

**System Release 7.17**  
**ASTRO® 25**  
**INTEGRATED VOICE AND DATA**



# **MLC 8000 Setup Guide**

**NOVEMBER 2016**

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# Document History

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# Contents

<b>Copyrights.....</b>	<b>3</b>
<b>Contact Us.....</b>	<b>5</b>
<b>Document History.....</b>	<b>7</b>
<b>List of Figures.....</b>	<b>15</b>
<b>List of Tables.....</b>	<b>17</b>
<b>List of Processes.....</b>	<b>19</b>
<b>List of Procedures.....</b>	<b>21</b>
<b>About MLC 8000 Setup Guide.....</b>	<b>23</b>
What Is Covered In This Manual.....	23
Helpful Background Information.....	24
Related Information.....	24
<b>Chapter 1: Common Information for MLC 8000 Implementations.....</b>	<b>27</b>
1.1 Navigating This Guide.....	27
1.2 Implementing MLC 8000s.....	29
1.2.1 MLC 8000 Devices Per Site Type.....	31
1.2.2 Examples of Subsystems Where MLC 8000s Can Be Used.....	32
1.2.3 MLC 8000 Ports and LEDs.....	32
1.4.1 MLC 8000 Hardware Views.....	33
1.2.4 MLC 8000 Safety and General Information.....	33
1.2.5 MLC 8000 Configuration Tool with Analog Display and Control Set Up.....	33
1.2.6 MLC 8000 Setting Up the MCN Server 8000 Remote Comparator Display Software.....	33
1.2.7 MLC 8000 Software and Configuration Updates.....	34
1.2.8 MLC 8000 Password Setup.....	35
1.2.9 MLC 8000 Considerations for Implementing MLC 8000s to Replace Existing Equipment.....	35
1.2.10 MLC 8000 Replacement of QUANTARs with GTR 8000 Base Radios.....	35
1.2.11 MLC 8000 Setting Up MOSCAD Network Fault Management (NFM) Monitoring.....	35
1.12.1 MLC 8000 Adding MLC 8000 Devices to the MLC 8000 Sites in Existing SDM3000 Builder Project.....	37
1.12.2 MLC 8000 Cabling MLC 8000 to SDM3000 RTU.....	38
1.12.3 MLC 8000 Link Converter and MOSCAD NFM I/O Monitoring Indications (IP Simulcast).....	39
1.12.4 MLC 8000 Link Converter MOSCAD NFM I/O Monitoring Indications (Non IP Simulcast).....	40
1.12.5 MLC 8000 Analog Comparator and MOSCAD NFM I/O Monitoring Indications (IP Simulcast).....	41

1.12.6 MLC 8000 Analog Comparator and MOSCAD NFM I/O Monitoring Indications (Non IP Simulcast).....	43
1.13 Optimization/Calibration for Conventional Simulcast.....	44
1.14 Considerations for Implementing MLC 8000s at Existing Trunking Sites.....	45
1.14.1 Examples of Trunking Configurations That Can Share Equipment.....	45
1.14.2 Channel Capacity Constraints When Conventional Shares Equipment With Trunking.....	47
1.14.3 Ethernet Bandwidth Considerations for MLC 8000s.....	47
1.14.4 Other Considerations for Implementing MLC 8000s at Trunking Simulcast Sites.....	48
1.15 Simulcast Site Reference Considerations.....	48
1.16 Jitter Buffer Considerations for Simulcast and Non-Simulcast.....	49
1.17 Configuring GTR 8000 Base Radios with CSS.....	50
1.18 GTR 8000 Configuration Settings .....	51
1.18.1 Conventional Configuration Settings for Analog Simulcast.....	51
1.18.2 Conventional Configuration Settings for Non Simulcast.....	52
1.18.3 Alignment Screen Settings.....	54
1.18.4 MLC 8000 Analog Comparator Parameters.....	54
1.19 Configuration Manager Settings.....	55
1.20 Installing MLC 8000s with Off-Site Preconfiguration.....	55
<b>Chapter 2: ASTRO 25 Analog-Only Non-Simulcast Voting Subsystem.....</b>	<b>61</b>
2.1 Implementing an ASTRO 25 Analog-Only Non-Simulcast Voting Subsystem.....	61
2.1.1 Installing Equipment for Each Channel in the Prime Site.....	61
2.1.2 Installing Equipment For Each Channel in Subsites.....	64
2.1.3 Configuring MLC 8000 Devices with the MLC 8000 Configuration Tool.....	66
2.1.4 Verifying the Installation and Configuration.....	68
2.2 ASTRO 25 Analog-Only Non-Simulcast Voting Subsystem Equipment Cabling.....	70
2.3 ASTRO 25 Analog-Only Non-Simulcast Voting Subsystem Troubleshooting.....	73
<b>Chapter 3: ASTRO 25 Analog-Only IP-Based Simulcast Subsystem.....</b>	<b>75</b>
3.1 Implementing an ASTRO 25 Analog-Only IP-Based Simulcast Subsystem.....	75
3.1.1 Installing Equipment for Each Channel in the Prime Site.....	75
3.1.2 Installing Equipment for Each Channel in Subsites.....	78
3.1.3 Configuring MLC 8000 Devices with the MLC 8000 Configuration Tool.....	80
3.1.4 Verifying the Installation and Configuration.....	82
3.2 ASTRO 25 Analog-Only IP-Based Simulcast Subsystem Equipment Cabling.....	84
3.3 ASTRO 25 Analog-Only IP-Based Simulcast Subsystem Troubleshooting.....	87
<b>Chapter 4: ASTRO 25 Mixed-Mode Non-Simulcast Voting Subsystem.....</b>	<b>89</b>
4.1 Implementing an ASTRO 25 Mixed-Mode Non-Simulcast Voting Subsystem.....	89
4.1.1 Installing Equipment for Each Channel in the Prime Site.....	89
4.1.2 Installing Equipment for Each Channel in Subsites.....	92

4.1.3 Configuring MLC 8000 Devices with the MLC 8000 Configuration Tool.....	94
4.1.4 Verifying the Installation and Configuration.....	96
4.2 ASTRO 25 Mixed-Mode Non-Simulcast Voting Subsystem Equipment Cabling.....	99
4.3 ASTRO 25 Mixed-Mode Non-Simulcast Voting Subsystem Troubleshooting.....	101
<b>Chapter 5: ASTRO 25 Conventional Mixed-Mode Simulcast Voting Subsystem.....</b>	<b>103</b>
5.1 Implementing an ASTRO 25 Conventional Mixed-Mode Simulcast Voting Subsystem.....	103
5.1.1 Installing Equipment for Each Channel in the Prime Site.....	103
5.1.2 Installing Equipment for Each Channel in Subsites.....	106
5.1.3 Configuring MLC 8000 Devices with the MLC 8000 Configuration Tool.....	109
5.1.4 Verifying the Installation and Configuration.....	111
5.2 ASTRO 25 Conventional Mixed-Mode Simulcast Voting Subsystem Equipment Cabling...	113
5.3 ASTRO 25 Conventional Mixed-Mode Simulcast Voting Subsystem Troubleshooting.....	117
<b>Chapter 6: ASTRO 25 Digital-Only Simulcast Voting Subsystem.....</b>	<b>119</b>
6.1 Implementing an ASTRO 25 Digital-Only Simulcast Voting Subsystem.....	119
6.1.1 Installing Equipment for Each Channel in Subsites.....	119
6.1.2 Configuring MLC 8000 Devices with the MLC 8000 Configuration Tool.....	122
6.1.3 Verifying the Installation and Configuration.....	124
6.2 ASTRO 25 Digital-Only Simulcast Voting Subsystem Equipment Cabling.....	125
6.3 ASTRO 25 Digital-Only Simulcast Voting Subsystem Troubleshooting.....	127
<b>Chapter 7: ASTRO 25 Circuit-Based Analog-Only Simulcast Voting Subsystem.....</b>	<b>129</b>
7.1 Implementing an ASTRO 25 Circuit-Based Analog-Only Simulcast Voting Subsystem.....	129
7.1.1 Installing Equipment for Each Channel in the Prime Site.....	129
7.1.2 Configuring MLC 8000 Devices with the MLC 8000 Configuration Tool.....	132
7.1.3 Verifying the Installation and Configuration.....	134
7.2 ASTRO 25 Circuit-Based Analog-Only Simulcast Voting Subsystem Equipment Cabling..	135
7.3 ASTRO 25 Circuit-Based Analog-Only Simulcast Voting Subsystem Troubleshooting.....	137
<b>Chapter 8: Circuit-Based Analog-Only Simulcast Voting Subsystem.....</b>	<b>139</b>
8.1 Implementing a Circuit-Based Analog-Only Simulcast Voting Subsystem.....	139
8.1.1 Installing Equipment for Each Channel in the Prime Site.....	139
8.1.2 Configuring MLC 8000 Devices with the MLC 8000 Configuration Tool.....	142
8.1.3 Verifying the Installation and Configuration.....	144
8.2 Circuit-Based Analog-Only Simulcast Voting Subsystem Equipment Cabling.....	145
8.3 Circuit-Based Analog-Only Simulcast Voting Subsystem Troubleshooting.....	147
<b>Chapter 9: Analog-Only IP-Based Simulcast Voting Subsystem.....</b>	<b>149</b>
9.1 Implementing an Analog-Only IP-Based Simulcast Voting Subsystem.....	149
9.1.1 Installing Equipment for Each Channel in the Prime Site.....	149
9.1.2 Installing Equipment for Each Channel in Subsites.....	152

9.1.3 Configuring MLC 8000 Devices with the MLC 8000 Configuration Tool.....	154
9.1.4 Verifying the Installation and Configuration.....	156
9.2 Analog-Only IP-Based Simulcast Voting Subsystem Equipment Cabling.....	158
9.3 Analog-Only IP-Based Simulcast Voting Subsystem Troubleshooting.....	160
<b>Chapter 10: MLC 8000 Radio Ports Cabling.....</b>	<b>163</b>
<b>Appendix A: Optimization/Calibration for Conventional Simulcast.....</b>	<b>165</b>
A.1 Overview of Simulcast Optimization.....	165
A.2 Test Equipment.....	166
A.3 Setting up Test Equipment.....	166
A.4 Calibrating the DSA to Measure FM Deviation.....	167
A.5 Test Connections.....	168
A.6 Checking RF Signal Quality.....	168
A.7 Optimizing/Calibrating Conventional Analog Circuit-Based Simulcast.....	169
A.7.1 Calibrating and Optimizing Circuit-Based Simulcast.....	169
A.7.2 Aligning the QUANTAR Base Radio.....	170
A.7.2.1 Base Station Alignment Characteristics.....	171
A.7.3 Modulation Compensation (QUANTAR).....	172
A.7.3.1 Rough Setting.....	172
A.7.3.2 Simulcast Setting.....	172
A.7.3.3 Fine-Tuning Modulation Compensation.....	173
A.7.4 Coarse Level Adjustment (Transmit Audio Path) (Circuit Based).....	175
A.7.4.1 Performing Coarse Level Adjustment (Transmit Audio Path 1 kHz).....	175
A.7.5 Coarse Level Adjustment (Conventional Systems PL/DPL Adjustment) (Circuit Based).....	176
A.7.5.1 Performing Coarse Level Adjustment (Conventional Systems PL/ DPL Adjustment).....	177
A.7.6 Fine Amplitude Adjustment (Circuit Based).....	177
A.7.6.1 Performing Fine Amplitude Adjustment.....	178
A.7.7 Final Circuit Based System Level Check.....	180
A.7.7.1 Performing a Final System-Level Check.....	180
A.8 Optimizing/Calibrating Conventional Analog IP-Based Simulcast.....	182
A.8.1 Configuring the MLC 8000 for IP-Based Simulcast.....	182
A.8.2 Coarse Level Adjustment for Transmit Audio Path (IP Based).....	183
A.8.2.1 Performing Coarse Level Adjustment (Transmit Audio Path 1 kHz).....	184
A.8.3 Coarse Level Adjustment (Conventional Systems PL/DPL Adjustment) (IP Based).....	185
A.8.3.1 Performing Coarse Level PL/DPL Adjustment (Conventional Systems).....	186
A.8.4 Fine Amplitude Adjustment (IP Based).....	187
A.8.4.1 Performing Fine Amplitude Adjustment.....	188
A.8.5 Final IP Based System Level Check.....	189

A.8.5.1 Performing a Final System-Level Check.....	190
<b>Appendix B: Troubleshooting the Optimization/Calibration.....</b>	<b>193</b>
B.1 Troubleshooting the Transmit (TX) Path for Simulcast Subsystems.....	193
B.2 Troubleshooting the Transmit (TX) Path for Non-Simulcast Subsystems.....	196
B.3 Troubleshooting General Transmit and Infrastructure for the GTR 8000.....	200
B.4 Troubleshooting Misaligned Reference Modulation Compensation (Final System-Level Check — IP Based Simulcast).....	202
B.5 Audio Level Setting.....	202
B.5.1 Audio Levels for the MLC 8000 Link Converter for Analog or Mixed Mode.....	204
B.5.2 Audio Levels for the Site Gateway (Conventional Channel Interface) for Analog or Mixed Mode.....	205
B.5.3 Audio Levels for Base Radios for Analog or Mixed Mode.....	206
B.5.4 Reducing Delay for Analog Simulcast.....	206
B.6 Checking Audio Polarity.....	207

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# List of Figures

Figure 1: MLC 8000 Front View.....	33
Figure 2: MLC 8000 Rear View.....	33
Figure 3: SDM3000 Advanced Unit – Rear View.....	38
Figure 4: SDM3000 I/O Expansion Basic Unit – Rear View.....	38
Figure 5: SDM3000 I/O Expansion Advanced Unit – Rear View.....	38
Figure 6: Example Diagram Conventional Expandable Site Subsystem Analog or Digital Co-located with Trunking Expandable Site Subsystem.....	46
Figure 7: ASTRO 25 Analog-Only Non-Simulcast Voting Subsystem Diagram.....	71
Figure 8: ASTRO 25 Analog-Only IP-Based Simulcast Subsystem Diagram.....	85
Figure 9: ASTRO 25 Mixed-Mode Non-Simulcast Voting Subsystem Diagram.....	99
Figure 10: ASTRO 25 Conventional Mixed-Mode Simulcast Voting Subsystem Diagram.....	114
Figure 11: Equipment Cabling for ASTRO 25 Digital-Only Simulcast Voting Subsystem Diagram.....	126
Figure 12: ASTRO 25 Circuit-Based Analog-Only Simulcast Voting Subsystem Diagram.....	135
Figure 13: Circuit-Based Conventional Analog-Only Simulcast Voting Subsystem Diagram.....	145
Figure 14: Analog-Only IP-Based Simulcast Voting Subsystem Diagram.....	158
Figure 15: Amplitude Optimization Test Setup.....	168
Figure 16: Frequency Response.....	173
Figure 17: Frequency Response Result.....	174
Figure 18: Coarse Level Adjustment (Transmit Audio Path) Setup Diagram.....	175
Figure 19: Coarse Level Adjustment (Conventional Systems PL/DPL Adjustment) Setup Diagram....	177
Figure 20: Fine Amplitude Adjustment Setup Diagram.....	178
Figure 21: Final System Level Check Setup Diagram.....	180
Figure 22: Coarse Level Adjustment for Transmit Audio Path Setup Diagram.....	184
Figure 23: BR Audio Monitoring and Calibration — IP Simulcast: Subsite Link Converter Tab.....	185
Figure 24: Coarse Level Adjustment (Conventional Systems PL/DPL Adjustment) Setup Diagram....	186
Figure 25: Modify Device Configuration – IP Simulcast Tab.....	187
Figure 26: Fine Amplitude Adjustment Setup Diagram.....	188
Figure 27: BR Audio Monitoring and Calibration — IP Simulcast: Subsite Link Converter Tab.....	189
Figure 28: Final System Level Check Setup Diagram.....	190
Figure 29: Voter Link Delay Management and Calibration Window – BR Calibration Tab for an IP Simulcast System.....	191
Figure 30: MCC 7500 Audio Level Settings Analog Unity Gain.....	203
Figure 31: MCC 7500 Audio Level Settings Mixed Mode Unity Gain.....	204

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# List of Tables

Table 1: MLC 8000 Devices Per Site Type.....	31
Table 2: Subsystem Examples.....	32
Table 3: MLC 8000 Link Converter and MOSCAD NFM I/O Monitoring Indications (IP Simulcast).....	39
Table 4: MLC 8000 Link Converter and MOSCAD NFM I/O Monitoring Indications (Non IP Simulcast).....	41
Table 5: MLC 8000 Analog Comparator and MOSCAD NFM I/O Monitoring Indications (IP Simulcast).....	42
Table 6: MLC 8000 Analog Comparator and MOSCAD NFM I/O Monitoring Indications (Non IP Simulcast).....	44
Table 7: MLC 8000 Subsite Link Converter Jitter Buffer Settings.....	49
Table 8: MLC 8000 Analog Comparator Jitter Buffer Settings.....	49
Table 9: Conventional Configuration settings in CSS for Analog Simulcast.....	51
Table 10: Conventional Configuration settings in CSS for Non Simulcast.....	52
Table 11: Alignment Screen settings in CSS for Analog Simulcast.....	54
Table 12: MLC 8000 Analog Comparator Parameters.....	54
Table 13: Equipment Cabling for ASTRO 25 Analog-Only Non-Simulcast Voting Subsystem.....	71
Table 14: Port Descriptions.....	72
Table 15: Equipment Cabling for ASTRO 25 Analog-Only IP-Based Simulcast Subsystem.....	85
Table 16: Port Descriptions.....	86
Table 17: Equipment Cabling for ASTRO 25 Mixed-Mode Non-Simulcast Voting Subsystem.....	99
Table 18: Port Descriptions.....	100
Table 19: Equipment Cabling for ASTRO 25 Conventional Mixed-Mode Simulcast Voting Subsystem.....	115
Table 20: Port Descriptions.....	116
Table 21: Equipment Cabling for ASTRO 25 Digital-Only Simulcast Voting Subsystem.....	126
Table 22: Port Descriptions.....	127
Table 23: Equipment Cabling for ASTRO 25 Circuit-Based Analog-Only Simulcast Voting Subsystem.....	136
Table 24: Port Descriptions.....	136
Table 25: Equipment Cabling for Circuit-Based Conventional Analog-Only Simulcast Voting Subsystem.....	145
Table 26: Port Descriptions.....	146
Table 27: Equipment Cabling for Analog-Only IP-Based Simulcast Voting Subsystem.....	159
Table 28: Port Descriptions.....	160
Table 29: Bessel Null Calibration Setup.....	167
Table 30: Base Station Alignment Characteristics.....	171
Table 31: Radio Deviation Settings (QUANTAR or GTR 8000).....	176
Table 32: Recovered Level Entry Log.....	182

Table 33: MLC 8000 Link Converter Parameters.....	204
Table 34: Site Gateway (Conventional Channel Interface) Audio Level Settings for Analog or Mixed Mode Conventional Channel.....	205
Table 35: Recommended Base Radio Audio Level Settings for Conventional Channels - Analog or Mixed mode.....	206
Table 36: Timing Dependencies.....	206

# List of Processes

Navigating This Guide .....	27
Implementing MLC 8000s .....	29
Setting Up the MCN Server 8000 Remote Comparator Display Software .....	33
Setting Up MOSCAD Network Fault Management (NFM) Monitoring .....	35
Installing MLC 8000s with Off-Site Preconfiguration .....	55
Implementing an ASTRO 25 Analog-Only Non-Simulcast Voting Subsystem .....	61
Installing Equipment for Each Channel in the Prime Site .....	61
Installing Equipment For Each Channel in Subsites .....	64
Configuring MLC 8000 Devices with the MLC 8000 Configuration Tool .....	66
Verifying the Installation and Configuration .....	68
Implementing an ASTRO 25 Analog-Only IP-Based Simulcast Subsystem .....	75
Installing Equipment for Each Channel in the Prime Site .....	75
Installing Equipment for Each Channel in Subsites .....	78
Configuring MLC 8000 Devices with the MLC 8000 Configuration Tool .....	80
Verifying the Installation and Configuration .....	82
Implementing an ASTRO 25 Mixed-Mode Non-Simulcast Voting Subsystem .....	89
Installing Equipment for Each Channel in the Prime Site .....	89
Installing Equipment for Each Channel in Subsites .....	92
Configuring MLC 8000 Devices with the MLC 8000 Configuration Tool .....	94
Verifying the Installation and Configuration .....	96
Implementing an ASTRO 25 Conventional Mixed-Mode Simulcast Voting Subsystem .....	103
Installing Equipment for Each Channel in the Prime Site .....	103
Installing Equipment for Each Channel in Subsites .....	106
Configuring MLC 8000 Devices with the MLC 8000 Configuration Tool .....	109
Verifying the Installation and Configuration .....	111
Implementing an ASTRO 25 Digital-Only Simulcast Voting Subsystem .....	119
Installing Equipment for Each Channel in Subsites .....	119
Configuring MLC 8000 Devices with the MLC 8000 Configuration Tool .....	122
Verifying the Installation and Configuration .....	124
Implementing an ASTRO 25 Circuit-Based Analog-Only Simulcast Voting Subsystem .....	129
Installing Equipment for Each Channel in the Prime Site .....	129
Configuring MLC 8000 Devices with the MLC 8000 Configuration Tool .....	132
Verifying the Installation and Configuration .....	134
Implementing a Circuit-Based Analog-Only Simulcast Voting Subsystem .....	139
Installing Equipment for Each Channel in the Prime Site .....	139
Configuring MLC 8000 Devices with the MLC 8000 Configuration Tool .....	142

Verifying the Installation and Configuration .....	144
Implementing an Analog-Only IP-Based Simulcast Voting Subsystem .....	149
Installing Equipment for Each Channel in the Prime Site .....	149
Installing Equipment for Each Channel in Subsites .....	152
Configuring MLC 8000 Devices with the MLC 8000 Configuration Tool .....	154
Verifying the Installation and Configuration .....	156
Calibrating and Optimizing Circuit-Based Simulcast .....	169
Configuring the MLC 8000 for IP-Based Simulcast .....	182

# List of Procedures

Adding MLC 8000 Devices to the MLC 8000 Sites in Existing SDM3000 Builder Project .....	37
Configuring GTR 8000 Base Radios with CSS .....	50
Setting up Test Equipment .....	166
Calibrating the DSA to Measure FM Deviation .....	167
Checking RF Signal Quality .....	168
Aligning the QUANTAR Base Radio .....	170
Performing Coarse Level Adjustment (Transmit Audio Path 1 kHz) .....	175
Performing Coarse Level Adjustment (Conventional Systems PL/ DPL Adjustment) .....	177
Performing Fine Amplitude Adjustment .....	178
Performing a Final System-Level Check .....	180
Performing Coarse Level Adjustment (Transmit Audio Path 1 kHz) .....	184
Performing Coarse Level PL/DPL Adjustment (Conventional Systems) .....	186
Performing Fine Amplitude Adjustment .....	188
Performing a Final System-Level Check .....	190
Troubleshooting the Transmit (TX) Path for Simulcast Subsystems .....	193
Troubleshooting the Transmit (TX) Path for Non-Simulcast Subsystems .....	196
Troubleshooting General Transmit and Infrastructure for the GTR 8000 .....	200
Troubleshooting Misaligned Reference Modulation Compensation (Final System-Level Check — IP Based Simulcast) .....	202
Checking Audio Polarity .....	207

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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 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 24](#) 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 27](#) provides information that is common to all MLC 8000 implementations.
- [ASTRO 25 Analog-Only Non-Simulcast Voting Subsystem on page 61](#) 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 103](#) provides 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 163](#) provides figures and tables defining the cables used in the various MLC 8000 implementations.
- [Optimization/Calibration for Conventional Simulcast on page 165](#) provides optimization/calibration procedures for conventional analog circuit-based and IP-based simulcast subsystems.
- [Troubleshooting the Optimization/Calibration on page 193](#) 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
<i>Standards and Guidelines for Communication Sites</i>	Provides standards and guidelines that should be followed when setting up a Motorola Solutions communications site. Also known as the R56 manual. This may be purchased on CD 9880384V83, by calling the North America Parts Organization at 800-422-4210 (or the international number: 302-444-9842).
<i>System Overview and Documentation</i>	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.
<i>MLC 8000 Configuration Tool User Guide</i>	Provides information about software used for configuration, analog voting display, and analog voting control for the MLC 8000 device, which is used as an analog conventional comparator/voter for analog IP-based simulcast and non-simulcast voting, and as a subsite link converter for conventional analog, digital and mixed mode channels.
<i>MLC 8000 Comparator Feature Guide</i>	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.
<i>Configuration/Service Software (CSS) Online Help</i>	Provides descriptions and important information for all screens and parameters used with all G-series devices. For the conventional GTR 8000 Base Radio, see the “Conventional Site – Analog/Mixed Mode” contents for digital, analog, and mixed mode conventional help.

*Table continued...*

Related Information	Purpose
<i>QUANTAR® and QUANTRO® Radio Service Software (RSS) Instruction Manual</i> (6881085E35)	Provides descriptions and important information for screens and parameters used with Motorola Solutions base station products and ancillary equipment.
<i>GCM 8000 Comparator</i>	Covers the installation, configuration and management of the GCM 8000 Comparator that supports voting, multicast and simulcast operations.
<i>GTR 8000 Expandable Site Subsystem</i>	Includes information about the GTR 8000 Expandable Site Subsystem (containing base radio, site controller, X-hub, and RDM components) which provides the RF interface for voice, data and control traffic transmissions between the infrastructure equipment and subscriber radios that use the system.
<i>QUANTAR Instruction Manual</i> (6881095E05)	Provides all relating information for the installation and operation of the QUANTAR® for conventional, ASTRO®, 6809 Trunking, and Intellicom Repeater systems.
<i>GPS Simulcast Installation</i> (6881098E65)	Describes the configuration, operation, and optimization of equipment unique to analog simulcast systems using Digital Simulcast Modems, second generation (DSM-IIIs) (digital transport; Trunked and Conventional systems), ASTRO® simulcast systems (Trunked and Conventional systems), and mixed mode simulcast systems (Trunked systems only).
<i>GGM 8000 System Gateway</i>	Provides information relating to the installation, configuration and management of the GGM 8000 Gateway as used in various network locations.
<i>Provisioning Manager</i>	The Provisioning Manager manual provides a description of the Provisioning Manager server application, includes information to tailor this application for system use and contains information to provision your ASTRO 25 radio communication system with various system-level, user-level and device-level configuration parameters required for proper system operation. This manual also includes reference and troubleshooting information to ensure efficient and effective use of this application.
<i>Configuration Manager for Conventional Systems User Guide</i>	Covers the use of the Configuration Manager application to configure Conventional System parameters for consoles, channels and user objects.
<i>L and M Core Conventional Architectures Engineer Guide</i>	Identifies and describes the Centralized Conventional Architectures and Distributed Conventional Architecture supported by an L Series or an M Series Zone Core in an ASTRO® 25 system designed to support trunking and/or conventional channel resources.
<i>K Core Conventional Architecture Engineer Guide</i>	Provides information identifying the conventional architectures of the Conventional Hub Sites and Conventional Base Radio Sites in the ASTRO 25 Conventional & Integrated Data System supported by the K core.
<i>Conventional Operations</i>	Provides information regarding conventional channel resource operating characteristics in standalone systems or ASTRO 25 radio communication systems with K Series, L Series or M Series.

Table continued...

Related Information	Purpose
<i>MOSCAD Network Fault Management Feature Guide</i>	Provides information about an optional solution that provides tools to collect and forward data concerning the state of devices in ASTRO® 25 systems. Includes information about installation, configuration, management and use of MOSCAD® Network Fault Management (NFM).
<i>SDM3000 (Site Device Manager) Owner's Manual</i>	Provides information for the Motorola Solutions SDM3000 hardware-based devices and SDM3000 I/O Expansion Unit models.  This documentation is installed with the SDM3000 Builder application on the MOSCAD NFM Graphical Master Computer (GMC) and on some service laptops.
<i>SDM3000 Builder User Guide</i>	Provides information required to install, configure, manage and use the SDM3000 Builder software that is used 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.
<i>GMC/GWS for MOSCAD NFM Operator Manual</i>	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. This documentation is installed on the GMC and on GWS as part of the GMC Application from the <i>GMC/GWS GUI and SDM3000 Config S/W and Doc for MOSCAD NFM DVD</i> (F5628A).
<i>MCN Server 8000™ Remote Comparator Display Software for Motorola Solutions IP Comparators manual</i>	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, MLC 8000 Analog Comparator, and Mixed Mode voting systems.

## 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 32](#).
- 2 Access the appropriate content in this manual to aid in installing the MLC 8000 devices.

If...	Then...
<b>If you want to install the MLC 8000s in an ASTRO® 25 analog-only non-simulcast voting subsystem,</b>	perform the following actions: <ol style="list-style-type: none"><li>a Read <a href="#">Common Information for MLC 8000 Implementations on page 27</a>.</li><li>b Use <a href="#">ASTRO 25 Analog-Only Non-Simulcast Voting Subsystem on page 61</a> to install the MLC 8000 hardware.</li><li>c Consult with <a href="#">MLC 8000 Radio Ports Cabling on page 163</a> for cabling information.</li></ol>
<b>If you want to install the MLC 8000s in an ASTRO® 25 analog-only IP-based simulcast subsystem,</b>	perform the following actions: <ol style="list-style-type: none"><li>a Read <a href="#">Common Information for MLC 8000 Implementations on page 27</a>.</li><li>b Use <a href="#">ASTRO 25 Analog-Only IP-Based Simulcast Subsystem on page 75</a> to install the MLC 8000 hardware.</li></ol>

If...	Then...
	<p><b>c</b> Consult with <a href="#">MLC 8000 Radio Ports Cabling on page 163</a> for cabling information.</p>
<b>If you want to install the MLC 8000s in an ASTRO® 25 mixed mode non-simulcast voting subsystem</b>	<p>perform the following actions:</p> <p><b>a</b> Read <a href="#">Common Information for MLC 8000 Implementations on page 27</a>.</p> <p><b>b</b> Use <a href="#">ASTRO 25 Mixed-Mode Non-Simulcast Voting Subsystem on page 89</a> to install the MLC 8000 hardware.</p> <p><b>c</b> Consult with <a href="#">MLC 8000 Radio Ports Cabling on page 163</a> for cabling information.</p>
<b>If you want to install the MLC 8000s in a conventional mixed-mode simulcast voting subsystem,</b>	<p>perform the following actions:</p> <p><b>a</b> Read <a href="#">Common Information for MLC 8000 Implementations on page 27</a>.</p> <p><b>b</b> Use <a href="#">ASTRO 25 Conventional Mixed-Mode Simulcast Voting Subsystem on page 103</a> to install the MLC 8000 hardware.</p> <p><b>c</b> Consult with <a href="#">MLC 8000 Radio Ports Cabling on page 163</a> for cabling information.</p>
<b>If you want to install the MLC 8000s in an ASTRO® 25 digital-only simulcast voting subsystem,</b>	<p>perform the following actions:</p> <p><b>a</b> Read <a href="#">Common Information for MLC 8000 Implementations on page 27</a>.</p> <p><b>b</b> Use <a href="#">ASTRO 25 Digital-Only Simulcast Voting Subsystem on page 119</a> to install the MLC 8000 hardware.</p> <p><b>c</b> Consult with <a href="#">MLC 8000 Radio Ports Cabling on page 163</a> for cabling information.</p>
<b>If you want to install the MLC 8000s in an ASTRO® 25 circuit-based analog-only simulcast voting subsystem,</b>	<p>perform the following actions:</p> <p><b>a</b> Read <a href="#">Common Information for MLC 8000 Implementations on page 27</a>.</p> <p><b>b</b> Use <a href="#">ASTRO 25 Circuit-Based Analog-Only Simulcast Voting Subsystem on page 129</a> to install the MLC 8000 hardware.</p> <p><b>c</b> Consult with <a href="#">MLC 8000 Radio Ports Cabling on page 163</a> for cabling information.</p>
<b>If you want to install the MLC 8000s in a circuit-based analog-only simulcast voting subsystem,</b>	<p>perform the following actions:</p> <p><b>a</b> Read <a href="#">Common Information for MLC 8000 Implementations on page 27</a>.</p> <p><b>b</b> Use <a href="#">Circuit-Based Analog-Only Simulcast Voting Subsystem on page 139</a> to install the MLC 8000 hardware.</p> <p><b>c</b> Consult with <a href="#">MLC 8000 Radio Ports Cabling on page 163</a> for cabling information.</p>
<b>If you want to install the MLC 8000s in an analog-only IP-based simulcast voting subsystem,</b>	<p>perform the following actions:</p> <p><b>a</b> Read <a href="#">Common Information for MLC 8000 Implementations on page 27</a>.</p>

If...	Then...
	<p><b>b</b> Use <a href="#">Analog-Only IP-Based Simulcast Voting Subsystem on page 149</a> to install the MLC 8000 hardware.</p> <p><b>c</b> Consult with <a href="#">MLC 8000 Radio Ports Cabling on page 163</a> for cabling information.</p>

3 Optimize and calibrate the settings for conventional analog circuit-based and IP-based simulcast subsystems. See [Optimization/Calibration for Conventional Simulcast on page 165](#).



**NOTICE:** If you run into issues with the MLC 8000 implementation, consult with [Troubleshooting the Optimization/Calibration on page 193](#).

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

If...	Then...
<b>MOSCAD NFM</b>	See <a href="#">Setting Up MOSCAD Network Fault Management (NFM) Monitoring on page 35</a> for more information.
<b>MCN Server 8000™ Remote Comparator Display Software</b>	See <a href="#">Setting Up the MCN Server 8000 Remote Comparator Display Software on page 33</a> for more information.
<b>Conventional GTR 8000 Base Radios, if replacing QUANTAR® Base Radios</b>	See <a href="#">Replacement of QUANTARs with GTR 8000 Base Radios on page 35</a> 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 32](#).

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

If...	Then...
<b>MOSCAD NFM</b>	See <a href="#">Setting Up MOSCAD Network Fault Management (NFM) Monitoring on page 35</a> for more information.
<b>MCN Server 8000™ Remote Comparator Display Software</b>	See <a href="#">Setting Up the MCN Server 8000 Remote Comparator Display Software on page 33</a> for more information.
<b>Conventional GTR 8000 Base Radios, if replacing QUANTAR® Base Radios</b>	See <a href="#">Replacement of QUANTARs with GTR 8000 Base Radios on page 35</a> 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 31](#).
- 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...
<b>GCM 8000 comparator</b>	Installed at the following site types: <ul style="list-style-type: none"> <li>• ASTRO 25 Mixed-Mode Non-Simulcast Voting Subsystem</li> <li>• ASTRO 25 Digital-Only Simulcast Voting Subsystem (With QUANTAR® station)</li> </ul>
<b>Site Gateway (Conventional Channel Interface), that is, GGM 8000 Gateway hardware platform</b>	Installed at the following site types: <ul style="list-style-type: none"> <li>• ASTRO 25 Analog-Only Non-Simulcast Voting Subsystem</li> <li>• ASTRO 25 Analog-Only IP-Based Simulcast Subsystem</li> <li>• ASTRO 25 Mixed-Mode Non-Simulcast Voting Subsystem</li> <li>• ASTRO 25 Circuit-Based Analog-Only Simulcast Subsystem</li> </ul> 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.
<b>Simulcast Site Reference devices</b>	Installed at the following site types: <ul style="list-style-type: none"> <li>• ASTRO 25 Analog-Only IP-Based Simulcast Subsystem</li> <li>• Analog-Only IP-Based Simulcast Voting Subsystem</li> </ul> If the Simulcast Site Reference device does not have sufficient capacity, then you may want to install a certified distribution amplifier. See <a href="#">Simulcast Site Reference Considerations on page 48</a>
<b>MCN Server 8000 Remote Comparator Display Software (server/client)</b>	Two PCs required

5 Review bandwidth and other considerations, see [Ethernet Bandwidth Considerations for MLC 8000s on page 47](#).

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.	Base Radio site
	The MLC 8000 Subsite Link Converter can connect to up to four co-located receivers.	
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.	Base Radio site
	The MLC 8000 Subsite Link Converter can connect to up to four co-located receivers.	
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 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 <a href="#">ASTRO 25 Analog-Only Non-Simulcast Voting Subsystem on page 61</a>
ASTRO 25 Analog-Only IP-Based Simulcast Subsystem	See <a href="#">ASTRO 25 Analog-Only IP-Based Simulcast Subsystem on page 75</a>
ASTRO 25 Mixed-Mode Non-Simulcast Voting Subsystem	See <a href="#">ASTRO 25 Mixed-Mode Non-Simulcast Voting Subsystem on page 89</a>
ASTRO 25 Digital-Only Simulcast Voting Subsystem (with QUANTAR® station)	See <a href="#">ASTRO 25 Digital-Only Simulcast Voting Subsystem on page 119</a>
ASTRO 25 Circuit-Based Analog-Only Simulcast Voting Subsystem	See <a href="#">ASTRO 25 Circuit-Based Analog-Only Simulcast Voting Subsystem on page 129</a>
Circuit-Based Analog-Only Simulcast Voting Subsystem	See <a href="#">Circuit-Based Analog-Only Simulcast Voting Subsystem on page 139</a>
Analog-Only IP-Based Simulcast Voting Subsystem	See <a href="#">Analog-Only IP-Based Simulcast Voting Subsystem on page 149</a>

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 45](#).

## 1.4

## MLC 8000 Ports and LEDs

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

1.4.1

## MLC 8000 Hardware Views

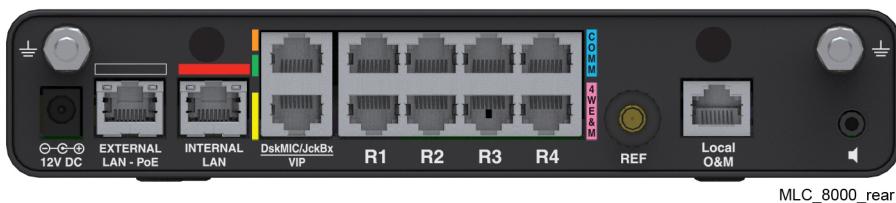
### Front and Rear Views of the MLC 8000

 **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



Figure 2: MLC 8000 Rear View



1.5

## MLC 8000 Safety and General Information

Refer to the *MLC 8000 Comparator Feature Guide* manual.

1.6

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

Refer to the *MLC 8000 Configuration Tool User Guide* manual 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* manual.

- 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 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
- MLC 8000 Analog Comparators
- Mixed Mode Voting — both GCM 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 dispatch console or a customer-provided PC for the MCN Client
- 2  **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.
- 3 Cable the hardware by connecting the PCs to the LAN switch using an RJ45 connector.
- 4 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
- 5 Generate the system configuration files. Refer to the following sections in the *MCN Server 8000™ Remote Comparator Display Software for Motorola Solutions IP Comparators* manual:
  - “GCM 8000 Interfacing” section
  - “MLC 8000 Interfacing” section
- 6 You must enter specific information, such as the IP address of the comparator, into the MCN Server 8000 system data files.
- 7 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* manual 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* manual 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* manual.

**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* manual
- 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* manual.

- 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 37](#).

- 6 Build GMC Configuration and Tags.

See “Building GMC Configuration and Tags” in the *MOSCAD Network Fault Management Feature Guide* manual.

- 7 Configure SDM3000 RTU.

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



**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* manual.

- 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* manual.

### 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* manual 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* manual.

**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 39](#)
- [MLC 8000 Link Converter MOSCAD NFM I/O Monitoring Indications \(Non IP Simulcast\) on page 40](#)
- [MLC 8000 Analog Comparator and MOSCAD NFM I/O Monitoring Indications \(IP Simulcast\) on page 41](#)
- [MLC 8000 Analog Comparator and MOSCAD NFM I/O Monitoring Indications \(Non IP Simulcast\) on page 43](#)

### SDM3000 RTU Ports

See [MLC 8000 Ports and LEDs on page 32](#) 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 163](#).

**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
- <xxxxxxxxxx> 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 Wir- ing Pun- ch Bloc- k		SDM3000 Builder						
	#	Name	I/O	Ob- ject	Name	"On" Message	"Off" Mes- sage	Descrip- tion	Leg- end
1	5v	Output	AI	EXS- xxxxxx xxxx	Present	Not Present or VIP cable is discon- nected	EXS- xxxxxxxx xx	Unit pres- ence	major
3	VIP 2	Output	DI	GPN- xxxxxx xxxx	Not Synch(G PS)	GPS in synch	GPN- xxxxxxxx xx	Synch with GPS	minor

Table continued...

Pin	I/O Wir- ing		SDM3000 Builder						
	Pun ch	Bloc k							
#	Name	I/O	Ob- ject	Name	"On" Message	"Off" Mes- sage	Descrip- tion	Leg- end	Se- verity
4	VIP 3	Output	DI	L2V-xxxxxx xxxx	VGU link failed	VGU link OK	L2V-xxxxxxxx xx	Cmprtr Ink fail	major
5	VIP 4	Output	DI	L2B-xxxxxx xxxx	BR link failed	BR links OK	L2B-xxxxxxxx xx	Link to BR fail	major
6	VIP 5	Output	DI	BLT-xxxxxx xxxx	Bad Launch time	Launch time OK	BLT-xxxxxxxx xx	Bad launch time	minor
7	VIP 6	Input	DO	RST-xxxxxx xxxx	Device restart	RST complete	RST-xxxxxxxx xx	Re-start 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
- <xxxxxxxxxx> 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 Wir- ing Pun ch Bloc k		SDM3000 Builder							
	#	Name	I/O	Ob- ject	Name	"On" Mes- sage	"Off" Message	Description	Leg- end	Se- verity
1	5v	Output	AI	EXS- xxxxxx xxxx	Present	Not Present or VIP ca- ble is dis- connec- ted		EXS- xxxxxx xxx	Unit pres- ence	major
3	VIP 2	N/A	N/A				Not used			
4	VIP 3	Output	DI	L2V- xxxxxx xxxx	VGU links fail	VGU link(s) OK	L2V- xxxxxx xxx	Cmprt r Ink fail		major
5	VIP 4	Output	DI	L2B- xxxxxx xxxx	BR links failed	BR link(s) OK	L2B- xxxxxx xxx	Link to BR fail		major
6	VIP 5	N/A	N/A			Not used				
7	VIP 6	Input	DO	RST- xxxxxx xxxx	Device restart	RST complete	RST- xxxxxx xxx	Re- start de- vice		nor- mal

#### 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

- <xxxxxxxxxx> 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 Wir- ing		SDM3000 Builder							
	#	Name	I/O	Ob- ject	Name	"On" Mes- sage	"Off" Mes- sage	Description	Leg- end	Se- verity
1	5v	Output	AI	EXS- xxxxxx xxxxx	Present	Not Present or VIP cable is discon- nected	EXS- xxxxxxxxxx	Unit pres- ence		critical
3	VIP2	Output	DI	GPN- xxxxxx xxxxx	Not Sync (Lo- cation)	Location in synch	GPN- xxxxxxxxxx	Synch with Loca- tion		critical
4	VIP3	Output	DI	L2B- xxxxxx xxxxx	BR links failed	BR links OK	L2B- xxxxxxxxxx	Link to BR fail		major
5	VIP4	Output	DI	LDL- xxxxxx xxxxx	Bad link delay or console port's ALC is out of dynam- ic range	AGUs in synch and con- sole port's ALC is within dynamic range	LDL- xxxxxxxxxx	Link delay or con- sole port's ALC dy- namic range		major

Table continued...

Pin	I/O Wir- ing		SDM3000 Builder								
	Pun ch	Blo ck									
#	Name	I/O	Ob- ject	Name	"On" Mes- sage	"Off" Mes- sage	Description	Leg- end	Se- verity		
6	VIP5	N/A	N/A				Not Used				
7	VIP6	Input	DO	RST- xxxxxx xxxx	Device restart	RST com- plete	RST- xxxxxxxxxx	Re- start device	nor- mal		

#### 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
- <xxxxxxxxxx> 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 Wir- ing		SDM3000 Builder						
	Pun ch	Bloc k							
#	Name	I/O	Ob- ject	Name	"On" Mes- sage	"Off" Mes- sage	Descrip- tion	Leg- end	Se- verity
1	5v	Output	AI	EXS-xxxxxx xxxxx	Present	Not Present or VIP cable is discon- nected	EXS- xxxxxxxxxx x	Unit pres- ence	critical
3 VIP 2 N/A N/A Not used									
4	VIP 3	Output	DI	L2B-xxxxxx xxxxx	BR links failed	BR links OK	L2B- xxxxxxxxxx x	Link to BR fail	major
5	VIP 4	Output	DI	NOS-xxxxxx xxxxx	BR not synche d or console port's ALC is out of dynam- ic range	BRs synched and console port's ALC is within dynamic range	NOS- xxxxxxxxxx x	BR not synch ed or con- sole port's ALC is out of dy- namic range	major
6	VIP 5	N/A	N/A				Not Used		
7	VIP 6	Input	DO	RST-xxxxxx xxxxx	Device restart	RST com- plete	RST- xxxxxxxxxx x	Re- start device	normal

## 1.13

**Optimization/Calibration for Conventional Simulcast**See [Optimization/Calibration for Conventional Simulcast on page 165](#).

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:

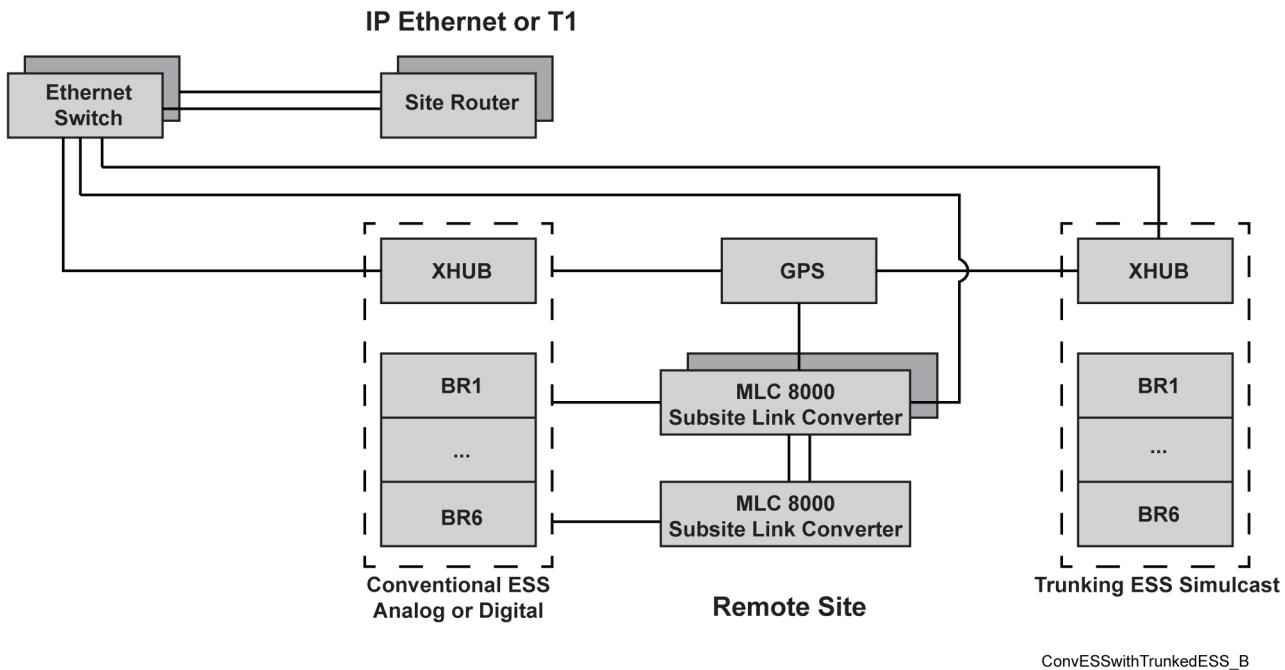
- Sharing of transport equipment that is already installed at a trunked IP Simulcast subsystem by analog conventional channel equipment.
- Sharing of transport equipment that is already installed at a trunked IP Simulcast subsystem by analog conventional channel equipment, plus sharing of site reference/timing 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 47](#).

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* manual.

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**



ConvESSwithTrunkedESS\_B



**IMPORTANT:** In trunked simulcast subsites, external Hewlett Packard (HP) ProCurve 2610 or HP 2620 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 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 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 GCM 8000 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* manual for information about modifying the GCM 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 Hewlett Packard (HP) ProCurve 2610 or HP 2620 switch. Adding an external HP 2610 or HP 2620 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* manual for instructions on how to cable the MLC 8000 to the Simulcast Site Reference.

For more information about these TRAK devices, refer to the *Simulcast Site Reference* manual 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 49](#).

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 49](#).

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	Y.1541 IPDV Jitter Protection (ms)	Frame Size (ms)
Minimum Jitter Buffer Setting (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	Y.1541 IPDV Jitter Protection (ms)	Frame Size (ms)
Minimum Jitter Buffer Setting (ms)		
20 (default)	10	20
40	20	20
50	30	20

*Table continued...*

MLC 8000 Analog Comparator Minimum Jitter Buffer Setting (ms)	Y.1541 IPDV Jitter Protection (ms)	Frame Size (ms)
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.
- 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 50](#) 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 <b>Analog Only</b> .
		Frequency Reference	Select <b>External 5 MHz Back Panel or External 10 MHz Back Panel</b> (depending on the available frequency reference source) for the conventional standalone GTR 8000 Base Radio used in simulcast.
			 <b>NOTICE:</b> Refer to "Frequency Reference" in the CSS Online Help.
Options	n/a	Wildcard	Select <b>Basic</b> .
Infrastructure Interface	Common	Comparator Type	Select <b>DIGI-TAC or MLC 8000</b> .
		Fallback In-Cabinet Repeat	The default is <b>Disabled</b> .
		Analog Simulcast Reverse Burst	Select <b>External</b> for an external source (such as the MLC 8000 Analog Comparator) generating the reverse burst.
		Status Tone	Select <b>Enabled</b> .
			 <b>IMPORTANT:</b> If Status Tone is not enabled, the MLC 8000 Subsite Link Converter fails to recognize the GTR 8000 Base Radio.
		Tx Notch Filter	Select <b>Disabled</b> .

Table continued...

Window in CSS	Tab	Field	Value
		Rx Notch Filter	Select <b>Enabled</b> . Notch Filter must be enabled. If not, voice can cause status tone to be detected.
			 <b>IMPORTANT:</b> 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 <b>PL</b> 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 <b>Disabled</b> .
	Filters and Alarms	Pre-emphasis	Select <b>Enabled</b> .
		De-emphasis	Select <b>Enabled</b> .
		Compander	Select either <b>Disabled</b> or <b>Enabled</b> .
	PL/DPL	Rx Squelch Type	Select <b>PL</b> (if needed for your system requirements) to match the setting of <b>PL</b> in the <b>PL/DPL</b> 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 <b>Base</b> .
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 <b>Analog Only</b> .
		Frequency Reference	Select <b>Internal Frequency Reference</b> 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
			 <b>NOTICE:</b> Refer to "Frequency Reference" in the CSS Online Help.
Options	n/a	Wildcard	Select <b>Basic</b> .
Infrastructure Interface	Common	Comparator Type	Select <b>ASTRO-TAC or GCM 8000 with MLC 8000</b> .
		Fallback In-Cabinet Repeat	The default is <b>Disabled</b> .
		Status Tone	Select <b>Enabled</b> .
			 <b>IMPORTANT:</b> If Status Tone is not enabled, the MLC 8000 Subsite Link Converter fails to recognize the GTR 8000 Base Radio.
		Tx Notch Filter	Select <b>Enabled</b> when tone remote (TRC) is used.
		Rx Notch Filter	Select <b>Enabled</b> . Notch Filter must be enabled. If not, voice can cause status tone to be detected.
			 <b>IMPORTANT:</b> 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 <b>PL</b> 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 <b>Disabled</b> .
	Filters and Alarms	Pre-emphasis	Select <b>Enabled</b> .
		De-emphasis	Select <b>Enabled</b> .
		Compander	Select either <b>Disabled</b> or <b>Enabled</b> .
	PL/DPL	Rx Squelch Type	Select <b>PL</b> (if needed for your system requirements) to match the setting of <b>PL</b> in the <b>PL/DPL</b> 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 <b>Base</b> .
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	<p>The result of subtracting this amount from Peak Audio Level should reflect the <b>Input level Differential (db)</b> setting for the MLC 8000 Subsite Link Converter.</p> <ul style="list-style-type: none"> <li>Input Level Differential = Status Tone/ALMT Level Below Peak Audio + 4.4</li> </ul>



**NOTICE:** See [Audio Level Setting on page 202](#).

## 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 <b>Pre-Emphasis</b> check box in the Modify Device Configuration window for MLC 8000 Analog Comparator (VGU), IP Simulcast tab.	Yes
If Comander is Enabled	If compression* is enabled, select the <b>Compression</b> check box in the Modify Device Configuration window for MLC 8000 Analog Comparator (VGU), IP Simulcast tab.	Yes
Rx Squelch Type = PL	In the <b>PL/DPL</b> list, select <b>PL</b> 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 background 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* 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
- **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* and *Configuration Manager - Conventional* manuals.

## 1.20

## Installing MLC 8000s with Off-Site Preconfiguration

**Prerequisites:** Review the following prerequisites:

- See [Implementing MLC 8000s on page 29](#).
- Set up the Conventional Channels (in *Provisioning Manager* for ASTRO® 25 M series and L series zone core systems, and in *Configuration Manager* for K cores). See [Configuration Manager Settings on page 55](#).

- 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* manual.

**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:**

- If analog configuration, then prestage the MLC 8000 Analog Comparators and MLC 8000 Subsite Link Converters.
  - Obtain the software and login information:
    - MLC 8000 Configuration Tool
    - Login and password information
  - 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 61](#)
      - [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 163](#)
- 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* manual.

- If mixed mode configuration, perform the following steps:

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

- Obtain the software and login information:
  - MLC 8000 Configuration Tool
  - Login and password information
- 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 163](#)
- 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* manual.

**Prestage the mixed mode GCM 8000 Comparators.**

- a Obtain the software and login information:
  - appropriate cables
  - SWDL, CSS, UNC
  - Login and password information  
See “Pre-Installation Tasks” in the *GCM 8000 Comparator Feature Guide* manual.
- b Obtain the necessary tools and equipment, including general tools needed to install, optimize, and service equipment.  
See “General Installation/Troubleshooting Tools” in the *GCM 8000 Comparator Feature Guide* manual.

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 163](#)
- 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* manual.

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* manual. 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...
<b>Option 1: IF the system is prestaged off-site (not at the RF site), and IP address and channel cluster information is available,</b>	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 <a href="#">step 6</a>
<b>Option 2. IF the system is prestaged off-site (not at the RF site), and IP address and channel cluster information is not available,</b>	Use the default IP address, provision a 'dummy' cluster, and download new software to the device (if available). Continue to <a href="#">step 7</a>
<b>Option 3. IF the system is not prestaged off-site,</b>	Continue to <a href="#">step 8</a>



**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 66](#)
  - 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 142](#)
  - For Analog-Only IP-Based Simulcast Voting Subsystem, see [Configuring MLC 8000 Devices with the MLC 8000 Configuration Tool on page 154](#)



**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* manual.
- 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* manual.

- 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* manual.

- 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* manual.

- 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 61](#)
  - [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 29](#).

**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 61](#).
- 2 Perform the tasks to install equipment at subsites. See [Installing Equipment For Each Channel in Subsites on page 64](#).
- 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 66](#).
- 4 Verify the installation and configuration performed in this implementation. See [Verifying the Installation and Configuration on page 68](#).

#### 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 "Installation" in the *GGM 8000 System Gateway* manual.
- 2 Configure Site Gateways (Conventional Channel Interface).  
See "GGM 8000 Configuration" in the *GGM 8000 System Gateway* manual.
- 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* manual.

**b** Mount the MLC 8000 on a tray.

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

**c** Ground the MLC 8000 on a tray.

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

**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* manual.

**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* manual.

**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* manual.

**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* manual.

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

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

**7** Connect the MLC 8000 Analog Comparator to the switch.

See [ASTRO 25 Analog-Only Non-Simulcast Voting Subsystem Equipment Cabling on page 70](#).

**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 70](#).

**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 35](#).

**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 38](#).

**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* manual.



**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* manual.

**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* manual.

- Verify the MLC 8000 power LED turns RED (which indicates the MLC 8000 is in booting state) and after a while, it turns GREEN.
- (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* manual. 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 33](#).



**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* manual.

**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* manual.



**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 64](#).

### 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* manual.
  - b Mount the MLC 8000 on a tray.
 

See "Mounting MLC 8000 on the Tray" in the *MLC 8000 Comparator Feature Guide* manual.
  - c Ground the MLC 8000 on a tray.
 

See "Grounding an MLC 8000 in a Tray" in the *MLC 8000 Comparator Feature Guide* manual.
  - 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* manual.
  - 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* manual.
- 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* manual.
- 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* manual.
- 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 <i>MAC Port Lockdown</i> manual.

If...	Then...
	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 <i>MAC Port Lockdown</i> manual.
	Determine the switch configuration, to find an unused port.  See “HP Switches – Determining Port Connections in ASTRO 25 Systems” in the <i>System LAN Switches</i> manual.
<b>No</b>	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 <i>MAC Port Lockdown</i> manual.
	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 <i>MAC Port Lockdown</i> manual.

- 5 Connect the MLC 8000 Subsite Link Converter to the switch.  
See [ASTRO 25 Analog-Only Non-Simulcast Voting Subsystem Equipment Cabling on page 70](#).
- 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 70](#).
- 7 Configure the base radios to interface with the MLC 8000 devices.  
See [Conventional Configuration Settings for Non Simulcast on page 52](#).
- 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 35](#).
- 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 38](#).
- 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* manual.

 **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* manual.
- 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* manual.

- 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 66.

#### 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...
<b>If the system is pre-staged off site (not at the RF site), and the IP address and channel cluster information is available,</b>	When off site, perform the following options: <a href="#">step 2 - step 12</a> . When on site, retrieve the saved configuration, go to <a href="#">step 13</a> to finish the configuration.
<b>If the system is pre-staged off site (not at the RF site), and IP address and channel cluster information is not available,</b>	On site use these steps to update the configuration and provide the actual IP addresses and channel cluster information, and then set up associations.
<b>If the system is not pre-staged off site,</b>	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* manual.

- 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* manual.

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* manual.

5 Provide the name and type for the channel cluster.

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

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* manual.

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* manual.

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* manual.

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* 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.

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* manual.

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* manual.



**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* manual.



**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* manual.



**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* manual.

The MLC 8000 devices are configured.

**Postrequisites:** See [Verifying the Installation and Configuration on page 68](#).

#### 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...
<b>Yes</b>	For K core systems, run MAC Port Lockdown on the switches. See “Locking HP Switch Ports” in the <i>MAC Port Lockdown</i> manual.
	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 <i>MAC Port Lockdown</i> manual.
<b>No</b>	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 <i>MAC Port Lockdown</i> manual.

If...	Then...
	<p>For M series and L series zone core systems, disable open (unused) ports on switches.</p> <p>See “Locking HP Switch Ports Using a VoyenceControl Template” in the <i>MAC Port Lockdown</i> manual.</p>

- 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* manual.
  - 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* manual.
- 3 Confirm the status of the links.

Devices	Procedure References
<b>MLC 8000 Analog Comparator to MLC 8000 Subsite Link Converter (IP)</b>	
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 <i>MLC 8000 Comparator User Guide</i> manual.
Use MOSCAD NFM. Only if the MO-SCAD NFM subsystem is available in your system.	See “MLC 8000 Analog Comparator — MOSCAD NFM Events Troubleshooting (Non IP Simulcast System)” in the <i>MLC 8000 Comparator User Guide</i> manual.
Pull a log file of the device for error messages.	See “MLC 8000 Device Logs and Recommended Actions” in the <i>MLC 8000 Comparator User Guide</i> manual.
<b>MLC 8000 Subsite Link Converter to Base Radio (4-wire)</b>	
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 <i>MLC 8000 Comparator User Guide</i> manual.
Use MOSCAD NFM. Only if the MO-SCAD NFM subsystem is available in your system.	See “MLC 8000 Link Converter — MO-SCAD NFM Events Troubleshooting (Non IP Simulcast System)” in the <i>MLC 8000 Comparator User Guide</i> manual.
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	See “MLC 8000 Link Converter — MO-SCAD NFM Events Troubleshooting (Non IP Simulcast System)” in the <i>MLC 8000 Comparator User Guide</i> manual.

Table continued...

Devices	Procedure References
VIP to indicate status. So, check each of the four connections.	
Pull a log file of the device for error messages.	See "MLC 8000 Device Logs and Recommended Actions" in the <i>MLC 8000 Comparator User Guide</i> manual.
<b>MLC 8000 Analog Comparator to Site Gateways (Conventional Channel Interface) (4-wire)</b>	
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.

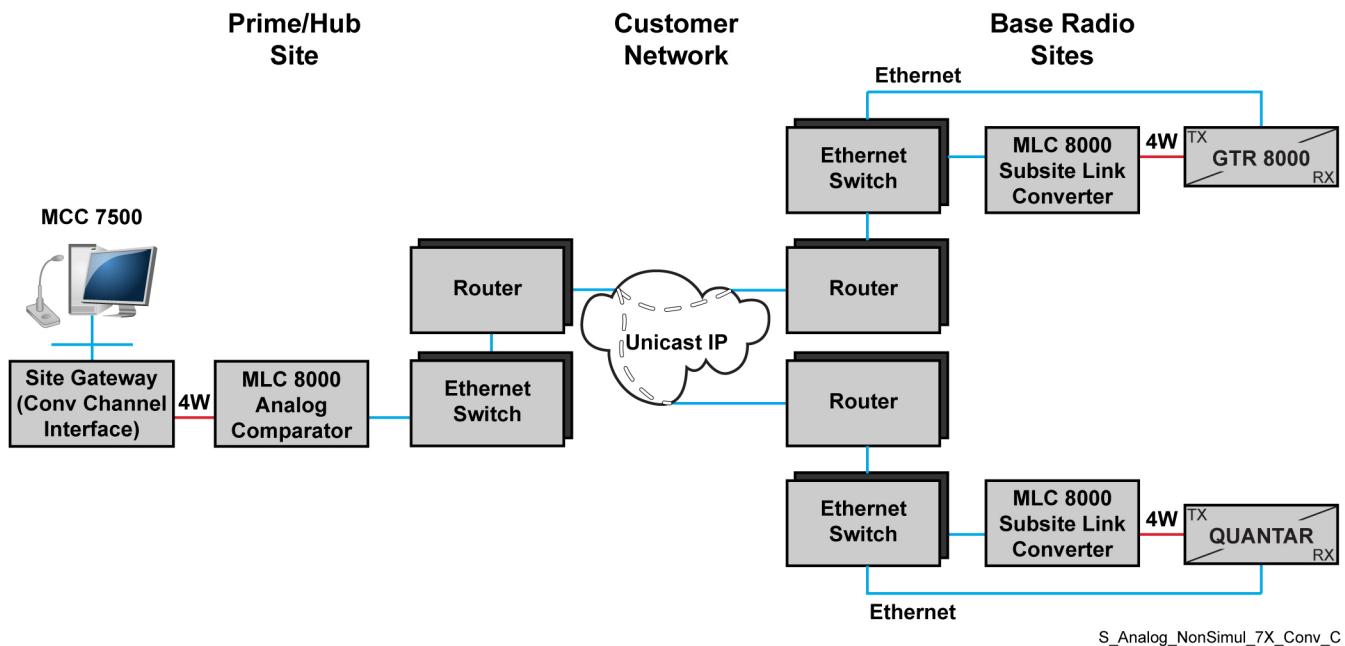
- See "Performing Calibration for an MLC 8000 Subsite Link Converter" in the *MLC 8000 Configuration Tool User Guide* manual.
- See "Performing Calibration for an MLC 8000 Analog Comparator" in the *MLC 8000 Configuration Tool User Guide* manual.

## 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 163](#).

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
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
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

Table continued...

From MLC 8000 Analog Comparator (Prime Site)		To Destination device:		
Port	Connector Type	Device	Connector Type	Cable Description
VIP	RJ45	SDM3000 RTU	I/O Wiring Punch Block	MLC 8000 to MOSCAD NFM Cable
R1-4 4W-E&M	RJ45	QUANTAR® Base Radio (or QUANTAR® Satellite Receiver)	Punch Block	4W MLC 8000 to QUANTAR Cable (Non-Simulcast)
			 <b>NOTICE:</b> In a QUANTAR® Satellite Receiver, 2-wires are always OK.	
R1-4 4W-E&M	RJ45	GTR 8000 Base Radio or GPW 8000	RJ45 Wire-line port	4W MLC 8000 to GTR 8000 Cable (Non-Simulcast)
			 <b>NOTICE:</b> In a GPW Satellite Receiver, 2-wires are always OK.	
R1-4 4W-E&M	RJ45	GTR 8000 Base Radio or GPW 8000, Analog TELCO	RJ45 Wire-line port	4W MLC 8000 to GTR 8000 Cable (Non-Simulcast)
			 <b>NOTICE:</b> In a GPW Satellite Receiver, 2-wires are always OK.	50-pin System Connector, mini SCSI <b>4W MLC 8000 to GTR 8000 Cable (Non-Simulcast) for T57 DLN6821A Cable Assembly Connection</b>



**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 <i>MLC 8000 Comparator Feature Guide</i> manual.
LAN switch	See “HP Switches – Determining Port Connections in ASTRO 25 Systems” in the <i>System LAN Switches</i> manual.
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 <i>SDM3000 Owner’s Manual</i> .

Table continued...

Device	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 <a href="#">Setting Up MOSCAD Network Fault Management (NFM) Monitoring on page 35</a> .
Site Gateway (Conventional Channel Interface)	“Making a Physical 4-W Connection on MLC 8000 Analog Comparator to CCGW” in the <i>GGM 8000 System Gateway</i> manual
QUANTAR® Base Radio	“Backplane Connectors Information” in the <i>QUANTAR Instruction Manual</i> (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 <i>GTR 8000 Base Radio</i> manual  “Transceiver Ports (Front)” in the <i>GTR 8000 Expandable Site Subsystem</i> manual

## 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 196](#).

For general conventional troubleshooting, refer to the *Conventional Operations* manual.

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

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## 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 29](#).

**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* manual.
- 2 Configure Site Gateways (Conventional Channel Interface).

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

**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* manual.

**b** Mount the MLC 8000 on a tray.

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

**c** Ground the MLC 8000 on a tray.

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

**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* manual.



**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* manual.

**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* manual.

**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* manual.

**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* manual.

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

If...	Then...
<b>Yes</b>	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 <i>MAC Port Lockdown</i> manual.
	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 VoyanceControl Template” in the <i>MAC Port Lockdown</i> manual.
	Determine the switch configuration, to find an unused port. See “HP Switches – Determining Port Connections in ASTRO 25 Systems” in the <i>System LAN Switches</i> manual.
<b>No</b>	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 <i>MAC Port Lockdown</i> manual.

If...	Then...
	<p>For M series and L series zone core systems, enable and configure unused ports on switches.</p> <p>See “Enabling/Disabling Ports on HP Switches Using VoyanceControl” in the <i>MAC Port Lockdown</i> manual.</p>

- 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 35](#).
- 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 38](#).
- 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* manual.

 **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* manual.
- 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* manual.

  - 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* manual. 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 33](#).



**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* manual.

**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* manual.



**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* manual.

**b** Mount the MLC 8000 on a tray.

See "Mounting MLC 8000 on the Tray" in the *MLC 8000 Comparator Feature Guide* manual.

**c** Ground the MLC 8000 on a tray.

See "Grounding an MLC 8000 in a Tray" in the *MLC 8000 Comparator Feature Guide* manual.

**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* manual.



**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* manual.

**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* manual.

- 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* manual.
- 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* manual.
- 4 Is MAC Port Lockdown used on the system? (Disable MAC Port Lockdown if applicable)

If... Then...	
<b>Yes</b>	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 <i>MAC Port Lockdown</i> manual.
	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 <i>MAC Port Lockdown</i> manual.
	Determine the switch configuration, to find an unused port. See “HP Switches – Determining Port Connections in ASTRO 25 Systems” in the <i>System LAN Switches</i> manual.
<b>No</b>	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 <i>MAC Port Lockdown</i> manual.
	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 <i>MAC Port Lockdown</i> manual.

- 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](#).
- 7  **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®).
- 8 Configure the base radios to interface with the MLC 8000 devices.  
 See [Conventional Configuration Settings for Analog Simulcast on page 51](#).
- 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 35](#).
- 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 38](#).
- 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* manual.



**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* manual.

**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* manual.

- Verify the MLC 8000 power LED turns RED (which indicates the MLC 8000 is in booting state) and after a while, it turns GREEN.
- 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...
<b>Option 1: IF the system is prestaged off-site (not at the RF site), and IP address and channel cluster information is available</b>	When off-site perform <a href="#">step 2- step 12</a> When onsite, retrieve the saved configuration, skip to <a href="#">step 13</a> and finish the configuration.
<b>Option 2: IF the system is prestaged off-site (not at the RF site), and IP address</b>	On site, use these steps to update the configuration and provide the actual IP address-

If...	Then...
<b>and channel cluster information is not available</b>	es and channel cluster information, and then set up associations.
<b>Option 3: IF the system is not prestaged off-site</b>	Perform all the steps here.

- 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* manual.
- 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* manual.
- 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* manual.
- Provide the name and type for the channel cluster.  
 See “Defining a Conventional Channel Cluster” in the *MLC 8000 Configuration Tool User Guide* manual.
- 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* manual.
- 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.
- 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* manual.
- Configure the MLC 8000 Analog Comparator.  
 See “Configuring an MLC 8000 Analog Comparator for an IP Simulcast System” in the *MLC 8000 Configuration Tool User Guide* manual.
- 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* 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.

**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* manual.

**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* manual.



**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* manual.



**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* manual.



**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* manual.

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...
<b>Yes</b>	For K core systems, run MAC Port Lockdown on the switches. See “Locking HP Switch Ports” in the <i>MAC Port Lockdown</i> manual.
	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 <i>MAC Port Lockdown</i> manual.
<b>No</b>	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 <i>MAC Port Lockdown</i> manual.
	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 <i>MAC Port Lockdown</i> manual.

- 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* manual.
  - 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* manual.
- 3 Confirm the status of the links.

Devices	Procedure References
<b>MLC 8000 Analog Comparator to MLC 8000 Subsite Link Converter (IP)</b>	
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 <i>MLC 8000 Comparator Feature Guide</i> manual.
Use MOSCAD NFM. Only if the MO-SCAD NFM subsystem is available in your system.	See “MLC 8000 Analog Comparator — MOSCAD NFM Events Troubleshooting (IP Simulcast System)” in the <i>MLC 8000 Comparator Feature Guide</i> manual.
Pull a log file of the device for error messages.	See “MLC 8000 Device Logs and Recommended Actions” in the <i>MLC 8000 Comparator Feature Guide</i> manual.

Table continued...

Devices	Procedure References
<b>MLC 8000 Subsite Link Converter to Base Radio (4-wire)</b>	
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 <i>MLC 8000 Comparator Feature Guide</i> manual.
Use MOSCAD NFM. Only if the MOSCAD NFM subsystem is available in your system.	See “MLC 8000 Link Converter — MOSCAD NFM Events Troubleshooting (IP Simulcast System)” in the <i>MLC 8000 Comparator Feature Guide</i> manual.
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.	
Pull a log file of the device for error messages.	See “MLC 8000 Device Logs and Recommended Actions” in the <i>MLC 8000 Comparator Feature Guide</i> manual.
<b>MLC 8000 Analog Comparator to Site Gateways (Conventional Channel Interface) (4-wire)</b>	
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.

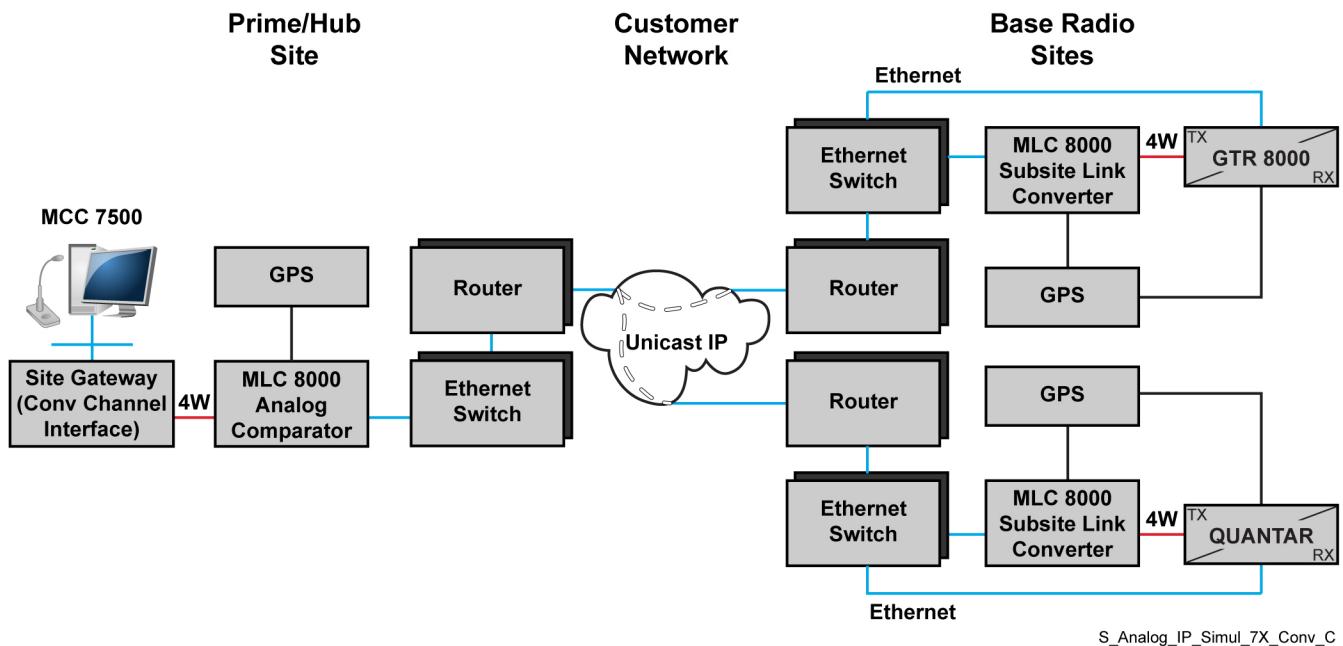
- See “Performing Calibration for an MLC 8000 Subsite Link Converter” in the *MLC 8000 Configuration Tool User Guide* manual.
- See “Performing Calibration for an MLC 8000 Analog Comparator” in the *MLC 8000 Configuration Tool User Guide* manual.
- Continue to [Optimization/Calibration for Conventional Simulcast](#) on page 165.

### 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



S\_Analog\_IP\_Simul\_7X\_Conv\_C



**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 163](#).

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.
			T-BNC	REF signal cable (FKN8718)
				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	<a href="#">MLC 8000 to MOSCAD NFM Cable</a>
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)		
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	50 Pin Connector	4W MLC 8000 to QUANTAR Cable (IP Simulcast)
		 <b>NOTICE:</b> In a QUANTAR® Satellite Receiver, 2-wires are always OK.		
R4 4W-E&M	RJ45	GTR 8000 Base Radio or GPW 8000	RJ45 Punch Block	4W MLC 8000 to GTR 8000 Cable (IP Simulcast)
		 <b>NOTICE:</b> In a GPW Satellite Receiver, 2-wires are always OK.		



**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 ASTRO 25 Analog-Only IP-Based Simulcast Subsystem

Table 16: Port Descriptions

Device	Manual
MLC 8000	See “MLC 8000 Ports” in the <i>MLC 8000 Comparator Feature Guide</i> manual.
Simulcast Site Reference device	See “Cabling the TRAK 9100 SSR” in the <i>Simulcast Site Reference</i> manual.

Table continued...

Device	Manual
LAN switch	See “HP Switches – Determining Port Connections in ASTRO 25 Systems” in the <i>System LAN Switches</i> manual.
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 <i>SDM3000 Owner’s Manual</i> .  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 <a href="#">Setting Up MOSCAD Network Fault Management (NFM) Monitoring on page 35</a> .
Site Gateway (Conventional Channel Interface)	“Making a Physical 4-W Connection on MLC 8000 Analog Comparator to CCGW” in the <i>GGM 8000 System Gateway</i> manual
QUANTAR® Base Radio	“Backplane Connectors Information” in the <i>QUANTAR Instruction Manual</i> (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 <i>GTR 8000 Base Radio</i> manual “Transceiver Ports (Front)” in the <i>GTR 8000 Expandable Site Subsystem</i> manual



**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.

### 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 206](#).

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 193](#).

For general conventional troubleshooting, refer to the *Conventional Operations* manual.

Refer to the *MLC 8000 Comparator Feature Guide* manual 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 29](#).



**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* manual.

- 2 Configure Site Gateways (Conventional Channel Interface).

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



**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* manual.

**b** Mount the MLC 8000 on a tray.

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

**c** Ground the MLC 8000 on a tray.

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

**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* manual.

**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* manual.

**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* manual.

**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* manual.

**6** Install the GCM 8000 Digital Comparator.

See “Mounting the GCM 8000 Comparator” in the *GCM 8000 Comparator Feature Guide* manual.

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

If...	Then...
<b>Yes</b>	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 <i>MAC Port Lockdown</i> manual.
	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 <i>MAC Port Lockdown</i> manual.
	Determine the switch configuration, to find an unused port. See “HP Switches – Determining Port Connections in ASTRO 25 Systems” in the <i>System LAN Switches</i> manual.
<b>No</b>	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 <i>MAC Port Lockdown</i> manual.

If...	Then...
	<p>For M series and L series zone core systems, enable and configure unused ports on switches.</p> <p>See “Enabling/Disabling Ports on HP Switches Using VoyanceControl” in the <i>MAC Port Lockdown</i> manual.</p>

- 8 Connect the MLC 8000 Analog Comparator to the switch.  
See [ASTRO 25 Mixed-Mode Non-Simulcast Voting Subsystem Equipment Cabling on page 99](#).
- 9 Connect the GCM 8000 Digital Comparator to the switch.  
See “Cabling” in the *GCM 8000 Comparator* manual.
- 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 99](#).
- 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 35](#).
- 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 38](#).
- 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* manual.

 **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* manual.
- 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 GCM 8000 Digital Comparator ON.  
See “Power Up” in the *GCM 8000 Comparator Feature Guide* manual.
- 16 In IP Mixed Mode configurations, disable Simulcast operation on the GCM 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* manual.

  - 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* manual. 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 33](#).



**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* manual.

**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* manual.



**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* manual.
  - b Mount the MLC 8000 on a tray.
 

See “Mounting MLC 8000 on the Tray” in the *MLC 8000 Comparator Feature Guide* manual.
  - c Ground the MLC 8000 on a tray.
 

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

**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* manual.

**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* manual.

**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* manual.

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

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

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

See [ASTRO 25 Mixed-Mode Non-Simulcast Voting Subsystem Equipment Cabling on page 99](#).

**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 99](#).

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

See [Conventional Configuration Settings for Non Simulcast on page 52](#).

**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 35](#).

**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 38](#).

**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* manual.



**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* manual.

**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* manual.

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

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

If...	Then...
<b>Option 1: IF the system is prestaged off-site (not at the RF site), and IP address and channel cluster information is available</b>	When off-site perform <a href="#">step 2- step 12</a> When on site, retrieve the saved configuration, skip to <a href="#">step 13</a> and finish the configuration.

If...	Then...
<b>Option 2: IF the system is prestaged off-site (not at the RF site), and IP address and channel cluster information is not available</b>	On site, use these steps to update the configuration and provide the actual IP addresses and channel cluster information, and then set up associations.
<b>Option 3: IF the system is not prestaged off-site</b>	Perform all the steps here.

- 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* manual.
- 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* manual.
- 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* manual.
- Provide the name and type for the channel cluster.
 

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

**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* manual.

**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* manual.



**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* manual.



**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* manual.



**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...
<b>Yes</b>	For K core systems, run MAC Port Lockdown on the switches. See “Locking HP Switch Ports” in the <i>MAC Port Lockdown</i> manual.
	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 <i>MAC Port Lockdown</i> manual.
<b>No</b>	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 <i>MAC Port Lockdown</i> manual.
	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 <i>MAC Port Lockdown</i> manual.

**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* manual.
- 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* manual.

**3** Confirm the status of the links.

Devices	Procedure References
<b>MLC 8000 Analog Comparator to MLC 8000 Subsite Link Converter (IP)</b>	
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 <i>MLC 8000 Comparator Feature Guide</i> manual.
Use MOSCAD NFM. Only if the MO-SCAD NFM subsystem is available in your system.	See “MLC 8000 Analog Comparator — MOSCAD NFM Events Troubleshooting (Non IP Simulcast System)” in the <i>MLC 8000 Comparator Feature Guide</i> manual.
Pull a log file of the device for error messages.	See “MLC 8000 Device Logs and Recommended Actions” in the <i>MLC 8000 Comparator Feature Guide</i> manual.

*Table continued...*

Devices	Procedure References
<b>GCM 8000 Digital Comparator to MLC 8000 Subsite Link Converter (IP)</b>	
Check the COMM LED.	See "MLC 8000 Link Converter LEDs" in the <i>MLC 8000 Comparator Feature Guide</i> manual.
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 <i>MLC 8000 Comparator Feature Guide</i> manual.
<b>MLC 8000 Subsite Link Converter to Base Radio (4-wire)</b>	
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 <i>MLC 8000 Comparator Feature Guide</i> manual.
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 <i>MLC 8000 Comparator Feature Guide</i> manual.
Pull a log file of the device for error messages.	See "MLC 8000 Device Logs and Recommended Actions" in the <i>MLC 8000 Comparator Feature Guide</i> manual.
<b>MLC 8000 Analog Comparator to Site Gateways (Conventional Channel Interface) (4-wire)</b>	
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.

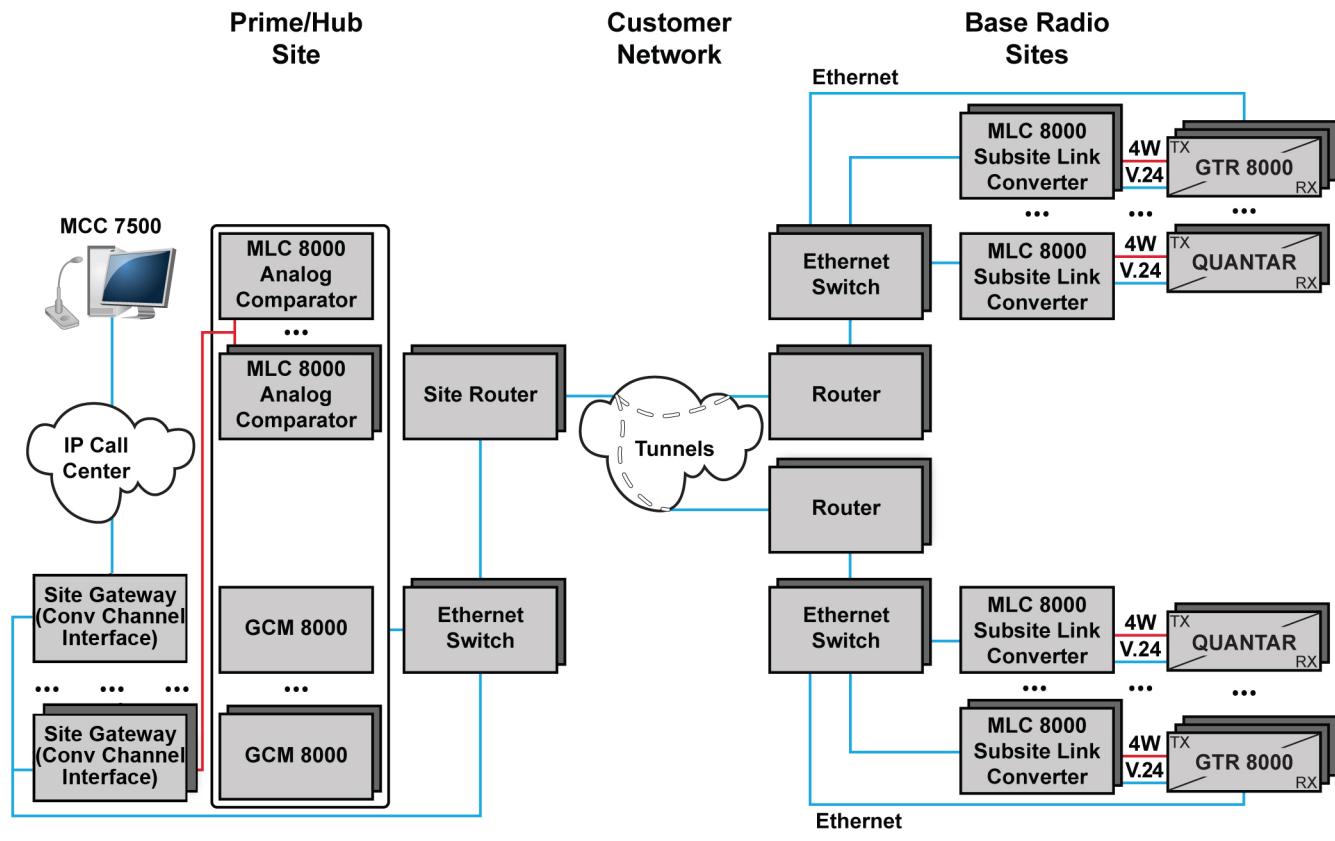
- See "Performing Calibration for an MLC 8000 Subsite Link Converter" in the *MLC 8000 Configuration Tool User Guide* manual.
- See "Performing Calibration for an MLC 8000 Analog Comparator" in the *MLC 8000 Configuration Tool User Guide* manual.

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



S\_Mixed\_NonSimul\_7X\_Conv\_B



**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 163](#).

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

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
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
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
R1-4 4W-E&M	RJ45	QUANTAR® Base Radio	Punch Block	4W MLC 8000 to QUANTAR Cable (Non-Simulcast)
R1-4 4W-E&M	RJ45	GTR 8000 Base Radio	RJ45 Wire-line port	4W MLC 8000 to GTR 8000 Cable (Non-Simulcast)
R1-4 4W-E&M	RJ45	GTR 8000 Base Radio, Analog TELCO	RJ45	4W MLC 8000 to GTR 8000 Cable (Non-Simulcast)
			50-pin System Connector, mini SCSI	4W MLC 8000 to GTR 8000 Cable (Non-Simulcast) for T57 DLN6821A Cable Assembly Connection
R1-4 COMM	RJ45	GTR 8000 Base Radio QUANTAR® Base Radio	RJ45 RJ45	V.24 MLC 8000 to GTR 8000/ QUANTAR Cable

## 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 <i>MLC 8000 Comparator Feature Guide</i> manual.
LAN switch	See “HP Switches – Determining Port Connections in ASTRO 25 Systems” in the <i>System LAN Switches</i> manual.
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 <i>SDM3000 Owner’s Manual</i> .

Table continued...

Device	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 <a href="#">Setting Up MOSCAD Network Fault Management (NFM) Monitoring on page 35</a> .
Site Gateway (Conventional Channel Interface)	“Making a Physical 4-W Connection on MLC 8000 Analog Comparator to CCGW” in the <i>GGM 8000 System Gateway</i> manual
QUANTAR® Base Radio	“Backplane Connectors Information” in the <i>QUANTAR Instruction Manual</i> (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 <i>GTR 8000 Base Radio</i> manual  “Transceiver Ports (Front)” in the <i>GTR 8000 Expandable Site Subsystem</i> manual.

#### 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 196](#).

For general conventional troubleshooting, refer to the *Conventional Operations* manual.

Refer to the *MLC 8000 Comparator Feature Guide* manual 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 29.

 **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* manual.
- 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* manual.

**2** Configure Site Gateways (Conventional Channel Interface).

See "GGM 8000 Configuration" in the *GGM 8000 System Gateway* manual.



**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* manual.

**b** Mount the MLC 8000 on a tray.

See "Mounting MLC 8000 on the Tray" in the *MLC 8000 Comparator Feature Guide* manual.

**c** Ground the MLC 8000 on a tray.

See "Grounding an MLC 8000 in a Tray" in the *MLC 8000 Comparator Feature Guide* manual.

**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* manual.

**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* manual.

**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* manual.

**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* manual.

**6** Install the GCM 8000 Digital Comparator.

See "Mounting the GCM 8000 Comparator" in the *GCM 8000 Comparator* manual.

**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 <i>MAC Port Lockdown</i> manual.
	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 <i>MAC Port Lockdown</i> manual.
	Determine the switch configuration, to find an unused port.

If...	Then...
	See “HP Switches – Determining Port Connections in ASTRO 25 Systems” in the <i>System LAN Switches</i> manual.
<b>No</b>	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 <i>MAC Port Lockdown</i> manual.
	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 <i>MAC Port Lockdown</i> manual.

- 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 GCM 8000 Digital Comparator to the switch.  
See “Cabling” in the *GCM 8000 Comparator* manual.
- 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 35](#).
- 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 38](#).
- 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* manual.

 **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* manual.
- 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 GCM 8000 Digital Comparator ON.  
See “Power Up” in the *GCM 8000 Comparator* manual.
- 16 For Mixed Mode Non Simulcast Voting Subsystem configurations, use CSS to disable Simulcast operation on the GCM 8000. Otherwise, for the Conventional Mixed-Mode Simulcast Voting Subsystem configurations, use CSS to enable Simulcast operation on the GCM 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* manual.

- 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* manual. 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<sup>TM</sup> Remote Comparator Display Software. See [Setting Up the MCN Server 8000 Remote Comparator Display Software on page 33](#).



**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* manual.

**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* manual.



**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<sup>®</sup> 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* manual.

- b** Mount the MLC 8000 on a tray.

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

- c** Ground the MLC 8000 on a tray.

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

- 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* manual.



**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* manual.

- 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* manual.

- 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* manual.

- 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* manual.

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

If... Then...	
<b>Yes</b>	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 <i>MAC Port Lockdown</i> manual.
	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 <i>MAC Port Lockdown</i> manual.
	Determine the switch configuration, to find an unused port. See “HP Switches – Determining Port Connections in ASTRO 25 Systems” in the <i>System LAN Switches</i> manual.
<b>No</b>	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 <i>MAC Port Lockdown</i> manual.
	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 <i>MAC Port Lockdown</i> manual.

- 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 *GTR 8000 Base Radio* manual.

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

See [GTR 8000 Configuration Settings on page 51](#).

- 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 35](#).

- 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 38](#).

- 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* manual.



**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* manual.

- 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* manual.

- 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...
<b>Option 1: IF the system is prestaged off-site (not at the RF site), and IP address and channel cluster information is available</b>	When off-site perform <a href="#">step 2- step 12</a> When on site, retrieve the saved configuration, skip to <a href="#">step 13</a> and finish the configuration.
<b>Option 2: IF the system is prestaged off-site (not at the RF site), and IP address and channel cluster information is not available</b>	On site, use these steps to update the configuration and provide the actual IP addresses and channel cluster information, and then set up associations.
<b>Option 3: IF the system is not prestaged off-site</b>	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* manual.
- 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* manual.
- 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* manual.
- 5 Provide the name and type for the channel cluster.  
See “Defining a Conventional Channel Cluster” in the *MLC 8000 Configuration Tool User Guide* manual.
- 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* manual.
- 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* manual.
- 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* 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.

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* manual.

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* manual 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* 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.

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* manual.

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* manual.



**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* manual.



**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* manual.



**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 <i>MAC Port Lockdown</i> manual.
	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 <i>MAC Port Lockdown</i> manual.
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 <i>MAC Port Lockdown</i> manual.
	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 <i>MAC Port Lockdown</i> manual.

**2** Verify connectivity.

- 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* manual.
- 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* manual.

- 3 Confirm the status of the links.

Devices	Procedure References
<b>MLC 8000 Analog Comparator to MLC 8000 Subsite Link Converter (IP)</b>	
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 <i>MLC 8000 Comparator Feature Guide</i> manual.
Use MOSCAD NFM. Only if the MO-SCAD NFM subsystem is available in your system.	See “MLC 8000 Analog Comparator — MOSCAD NFM Events Troubleshooting (Non IP Simulcast System)” in the <i>MLC 8000 Comparator Feature Guide</i> manual.
Pull a log file of the device for error messages.	See “MLC 8000 Device Logs and Recommended Actions” in the <i>MLC 8000 Comparator Feature Guide</i> manual.
<b>GCM 8000 Digital Comparator to MLC 8000 Subsite Link Converter (IP)</b>	
Check the COMM LED.	See “MLC 8000 Link Converter LEDs” in the <i>MLC 8000 Comparator Feature Guide</i> manual.
Use MOSCAD NFM. Only if the MO-SCAD NFM subsystem is available in your system.	See “MLC 8000 Link Converter — MO-SCAD NFM Events Troubleshooting (IP Simulcast System)” in the <i>MLC 8000 Comparator Feature Guide</i> manual.
Check for a VIP 3 event, which indicates the comparator link failed.	
<b>MLC 8000 Subsite Link Converter to Base Radio (4-wire)</b>	
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 <i>MLC 8000 Comparator Feature Guide</i> manual.
Use MOSCAD NFM. Only if the MO-SCAD NFM subsystem is available in your system.	See “MLC 8000 Link Converter — MO-SCAD NFM Events Troubleshooting (IP Simulcast System)” in the <i>MLC 8000 Comparator Feature Guide</i> manual.
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.	
Pull a log file of the device for error messages.	See “MLC 8000 Device Logs and Recommended Actions” in the <i>MLC 8000 Comparator Feature Guide</i> manual.
<b>MLC 8000 Analog Comparator to Site Gateways (Conventional Channel Interface) (4-wire)</b>	

Table continued...

Devices	Procedure References
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.

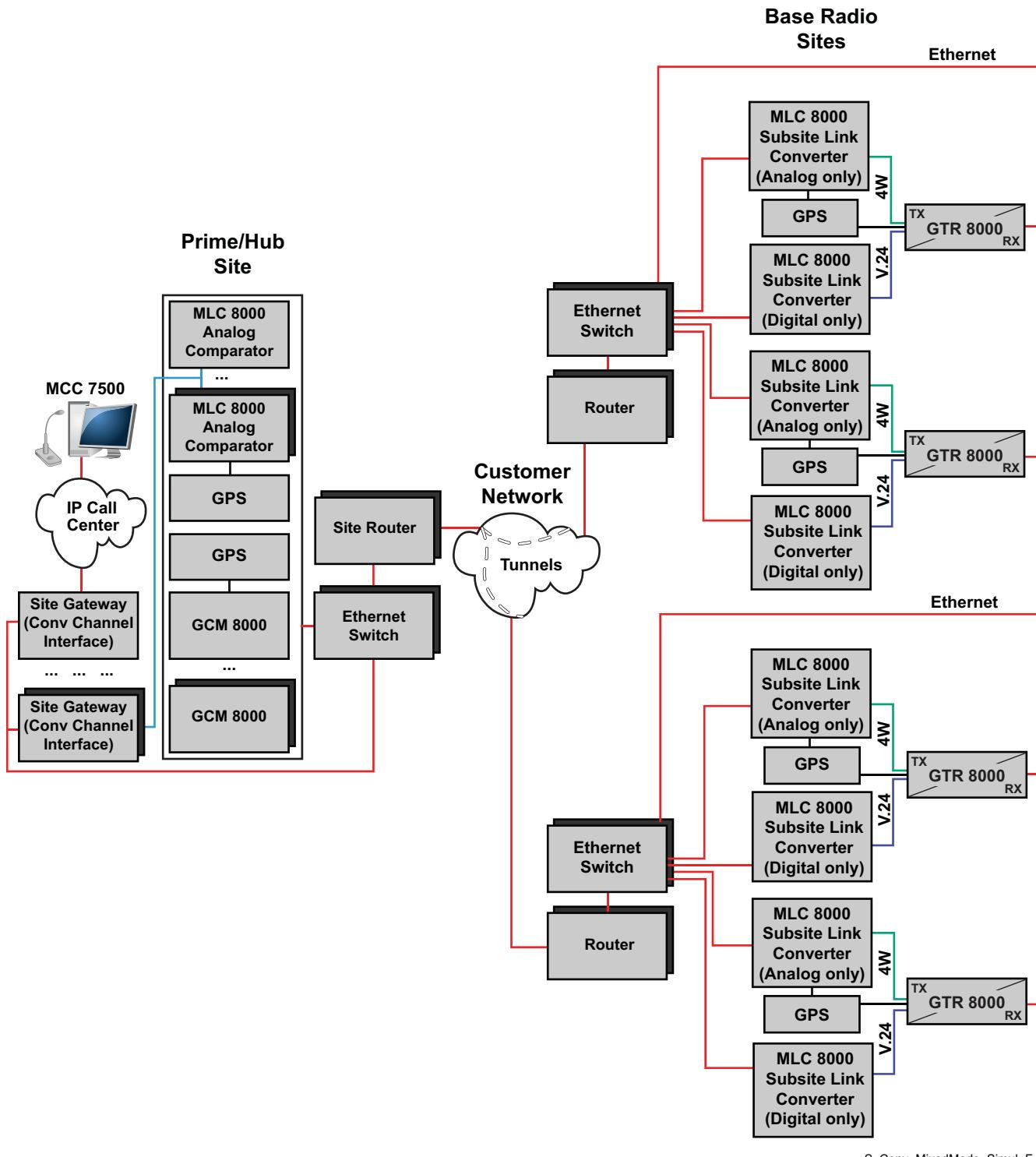
- See “Performing Calibration for an MLC 8000 Subsite Link Converter” in the *MLC 8000 Configuration Tool User Guide* manual.
- See “Performing Calibration for an MLC 8000 Analog Comparator” in the *MLC 8000 Configuration Tool User Guide* manual.

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



S\_Conv\_MixedMode\_Simul\_F



**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 163](#).

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
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
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
R1-4 4W-E&M	RJ45	GTR 8000 Base Radio	RJ45 Wire-line port	4W MLC 8000 to GTR 8000 Cable (IP Simulcast)
R1-4 4W-E&M	RJ45	GTR 8000 Base Radio, Analog TELCO	RJ45	4W MLC 8000 to GTR 8000 Cable (IP Simulcast)
			50-pin System Connector, mini SCSI	4W MLC 8000 to GTR 8000 Cable (IP Simulcast)
R1-4 COMM	RJ45	GTR 8000 Base Radio	RJ45 RJ45	V.24 MLC 8000 to GTR 8000/ QUANTAR Cable

From MLC 8000 Analog Comparator (Prime Site)		To Destination device:		
Port	Connector Type	Device	Connector Type	Description
				<b>NOTICE:</b> 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 <i>MLC 8000 Comparator Feature Guide</i> manual.
Simulcast Site Reference device	See “Cabling the TRAK 9100 SSR” in the <i>Simulcast Site Reference</i> manual.
LAN switch	See “HP Switches – Determining Port Connections in ASTRO 25 Systems” in the <i>System LAN Switches</i> manual.
SDM3000 RTU	<p>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 <i>SDM3000 Owner’s Manual</i>.</p> <p>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.</p> <p>See also <a href="#">Setting Up MOSCAD Network Fault Management (NFM) Monitoring</a> on page 35.</p>
Site Gateway (Conventional Channel Interface)	“Making a Physical 4-W Connection on MLC 8000 Analog Comparator to CCGW” in the <i>GGM 8000 System Gateway</i> manual
GTR 8000 Base Radio	<p>“Transceiver Ports – Front” in the <i>GTR 8000 Base Radio</i> manual</p> <p>“Transceiver Ports (Front)” in the <i>GTR 8000 Expandable Site Subsystem</i> manual</p>



**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 193](#).

For general conventional troubleshooting, refer to the *Conventional Operations* manual.

Refer to the *MLC 8000 Comparator Feature Guide* manual 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 29](#).

**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 124](#).

#### 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* manual.
  - b Mount the MLC 8000 on a tray.  
See “Mounting MLC 8000 on the Tray” in the *MLC 8000 Comparator Feature Guide* manual.
  - c Ground the MLC 8000 on a tray.  
See “Grounding an MLC 8000 in a Tray” in the *MLC 8000 Comparator Feature Guide* manual.
  - 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* manual.

- 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* manual.
- 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* manual.
- 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* manual.
- 4 Is MAC Port Lockdown used on the system? (Disable MAC Port Lockdown if applicable)

If...	Then...
<b>Yes</b>	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 <i>MAC Port Lockdown</i> manual.
	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 <i>MAC Port Lockdown</i> manual.
	Determine the switch configuration, to find an unused port. See “HP Switches – Determining Port Connections in ASTRO 25 Systems” in the <i>System LAN Switches</i> manual.
<b>No</b>	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 <i>MAC Port Lockdown</i> manual.
	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 <i>MAC Port Lockdown</i> manual.

- 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 51](#).
- 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 35](#).
- 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 38](#).
- 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* manual.



**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* manual.

**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* manual.

- 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* manual. 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 33](#).



**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* manual.

**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* manual.



**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...
<b>Option 1: IF the system is prestaged off-site (not at the RF site), and IP address and channel cluster information is available</b>	When off-site perform <a href="#">step 2- step 11</a> When on site, retrieve the saved configuration, skip to <a href="#">step 12</a> and finish the configuration.
<b>Option 2: IF the system is prestaged off-site (not at the RF site), and IP address and channel cluster information is not available</b>	On site, use these steps to update the configuration and provide the actual IP addresses and channel cluster information, and then set up associations.
<b>Option 3: IF the system is not prestaged off-site</b>	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* manual.

- 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* manual.

- 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* manual.

- 5 Provide the name and type for the channel cluster.

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

- 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* manual.
- 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* manual.
- 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* manual.
- 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* 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.
- 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>).
- 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* manual.

 **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* manual.

 **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 124](#).

## 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...
<b>Yes</b>	For Kc core systems, run MAC Port Lockdown on the switches. See “Locking HP Switch Ports” in the <i>MAC Port Lockdown</i> manual.
	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 <i>MAC Port Lockdown</i> manual.
<b>No</b>	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 <i>MAC Port Lockdown</i> manual.
	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 <i>MAC Port Lockdown</i> manual.

- 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* manual.
  - 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* manual.
- 3 Confirm the status of the links.

Devices	Procedure References
<b>GCM 8000 Digital Comparator to MLC 8000 Subsite Link Converter (IP)</b>	
Check the COMM LED.	See “MLC 8000 Link Converter LEDs” in the <i>MLC 8000 Comparator Feature Guide</i> manual.
Use MOSCAD NFM. Only if the MO-SCAD NFM subsystem is available in your system.	See “MLC 8000 Link Converter — MO-SCAD NFM Events Troubleshooting (IP Simulcast System)” in the <i>MLC</i>

*Table continued...*

Devices	Procedure References
Check for a VIP 3 event, which indicates the comparator link failed.	<i>8000 Comparator Feature Guide</i> manual.
<b>MLC 8000 Subsite Link Converter to Base Radio (V.24)</b>	
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 <i>MLC 8000 Comparator Feature Guide</i> manual.
Use MOSCAD NFM. Only if the MO-SCAD 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 — MO-SCAD NFM Events Troubleshooting (IP Simulcast System)” in the <i>MLC 8000 Comparator Feature Guide</i> manual.
Pull a log file of the device for error messages.	See “MLC 8000 Device Logs and Recommended Actions” in the <i>MLC 8000 Comparator Feature Guide</i> manual.

- 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.

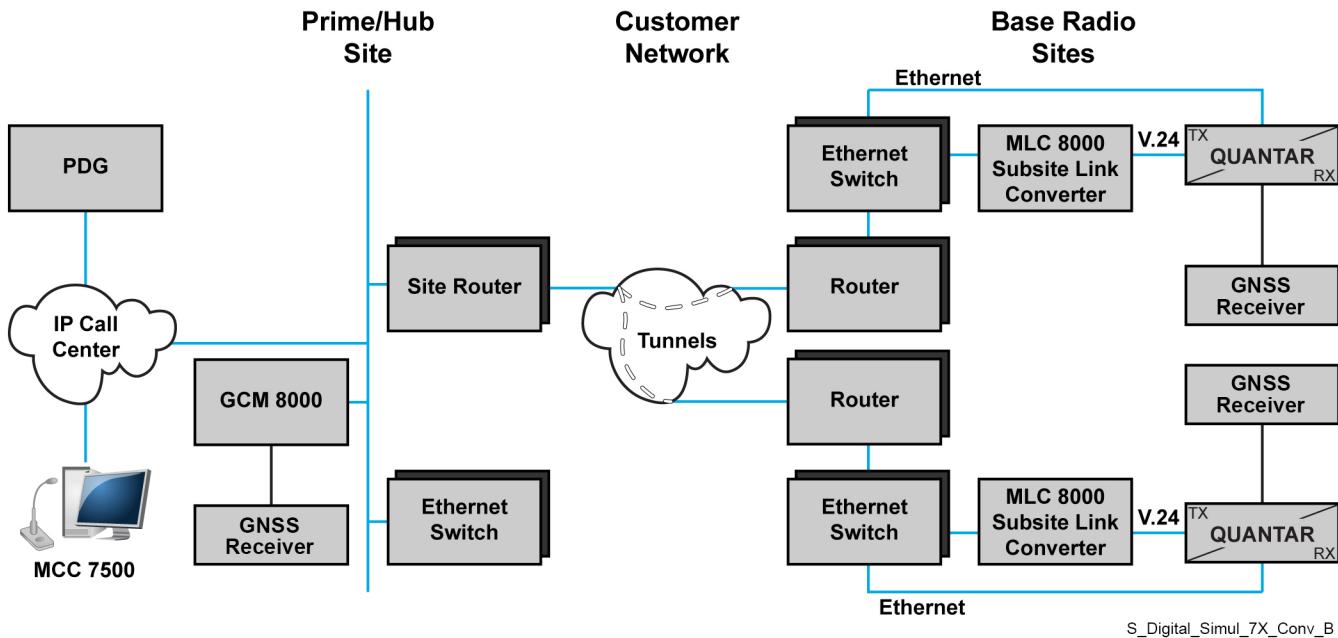
**Postrequisites:** No calibration is required for digital-only systems.

## 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 163](#).

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-RJ45 one-to-one cable
VIP	RJ-45	SDM3000 RTU	I/O Wiring Punch Block	MLC 8000 to MOSCAD NFM Cable
R1-4 COMM	RJ-45	GTR 8000 Base Radio QUANTAR® Station	RJ-45	V.24 MLC 8000 to GTR 8000/ QUANTAR Cable

## Port Descriptions for ASTRO 25 Digital-Only Simulcast Voting Subsystem

Table 22: Port Descriptions

Device	Manual
MLC 8000	See “MLC 8000 Ports” in the <i>MLC 8000 Comparator Feature Guide</i> manual.
LAN switch	See “HP Switches – Determining Port Connections in ASTRO 25 Systems” in the <i>System LAN Switches</i> manual.
SDM3000 RTU	<p>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 <i>SDM3000 Owner’s Manual</i>.</p> <p>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.</p> <p>See also <a href="#">Setting Up MOSCAD Network Fault Management (NFM) Monitoring on page 35</a>.</p>
QUANTAR® Station	“Backplane Connectors Information” in the <i>QUANTAR Instruction Manual</i> (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 <i>GTR 8000 Base Radio</i> manual and “Transceiver Ports (Front)” in the <i>GTR 8000 Expandable Site Subsystem</i> manual.

## 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 193](#).

For general conventional troubleshooting, refer to the *Conventional Operations* manual.

See the *MLC 8000 Comparator Feature Guide* manual 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 29](#).

**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* manual.
- 2 Configure Site Gateways (Conventional Channel Interface).  
See “GGM 8000 Configuration” in the *GGM 8000 System Gateway* manual.
- 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* manual.

**b** Mount the MLC 8000 on a tray.

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

**c** Ground the MLC 8000 on a tray.

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

**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* manual.

**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* manual.

**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* manual.

**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* manual.

**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* manual.

**b** Mount the MLC 8000 on a tray.

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

**c** Ground the MLC 8000 on a tray.

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

**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* manual.

**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* manual.

**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* manual.

**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* manual.

**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 35](#).
- 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 38](#).
- 15** Optional: Connect the MLC 8000 Subsite Link Converter to the SDM3000 RTU.  
See [Cabling MLC 8000 to SDM3000 RTU on page 38](#).
- 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* manual.
  - 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* manual. 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<sup>TM</sup> Remote Comparator Display Software. See [Setting Up the MCN Server 8000 Remote Comparator Display Software on page 33](#).  
 **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* manual.
- 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* manual.



**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...
<b>Option 1: IF the system is prestaged off-site (not at the RF site), and IP address and channel cluster information is available</b>	When off-site, perform <a href="#">step 2-step 12</a> When on site, retrieve the saved configuration, skip to <a href="#">step 13</a> and finish the configuration.
<b>Option 2: IF the system is prestaged off-site (not at the RF site), and IP address and channel cluster information is not available</b>	On site, use these steps to update the configuration and provide the actual IP addresses and channel cluster information, and then set up associations.
<b>Option 3: IF the system is not prestaged off-site</b>	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* manual.

- 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* manual.

- 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* manual.

- 5 Provide the name and type for the channel cluster.

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

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

 **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* manual.



**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* manual.
  - 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* manual.
- 2 Confirm the status of the links.

Devices	Procedure References
<b>MLC 8000 Analog Comparator to MLC 8000 Subsite Link Converter (IP)</b>	
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 <i>MLC 8000 Comparator Feature Guide</i> manual.
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 <i>MLC 8000 Comparator Feature Guide</i> manual.
Pull a log file of the device for error messages.	See “MLC 8000 Device Logs and Recommended Actions” in the <i>MLC 8000 Comparator Feature Guide</i> manual.
<b>MLC 8000 Analog Comparator to Site Gateways (Conventional Channel Interface) (4-wire)</b>	
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.

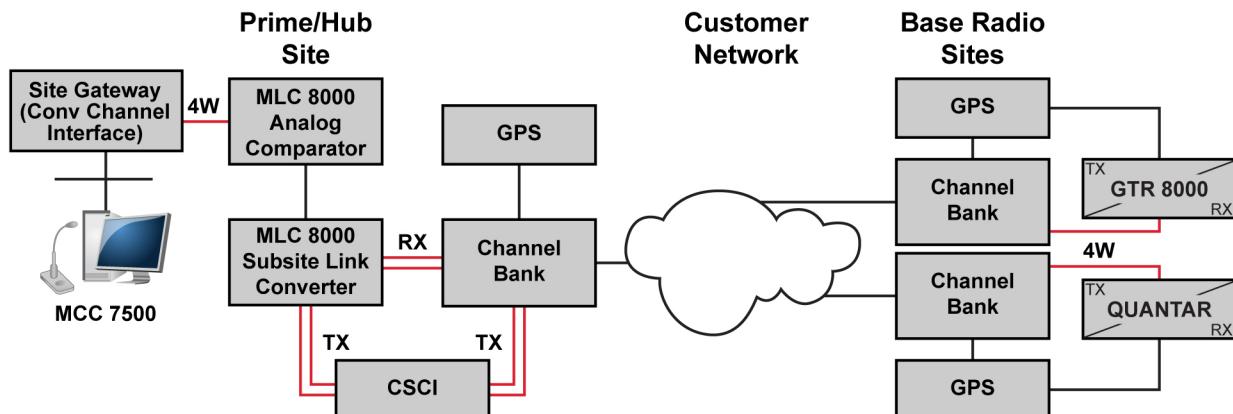
- See “Performing Calibration for an MLC 8000 Subsite Link Converter” in the *MLC 8000 Configuration Tool User Guide* manual.
- See “Performing Calibration for an MLC 8000 Analog Comparator” in the *MLC 8000 Configuration Tool User Guide* manual.
- Continue to [Optimization/Calibration for Conventional Simulcast](#) on page 165.

## 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**



S\_Analog\_Circuit\_Simul\_7X\_Voting\_C



**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 163](#).

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
VIP	RJ45	SDM3000 RTU	I/O Wiring Punch Block	<a href="#">MLC 8000 to MOSCAD NFM Cable</a>
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
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	<a href="#">CENTRACOM to MLC 8000 through CTI</a>
R1-4 COMM	RJ45	Channel Bank	SRU card	<a href="#">V.24 MLC 8000 to Channel Bank SRU Card Cable</a>
VIP	RJ45	SDM3000 RTU	I/O Wiring Punch Block	<a href="#">MLC 8000 to MOSCAD NFM Cable</a>

## 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 <i>MLC 8000 Comparator Feature Guide</i> manual.
LAN switch	See “HP Switches – Determining Port Connections in ASTRO 25 Systems” in the <i>System LAN Switches</i> manual.
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 <i>SDM3000 Owner’s Manual</i> .  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 <a href="#">Setting Up MOSCAD Network Fault Management (NFM) Monitoring on page 35</a> .
Site Gateway (Conventional Channel Interface)	See “Making a Physical 4-W Connection on MLC 8000 Analog Comparator to CCGW” in the <i>GGM 8000 System Gateway</i> manual
CSCI	See “CSCI-to-Punchblock Cabling” in the <i>GPS Simulcast Installation</i> manual (6881098E65). Refers to a legacy comparator, but this is applicable to the MLC 8000.
Channel Bank	See the <i>GPS Simulcast Installation</i> 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 193](#).

For general conventional troubleshooting, refer to the *Conventional Operations* manual.

Refer to the *MLC 8000 Comparator Feature Guide* manual 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 (68P81098E6) 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 29](#).

**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 142](#).
- 3 Verify the installation and configuration performed in this implementation. See [Verifying the Installation and Configuration on page 144](#).

#### 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* manual.
  - b Mount the MLC 8000 on a tray.  
See “Mounting MLC 8000 on the Tray” in the *MLC 8000 Comparator Guide* manual.
  - c Ground the MLC 8000 on a tray.  
See “Grounding an MLC 8000 in a Tray” in the *MLC 8000 Comparator Feature Guide* manual.
  - 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 Guide* manual.
  - 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* manual.

- 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* manual.

- 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* manual.

- 4 Install the MLC 8000 Subsite Link Converter in a rack or cabinet.

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

- 5 Mount the MLC 8000 on a tray.

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

- 6 Ground the MLC 8000 on a tray.

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

- 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 Guide* manual.

- 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* manual.

- 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* manual.

- 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* manual.

- 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 35](#).

- 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 38](#).

- 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 38](#).

**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* manual.

- 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* manual. 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 33](#).



**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* manual.

**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* manual.



**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 142](#).

## 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...
<b>Option 1: IF the system is prestaged off-site (not at the RF site), and IP address and channel cluster information is available</b>	When off-site, perform <a href="#">step 2- step 12</a> When on site, retrieve the saved configuration, skip to <a href="#">step 13</a> and finish the configuration.
<b>Option 2: IF the system is prestaged off-site (not at the RF site), and IP address and channel cluster information is not available</b>	On site, use these steps to update the configuration and provide the actual IP addresses and channel cluster information, and then set up associations.
<b>Option 3: IF the system is not prestaged off-site</b>	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* manual.

- 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* manual.

- 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* manual.

- 5 Provide the name and type for the channel cluster.

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

- 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* manual.

- 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 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* manual.

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* manual.

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* 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.

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* manual.

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* manual.



**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* manual.



**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* manual.

The MLC 8000 devices are configured.

**Postrequisites:** See [Verifying the Installation and Configuration on page 144](#).

### 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* manual.
  - 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* manual.
- 2 Confirm the status of the links.

Devices	Procedure References
<b>MLC 8000 Analog Comparator to MLC 8000 Subsite Link Converter (IP)</b>	
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 <i>MLC 8000 Comparator Feature Guide</i> manual.
Use MOSCAD NFM. Only if the MO-SCAD NFM subsystem is available in your system.	See “MLC 8000 Analog Comparator — MOSCAD NFM Events Troubleshooting (IP Simulcast System)” in the <i>MLC 8000 Comparator Feature Guide</i> manual.
Pull a log file of the device for error messages.	See “MLC 8000 Device Logs and Recommended Actions” in the <i>MLC 8000 Comparator Feature Guide</i> manual.
<b>MLC 8000 Analog Comparator to Analog Console (4-wire)</b>	
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.

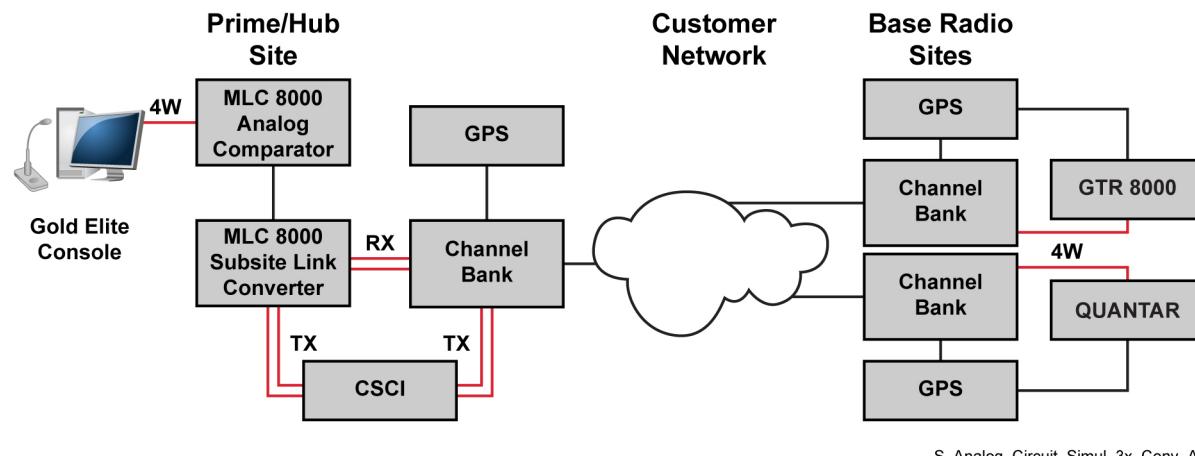
- See “Performing Calibration for an MLC 8000 Subsite Link Converter” in the *MLC 8000 Configuration Tool User Guide* manual.
- See “Performing Calibration for an MLC 8000 Analog Comparator” in the *MLC 8000 Configuration Tool User Guide* manual.
- Continue to [Optimization/Calibration for Conventional Simulcast](#) on page 165.

## 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**



S\_Analog\_Circuit\_Simul\_3x\_Conv\_A



**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 163.

**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

*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
From MLC 8000 Subsite Link Converter (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 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
VIP	RJ45	SDM3000 RTU	I/O Wiring Punch Block	MLC 8000 to MOSCAD NFM Cable
R1-4 COMM	RJ45	Channel Bank	RJ45	4W MLC 8000 to Channel Bank DSM-II Card Cable (Circuit-Based Simulcast)

## 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 <i>MLC 8000 Comparator Feature Guide</i> manual.
Ethernet Switch	See the manufacturer’s manual.
MC2500 analog console	See the <i>MC2500™ Multi-channel Deskset L3217 Operator and Installation Manual</i> (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 <i>SDM3000 Owner’s Manual</i> .  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 <a href="#">Setting Up MOSCAD Network Fault Management (NFM) Monitoring on page 35</a> .
CSCI	See “CSCI-to-Punchblock Cabling” in the <i>GPS Simulcast Installation</i> manual (6881098E65). Refers to a legacy comparator, but this is applicable to the MLC 8000.
Channel Bank	See “DSM-II Pinouts” in the <i>GPS Simulcast Installation</i> 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 193](#).

For general conventional troubleshooting, refer to the *Conventional Operations* manual.

Refer to the *MLC 8000 Comparator Feature Guide* manual 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 29](#).

**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 152](#).
- 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 154](#)
- 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* manual.
  - b Mount the MLC 8000 on a tray.  
See “Mounting MLC 8000 on the Tray” in the *MLC 8000 Comparator Feature Guide* manual.
  - c Ground the MLC 8000 on a tray.  
See “Grounding an MLC 8000 in a Tray” in the *MLC 8000 Comparator Feature Guide* manual.
  - 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* manual.



**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* manual.

**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* manual.

**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* manual.

**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* manual.

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

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

**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 35.

- 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 38](#).
- 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* manual.

  - 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* manual. 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 33](#).

 **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* manual.
- 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* manual.

 **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 152](#).

## 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* manual.
  - b Mount the MLC 8000 on a tray.
 

See “Mounting MLC 8000 on the Tray” in the *MLC 8000 Comparator Feature Guide* manual.
  - c Ground the MLC 8000 on a tray.
 

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

 **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* manual.
- 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* manual.
- 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* manual.
- 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* manual.
- 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 <i>MAC Port Lockdown</i> manual.
	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 VoyanceControl Template” in the <i>MAC Port Lockdown</i> manual.
	Determine the switch configuration, to find an unused port.

If...	Then...
	See “HP Switches – Determining Port Connections in ASTRO 25 Systems” in the <i>System LAN Switches</i> manual.
<b>No</b>	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 <i>MAC Port Lockdown</i> manual.
	For M series and L series zone core systems, enable and configure unused ports on switches. See “Enabling/Disabling Ports on HP Switches Using VoyanceControl” in the <i>MAC Port Lockdown</i> manual.

- 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](#).
- 7  **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®).
- 8 Configure the base radios to interface with the MLC 8000 devices.  
See [Conventional Configuration Settings for Analog Simulcast on page 51](#).
- 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 35](#).
- 10 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 38](#).
- 11 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* manual.

- 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 154](#).

## 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...
<b>Option 1: IF the system is prestaged off-site (not at the RF site), and IP address and channel cluster information is available</b>	When off-site, perform <a href="#">step 2- step 12</a> When on site, retrieve the saved configuration, skip to <a href="#">step 13</a> and finish the configuration.
<b>Option 2: IF the system is prestaged off-site (not at the RF site), and IP address and channel cluster information is not available</b>	On site, use these steps to update the configuration and provide the actual IP addresses and channel cluster information, and then set up associations.
<b>Option 3: IF the system is not prestaged off-site</b>	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* manual.

- 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* manual.

- 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* manual.

- 5 Provide the name and type for the channel cluster.

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

- 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* manual.

- 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* manual.

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* manual.

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* 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.

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* manual.

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* manual.



**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* manual.



**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* manual.



**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* manual.

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...
<b>Yes</b>	For K core systems, run MAC Port Lockdown on the switches. See “Locking HP Switch Ports” in the <i>MAC Port Lockdown</i> manual.
	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 <i>MAC Port Lockdown</i> manual.
<b>No</b>	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 <i>MAC Port Lockdown</i> manual.
	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 <i>MAC Port Lockdown</i> manual.

**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* manual.

**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* manual.

**3** Confirm the status of the links.

Devices	Procedure References
<b>MLC 8000 Analog Comparator to MLC 8000 Subsite Link Converter (IP)</b>	
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 <i>MLC 8000 Comparator Feature Guide</i> manual.
Use MOSCAD NFM. Only if the MO-SCAD NFM subsystem is available in your system.	See “MLC 8000 Analog Comparator — MOSCAD NFM Events Troubleshooting (IP Simulcast System)” in the <i>MLC 8000 Comparator Feature Guide</i> manual.
Pull a log file of the device for error messages.	See “MLC 8000 Device Logs and Recommended Actions” in the <i>MLC 8000 Comparator Feature Guide</i> manual.
<b>MLC 8000 Subsite Link Converter to Base Radio (4-wire)</b>	
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 <i>MLC 8000 Comparator Feature Guide</i> manual.
Use MOSCAD NFM. Only if the MO-SCAD NFM subsystem is available in your system.	See “MLC 8000 Link Converter — MO-SCAD NFM Events Troubleshooting (IP Simulcast System)” in the <i>MLC 8000 Comparator Feature Guide</i> manual.
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 Comparator Feature Guide
Pull a log file of the device for error messages.	See “MLC 8000 Device Logs and Recommended Actions” in the <i>MLC 8000 Comparator Feature Guide</i> manual.
<b>MLC 8000 Analog Comparator to Analog Console (4-w)</b>	
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.

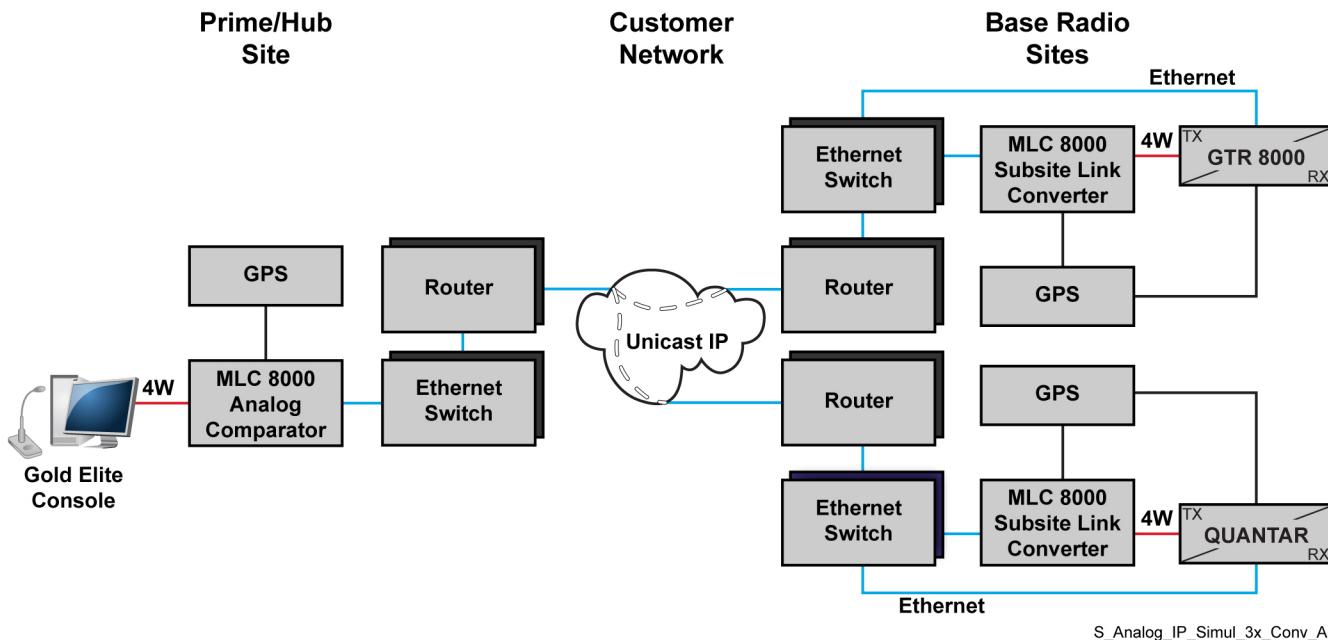
- See “Performing Calibration for an MLC 8000 Subsite Link Converter” in the *MLC 8000 Configuration Tool User Guide* manual.
- See “Performing Calibration for an MLC 8000 Analog Comparator” in the *MLC 8000 Configuration Tool User Guide* manual.
- Continue to [Optimization/Calibration for Conventional Simulcast](#) on page 165.

## 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 163](#).

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
External LAN PoE	RJ45	LAN Switch	RJ45	RJ45-to-RJ45 one-to-one cable
VIP	RJ45	SDM3000 RTU	I/O Wiring Punch Block	<a href="#">MLC 8000 to MOSCAD NFM Cable</a>
R1 4W-E&M	RJ45	MC2500	DB25	<a href="#">4-Wire MLC 8000 to MC2500 Analog Console Cable</a>
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	<a href="#">MLC 8000 to MOSCAD NFM Cable</a>
R1 4W-E&M	RJ45	QUANTAR® Base Radio (or QUANTAR® Satellite Receiver), TELCO	50 Pin Connector	<a href="#">4W MLC 8000 to QUANTAR Cable (IP Simulcast)</a>
		 <b>NOTICE:</b> In a QUANTAR® Satellite Receiver, 2-wires are always OK.		
R14W-E&M	RJ45	GTR 8000 Base Radio or GPW 8000, 4W Gen-Tx	RJ45 Punch Block	<a href="#">4W MLC 8000 to GTR 8000 Cable (IP Simulcast)</a>

From MLC 8000 Analog Comparator		To Destination device:		
Port	Connector Type	Device	Connector Type	Description
		 <b>NOTICE:</b> In a GPW Satellite Receiver, 2-wires are always OK.		
		 <b>NOTICE:</b> 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 <i>MLC 8000 Comparator Feature Guide</i> manual.
Simulcast Site Reference device	See the manufacturer’s manual.
Ethernet Switch	See the manufacturer’s manual.
MC2500 analog console	See the <i>MC2500™ Multi-channel Deskset L3217 Operator and Installation Manual</i> (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 <i>SDM3000 Owner’s Manual</i> .  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 <a href="#">Setting Up MOSCAD Network Fault Management (NFM) Monitoring</a> on page 35.
QUANTAR® Base Radio	See “Backplane Connectors Information” in the <i>QUANTAR Instruction Manual</i> (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 <i>GTR 8000 Base Radio</i> manual (6871020P77)

### 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 193.

For general conventional troubleshooting, refer to the *Conventional Operations* manual.

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

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## 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](#) for 4-wire MLC 8000 connections to GTR 8000s.

Please contact Motorola Solutions System Support Center for information about adapters which you can order.

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## 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  $\pm 0.15$  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  $\pm 0.15$  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  $\pm 0.15$  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 166](#).

**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.

- 1 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 29: 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.

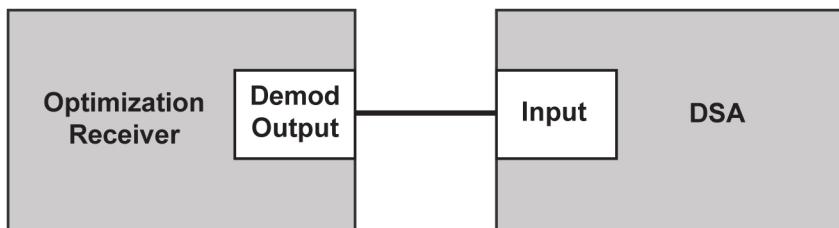
## A.5

### 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 15: Amplitude Optimization Test Setup**



AmplitudeOptimizationTestSetup\_A

## 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 178](#) for circuit-based systems or [Performing Fine Amplitude Adjustment on page 188](#) 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 169](#)
- [Optimizing/Calibrating Conventional Analog IP-Based Simulcast on page 182](#)

## 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 166](#))
- The following tasks must be completed:
  - "Performing Calibration for an MLC 8000 Subsite Link Converter" in the *MLC 8000 Configuration Tool User Guide* manual.
  - "Performing Calibration for an MLC 8000 Analog Comparator" in the *MLC 8000 Configuration Tool User Guide* manual.

**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...
<b>QUANTAR® Base Radios</b>	<ul style="list-style-type: none"> <li><b>a</b> Perform base radio alignment. See <a href="#">Aligning the QUANTAR Base Radio on page 170</a>.</li> <li><b>b</b> Perform the procedures for modulation compensation. See <a href="#">Modulation Compensation (QUANTAR) on page 172</a>.</li> </ul>
<b>GTR 8000 Base Radios</b>	Perform the “Rx Wireline Alignment Procedure” in the <i>CSS Online Help</i> . This procedure is required for circuit-based systems only.

- 2 Set up test equipment. See [Setting up Test Equipment on page 166](#).
- 3 Perform coarse level adjustment for the transmit audio path. See [Performing Coarse Level Adjustment \(Transmit Audio Path 1 kHz\) on page 175](#).
- 4 Perform a coarse level PL/DPL adjustment. See [Performing Coarse Level Adjustment \(Conventional Systems PL/ DPL Adjustment\) on page 177](#).
- 5 Perform fine amplitude adjustment. See [Performing Fine Amplitude Adjustment on page 178](#).
- 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 180](#). 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 30: Base Station Alignment Characteristics on page 171](#).

## A.7.2.1

## Base Station Alignment Characteristics

Table 30: Base Station Alignment Characteristics

Characteristic	Procedure
Reference Oscillator	<p>Verify that the QUANTAR® Base Radio internal reference oscillator is netted to 5 MHz input from GPS rubidium frequency standard.</p> <p> <b>NOTICE:</b> This alignment takes a minimum of 5 minutes per station. If the station control board is changed, the autonet alignment must be performed again.</p> <p> <b>NOTICE:</b> 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.</p>
TX Power Output	<p>Verify output power; adjust if required.</p> <p> <b>NOTICE:</b> TX power output is typically pre-aligned at the factory.</p>
Squelch	Set squelch according to system design (for example, portable coverage or mobile coverage) to ensure proper voting operation.
Receive Wireline	<ul style="list-style-type: none"> <li>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.</li> <li>Verify that the status tone level is set to -18.6 dBm.</li> </ul> <p> <b>NOTICE:</b> 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</p>
TX Deviation Gain Adjustment	<p>Verify that the base radio is set for 60% system deviation.</p> <p> <b>NOTICE:</b> 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.</p>
Reference Modulation Compensation	<p>Verify that the modulation compensation (MOD COMP) is adjusted by going through appropriate procedure. If MOD COMP is properly adjusted, then make no changes.</p> <p> <b>NOTICE:</b> 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 <a href="#">Modulation Compensation (QUANTAR) on page 172</a>.</p>

 **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 172](#)
- [Simulcast Setting on page 172](#)
- [Fine-Tuning Modulation Compensation on page 173](#)



**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 166](#) and proceed to review [Simulcast Setting on page 172](#) and [Fine-Tuning Modulation Compensation on page 173](#).

#### 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 173](#) 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.

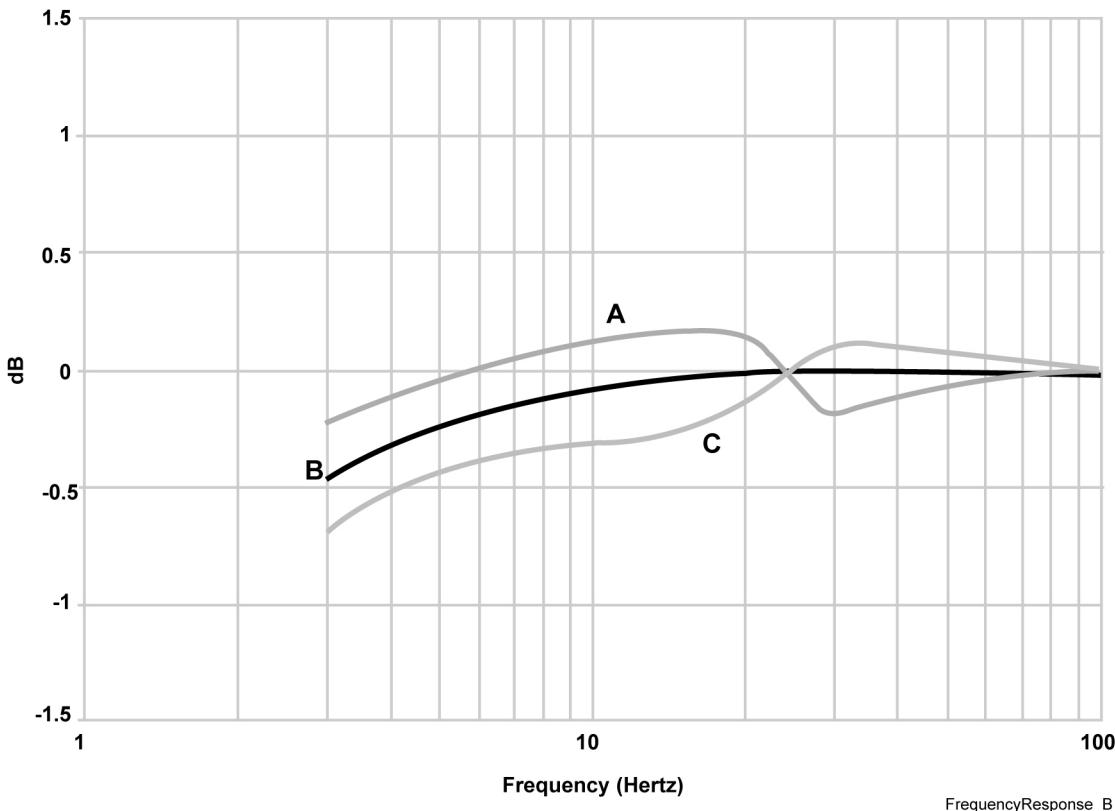
## A.7.3.3

**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 16: 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 16: Frequency Response on page 173](#), 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.

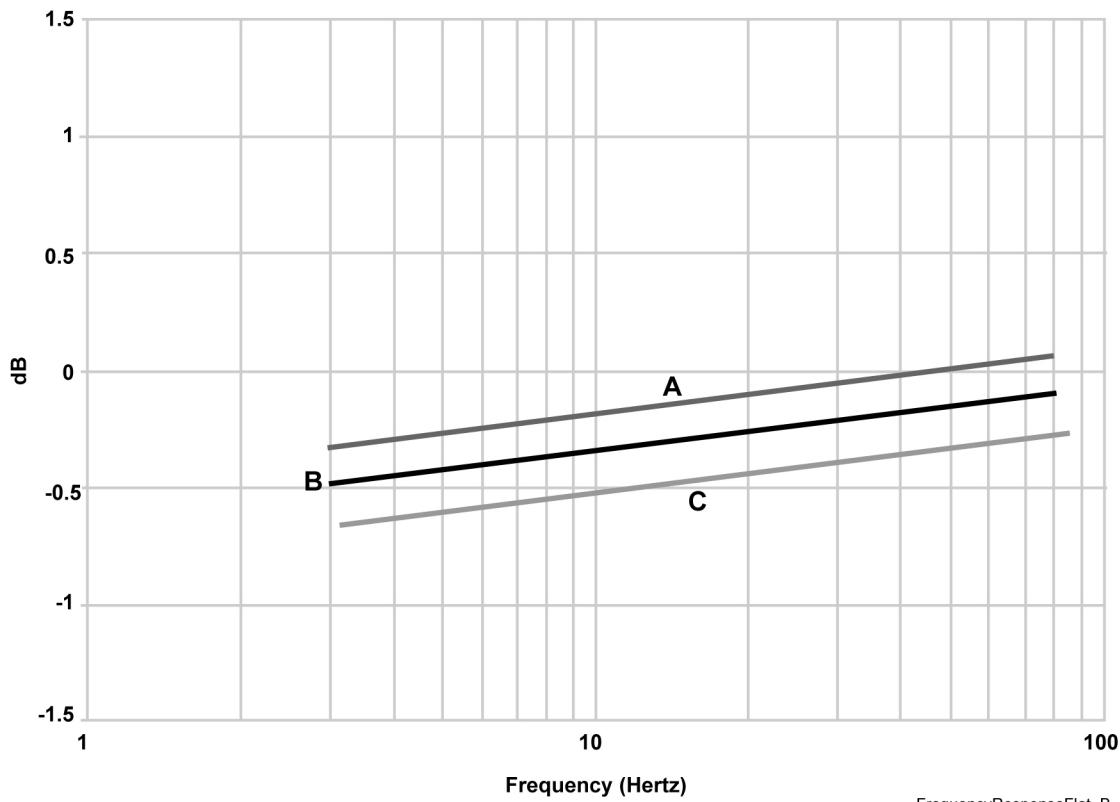
[Figure 16: Frequency Response on page 173](#) shows the worst case situation where the desired frequency response (trace B) is exactly halfway between two modulation compensation settings. In this case, if you started with trace A, you would lower the numbers in the TX Deviation Gain Adjust window by 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 17: Frequency Response Result**

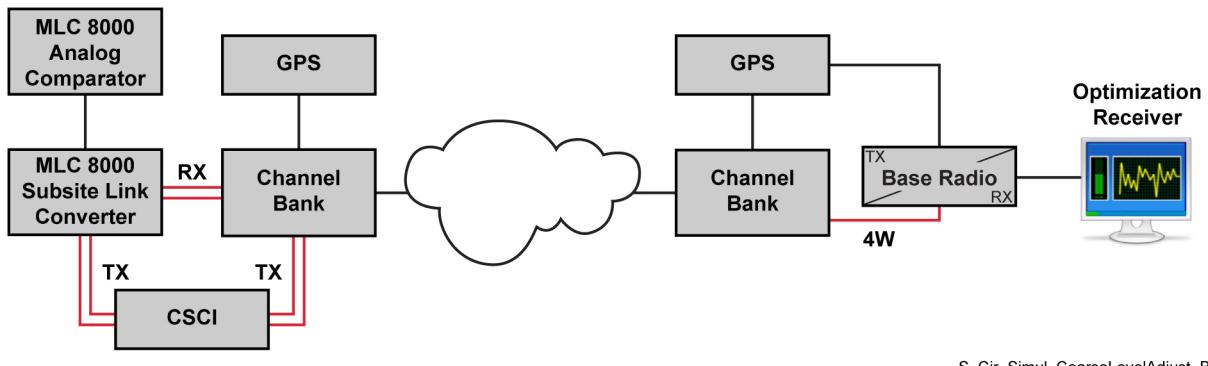


#### A.7.4

### Coarse Level Adjustment (Transmit Audio Path) (Circuit Based)

To perform a coarse level adjustment, perform the test setup as shown in [Figure 18: Coarse Level Adjustment \(Transmit Audio Path\) Setup Diagram on page 175](#).

**Figure 18: Coarse Level Adjustment (Transmit Audio Path) Setup Diagram**



S\_Cir\_Simul\_CoarseLevelAdjust\_B

#### 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 170](#).
- 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  $\pm 100$  Hz. Adjust the input level to eliminate the  $\pm 100$  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  $\pm 0.1$  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  $\pm 0.10$  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 167](#).
- 7 **NOTICE:** The base radio can be keyed-up by activating the E1-Lead in the remote, loopback, or sl-lb DSM-II ports.
- 8 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.
- 9 Repeat [step 6](#) and [step 7](#) for every site on the channel.
- 10 When the deviation for the last site has been verified, turn off the 1 kHz tone.
- 11 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 31: Radio Deviation Settings (QUANTAR or GTR 8000)

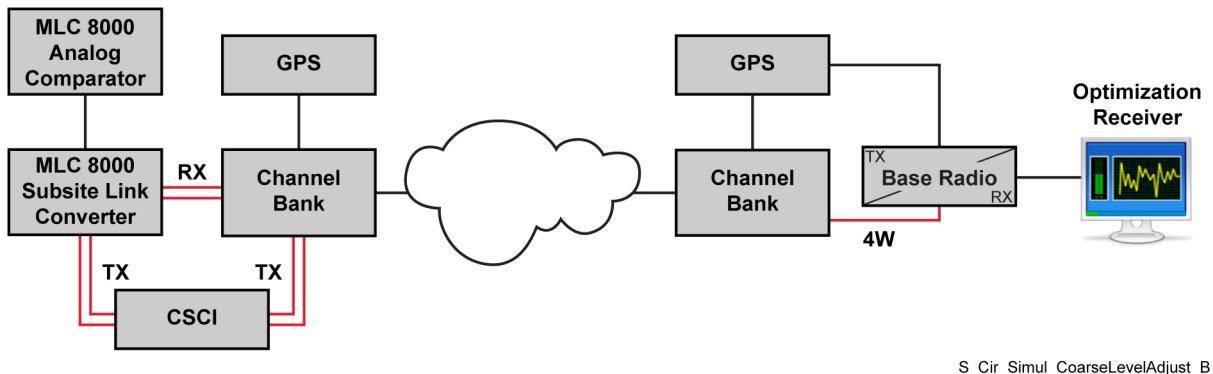
Deviation Adjustment	Frequency Range		
	25 kHz channels	NPSPAC Channels	12.5 kHz Channels
100% full system deviation	5.0 kHz	4.0 kHz	2.5 kHz
Maximum station deviation	4.6 kHz	3.7 kHz	2.3 kHz
60% full system deviation	3.0 kHz	2.4 kHz	1.5 kHz
40% full system deviation	2.0 kHz	1.6 kHz	1.0 kHz
Coded deviation (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 19: Coarse Level Adjustment \(Conventional Systems PL/DPL Adjustment\) Setup Diagram on page 177](#).

**Figure 19: 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:

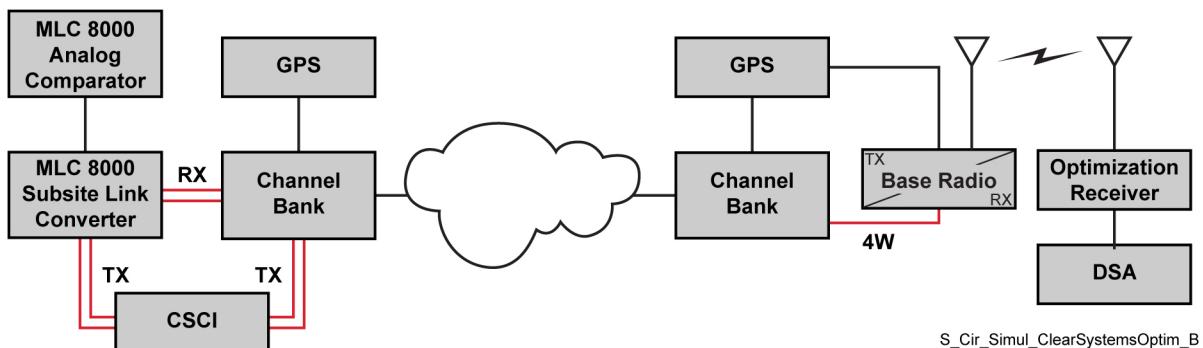
- 1 Disconnect the audio lines between the comparator and CSCI.
- 2 Key up a radio and verify that it is assigned to the channel under test.
- 3 With a service monitor, measure the deviation of the received PL/DPL. (With the audio lines disconnected, no audio is present in the received modulation.)
- 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 20: Fine Amplitude Adjustment Setup Diagram on page 178](#).

**Figure 20: 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 166](#).
- 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.

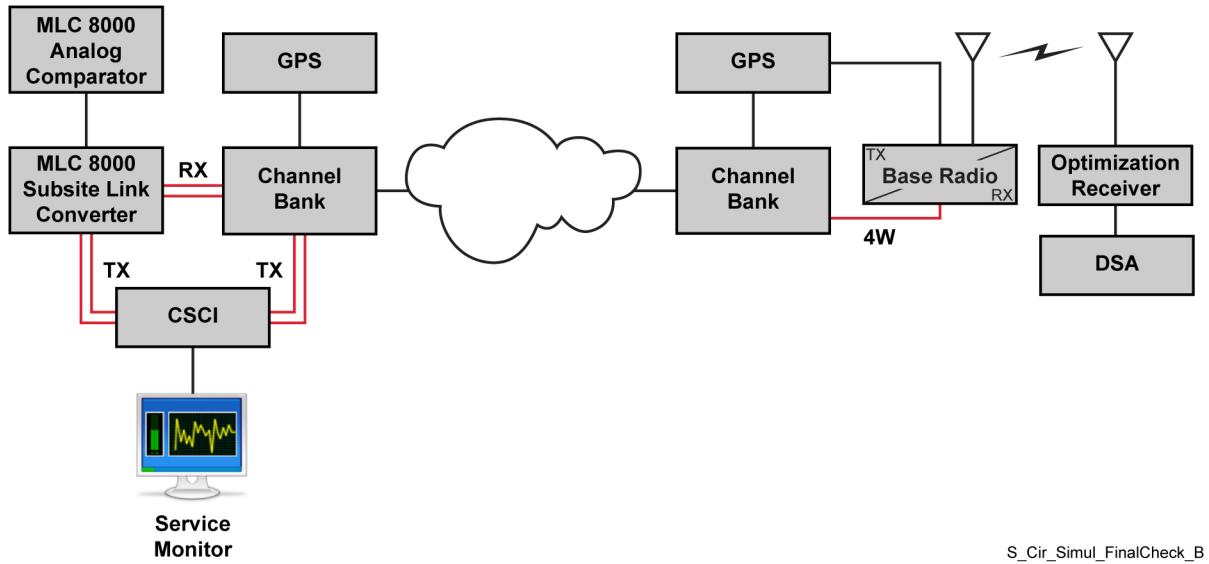
**19** Repeat [step 2](#) through [step 18](#) for each channel in the system.

#### A.7.7

### Final Circuit Based System Level Check

For the final system check, perform the test setup as shown in [Figure 21: Final System Level Check Setup Diagram on page 180](#).

**Figure 21: 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 32: Recovered Level Entry Log on page 182](#). 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 178](#) 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 32: Recovered Level Entry Log on page 182](#) that is used for your system log, enter the 20 Hz reference level obtained in [Performing Fine Amplitude Adjustment on page 178](#).

- 11 Set the frequencies and note the levels as follows:

Set the frequency of the generator to <b>15 Hz</b> .	Note the level recovered from the optimization receiver. Enter this level in the 15 Hz column of the <a href="#">Table 32: Recovered Level Entry Log on page 182</a> for the site.
Set the frequency of the generator to <b>12 Hz</b> .	Note the level recovered from the optimization receiver. Enter this level in the 12 Hz column of <a href="#">Table 32: Recovered Level Entry Log on page 182</a> for the site.
Set the frequency of the generator to <b>10 Hz</b> .	Note the level recovered from the optimization receiver. Enter this level in the 10 Hz column of <a href="#">Table 32: Recovered Level Entry Log on page 182</a> for the site.
Set the frequency of the generator to <b>7 Hz</b> .	Note the level recovered from the optimization receiver. Enter this level in the 7 Hz column of <a href="#">Table 32: Recovered Level Entry Log on page 182</a> for the site.
Set the frequency of the generator to <b>5 Hz</b> .	Note the level recovered from the optimization receiver. Enter this level in the 5 Hz column of <a href="#">Table 32: Recovered Level Entry Log on page 182</a> 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 32: Recovered Level Entry Log on page 182](#) 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 170](#) 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 32: Recovered Level Entry Log

Site	CHANNEL #_____					
	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 166](#))
- The following tasks must be completed:
  - “Performing Calibration for an MLC 8000 Subsite Link Converter” in the *MLC 8000 Configuration Tool User Guide* manual.
  - “Performing Calibration for an MLC 8000 Analog Comparator” in the *MLC 8000 Configuration Tool User Guide* manual.

**When and where to use:** This process covers optimization/calibration for conventional analog IP-based simulcast systems.

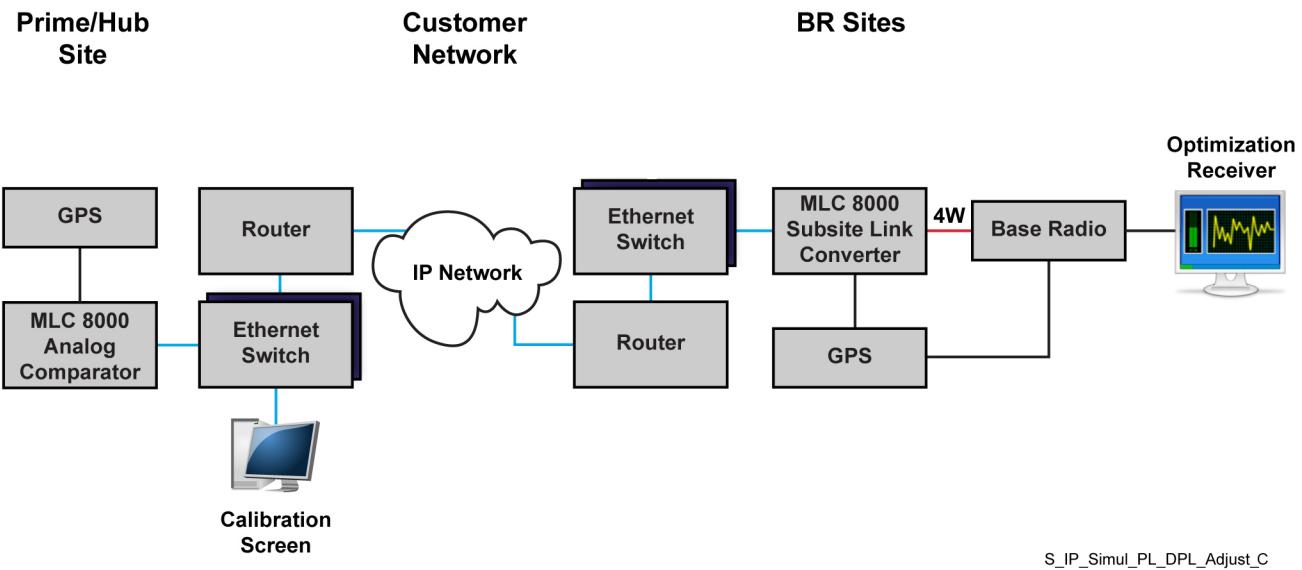
**Process:**

- 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 170](#).
  - b Perform the procedures for modulation compensation. See [Modulation Compensation \(QUANTAR\) on page 172](#).
- 2 Set up the test equipment. See [Setting up Test Equipment on page 166](#).
- 3 Perform coarse level adjustment for the transmit audio path. See [Performing Coarse Level Adjustment \(Transmit Audio Path 1 kHz\) on page 184](#).
- 4 Perform a coarse level PL/DPL adjustment. See [Performing Coarse Level PL/DPL Adjustment \(Conventional Systems\) on page 186](#).
- 5 Perform fine amplitude adjustment. See [Performing Fine Amplitude Adjustment on page 188](#).
- 6 Perform a final system level check. See [Performing a Final System-Level Check on page 190](#).  
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 22: Coarse Level Adjustment for Transmit Audio Path Setup Diagram on page 184](#).

**Figure 22: 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's internal TX Deviation Adjustment procedure adjusts the transmitter deviation to 60% system  $\pm 100$  Hz. Adjust the MLC 8000 output level to eliminate the  $\pm 100$  Hz discrepancy in the deviation.

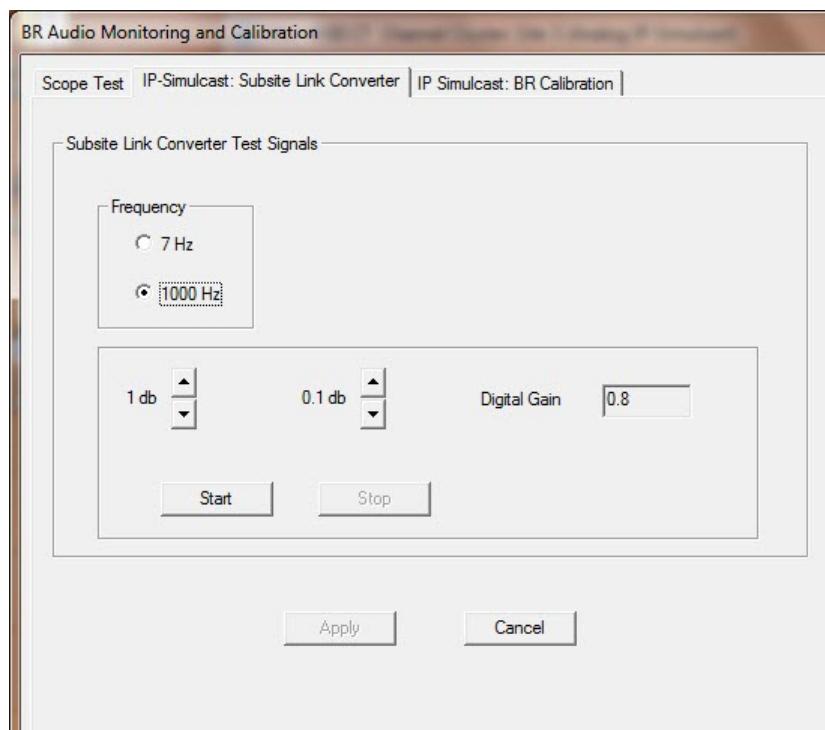
**Procedure:**

- 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 Hz** (1 kHz) test tone output. Click **Start**.

**Figure 23: 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.

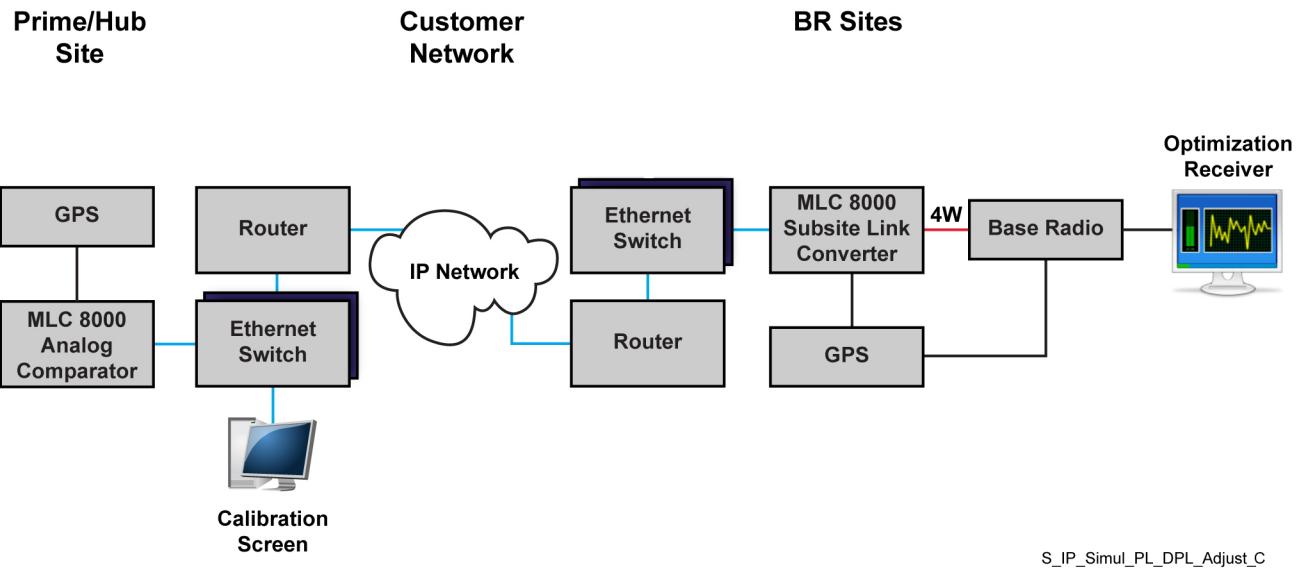
- 4 If the system deviation is **not** at 60% (1.5 kHz for 12.5 kHz channels, 3.0 kHz deviation for 25 kHz channels), adjust the output level of the MLC 8000 Subsite Link Converter by using the up/down arrows in the Subsite Link Converter Test Signals area to select the **DB** settings. Click **Apply** 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 24: Coarse Level Adjustment \(Conventional Systems PL/DPL Adjustment\) Setup Diagram](#) on page 186.

**Figure 24: 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:

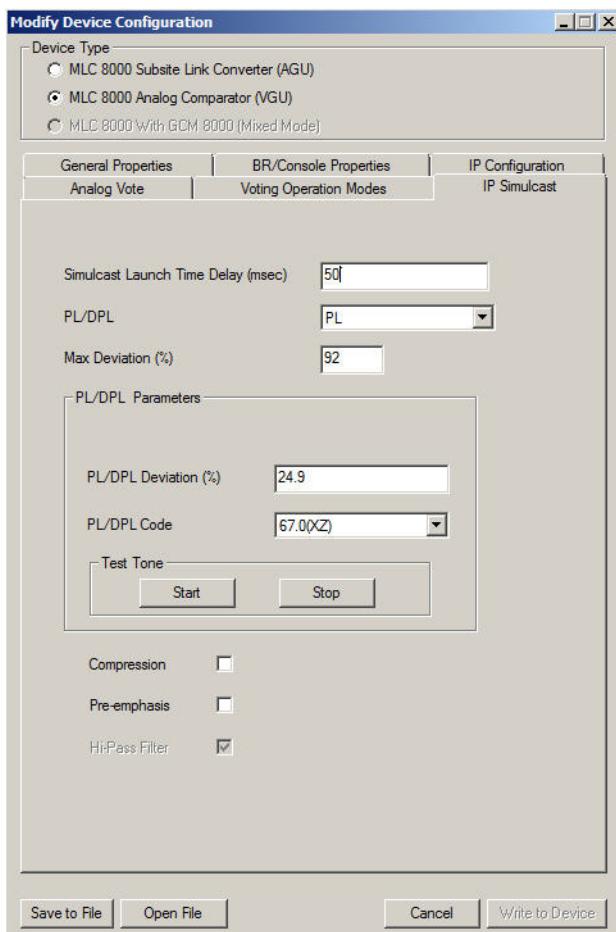
- The MLC 8000 Analog Comparator is already codec calibrated to produce -10dBm +/-1.5dB, and PL/DPL is enabled.
- The MLC 8000 Configuration Tool with Analog Display and Control is operational.

**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 25: 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.

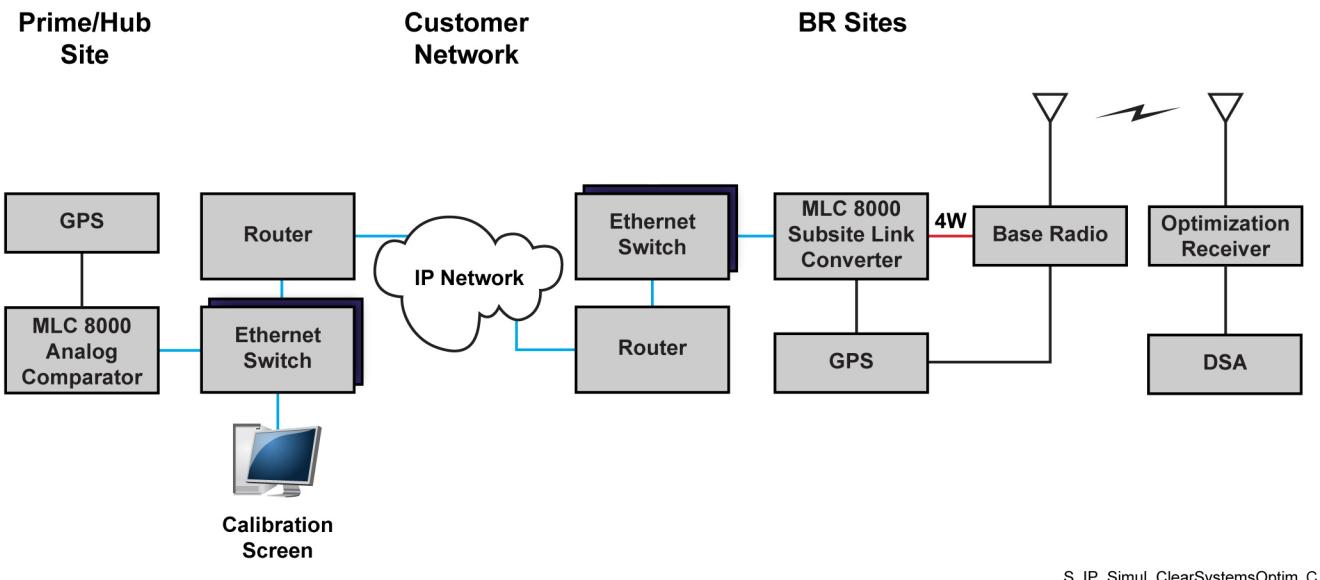
- 4 Select a value from the **PL/DPL Code** list to specify which PL tone or DPL code should be inserted into the voice stream.
- 5 Click **Write to Device** to save these changes to the MLC 8000 Analog Comparator. The device resets and the configuration window closes. Wait for the reset to complete.
- 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 26: Fine Amplitude Adjustment Setup Diagram](#) on page 188.

**Figure 26: 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.

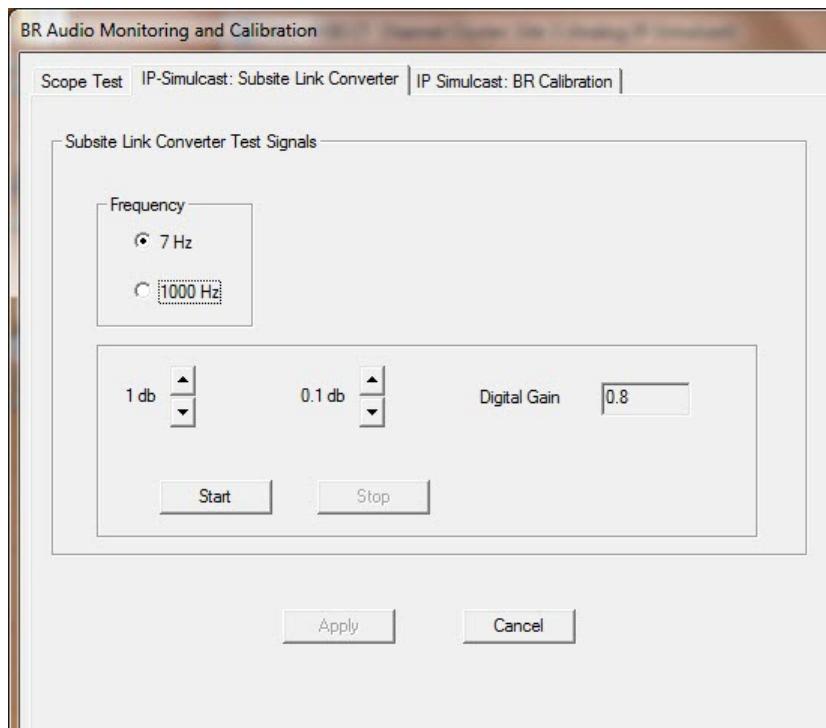
## Procedure:

- 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 Stream 1** or **IP Stream 2** button.

The IP Simulcast: Subsite Link Converter tab appears

4 Click **7 Hz** to generate the reference PTT test tone. Click **Start**.

**Figure 27: 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.

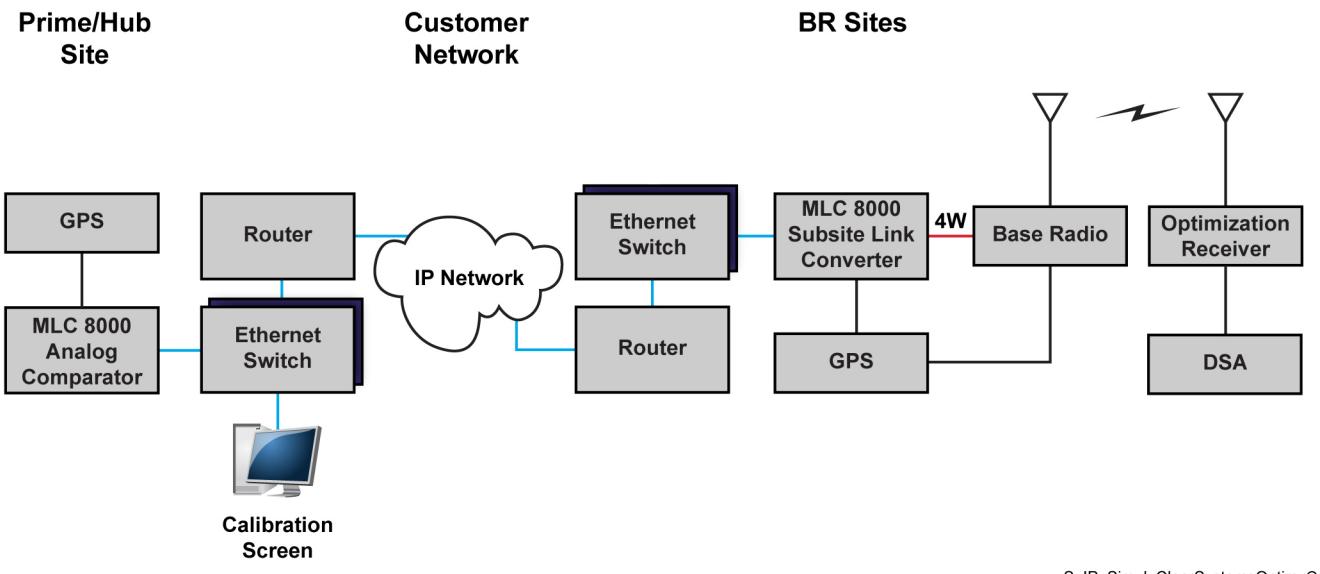
 **NOTICE:** The first time you perform **step 3** through **step 6** is with the reference site and reference value. Subsequent repetition is for each non-reference site on the same channel.

- 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 28: Final System Level Check Setup Diagram on page 190](#).

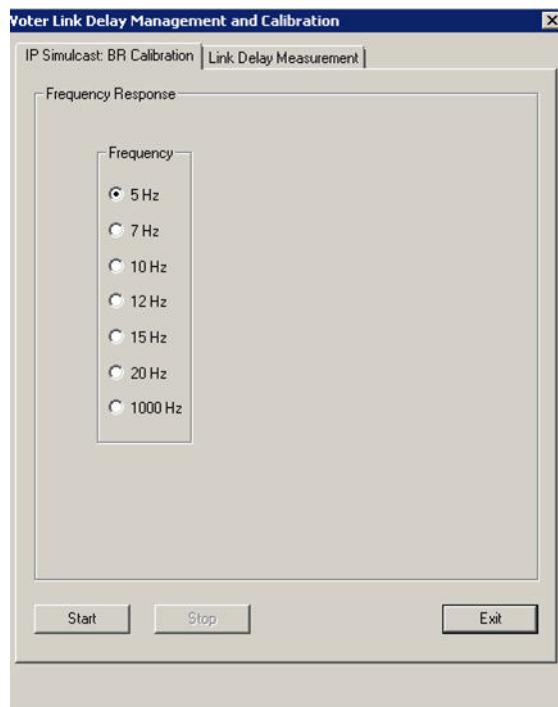
**Figure 28: Final System Level Check Setup Diagram****A.8.5.1****Performing a Final System-Level Check**

**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 29: 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:

<b>Frequency of the MLC 8000 Analog Comparator generator</b>	<b>Recovered Level Entry Log for the site</b>
Set to <b>20 Hz</b> .	Enter the level recovered from the optimization receiver in the 20 Hz column.
Set to <b>15 Hz</b> .	Enter the level recovered from the optimization receiver in the 15 Hz column.
Set to <b>12 Hz</b> .	Enter the level recovered from the optimization receiver in the 12 Hz column.
Set to <b>10 Hz</b> .	Enter the level recovered from the optimization receiver in the 10 Hz column.
Set to <b>5 Hz</b> .	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 through 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 200](#).
- 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 200](#). 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...
<b>MLC 8000 Subsite Link Converter</b>	
<b>Is the Comm LED on the MLC 8000 Subsite Link Converter RED?</b>	The link to one comparator or more has failed.
<b>Is the MLC 8000 Subsite Link Converter in the MLC 8000 Analog Comparator list?</b>	If Yes, then continue to the next step. If No, then add the MLC 8000 Subsite Link Converter to the voter list.
<b>The connection to the IP network is lost. Can you ping the MLC 8000 Subsite Link Converter from the MLC 8000 Analog Comparator?</b>	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).
<b>MLC 8000 Analog Comparator</b>	
<b>The connection to the IP network is lost. Can you ping the MLC 8000 Analog Comparator from the MLC 8000 Subsite Link Converter?</b>	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).
<b>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</b>	This issue might be either a problem of the IP network or a network cable should be checked (or replaced).

If...	Then...
<b>that it lost connection to the base radio).</b>	
<b>One of the associated MLC 8000 Subsite Link Converters is going through a reset or a power outage has occurred.</b>	<p><b>a</b> Wait several minutes to see if the LED returns to green, which occurs when the MLC 8000 Subsite Link Converter has recovered its connection.</p> <p><b>b</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.</p>

**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...
<b>Is the MLC 8000 Subsite Link Converter connected to a composite signal using the daisy chain method?</b>	<p>If Yes, then continue to the next step.</p> <p>If No, then connect the MLC 8000 Subsite Link Converter to a composite signal, using the daisy chain method.</p> <p>Refer to "Installing MLC 8000 REF Input Signals for IP Simulcast System" in the <i>MLC 8000 Comparator Feature Guide</i> manual 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.</p>
<b>Is the MLC 8000 Subsite Link Converter configured as IP Simulcast type in the MLC 8000 Configuration Tool?</b>	<p>If Yes, then continue to the next step.</p> <p>If No, then configure the cluster as IP Simulcast.</p>

**7** Check that the MLC 8000 Subsite Link Converter is connected through 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 TxRx 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 **TxRx 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).

- 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**.
- 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.
- Select the **Input From Radio/Console** radio button and click **Start**.
- If no signal displays in the Audio Monitoring and Calibration window, check the hardware (such as cables, base radios, MLC 8000 Subsite Link Converters).
- 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* manual, 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 through 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 200](#).
- 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 200](#). 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...
<b>MLC 8000 Subsite Link Converter</b>	

If...	Then...
<b>Is the Comm LED on the MLC 8000 Subsite Link Converter RED?</b>	The link to one comparator or more has failed.
<b>Is the MLC 8000 Subsite Link Converter in the MLC 8000 Analog Comparator list?</b>	If Yes, then continue to the next step. If No, then add the MLC 8000 Subsite Link Converter to the voter list.
<b>The connection to the IP network is lost. Can you ping the MLC 8000 Subsite Link Converter from the MLC 8000 Analog Comparator?</b>	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).
<b>MLC 8000 Analog Comparator</b>	
<b>The connection to the IP network is lost. Can you ping the MLC 8000 Analog Comparator from the MLC 8000 Subsite Link Converter?</b>	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).
<b>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).</b>	This issue might be either a problem of the IP network or a network cable should be checked (or replaced).
<b>One of the associated MLC 8000 Subsite Link Converters is going through a reset or a power outage has occurred.</b>	<p><b>a</b> Wait several minutes to see if the LED returns to green, which occurs when the MLC 8000 Subsite Link Converter has recovered its connection.</p> <p><b>b</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.</p>

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...
<b>Is the MLC 8000 Subsite Link Converter configured as IP Simulcast type in the MLC 8000 Configuration Tool?</b>	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...
<b>Yes</b>	Check whether the GTR 8000 receives the correct voice payload to transmit: <ul style="list-style-type: none"> <li>• For analog wireline, check with an oscilloscope that voice is present on the wire.</li> <li>• For digital wireline, check with a network analyzer that voice frames are transmitted.</li> </ul>
<b>No</b>	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...
<b>Infrastruc-ture:</b>	Determine if the link is digital or analog. Continue to the next step.
<b>Repeat:</b>	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...
<b>Analog</b>	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.
<b>Digital</b>	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...
<b>Failed</b>	Determine if the connection is V.24 or Ethernet. Continue to the next step.
<b>Operational</b>	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...
<b>V.24</b>	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.
<b>Ethernet</b>	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...
<b>Yes</b>	Check the configuration, using <i>Provisioning Manager</i> or <i>Configuration Manager</i> .
<b>No</b>	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.

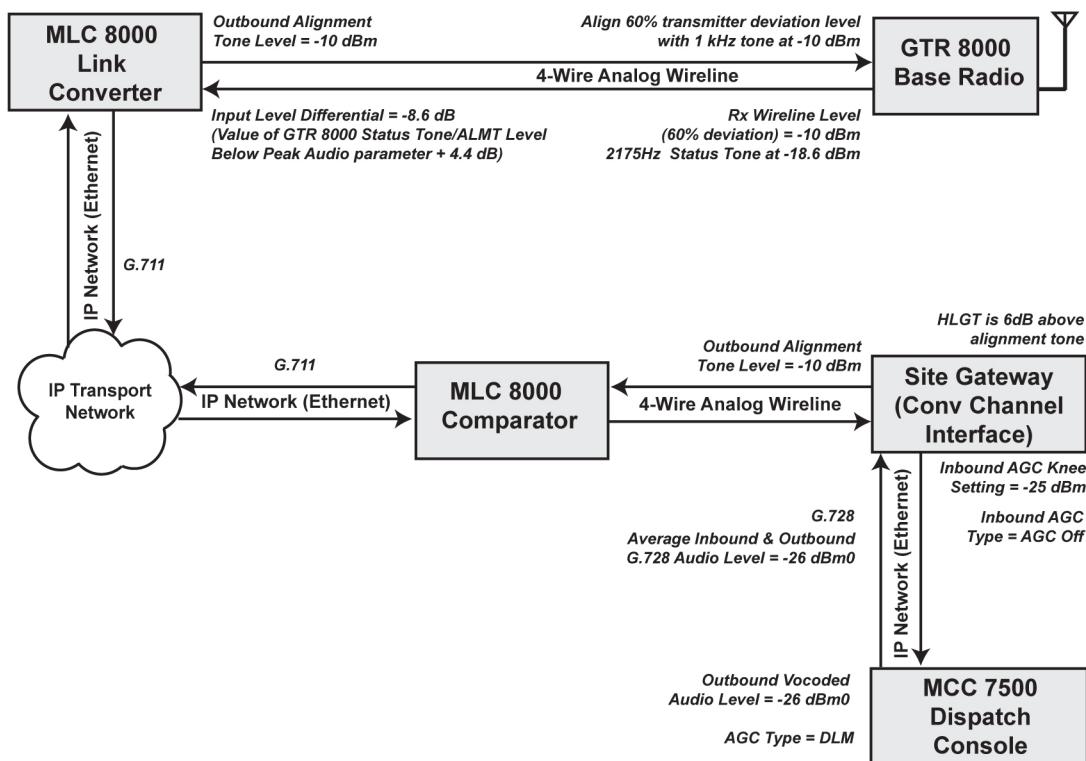
- 3 Use the up/down arrows to adjust the **Gain** for one or more MLC 8000 Subsite Link Converters until the non-reference site is  $\leq 0.3$  dB of the reference site.
- 4 Click **Save to File** to save the gain information to a file for later reference.
- 5 Return to [Configuring the MLC 8000 for IP-Based Simulcast on page 182](#).
  - 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

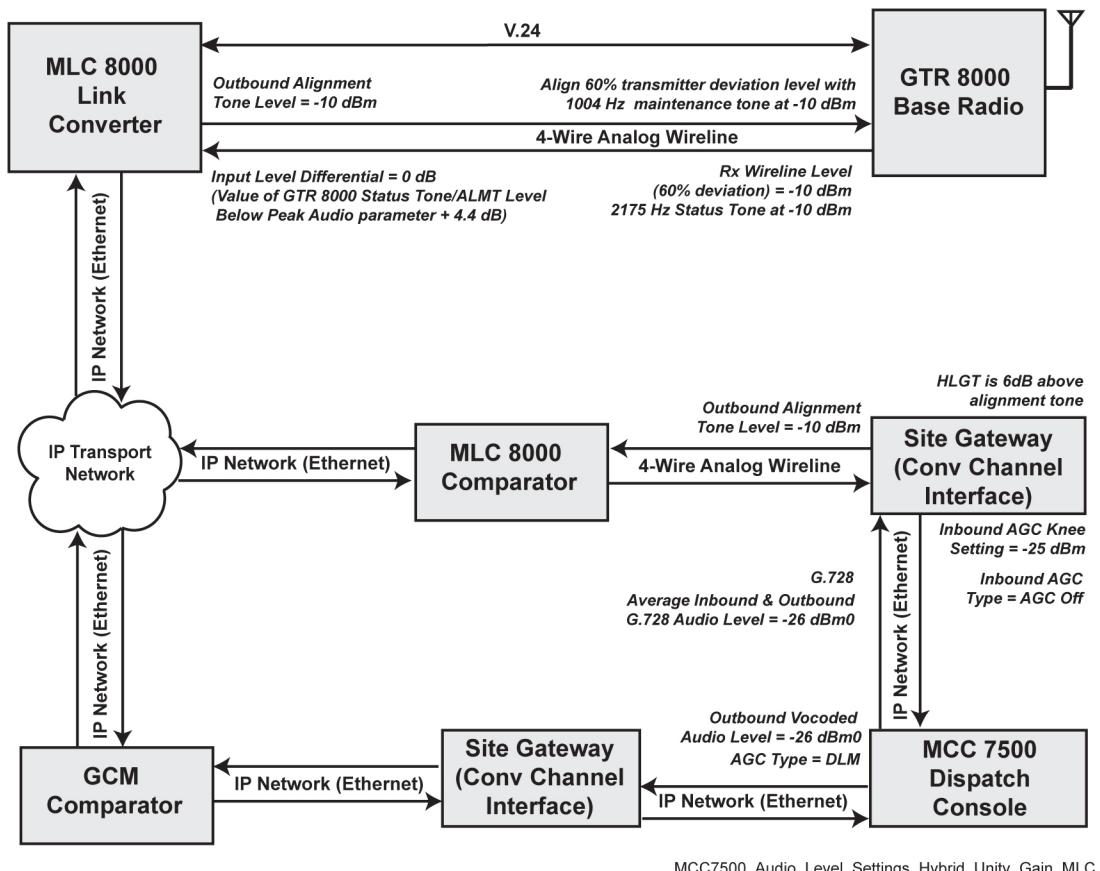
Audio level setting involves the interaction of key parameters that are set for the devices in the system, such as the MLC 8000 Link Converter, Site Gateway (Conventional Channel Interface), base radios, and consoles.

**Figure 30: MCC 7500 Audio Level Settings Analog Unity Gain**



MCC7500\_Audio\_Level\_Settings\_Analog\_Unity\_Gain\_MLC\_A

Figure 31: MCC 7500 Audio Level Settings Mixed Mode Unity Gain



MCC7500\_Audio\_Level\_Settings\_Hybrid\_Unity\_Gain\_MLC\_A

### 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 33: MLC 8000 Link Converter Parameters

MLC 8000 Subsite Link Converter parameter in the Configuration Tool	Corresponding GTR 8000 parameter in CSS
<b>Input Level Differential (dB)</b> in the BR advanced configuration for port window.	<b>Status Tone/ALMT Level Below Peak Audio</b> (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
<b>Input Level Differential</b> in Figure 30: MCC 7500 Audio Level Settings Analog Unity Gain on page 203 is <b>-8.6 dB</b> .	The corresponding <b>Status Tone/ALMT Level Below Peak Audio</b> parameter is <b>-13 dB</b> .
<b>Input Level Differential</b> in Figure 31: MCC 7500 Audio Level Settings Mixed Mode Unity Gain on page 204 is <b>0 dB</b> .	The corresponding <b>Status Tone/ALMT Level Below Peak Audio</b> is <b>-4.4 dB</b> .

### B.5.2

## Audio Levels for the Site Gateway (Conventional Channel Interface) for Analog or Mixed Mode

Figure 30: MCC 7500 Audio Level Settings Analog Unity Gain on page 203 and Figure 31: MCC 7500 Audio Level Settings Mixed Mode Unity Gain on page 204 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 34: 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
<b>Outbound Path (from console, to station)</b>		
Outbound Alignment Tone Level	-10 dBm	-5 dBm
Average Outbound G.728* Audio Level	-26 dBm0	-26 dBm0
<b>Inbound Path (from station, to console)</b>		
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 35: 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
<b>Rx Wireline Level</b> (on the <b>Rx Wireline Alignment</b> tab of the <b>Alignment Screen</b> window)	-10 dBm	-5 dBm
<b>Status Tone</b> (Common tab of the <b>Infrastructure Interface</b> window)	Enabled	Enabled
<b>Tx Wireline Level</b> (on the <b>Tx Wireline Alignment</b> tab of the <b>Alignment Screen</b> window)	-10 dBm	-21 dBm
<b>Analog Repeater Boost</b> (Key Up Controls tab of the <b>Channel Configuration</b> 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 36: 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	<b>80 ms</b> /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	<b>0 ms</b> /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,	<p>perform the following actions:</p> <ul style="list-style-type: none"> <li><b>a</b> 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.</li> <li><b>b</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.</li> </ul>

If...	Then...
If the system is IP-based,	<p>perform the following actions:</p> <ul style="list-style-type: none"><li>a Follow the steps in <a href="#">Performing Coarse Level PL/DPL Adjustment (Conventional Systems) on page 186</a> to set the <b>PL/DPL</b> list to <b>DPL</b> to specify DPL should be inserted into the voice stream.</li><li>b Start the test tone.</li><li>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.</li></ul>

- 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.