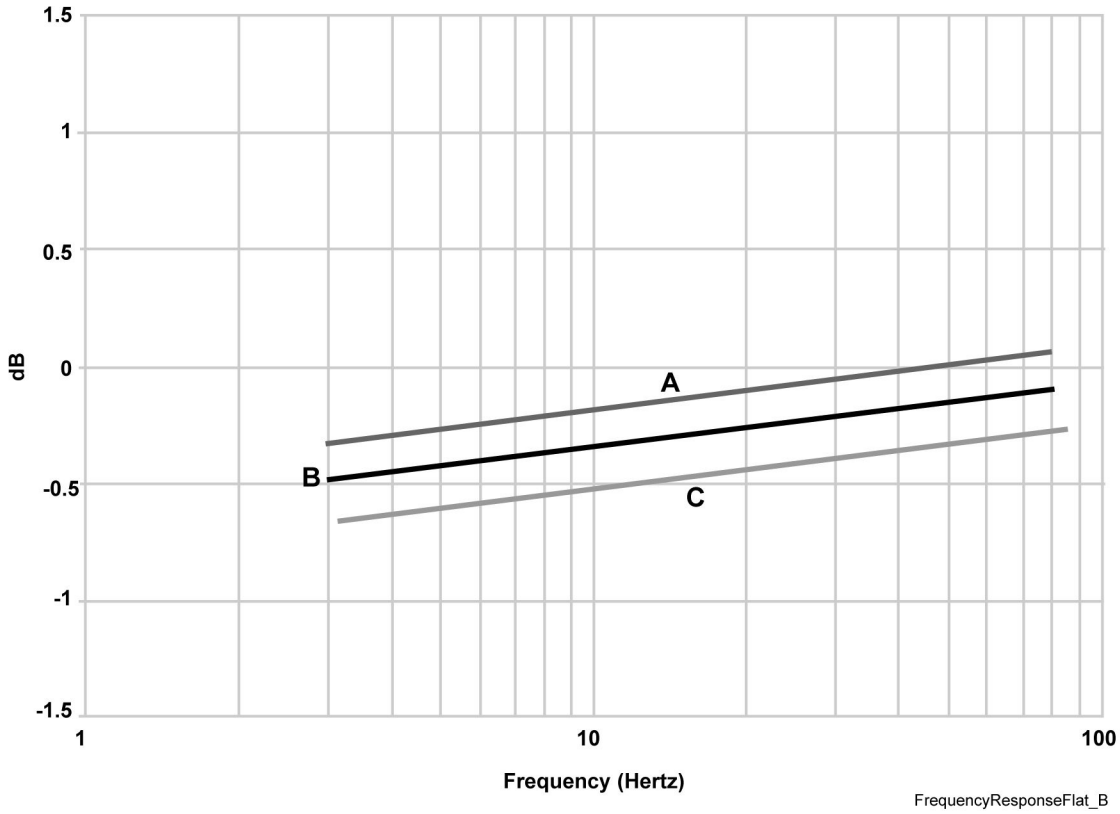
Figure 44: Frequency Response on page 203 shows the worst case situation where the desired frequency response (trace B) is exactly halfway between two modulation compensation settings. In this case, if you started with trace A, you would lower the numbers in the TX Deviation Gain Adjust window by 80 Hz to increase the deviation by the 0.2 dB needed to flatten the frequency response. This makes trace A look exactly like trace B except that it is 0.2 dB above trace B. The gain in the channel bank is then reduced by 0.2 dB when performing the Fine Amplitude Adjustment to move trace A down to match trace B.

In the worst case, you should only change the deviation by 0.2 dB. Use the modulation compensation setting to get as close as possible to the desired frequency response, then make the smallest possible change to the deviation setting necessary to achieve a flat frequency response. Changing the deviation by altering the data entered in the RSS deviation window affects the analog and the ASTRO deviation. Though changing the ASTRO deviation less than 0.2 dB has no measurable effect on system performance, avoid larger changes in deviation.

To save time, change only two of the values on the TX Deviation Gain Adjust window. The TX Deviation Gain Adjust window prompts you to enter the deviation that you measure at four different test frequencies. These frequencies represent the end points of the two VCO ranges. In simulcast, the base radio operates only on one frequency so that you only adjust two of the fields. Determine the normal operating frequency of the base radio and identify which two of the four test frequencies that it falls between. You only modify these two deviation settings.

The following figure shows an idealized result of adjusting the modulation compensation to achieve a flat response, which is evenly spaced and closes the gap between the frequency response curves for the stations involved. A response that falls between trace A and C is acceptable.

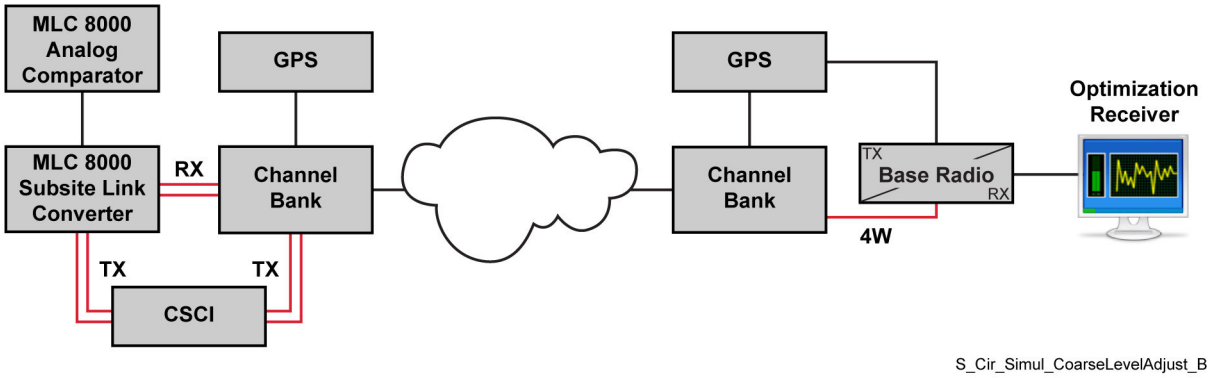
Figure 45: Frequency Response Result



A.7.4
Coarse Level Adjustment (Transmit Audio Path) (Circuit Based)

To perform a coarse level adjustment, perform the test setup as shown in Figure 46: Coarse Level Adjustment (Transmit Audio Path) Setup Diagram on page 205.

Figure 46: Coarse Level Adjustment (Transmit Audio Path) Setup Diagram



A.7.4.1
Performing Coarse Level Adjustment (Transmit Audio Path 1 kHz)

Prerequisites: Prerequisites include:

- The MLC 8000 Analog Comparator/MLC 8000 Subsite Link Converter is already codec calibrated to produce -10dBm +/-1.5dB, and PL/DPL is disabled.
- For the QUANTAR® base radios, perform the base radio alignment. See Aligning the QUANTAR Base Radio on page 200.
- For the GTR 8000 base radios in Circuit-based simulcast systems, perform the “Rx Wireline Alignment Procedure” in the CSS Online Help.

When and where to use: The following procedure describes how the base radio's internal Tx Deviation Adjustment procedure adjusts the transmitter deviation to 60% system ±100 Hz. Adjust the input level to eliminate the ±100 Hz discrepancy in the deviation.

Procedure:

1. On either the prime or slave DSM-II port interfacing to the comparator, turn on the 1 kHz test tone. (With the Rx TLP CLR set to 0 dB, the level of the tone is -10 dBm ±0.1 dB.) Activate the 1 kHz test tone as follows:
   a. From the DSM-II Test window, move the cursor with the arrow keys to highlight the **TONE** field of the desired port. Press ENTER.
   b. Use the arrow keys to select the **1 kHz** tone. When the desired setting is displayed, press ENTER.
   c. Press the **S** key to save changes. The port outputs a 1 kHz tone at the Rx output.

   With the 1 kHz tone going into the comparator, the comparator is unsquelched and voting that channel.
2. With the Transmission Test Set in the bridged mode, monitor the audio line between the comparator and the CSCI.
3. On the CSCI, disable PL/DPL by closing SW100-2 (Mute PL/DPL). Verify TDATA mute by observing the green LED on the CSCI change from illuminated to blinking.
4. Monitor the audio lines between the CSCI and SDA.

NOTICE: If the system is configured for broadcast, the monitoring point is between the CSCI and the DSM-II.

5 Adjust the CSCI output (R112) for a nominal -10 dBm output (-10 dBm in = -10 dBm out). Tolerance is . ±0.10 dB; final adjustment is done in step 7.

6 At each site on the channel, key up the one site base radio and measure the deviation with a service monitor. Use the Bessel Null calibration and DSA to check deviation. This increases the accuracy and minimizes issues with noise. See Calibrating the DSA to Measure FM Deviation on page 197.

NOTICE: The base radio can be keyed-up by activating the E1-Lead in the remote, loopback, or sl-lb DSM-II ports.

7 If the measured deviation is **not** 60% system deviation (1.5 kHz for 12.5 kHz channels, 2.4 kHz for NPSPAC channels, or 3.0 kHz for 25 kHz channels), adjust the Rx TLP CLR in the remote site DSM-II port. The deviation should be as close to target (1.5 kHz, 2.4 kHz, or 3.0 kHz) as the adjustment allows.

8 Repeat step 6 and step 7 for every site on the channel.

9 When the deviation for the last site has been verified, turn off the 1 kHz tone.

10 Repeat step 2 through step 9 for every channel in the system.

A.7.4.1.1
Base Radio Deviation Settings (QUANTAR or GTR 8000)

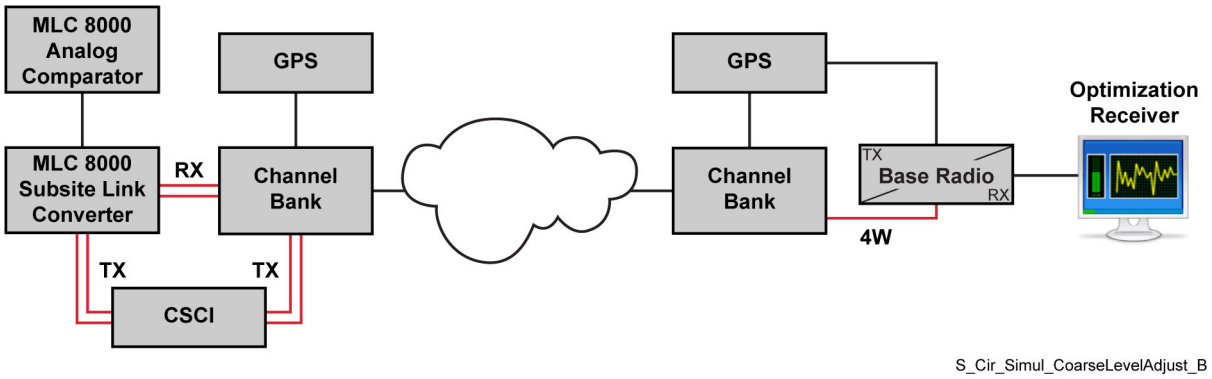
Table 68: Radio Deviation Settings (QUANTAR or GTR 8000)

	Frequency Range		
Deviation Adjustment	**25 kHz channels**	**NPSPAC Channels**	**12.5 kHz Channels**
100% full system deviation	5.0 kHz	4.0 kHz	2.5 kHz
Maximum station deviation	4.6 kHz	3.7 kHz	2.3 kHz
60% full system deviation	3.0 kHz	2.4 kHz	1.5 kHz
40% full system deviation	2.0 kHz	1.6 kHz	1.0 kHz
Coded deviation (QUANTAR® only)	4.0 kHz	2.4 kHz	none

A.7.5
Coarse Level Adjustment (Conventional Systems PL/DPL Adjustment) (Circuit Based)

To perform a coarse level adjustment, perform the test setup as shown in Figure 47: Coarse Level Adjustment (Conventional Systems PL/DPL Adjustment) Setup Diagram on page 207.

Figure 47: Coarse Level Adjustment (Conventional Systems PL/DPL Adjustment) Setup Diagram



A.7.5.1
Performing Coarse Level Adjustment (Conventional Systems PL/ DPL Adjustment)

Prerequisites: The MLC 8000 Analog Comparator/MLC 8000 Subsite Link Converter is already codec calibrated to produce -10dBm +/-1.5dB.

NOTICE: For systems with the CSCI, with audio and PL enabled, set the audio to maximum, which is approximately -7.3 dBm out of the CSCI, and make sure that the system is not over deviating. This setting ensures the CSCI is functioning properly and, since the gain added to the RX TLP Clear is after the limiting, ensures that system gain is not high.

Procedure:

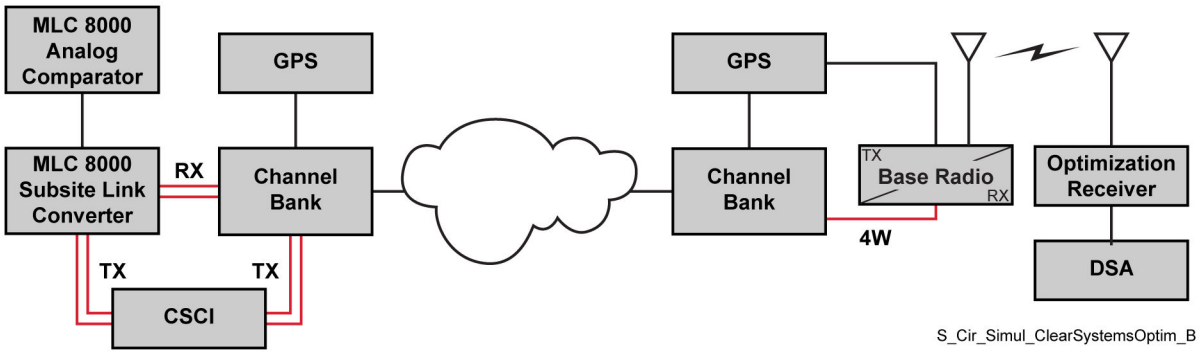
1. Disconnect the audio lines between the comparator and CSCI.
2. Key up a radio and verify that it is assigned to the channel under test.
3. With a service monitor, measure the deviation of the received PL/DPL. (With the audio lines disconnected, no audio is present in the received modulation.)
4. Using the CSCI (R141), adjust the PL/DPL data for **20%** system deviation. (500 Hz for 896 systems, 800 Hz for 821 systems, or 1 kHz for VHF, UHF and 806 systems.)

   NOTICE: The 20% system deviation is PL/DPL code specific. For example, if your system uses the PL code of 151, then the coarse level PL/DPL calibration is for the 151 PL code. If your system changes to 218, then re-execute the coarse level PL/DPL calibration, this time for the 218 PL code.

A.7.6
Fine Amplitude Adjustment (Circuit Based)

To perform fine amplitude adjustment, perform the test setup as shown in Figure 48: Fine Amplitude Adjustment Setup Diagram on page 208.

Figure 48: Fine Amplitude Adjustment Setup Diagram



A.7.6.1
Performing Fine Amplitude Adjustment

When and where to use: This procedure fine tunes the DSM-II output so the modulation levels (deviation) of all transmitters on a channel are equal for audio.

Procedure:

1. Set up test equipment. See Setting up Test Equipment on page 196.
2. Set the optimization receiver to monitor the channel under test. Verify that no active carriers are on the channel.
3. Log in to the TeNSr channel bank of the co-located remote site (or the remote site nearest or co-located to the prime site). This site serves as the reference site.
4. From the Main window of the DSM-II with the reference port, press the T key to access the Test window.

   NOTICE: The reference port is the DSM-II port at the reference site that is directly connected to the base radio. The reference port is either a rem, loopback, or sl-lb DSM-II port.
5. Place the DSM-II reference port for the channel under test into test mode as follows:
   a. Select the desired port by placing the cursor over the **TEST** field of the desired port. Press ENTER.
   b. At the bottom of the window, **on** and **off** options appear. Move the cursor over the **on** option. Press ENTER.
   c. Press the **S** key to save changes. The port under test is now in the test mode.
6. From the Test window of the reference port, turn on the internal 20 Hz tone as follows:
   a. From the Test window, move the cursor with the arrow keys to highlight the **TONE** field of the reference port. Press ENTER.
   b. At the bottom of the window, **off**, **1 kHz**, **20 Hz**, and **cal** options appear. Move the cursor over the **20 Hz** option. Press ENTER.
   c. Press the **S** key to save this change. The port outputs a 20 Hz tone at the Rx output.
7. From the Test window of the reference port, turn on the E1-Lead to issue a PTT to the base radio as follows:
   a. From the Test window, use the arrow keys to highlight the **E1** field of the reference port. Press ENTER.

b At the bottom of the window, **norm**, **on**, and **off** options appear. Move the cursor over the **on** option. Press ENTER.

c Press the **S** key to save changes. The E1-Lead is enabled for this port.

8 On the DSA, record the reference value: _____, as it is used later.

9 From the Test window, turn off the internal 20 Hz tone and place the E1-Lead back to normal operation. Turn off the test mode for the reference DSM-II port.

10 Select and log in to a different remote site TeNSR channel bank.

11 From the Main window of the DSM-II with the selected port, press the **T** key to enter the Test window.

12 Place the DSM-II port for the channel under test into test mode as follows:

a Select the desired port by placing the cursor over the **TEST** field of the desired port. Press ENTER.

b At the bottom of the window, **on** and **off** options appear. Move the cursor over the **on** option. Press ENTER.

c Press the **S** key to save changes. The port under test is in test mode.

13 From the Test window of the selected port, turn on the internal 20 Hz tone as follows:

a From the Test window, move the cursor with the arrow keys to highlight the **TONE** field of the selected port. Press ENTER.

b At the bottom of the window, **off**, **1 kHz**, **20 Hz**, and **cal** options appear. Move the cursor over the **20 Hz** option. Press ENTER.

c Press the **S** key to save this change. The port outputs a 20 Hz tone at the Rx output.

14 From the Test window of the selected port, turn on the E1-Lead to issue a PTT to the base radio as follows:

a From the Test window, use the arrow keys to highlight the **E1** field of the selected port. Press ENTER.

b At the bottom of the window, **norm**, **on**, and **off** options appear. Move the cursor over the **on** option. Press ENTER.

c Press the **S** key to save changes. The E1-Lead is enabled for this port.

15 Use the DSA to measure the signal at the optimization receiver output.

16 Note the reference value obtained in step 8. Adjust the RX TPL CLR of the selected port until the optimization receiver's discriminator output is equal to the reference value as follows:

a In the DSM-II Card window for the selected port, use the arrow keys to highlight the Rx TPL CLR field corresponding to the selected port.

b When the desired field is highlighted, press ENTER. An entry box appears at the bottom of the window.

c Enter a value to adjust the TPL. Press ENTER.

NOTICE: RX TPL CLR range is –16.3 dB to +6.8 dB in 0.1 dB increments.

d Press the **S** key to save the change.

e Repeat these substeps until the optimization receiver output value is as close as possible to the reference value.

17 From the Test window, turn the E1-Lead back to the normal position and turn off the internal 20 Hz tone. Turn off the test mode.

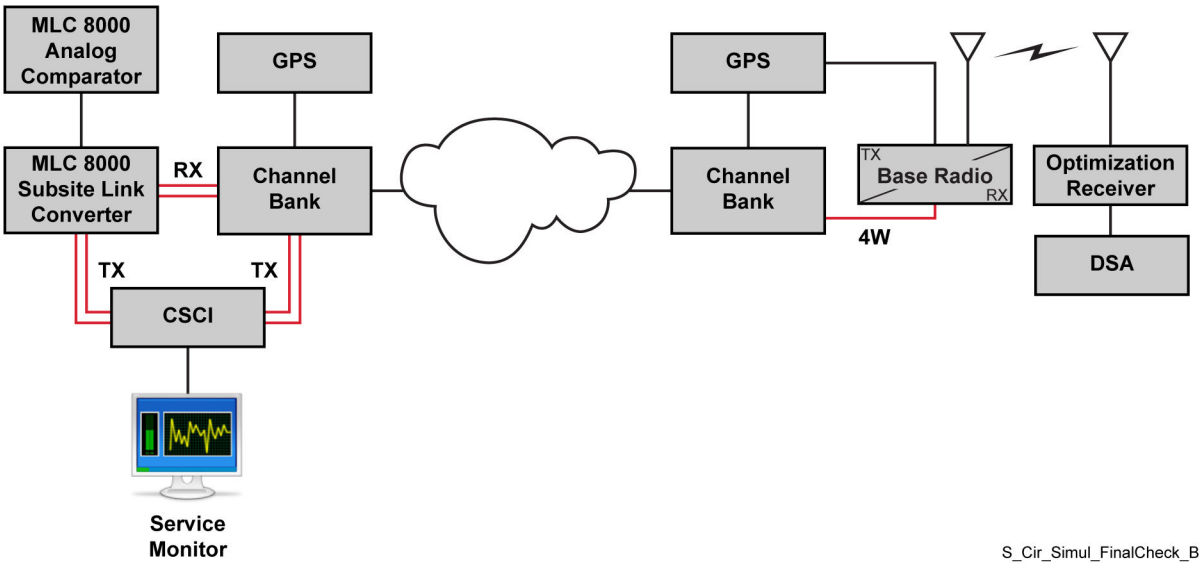
18 Repeat step 10 through step 17 for each site on the channel.

19 Repeat step 2 through step 18 for each channel in the system.

A.7.7
Final Circuit Based System Level Check

For the final system check, perform the test setup as shown in Figure 49: Final System Level Check Setup Diagram on page 210.

Figure 49: Final System Level Check Setup Diagram



A.7.7.1
Performing a Final System-Level Check

When and where to use: The final system level check must be performed for every channel in the system to confirm that the output levels for each site are no more than 0.3 dB of each other for each of the remaining test frequencies.

Procedure:

1. Make several photocopies of Table 69: Recovered Level Entry Log on page 212. This table serves as a log for recovered signal levels at various test frequencies. The data entered is used to check and verify system alignment.
2. Set up either the Service Monitor or the DSA to produce sine wave output and set the frequency to 20 Hz.
3. On the CSCI, disable PL/DPL by closing SW100-2 (Mute PL/ DPL). The green LED on the CSCI changes from illuminated to blinking.
4. Connect the Service Monitor or DSA output to CSCI. The CSCI requires a bantam plug.
5. Log in to the TeNSr channel bank of the station under test.
6. From the Main window of the DSM-II channel under test, press the **T** key to enter the Test window.
7. Place the DSM-II port for the channel under test into test mode as follows:
   - **a** Select the desired port by placing the cursor over the **TEST** field of the desired port. Press ENTER.
   - **b** At the bottom of the window, **on** and **off** options appear. Move the cursor over the **on** option. Press ENTER.

c Press the **S** key to save changes. The port under test is now in the test mode.

8 For the DSM-II port feeding the remote base radio (DSM-II programmed as rem, loopback, or sl-lb), key up the base radio as follows:

a From the Test window, use the arrow keys to highlight the **E1** field of the selected port. Press ENTER.

b At the bottom of the window, **norm**, **on**, and **off** options appear. Move the cursor over the **on** option. Press ENTER.

c Press the **S** key to save changes. The E1-Lead is enabled for this port.

NOTICE: In the following steps, the reference value recorded during the Performing Fine Amplitude Adjustment on page 208 procedure (step 8) is required as a reference.

9 Observe the reading on the DSA.

NOTICE: In step 9 through step 11, verify that the output of the CSCI and the optimization receiver exhibit a clean sine wave. Also verify that the modulation is approximately 60%.

10 In the copy of Table 69: Recovered Level Entry Log on page 212 that is used for your system log, enter the 20 Hz reference level obtained in Performing Fine Amplitude Adjustment on page 208.

11 Set the frequencies and note the levels as follows:

Set the frequency of the generator to **15 Hz**.	Note the level recovered from the optimization receiver. Enter this level in the 15 Hz column of the Table 69: Recovered Level Entry Log on page 212 for the site.
Set the frequency of the generator to **12 Hz**.	Note the level recovered from the optimization receiver. Enter this level in the 12 Hz column of Table 69: Recovered Level Entry Log on page 212 for the site.
Set the frequency of the generator to **10 Hz**.	Note the level recovered from the optimization receiver. Enter this level in the 10 Hz column of Table 69: Recovered Level Entry Log on page 212 for the site.
Set the frequency of the generator to **7 Hz**.	Note the level recovered from the optimization receiver. Enter this level in the 7 Hz column of Table 69: Recovered Level Entry Log on page 212 for the site.
Set the frequency of the generator to **5 Hz**.	Note the level recovered from the optimization receiver. Enter this level in the 5 Hz column of Table 69: Recovered Level Entry Log on page 212 for the site.

12 Set to E1-lead that was enabled in step 8 to norm. Key up the next base radio at the next site as described in step 8.

13 Repeat step 5 through step 12 for all sites in the system.

14 Re-enable the checked channel and disable the next channel to be measured.

15 Repeat step 2 through step 14 for all channels in the system.

NOTICE: The output of the CSA begins to drop when the frequency generated falls below 10 Hz. This drop causes the roll-off seen in the chart and is acceptable.

16 Verify that for each given frequency, the levels recorded in the Table 69: Recovered Level Entry Log on page 212 table are no more than 0.3 dB different for each site at a given frequency.

If the levels between sites for a given frequency vary by more than 0.3 dB, this variance indicates a misaligned Reference Modulation Compensation on one or more QUANTAR® base

radios. Repeat Aligning the QUANTAR Base Radio on page 200 for any base radio exceeding 0.3 dB misalignment.

The MOD COMP waveform, as displayed on the CSA, should appear as a square wave with a rising edge that transitions into a flat upper level with no humps or dips.

- A hump indicates that the low frequency (5 Hz, 7 Hz, 10 Hz) levels are hotter than the levels at the higher frequencies (12 Hz, 15 Hz, 20 Hz). Decrease the MOD COMP level.
- A dip indicates that the low frequency (5 Hz, 7 Hz, 10 Hz) levels are decreasing too rapidly relative to the levels at the higher frequencies (12 Hz, 15 Hz, 20 Hz). Increase the MOD COMP level.

NOTICE: Moving the Reference Modulation Compensation by only one step on the QUANTAR® RSS causes approximately a 0.4 dB change at 5 Hz. For this reason, setting the initial MOD COMP is critical to overall system optimization. A 0.3 dB difference between sites causes significant noise in non-capture/overlap areas.

A.7.7.1.1
Recovered Level Entry Log

Table 69: Recovered Level Entry Log

	CHANNEL #___					
Site	**20 Hz:**	**15 Hz:**	**12 Hz:**	**10 Hz:**	**7 Hz:**	**5 Hz:**
Site 1						
Site 2						
Site 3						
Site 4						
Site 5						
Site 6						
Site 7						
Site 8						
Site 9						
Site 10						

A.8
Optimizing/Calibrating Conventional Analog IP-Based Simulcast

This section provides the IP-based procedures for optimizing/calibrating Conventional analog IP-based simulcast.

A.8.1
Configuring the MLC 8000 for IP-Based Simulcast

Prerequisites: This process has the following prerequisites:

NOTICE: When the MLC 8000 is configured for IP Simulcast, the base radios have to be the same type, that is, either all QUANTAR® Base Radios or all GTR 8000 Base Radios. A mix of both is not allowed.

- Obtain the following:
  - Radio Service Software (RSS) or Configuration/Service Software (CSS)
  - Test Equipment (see Test Equipment on page 196)
- The following tasks must be completed:
  - “Performing Calibration for an MLC 8000 Subsite Link Converter” in the *MLC 8000 Configuration Tool User Guide*.
  - “Performing Calibration for an MLC 8000 Analog Comparator” in the *MLC 8000 Configuration Tool User Guide*.

When and where to use: This process covers optimization/calibration for conventional analog IP-based simulcast systems.

Process:

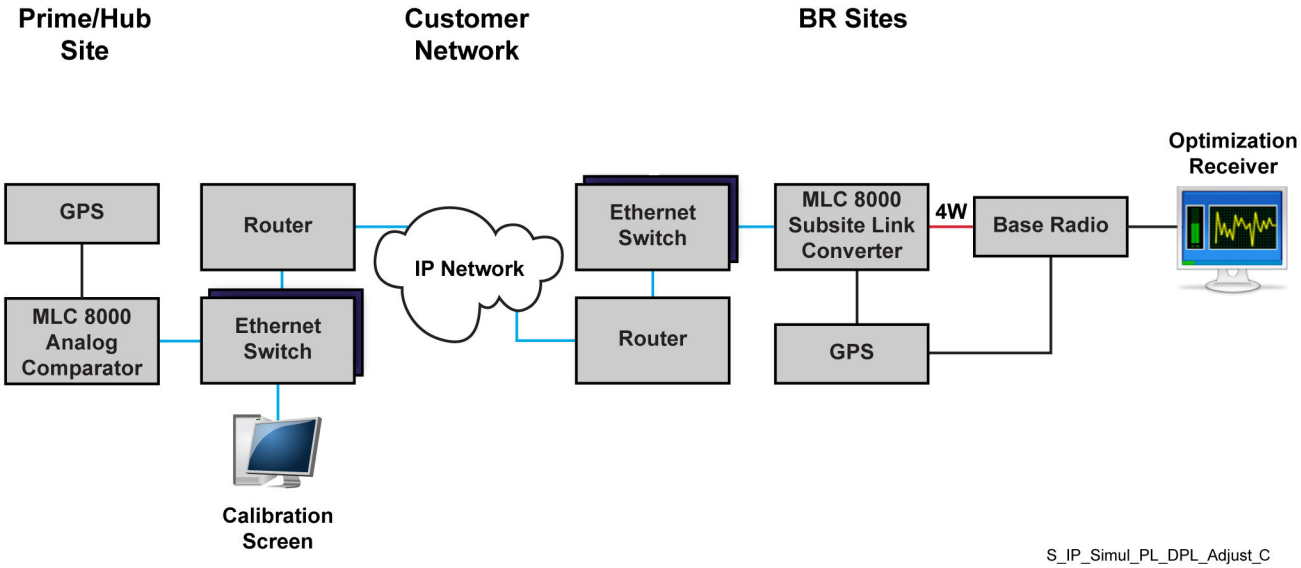
1. (QUANTAR® Base Radios only) Align the QUANTAR® base radios and perform modulation compensation.
   - **a** Perform the base radio alignment. See Aligning the QUANTAR Base Radio on page 200.
   - **b** Perform the procedures for modulation compensation. See Modulation Compensation (QUANTAR) on page 202.
2. Set up the test equipment. See Setting up Test Equipment on page 196.
3. Perform coarse level adjustment for the transmit audio path. See Performing Coarse Level Adjustment (Transmit Audio Path 1 kHz) on page 214.
4. Perform a coarse level PL/DPL adjustment. See Performing Coarse Level PL/DPL Adjustment (Conventional Systems) on page 216.
5. Perform fine amplitude adjustment. See Performing Fine Amplitude Adjustment on page 218.
6. Perform a final system level check. See Performing a Final System-Level Check on page 220.

   Optimization/calibration is complete.

A.8.2
Coarse Level Adjustment for Transmit Audio Path (IP Based)

To perform a coarse level adjustment, perform the test setup as shown in Figure 50: Coarse Level Adjustment for Transmit Audio Path Setup Diagram on page 214.

Figure 50: Coarse Level Adjustment for Transmit Audio Path Setup Diagram



A.8.2.1
Performing Coarse Level Adjustment (Transmit Audio Path 1 kHz)

Prerequisites: Prerequisites include:

- The MLC 8000 Analog Comparator/MLC 8000 Subsite Link Converter is already codec calibrated to produce -10 dBm +/-1.5 DB, and PL/DPL is disabled.
- For the QUANTAR® Base Radio, perform the base radio alignment. See “Aligning the QUANTAR Base Radio” in the *MLC 8000 Setup Guide*.
- For the GTR 8000 Base Radios in IP-based simulcast systems, no alignment is required.

When and where to use: The following procedure describes these adjustments:

- The transmit audio path starts at the comparator output and ends at the base radio. On the transmit audio path, adjust the comparator to provide a -10 dBm output level @ 1 kHz.
- The base radio' internal TX Deviation Adjustment procedure adjusts the transmitter deviation to 60% system ±100 Hz. Adjust the MLC 8000 output level to eliminate the ±100 Hz discrepancy in the deviation.

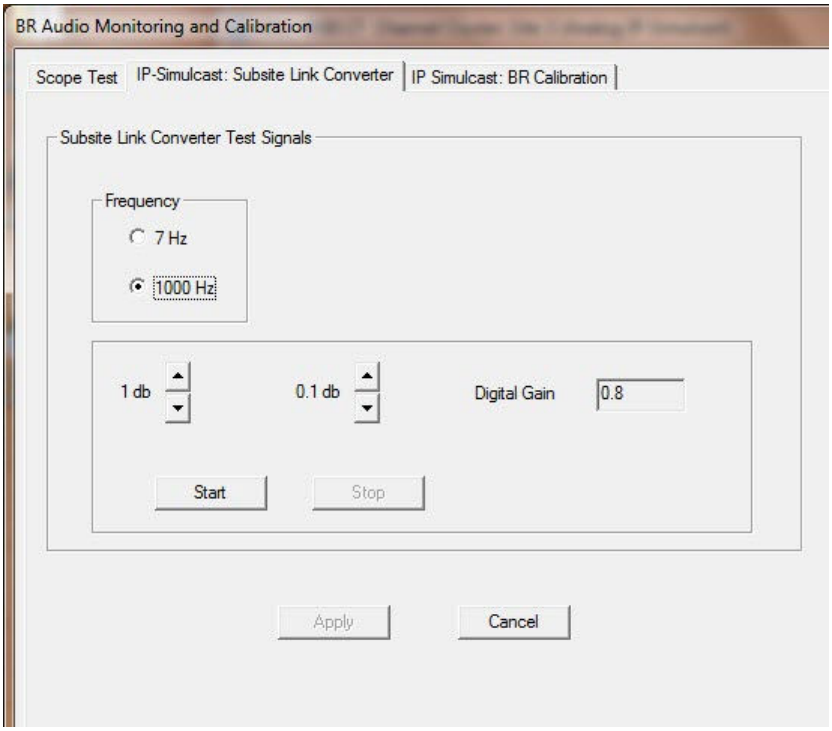
Procedure:

1. In the MLC 8000 Configuration Tool with Analog Display and Control application, right-click an MLC 8000 Subsite Link Converter (AGU), click the **Audio Monitoring** button. In the BR Audio Monitoring and Calibration window, select the **IP Simulcast Subsite Link Converter** tab.

   The IP Simulcast: Subsite Link Converter tab appears.

2. Click **1000 H**z (1 kHz) test tone output. Click **Start**.

Figure 51: BR Audio Monitoring and Calibration — IP Simulcast: Subsite Link Converter Tab



The test tone keys up the base radio.

3 At each site on the channel, key up one site base radio and measure the deviation with a service monitor.

NOTICE: Use the Bessel Null calibration of DSA and then use DSA to check the deviation.

4 If the system deviation is **not** at 60% (1.5 kHz for 12.5 kHz channels, 3.0 kHz deviation for 25 kHz channels), adjust the output level of the MLC 8000 Subsite Link Converter by using the up/down arrows in the Subsite Link Converter Test Signals area to select the **DB** settings. Click **Apply** to save the setting when 60% system deviation is achieved at the base radio. Tolerance is 10%.

5 Repeat step 3 and step 4 for every site on the channel.

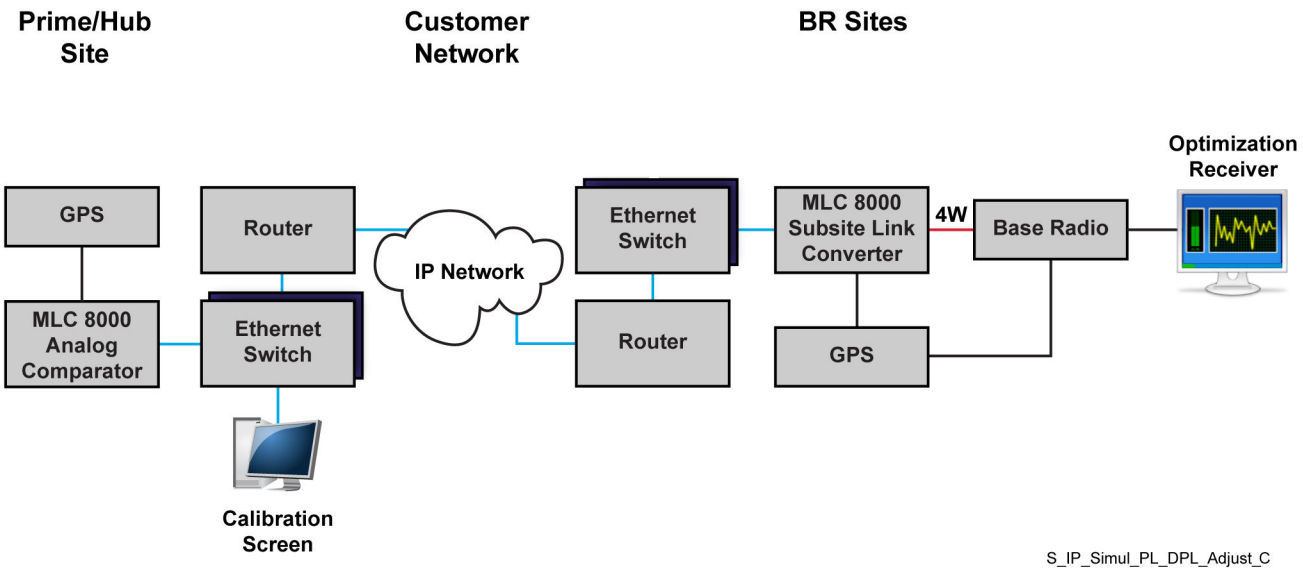
6 When the deviation for the last site has been verified, turn off the 1 kHz tone.

7 Repeat step 2 through step 6 for every channel in the system.

A.8.3
Coarse Level Adjustment (Conventional Systems PL/DPL Adjustment) (IP Based)

To perform a coarse level adjustment, perform the test setup as shown in Figure 52: Coarse Level Adjustment (Conventional Systems PL/DPL Adjustment) Setup Diagram on page 216.

Figure 52: Coarse Level Adjustment (Conventional Systems PL/DPL Adjustment) Setup Diagram



A.8.3.1

Performing Coarse Level PL/DPL Adjustment (Conventional Systems)

Prerequisites: Prerequisites include:

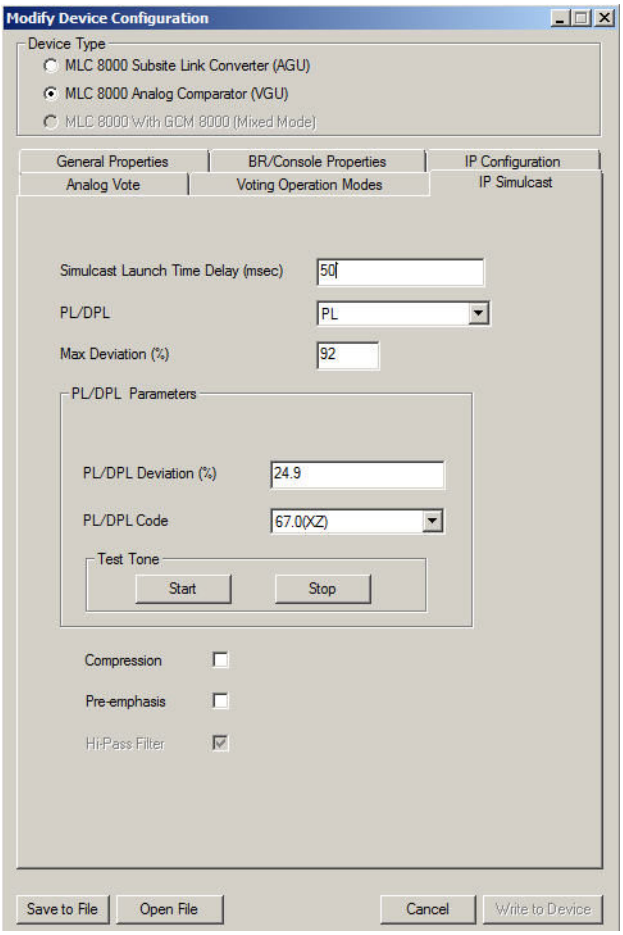
- The MLC 8000 Analog Comparator is already codec calibrated to produce -10dBm +/-1.5dB, and PL/DPL is enabled.
- The MLC 8000 Configuration Tool with Analog Display and Control is operational.

When and where to use: This procedure is performed against the reference site, which is the collocated remote site (or the remote site nearest or collocated to the prime site).

Procedure:

1. In the MLC 8000 Configuration Tool with Analog Display and Control, right-click a specific MLC 8000 Analog Comparator in the channel cluster tree, then select **Configure Device**. Click the **IP Simulcast** tab. This tab is only enabled in IP Simulcast configurations.
2. Set the PL/DPL field to **PL** or **DPL** to specify whether PL or DPL should be inserted into the voice stream.

Figure 53: Modify Device Configuration – IP Simulcast Tab



The **PL/DPL Deviation** and **PL/DPL Code** fields are open for editing.

3 In the **PL/DPL Deviation** box, type a number from `0.0` to `25.0` that produces 20% deviation.

NOTICE: The 20% system deviation is PL/DPL code specific. For example, if your system uses the PL code of 151, then the coarse level PL/DPL calibration is for the 151 PL code. If your system changes to 218, then re-execute the coarse level PL/DPL calibration, this time for the 218 PL code.

4 Select a value from the **PL/DPL Code** list to specify which PL tone or DPL code should be inserted into the voice stream.

5 Click **Write to Device** to save these changes to the MLC 8000 Analog Comparator.

The device resets and the configuration window closes. Wait for the reset to complete.

6 Reopen the **IP Simulcast** tab. Click **Start**.

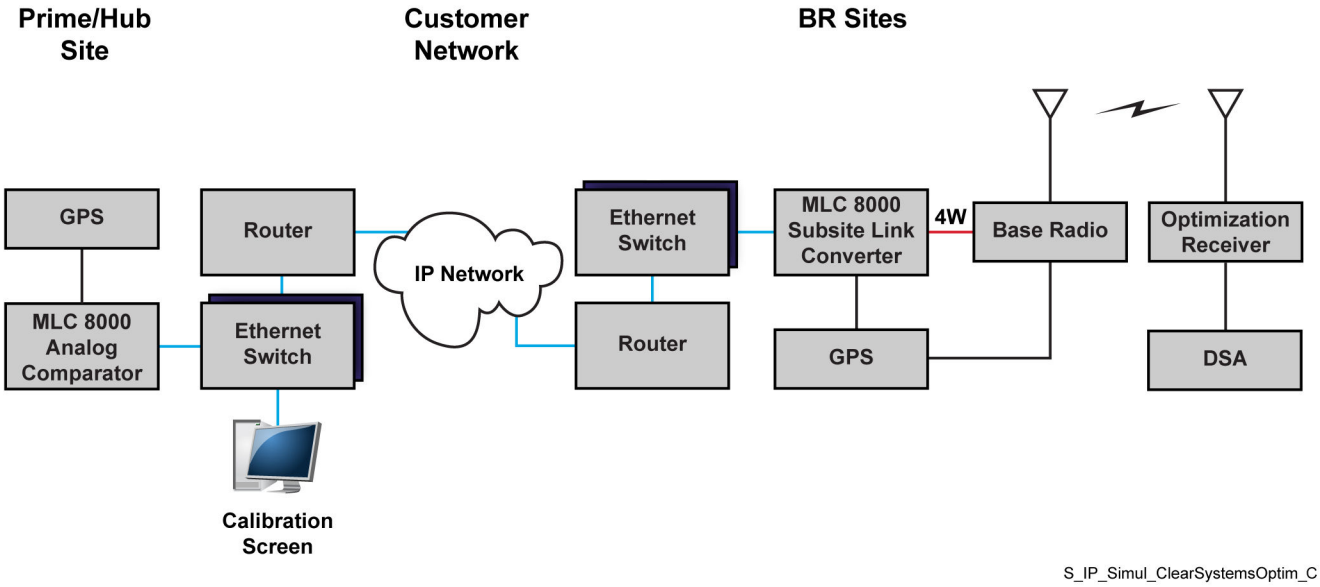
7 Check that the deviation is 20%. Key up the channel and adjust as needed. Repeat step 3 through step 6.

8 Repeat these steps on one channel per site.

A.8.4
Fine Amplitude Adjustment (IP Based)

To perform fine amplitude adjustment, perform the test setup as shown in Figure 54: Fine Amplitude Adjustment Setup Diagram on page 218.

Figure 54: Fine Amplitude Adjustment Setup Diagram



A.8.4.1
Performing Fine Amplitude Adjustment

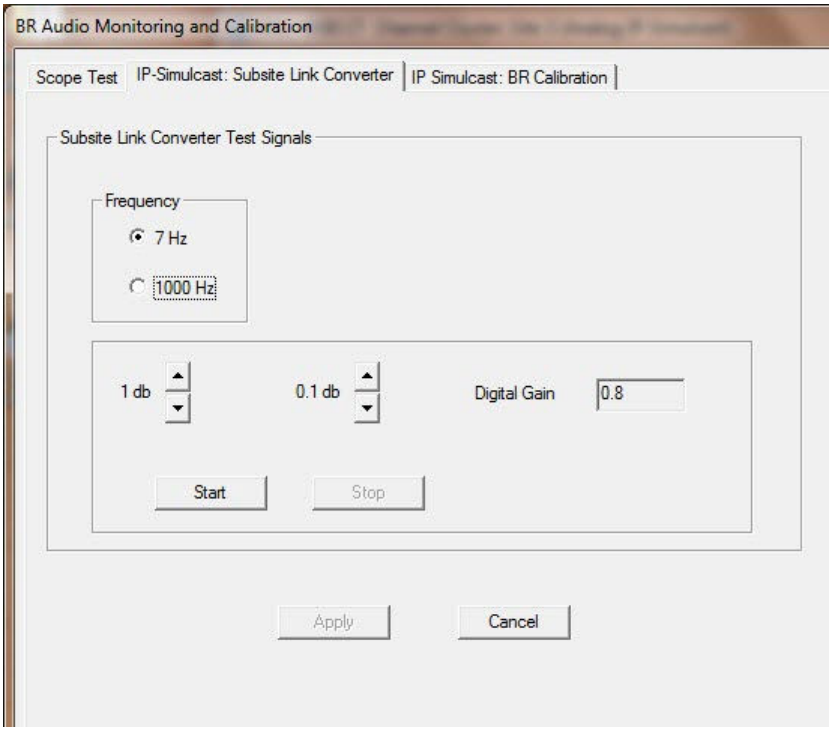
When and where to use: This procedure fine tunes the MLC 8000 Subsite Link Converter output so the modulation levels (deviation) of all transmitters on a channel are equal for audio.

Procedure:

1. Set up test equipment. See “Setting Up Test Equipment” in the *MLC 8000 Setup Guide*.
2. Set the optimization receiver to monitor the tested channel. Verify that no active carriers are on the channel.
3. In the MLC 8000 Configuration Tool with Analog Display and Control application, right-click an MLC 8000 Subsite Link Converter (AGU), click the **Audio Monitoring** button, then select the **IP Simulcast: Subsite Link Converter** tab.

   The IP Simulcast: Subsite Link Converter tab appears.
4. Click **7 Hz** to generate the reference PTT test tone. Click **Start**.

Figure 55: BR Audio Monitoring and Calibration — IP Simulcast: Subsite Link Converter Tab



5 Use the DSA to measure the signal at the optimization receiver output (this signal is the audio output to the test equipment).

6 Record the DSA-measured reference value of the reference site: _____, as it is used later.

7 Adjust the MLC 8000 Subsite Link Converter output for **7 Hz**at each non-reference site until the non-reference value is within **+/- 0.05 DB** of the reference value.

Repeat step 3 through step 6 for each non-reference site on the same channel, and each time adjust the output until they equal or match as close as possible to the reference value.

NOTICE: The first time you perform step 3 through step 6 is with the reference site and reference value. Subsequent repetition is for each non-reference site on the same channel.

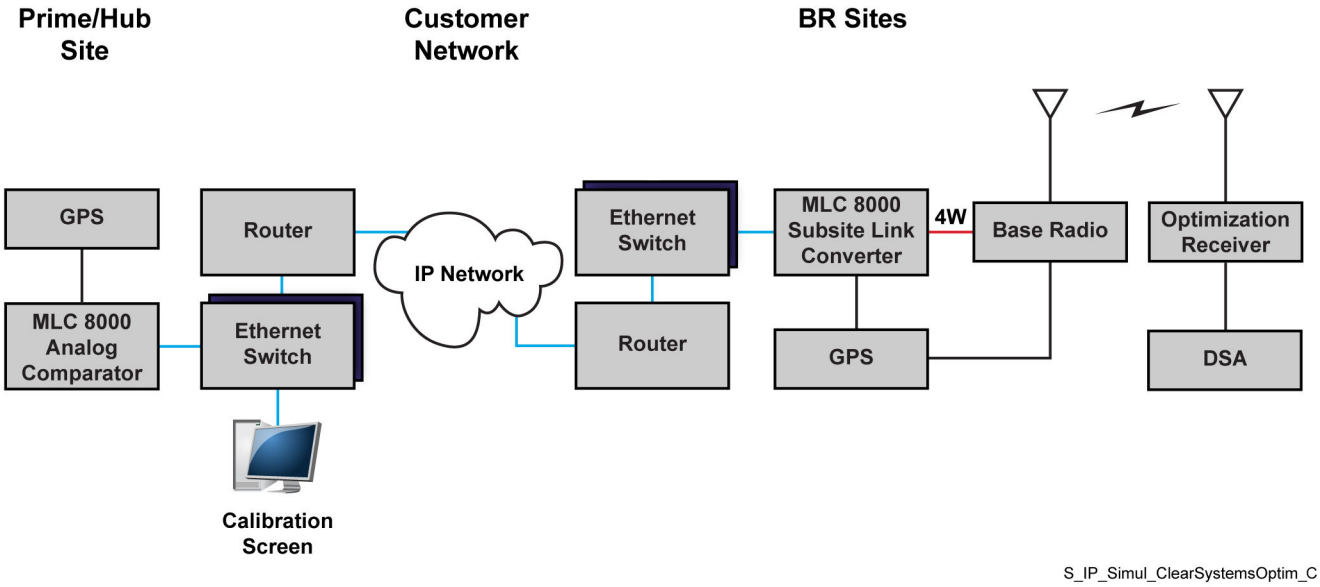
8 Repeat step 5 through step 7 for each site on the channel.

9 Repeat step 2 through step 8 for each channel in the system.

A.8.5
Final IP Based System Level Check

For the final system check, perform the test setup as shown in Figure 56: Final System Level Check Setup Diagram on page 220.

Figure 56: Final System Level Check Setup Diagram



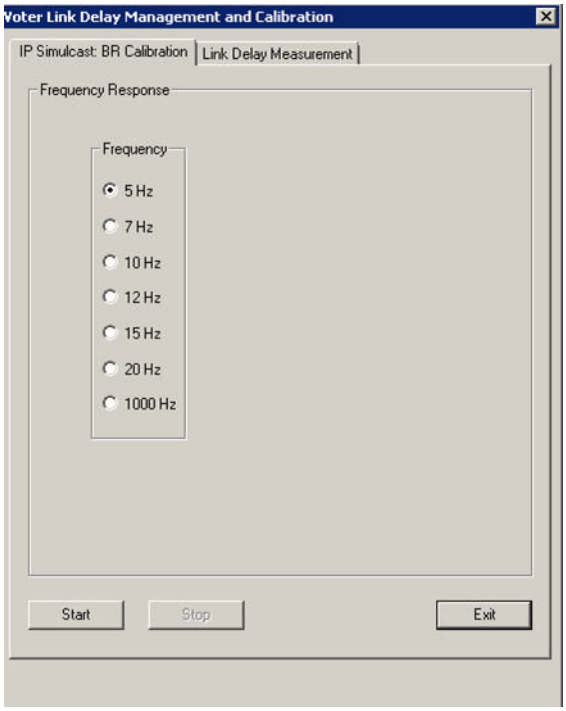
A.8.5.1
Performing a Final System-Level Check

When and where to use: Perform a final system level check for every channel in the system to confirm that the output levels for each site are no more than 0.3 DB of each other for each of the remaining test frequencies.

Procedure:

1. Make several photocopies of the “Recovered Level Entry Log” table in the*MLC 8000 Setup Guide*. This table serves as a log for recovered signal levels at various test frequencies. The data entered is used to check and verify system alignment.
2. From the MLC 8000 Configuration Tool main menu, select **Services → Link Delay Measurement**. In the **Voter Link Delay Management and Calibration** window, select the **IP Simulcast: BR Calibration** tab.
3. Use the MLC 8000 Analog Comparator to generate the **7 H** test frequency, then repeat for the other test frequencies: **20 Hz**, **15 Hz**, **12 Hz**, **10 Hz**, and **5 Hz**.

Figure 57: Voter Link Delay Management and Calibration Window – BR Calibration Tab for an IP Simulcast System



4 Set the MLC 8000 Analog Comparator to generate a **7 Hz** tone. Click **Start**.

5 Observe the reading on the DSA.

NOTICE: In step 5 through step 7, verify that the output of the optimization receiver is approximately 60%. See “Troubleshooting Misaligned Reference Modulation Compensation (Final System Level Check — IP Based)” in the *MLC 8000 Setup Guide* if the levels between sites for a given frequency vary by more than 0.3 DB of the reference site.

6 In the copy of the “Recovered Level Entry Log” in the *MLC 8000 Setup Guide* that is used for your system log, enter the **7 Hz**reference level obtained in “Performing Fine Amplitude Adjustment” in the *MLC 8000 Setup Guide*.

7 Set the frequencies and note the levels as follows:

Frequency of the MLC 8000 Analog Comparator generator	Recovered Level Entry Log for the site
Set to **20 Hz**.	Enter the level recovered from the optimization receiver in the 20 Hz column.
Set to **15 Hz**.	Enter the level recovered from the optimization receiver in the 15 Hz column.
Set to **12 Hz**.	Enter the level recovered from the optimization receiver in the 12 Hz column.
Set to **10 Hz**.	Enter the level recovered from the optimization receiver in the 10 Hz column.
Set to **5 Hz**.	Enter the level recovered from the optimization receiver in the 5 Hz column.

8 Repeat step 1 through step 7 for all sites on the channel.

9 Re-enable the measured channel and disable the next channel you want to measure.

10 Repeat step 3 through step 9 for all channels in the system.

NOTICE: The output of the DSA begins to drop when the frequency generated falls below 10 Hz. This drop causes the roll-off seen in the chart and is acceptable.

11 Verify that for each given frequency, the levels recorded in the “Recovered Level Entry Log” table in the *MLC 8000 Setup Guide* are no more than 0.3 DB different for each site at a given frequency. If the levels between sites for a given frequency vary by more than 0.3 DB, this variance indicates:

- One or more of the digital gains of the MLC 8000 Subsite Link Converters' require adjustment. For a site that exceeds 0.3 DB difference from the reference site at one of the test frequencies, adjust the MLC 8000 Subsite Link Converter Digital Gain up or down 0.1 DB towards the reference site value and repeat measurements for that site at each test frequency.
- One or more QUANTAR® Base Radios have misaligned Reference Modulation Compensation. (This issue is specific to QUANTAR® Base Radios and is not applicable to GTR 8000 Base Radios, which do not require Reference Modulation Compensations.)

Repeat “Aligning the QUANTAR Base Radio” in the *MLC 8000 Setup Guide* for any base radio exceeding 0.3 DB misalignment. MOD COMP waveform, as displayed on DSA, should appear as a square wave with a rising edge that transitions into a flat upper level with no humps or dips.

- A hump in the MOD COMP waveform indicates that the low frequency (5 Hz, 7 Hz, 10 Hz) levels are hotter than the levels at the higher frequencies (12 Hz, 15 Hz, 20 Hz). In this case, decrease the MOD COMP level.
- A dip in the MOD COMP waveform indicates that the low frequency (5 Hz, 7 Hz, 10 Hz) levels are decreasing too rapidly relative to the levels at the higher frequencies (12 Hz, 15 Hz, 20 Hz). In this case, increase the MOD COMP level.

NOTICE: Moving the Reference Modulation Compensation by only one step on the QUANTAR® RSS causes approximately a 0.4 DB change at 5 Hz. For this reason, setting the initial MOD COMP is critical to overall system optimization. A 0.3 DB difference between sites causes significant noise in non-capture/overlap areas.

Appendix B

Troubleshooting the Optimization/ Calibration

This section provides specific troubleshooting procedures and reference information to resolve issues that occur during the optimization or calibration for conventional subsystems.

B.1
Troubleshooting the Transmit (TX) Path for Simulcast Subsystems

Prerequisites:
The following equipment is required:

- Oscilloscope
- Communications Analyzer

When and where to use: This procedure is used to troubleshoot issues with the voting transmit path, including:

- MLC 8000 Analog Comparator
- MLC 8000 Subsite Link Converter
- Timing reference
- Network transport (routers and switches)
- GTR 8000 Base Radios

Symptoms include: Transmitters are not keying at all, keyed but not hearing voice, or keyed but voice has intermittent quality issues, or station dekeys during a call.

Procedure:

1. Determine if the STT signal is generated though the GTR 8000 to the MLC 8000 Subsite Link Converter Port 4.
   - If Yes, then continue to the next step.
   - If No, then configure the GTR 8000 Base Radio properly. See Troubleshooting General Transmit and Infrastructure for the GTR 8000 on page 230.
2. Determine if the input is calibrated in MLC 8000 Subsite Link Converter Port 4.
   - If Yes, then continue to the next step.
   - If No, then calibrate the input using the input calibration method for STT. Verify that **Input Level Differential (dB)** is set correctly before calibration on the BR advanced configuration window in the MLC 8000 Configuration Tool.
3. Look at the TX lines for activity using a service monitor.
   - If audio is not present on the TX lines, then continue to the next step.
   - If audio is present on the TX lines, then see Troubleshooting General Transmit and Infrastructure for the GTR 8000 on page 230. Observe where the PA LED is illuminated on key up attempts, look at the status panel screen on the CSS to see if the transmitter is active or not, and so on.

4 If the Port LED (Port 4 for IP Simulcast) of the MLC 8000 Subsite Link Converter is Red, then try to isolate the problem. The Red LED indicates a problem in the link from the base radio to the MLC 8000 Subsite Link Converter in the MLC 8000 Subsite Link Converter Rx direction. This problem occurs when MLC 8000 Subsite Link Converter does not receive a status tone from the base radio for a time specified by the **Status Tone Timeout (sec)** field of the MLC 8000 Configuration Tool (the default is 60 seconds).

   a Verify the configuration of the MLC 8000 Subsite Link Converter as follows:

   - **Input Level Differential** is configured properly
   - **Status Tone Timeout (sec)** is not configured to a too short value

   b If you check the configuration and fix it and problem still occurs, then re-calibrate the device.

   c At the base radio, make sure that the base radio is powered on and generating status tone. Connect to the base radio using a scope or multi-meter.

   d Check the cable between the MLC 8000 Subsite Link Converter and base radio in both directions.

   e If the problem still occurs, then contact Motorola Solutions.

5 Check that the Comm LED on the MLC 8000 Subsite Link Converter is green.

- If Yes, then continue to the next step.
- If No, the LED is RED, then continue troubleshooting:

If…	Then…
MLC 8000 Subsite Link Converter	
Is the Comm LED on the MLC 8000 Subsite Link Converter RED?	The link to one comparator or more has failed.
Is the MLC 8000 Subsite Link Converter in the MLC 8000 Analog Comparator list?	If Yes, then continue to the next step. If No, then add the MLC 8000 Subsite Link Converter to the voter list.
The connection to the IP network is lost. Can you ping the MLC 8000 Subsite Link Converter from the MLC 8000 Analog Comparator?	If Yes, then continue to the next step. If No, then troubleshoot the network connection. Contact Motorola Solutions Support Center (SSC) for issues with the configurations for the transport devices (routers and switches).
MLC 8000 Analog Comparator	
The connection to the IP network is lost. Can you ping the MLC 8000 Analog Comparator from the MLC 8000 Subsite Link Converter?	If Yes, then continue to the next step. If No, then troubleshoot the network connection. Contact Motorola Solutions Support Center (SSC) for issues with the configurations for the transport devices (routers and switches).
The link to one or more base radio has failed (either the MLC 8000 Subsite Link Converter is not responding to keep alive messages of the MLC 8000 Analog Comparator or the MLC 8000 Subsite Link Converter reports	This issue might be either a problem of the IP network or a network cable should be checked (or replaced).

If…	Then…
that it lost connection to the base radio).	
One of the associated MLC 8000 Subsite Link Converters is going through a reset or a power outage has occurred.	**a** Wait several minutes to see if the LED returns to green, which occurs when the MLC 8000 Subsite Link Converter has recovered its connection. **b** If after several minutes the COMM LED stays red, then pull the log file from the device to determine which MLC 8000 Subsite Link Converter has lost connection. Check the state of this MLC 8000 Subsite Link Converter – if it is indeed undergoing a power outage, then it will recover shortly.

6 Check that the R2 LED on the MLC 8000 Subsite Link Converter is green.

- If Yes, then continue to the next step.
- If No, then continue troubleshooting:

If…	Then…
Is the MLC 8000 Subsite Link Converter connected to a composite signal using the daisy chain method?	If Yes, then continue to the next step. If No, then connect the MLC 8000 Subsite Link Converter to a composite signal, using the daisy chain method. Refer to "Installing MLC 8000 REF Input Signals for IP Simulcast System" in the *MLC 8000 Comparator Feature Guide* for how to cable the MLC 8000 to the Simulcast Site Reference device. A maximum of eight MLC 8000 units can be connected in a daisy-chain configuration to one GPS port.
Is the MLC 8000 Subsite Link Converter configured as IP Simulcast type in the MLC 8000 Configuration Tool?	If Yes, then continue to the next step. If No, then configure the cluster as IP Simulcast.

7 Check that the MLC 8000 Subsite Link Converter is connected though port 4 (4–wire) to the base radio.

- If Yes, then continue to the next step.
- If No, then connect the MLC 8000 Subsite Link Converter port 4 (4–wire) to the base radio using proper cables and punch block if needed.

8 Determine if the MLC 8000 Subsite Link Converter is configured as Tx\Rx or Tx only on the MLC 8000 Analog Comparator list.

- If Yes, then continue to the next step.
- If No, then configure the MLC 8000 Subsite Link Converter as **Tx\Rx** or **Tx Only** in the MLC 8000 Configuration Tool.

9 Using the wiring scheme and a multi-meter, verify all the pins from RJ45 to GTR 8000 Base Radio are correct.

10 Determine if the system was calibrated.

- If Yes, the system is calibrated, then continue to the next step.
- If No, then recalibrate the system (time offset and gains).

11 If calibration fails after you made hardware changes, perform these steps.

NOTICE: If the Port LED (1–4) illuminates RED and then turns off, and you have made hardware changes, you have to perform calibration. This situation applies if hardware has been replaced (such as cables, base radios, MLC 8000 Subsite Link Converters, or MLC 8000 Analog Comparators).

a Select the MLC 8000 Analog Comparator to calibrate by clicking it in the channel cluster tree. Click the **Audio Monitoring** button or right-click the MLC 8000 Subsite Link Converter and then click **Audio Monitoring and Calibration**.

b Verify that there is an STT signal from the base radio and press the **Calibrate** button. If a success message appears, the calibration process is done. In case of a failure message, go to the next step.

c Select the **Input From Radio/Console** radio button and click **Start**.

d If no signal displays in the Audio Monitoring and Calibration window, check the hardware (such as cables, base radios, MLC 8000 Subsite Link Converters).

e If a full scale signal displays in the Audio Monitoring and Calibration window, adjust the **Input From Radio/Console** slider and click **Start** to resume audio monitoring. Repeat until the signal takes no more than 70-80% of the scale and press **Calibrate**.

12 Determine if the launch time delay in the MLC 8000 Analog Comparator is too small for network capabilities. Increase it and try again.

13 Using the *MLC 8000 Configuration Tool User Guide*, check the following:

- Check the log files for launch time errors from the MLC 8000 Subsite Link Converter. (The error is from the MLC 8000 Subsite Link Converter, but the adjustment is made in the MLC 8000 Analog Comparator). See “Managing MLC 8000 Device Logs”
- Determine if the simulcast launch time offset is correct in the Simulcast Launch Time Offset field. The default value for this field is 0 microseconds. See “Configuring an MLC 8000 Subsite Link Converter for an IP Simulcast System”

  NOTICE: Simulcast launch time is only applicable to Analog-Only IP-Based Simulcast configuration.
- See “Determining the Link Launch Time Delay in Analog IP-Simulcast” in the *MLC 8000 Configuration Tool User Guide*.

14 Using the wiring scheme and a multi-meter, verify all the pins from RJ45 to GTR 8000 are correct.

B.2 Troubleshooting the Transmit (TX) Path for Non-Simulcast Subsystems

Prerequisites: The following equipment is required:

- Oscilloscope
- Communications Analyzer

When and where to use: This procedure is used to troubleshoot issues with the voting transmit path, including:

- MLC 8000 Analog Comparator
- MLC 8000 Subsite Link Converter
- Network transport (routers and switches)

- GTR 8000 Base Radios

Symptoms include: Transmitters are not keying at all, keyed but not hearing voice, or keyed but voice has intermittent quality issues, or station dekeys during a call.

Procedure:

1. Determine if the STT signal is generated though the GTR 8000 to the MLC 8000 Subsite Link Converter Port 4.
   - If Yes, then continue to the next step.
   - If No, then configure the GTR 8000 Base Radio properly. See Troubleshooting General Transmit and Infrastructure for the GTR 8000 on page 230.
2. Determine if the input is calibrated in MLC 8000 Subsite Link Converter Ports 1–4, depending on the number of base radios.
   - If Yes, then continue to the next step.
   - If No, then calibrate the input using the input calibration method for STT. Verify that **Input Level Differential (dB)** is set correctly before calibration on the BR advanced configuration window in the MLC 8000 Configuration Tool.
3. Look at the TX lines for activity using a service monitor.
   - If audio is not present on the TX lines, then continue to the next step.
   - If audio is present on the TX lines, then see Troubleshooting General Transmit and Infrastructure for the GTR 8000 on page 230. Observe where the PA LED is illuminated on key up attempts, look at the status panel screen on the CSS to see if the transmitter is active or not, and so on.
4. If the Port LED (ports 1 - 4) of the MLC 8000 Subsite Link Converter is Red, then try to isolate the problem. The Red LED indicates a problem in the link from the base radio to the MLC 8000 Subsite Link Converter in the MLC 8000 Subsite Link Converter Rx direction. This problem occurs when MLC 8000 Subsite Link Converter does not receive a status tone from the base radio for a time specified by the **Status Tone Timeout (sec)** field of the MLC 8000 Configuration Tool (the default is 60 seconds).
   a. Verify the configuration of the MLC 8000 Subsite Link Converter as follows:
      - **Input Level Differential** is configured properly
      - **Status Tone Timeout (sec)** is not configured to a too short value
   b. If you check the configuration and fix it and problem still occurs, then recalibrate the device.
   c. At the base radio, make sure that the base radio is powered on and generating status tone/ ALMT. Connect to the base radio using a scope or multi-meter.
   d. Check the cable between the MLC 8000 Subsite Link Converter and base radio in both directions.
   e. If the problem still occurs, then contact Motorola Solutions.
5. Check that the Comm LED is green.
   - If Yes, then continue to the next step.
   - If No, the LED is RED, then continue troubleshooting:

If…	Then…
MLC 8000 Subsite Link Converter	
Is the Comm LED on the MLC 8000 Subsite Link Converter RED?	The link to one comparator or more has failed.

If…	Then…
Is the MLC 8000 Subsite Link Converter in the MLC 8000 Analog Comparator list?	If Yes, then continue to the next step. If No, then add the MLC 8000 Subsite Link Converter to the voter list.
The connection to the IP network is lost. Can you ping the MLC 8000 Subsite Link Converter from the MLC 8000 Analog Comparator?	If Yes, then continue to the next step. If No, then troubleshoot the network connection. Contact Motorola Solutions Support Center (SSC) for issues with the configurations for the transport devices (routers and switches).
MLC 8000 Analog Comparator	
The connection to the IP network is lost. Can you ping the MLC 8000 Analog Comparator from the MLC 8000 Subsite Link Converter?	If Yes, then continue to the next step. If No, then troubleshoot the network connection. Contact Motorola Solutions Support Center (SSC) for issues with the configurations for the transport devices (routers and switches).
The link to one or more base radio has failed (either the MLC 8000 Subsite Link Converter is not responding to keep alive messages of the MLC 8000 Analog Comparator or the MLC 8000 Subsite Link Converter reports that it lost connection to the base radio).	This issue might be either a problem of the IP network or a network cable should be checked (or replaced).
One of the associated MLC 8000 Subsite Link Converters is going through a reset or a power outage has occurred.	**a** Wait several minutes to see if the LED returns to green, which occurs when the MLC 8000 Subsite Link Converter has recovered its connection. **b** If after several minutes the COMM LED stays red, then pull the log file from the device to determine which MLC 8000 Subsite Link Converter has lost connection. Check the state of this MLC 8000 Subsite Link Converter – if it is indeed undergoing a power outage, then it will recover shortly.

6 Check that the R2 LED on the MLC 8000 Subsite Link Converter is green.

- If Yes, then continue to the next step.
- If No, then continue troubleshooting:

If…	Then…
Is the MLC 8000 Subsite Link Converter configured as IP Simulcast type in the MLC 8000 Configuration Tool?	If Yes, then continue to the next step. If No, then configure the cluster as IP Simulcast.

7 Problems with MLC 8000 Subsite Link Converter Tx are discovered at the base radio side when ALMT from the MLC 8000 Subsite Link Converter is either not transmitted at all or transmitted in

low quality or in low power. The corresponding Port LED at the MLC 8000 Subsite Link Converter may or may not be green (meaning that the MLC 8000 Subsite Link Converter may not be aware of this problem).

a Check that the MLC 8000 Subsite Link Converter outputs ALMT (this is done by scope or multi-meter). The gain of the transmitted ALMT should be in a proper gain (for example, -10 dB).

b If that does not help, then check that the dual gain amplifier (output direction and input direction) in the MLC 8000 Subsite Link Converter are configured properly.

c CODEC gain (as indicated by the sliders in the BR Audio Monitoring and Calibration window of the MLC 8000 Configuration Tool).

d If that does not help, determine whether there is no Tx in console-generated audio or in subscriber-generated audio or in both.

CAUTION: Analog Link Monitor Tone (ALMT) is only supported on Conventional Mixed Mode channels with the V.24 interface. It is not supported on Conventional Mixed Mode channels with the Ethernet interface and is not supported on analog conventional channels.

8 Check that the MLC 8000 Subsite Link Converter is connected though port 4 (4–wire) to the base radio.

- If Yes, then continue to the next step.
- If No, then connect the MLC 8000 Subsite Link Converter port 4 (4-wire) to the base radio using proper cables and punch block if needed.

9 Determine if the MLC 8000 Subsite Link Converter is configured as Tx\Rx or Tx only on the MLC 8000 Analog Comparator list.

- If Yes, then continue to the next step.
- If No, then configure the MLC 8000 Subsite Link Converter as **Tx\Rx** or **Tx Only** in the MLC 8000 Configuration Tool.

10 For tone remote (TRC), ensure that the link is correct for the Tx path.

11 For tone remote (TRC), if transmitting to the console with a TRC tone, the tone is distorted if too large in the MLC 8000 Analog Comparator. Recalibrate the input value on Port 1.

12 Using the wiring scheme and a multi-meter, verify all the pins from RJ45 to GTR 8000 Base Radio are correct.

13 Determine if the system was calibrated.

- If Yes, then continue to the next step.
- If No, then recalibrate the system (time offset and gains).

14 If calibration fails after you made hardware changes, perform these steps.

NOTICE: If the Port LED (1–4) illuminates RED and then turns off, and you have made hardware changes, you have to perform calibration. This situation applies if hardware has been replaced (such as cables, base radios, MLC 8000 Subsite Link Converters, or MLC 8000 Analog Comparators).

a Select the MLC 8000 Analog Comparator to calibrate by clicking it in the channel cluster tree. Click the **Audio Monitoring** button or right-click the MLC 8000 Subsite Link Converter and then click **Audio Monitoring and Calibration**.

b Verify that there is an STT/ALMT signal from the base radio and press the **Calibrate** button. If a success message appears, the calibration process is done. In case of a failure message, go to the next step.

c Select the **Input From Radio/Console** radio button and click **Start**.

d If no signal displays in the Audio Monitoring and Calibration window, check the hardware (such as cables, base radios, MLC 8000 Subsite Link Converters).

e If a full scale signal displays in the Audio Monitoring and Calibration window, adjust the **Input From Radio/Console** slider and click **Start** to resume audio monitoring. Repeat until the signal takes no more than 70-80% of the scale and press **Calibrate**.

15 Using the wiring scheme and a multi-meter, verify all the pins from RJ45 to GTR 8000 are correct.

B.3

Troubleshooting General Transmit and Infrastructure for the GTR 8000

Prerequisites: Perform the following steps first:

- Check the status report screen and status panel screen for warnings or failures that may indicate a cause for the problem you are trying to resolve.
- Ensure that wildcard configuration is not causing the GTR 8000 behavior.

Procedure:

1 Determine if the GTR 8000 Tx path to the antenna is operational. Check the GTR 8000 Tx path to the Antenna by clicking **Transmitter Test** on the CSS Transmitter Metering Screen. You can view the forward and reflected power and VSWR. For ideal responses, see the following:

- Forward Power should be within 10% of programmed power level.
- Reflected Power = **0**. Typically, a small amount of reflected power is indicated. Reflected power should be less than 4% of the forward power.
- VSWR is typically slightly greater than **1**, which is still acceptable, but should be less than 1.5:1.

NOTICE: Excessive VSWR or reflected power indicates a problem with coax cables or external equipment (such as, circulators, duplexers, combiners, or antennas) connected to the transmit port of the base radio.

NOTICE: If a circulator is in the TX path to the antenna, the readings only reflect the state of the GTR 8000 Tx path up to the circulator since the circulator absorbs reflected power. In this case, an external Wattmeter is needed. You can still use the **Transmitter Test** to key up the GTR 8000 and view the forward and reflected power on the External Wattmeter.

2 Check the Power Amplifier LED.

If…	Then…
Yes	Check whether the GTR 8000 receives the correct voice payload to transmit: • For analog wireline, check with an oscilloscope that voice is present on the wire. • For digital wireline, check with a network analyzer that voice frames are transmitted.
No	Determine if the voice is infrastructure or repeat sourced. Continue to the next step.

3 Determine if the voice is infrastructure or repeat sourced.

If…	Then…
Infrastructure:	Determine if the link is digital or analog. Continue to the next step.

If…	Then…
Repeat:	Check with the CSS Status Panel Screen that the GTR 8000 receives voice data with the correct Rx Qualifiers (PL, DPL or NAC). Check whether the GTR 8000 is configured for repeat. Check whether there is no other in-bound activity (for example, infrastructure) that could preempt repeat.

4 Determine if the link is digital or analog.

If…	Then…
Analog	Depending on configuration, ensure with an oscilloscope that key-up trigger is present either as wireline tone or as a wildcard external key-up input.
Digital	Check with the CSS Status Panel Screen whether the Infrastructure Link is operational. Continue to the next step.

5 Determine if the Infrastructure Link is operational.

If…	Then…
Failed	Determine if the connection is V.24 or Ethernet. Continue to the next step.
Operational	Ensure with V.24 or Ethernet packet analyzer that ICW and voice frames reaches the GTR 8000 Base Radio.

6 Determine if the connection is V.24 or Ethernet.

If…	Then…
V.24	Check the V.24 transmit clock setting. Check the link configuration of the device on the other side of the connection and ensure that the V.24 cable is not spoiled.
Ethernet	Determine if you can ping, Telnet, or connect CSS over the Ethernet to the GTR 8000. Continue to the next step.

7 Determine if you can ping, Telnet or connect CSS over the Ethernet to the GTR 8000.

If…	Then…
Yes	Check the configuration, using *Provisioning Manager* or Configuration Manager.
No	Check the network configuration: IP, gateway settings, switch and router configurations, physical connection

8 If Invalid launch time is reported, check following:

- Link delay setting
- 1PPS signal source

9 If many data packets are lost, check the following:

- Check the signal level at the receiver site with an analyzer.
- If the GTR 8000 is repeating data, verify that Packet Data Mode is configured to repeated on the receiving subscriber.

B.4

Troubleshooting Misaligned Reference Modulation Compensation (Final System-Level Check — IP Based Simulcast)

Coarse level calibration and fine amplitude adjustment procedures are important steps to ensure the reference modulation compensation in an IP-based simulcast system.

When and where to use: During a final system level check on IP-based simulcast systems, if the levels between sites (that is, the output of the channel across the subsites) for a given frequency vary by more than 0.3 dB of the reference site, this variance indicates a misaligned reference modulation compensation on one or more base radios. The coarse level calibration and fine amplitude adjustment procedures were likely not performed correctly and must be repeated.

Procedure:

1. In the MLC 8000 Configuration Tool with Analog Display and Control, select an **MLC 8000 Subsite Link Converter (AGU)** in the channel cluster tree, click the **Audio Monitoring** button.

   The Audio Monitoring and Calibration — IP Simulcast: BR Calibration tab appears. Use this tab to troubleshoot the modulation compensation issue. Unlike the window that appears when you select an MLC 8000 Analog Comparator (VGU), this window contains arrows used to adjust the digital gain.

2. Press the **Start** button.

   NOTICE: You must press the START button before you can adjust the Gain values.

3. Use the up/down arrows to adjust the **Gain** for one or more MLC 8000 Subsite Link Converters until the non-reference site is <= 0.3 dB of the reference site.

4. Click **Save to File** to save the gain information to a file for later reference.

5. Return to Configuring the MLC 8000 for IP-Based Simulcast on page 212.

   - For the QUANTAR Base Radios, repeat the base station alignment, modulation compensation, coarse level calibration, and fine amplitude adjustment procedures.
   - For the GTR 8000 Base Radios, repeat the coarse level calibration and fine amplitude adjustment procedures.

B.5

Audio Level Setting

Audio level setting involves the interaction of key parameters that are set for the devices in the system, such as the MLC 8000 Link Converter, Site Gateway (Conventional Channel Interface), base radios, and consoles.

Figure 58: MCC 7500 VPM Audio Level Settings Analog Unity Gain

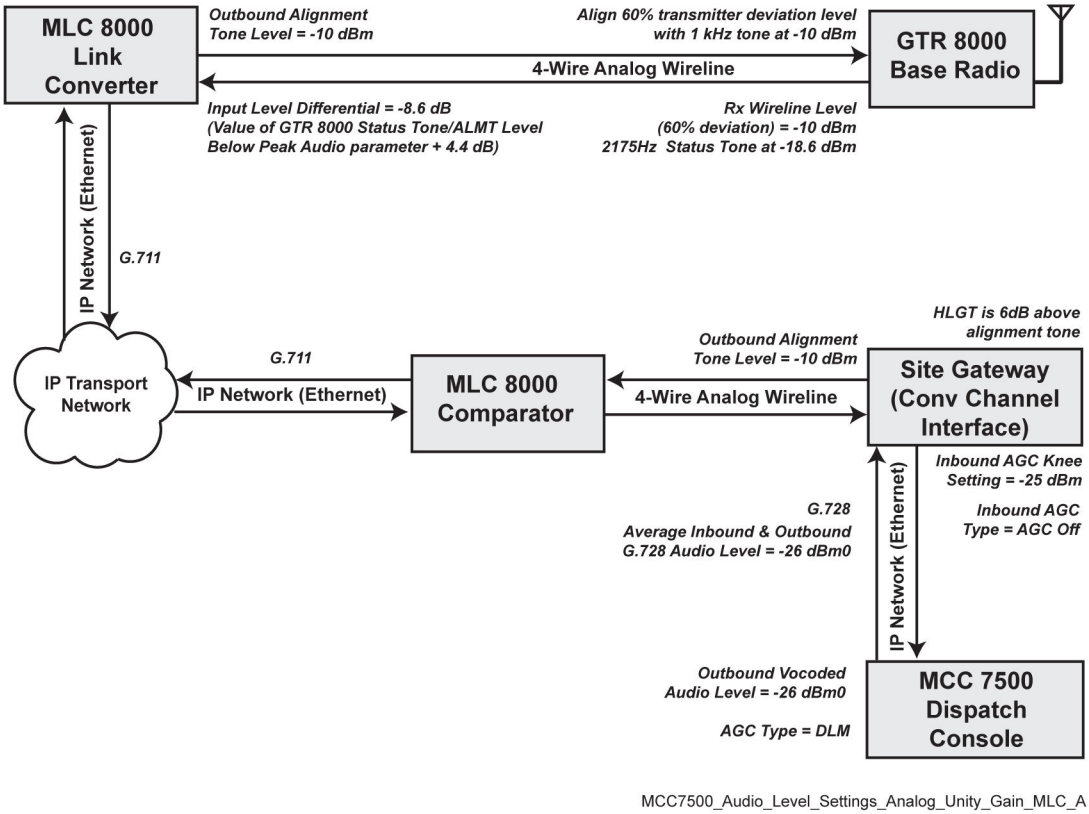
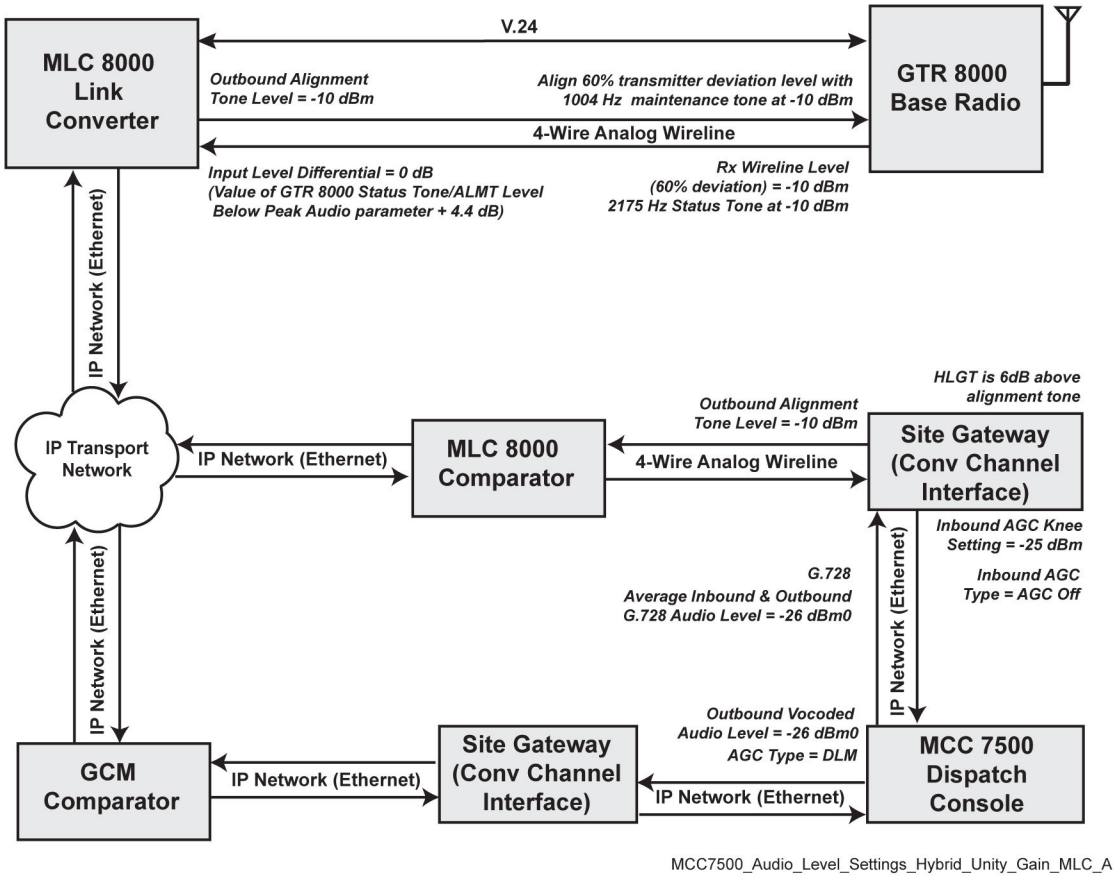


Figure 59: MCC 7500 VPM Audio Level Settings Mixed Mode Unity Gain



B.5.1

Audio Levels for the MLC 8000 Link Converter for Analog or Mixed Mode

Input Level Differential is important for two reasons: voting and system deviations. For voting, the MLC 8000 Input Level Differential parameter requires a calculation using the value in the Status Tone/ALMT Level Below Peak Audio field for the GTR 8000. The setting depends on whether the channel is analog only or mixed mode.

If the Rx Wireline level is set to -10 dBm in the GTR 8000, the general formula is:

- Input Level Differential = Status Tone/ALMT Level Below Peak Audio + 4.4, or
- Status Tone/ALMT Level Below Peak Audio = Input Level Differential - 4.4

For example, if Input Level Differential (dB) is 0, then Status Tone/ALMT Level Below Peak Audio is -4.4. Peak audio is considered 100% deviation.

Table 70: MLC 8000 Link Converter Parameters

MLC 8000 Subsite Link Converter parameter in the Configuration Tool	Corresponding GTR 8000 parameter in CSS
Input Level Differential (dB) in the BR advanced configuration for port window.	**Status Tone/ALMT Level Below Peak Audio** (on the Rx Wireline Alignment tab of the Alignment Screen window)

Table continued…

MLC 8000 Subsite Link Converter parameter in the Configuration Tool	Corresponding GTR 8000 parameter in CSS
Input Level Differential in Figure 58: MCC 7500 VPM Audio Level Settings Analog Unity Gain on page 233 is **-8.6 dB**.	The corresponding **Status Tone/ALMT Level Below Peak Audio** parameter is **-13 dB**.
Input Level Differential in Figure 59: MCC 7500 VPM Audio Level Settings Mixed Mode Unity Gain on page 234 is **0 dB**.	The corresponding **Status Tone/ALMT Level Below Peak Audio** is **-4.4 dB**.

B.5.2

Audio Levels for the Site Gateway (Conventional Channel Interface) for Analog or Mixed Mode

Figure 58: MCC 7500 VPM Audio Level Settings Analog Unity Gain on page 233 and Figure 59: MCC 7500 VPM Audio Level Settings Mixed Mode Unity Gain on page 234 show the Site Gateway (Conventional Channel Interface) conventional channel audio level parameters for analog or mixed mode. Audio level parameters must be configured separately for each analog or mixed mode channel in the Site Gateway (Conventional Channel Interface). These parameters are configured through *Provisioning Manager* or, in K core systems, the Configuration Manager.

NOTICE: Digital channels do not have Site Gateway (Conventional Channel Interface) audio level parameters.

Table 71: Site Gateway (Conventional Channel Interface) Audio Level Settings for Analog or Mixed Mode Conventional Channel

Parameter	Value	
	Unity Gain 4-Wire Analog Media	Lossy 4-Wire Analog Media
Outbound Path (from console, to station)		
Outbound Alignment Tone Level	-10 dBm	-5 dBm
Average Outbound G.728* Audio Level	-26 dBm0	-26 dBm0
Inbound Path (from station, to console)		
Average Inbound G.728 Audio Level	-26 dBm0	26 dBm0
Inbound AGC Knee Setting	-25 dBm	-20 dBm minus line loss in dB**
Inbound AGC Type	AGC Off	AGC On

* G.728 is an International Telecommunications Union (ITU) standard for coding telephone-bandwidth speech that was designed to provide speech quality equivalent to or better than that of previous standards. G.728 coding is suited for a wide range of applications, including both voice storage and voice communications, and performs well in the presence of multiple speakers and background noise.

** Example – For a line loss of 16 dB, the Inbound AGC Knee Setting would be -36 dBm.

The default values of these parameters correspond to the unity-gain column in the table. If lossy media are used to connect the station to the Site Gateway (Conventional Channel Interface), then adjust the "outbound alignment tone level" as shown in the table's lossy media column.

B.5.3

Audio Levels for Base Radios for Analog or Mixed Mode

Parameters are set to configure base radios when they interface to the Site Gateway (Conventional Channel Interface).

The following table shows recommended values for audio level parameter settings for the analog GTR 8000, QUANTAR®, MTR 3000 and MTR 2000 base radios.

Table 72: Recommended Base Radio Audio Level Settings for Conventional Channels - Analog or Mixed mode

Parameter	Value	
	Unity Gain 4-Wire Analog Media	Lossy 4-Wire Analog Media
Rx Wireline Level (on the **Rx Wireline Alignment** tab of the **Alignment Screen** window)	-10 dBm	-5 dBm
Status Tone (**Common** tab of the **Infrastructure Interface** window)	Enabled	Enabled
Tx Wireline Level (on the **Tx Wireline Alignment** tab of the Alignment Screen window)	-10 dBm	-21 dBm
Analog Repeater Boost (**Key Up Controls** tab of the **Channel Configuration** window)	Disabled	Disabled

B.5.4

Reducing Delay for Analog Simulcast

With an analog IP simulcast system, the access time has increased such that the originator of a subscriber transmission may hear the conclusion of the audio after dekey in a radio-to-radio call.

The echo risk may be mitigated by adjusting user-configurable parameters in the MLC 8000 Configuration Tool. The echo period is dependent on the delay through the infrastructure and the receive qualifiers configured in the subscriber.

All of the parameters in the following table can be used to reduce overall access time.

Table 73: Timing Dependencies

Parameter	Default/ Range	Description of Parameter	Considerations
Analog Voting Sample Period	**50 ms**/5 ms to 10000 ms	Sets the Signal Quality Measurement (SQM) sampling window length at the MLC 8000 Subsite Link Converter. During this window, the Digital Signal Processor (DSP) collects the voice stream coming from the base radio. After the window has closed, the DSP calculates the SQM value from the collected samplings. The SQM	Some loss of voting quality is expected as sample time is reduced. Voting quality is commensurate with the sampling duration.

Table continued…

Parameter	Default/ Range	Description of Parameter	Considerations
		number represents the quality of the received voice.	
Link Delay	**80 ms**/80 ms to 300 ms	From the first SQM value received at the voter, the voter starts the Link Delay timer and collects all SQM values in between.	This is the expected maximum inbound link delay, which is a function of transport delay plus the transport delay variation. The amount of reduction is coupled to behavior of transport on the system.
Simulcast Launch Time Offset	**0 ms**/000 ms to 999 ms	The Simulcast Launch Time compensates for the network delay variation.	Generally can be lowered if the network has stable (low jitter), high-speed transport. Directly reduces overall access time, specifically delay, for IP simulcast systems. Too low of reduction results in launch time errors which leads to audio quality issues.
Audio Truncation	Enabled/[Enabled..Disabled]	If checked (enabled), the default value, inbound audio samples used for calculating the SQM are discarded and the audio is played with truncation. If unchecked (disabled), the inbound audio samples used to calculate the SQM are played.	If enabled, causes audio processed during the sample period to be expressed as truncation which helps mitigate echoing effect. If disabled, the sample period contributes to delay.

NOTICE: MOSCAD NFM provides I/O monitoring of both Link Delay and Simulcast Launch Time.

B.6
Checking Audio Polarity

When and where to use: Use this procedure upon initial optimization and any time system changes are performed. Once completed and if the system has not changed, there is no need to perform these steps every time the system is re-optimized.

Procedure:

1 Perform the following actions depending on system configuration:

If…	Then…
If the system is circuit-based,	perform the following actions: **a** Inject into the CSCI an asymmetrical waveform (a 10 Hz sawtooth is ideal and is available from the ACTS DSA) and set the level to produce 60% system deviation. The deviation is not critical, ensure that modulation limiting does not occur. **b** From the prime site, key up one channel at a time and observe the modulation waveform on either the CSA or the DSA. On the first channel, note the shape of the waveform.

If…	Then…
If the system is IP-based,	perform the following actions: **a** Follow the steps in Performing Coarse Level PL/DPL Adjustment (Conventional Systems) on page 216 to set the **PL/DPL** list to **DPL** to specify DPL should be inserted into the voice stream. **b** Start the test tone. **c** From the prime site, key up one channel at a time and observe the modulation waveform on either the CSA or the DSA. On the first channel, note the shape of the waveform.

2 Individually key up the channel at each site and observe the waveform. It should be identical to the waveform observed in step 1. If the waveform is reversed, an audio polarity reversal exists and must be corrected.

3 Check the remaining channels, one site at a time and verify that the waveform is correct.