System Release 7.17
ASTRO ® 25
INTEGRATED VOICE AND DATA

Conventional Operations

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Document History

Version	Description	Date
MN003253A01-A	Original release of the *Conventional Operations* manual	November 2016

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About Conventional Operations

This manual 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.

What Is Covered In This Manual?

The following topics are included in this manual:

- Conventional Operations Overview on page 33 provides a high-level description of the conventional operations in an ASTRO® 25 Radio Communication system.
- Conventional Devices on page 37 provides hardware and operations details about the conventional operations in an ASTRO® 25 Radio Communication system.
- MCC 7500/7100 Dispatch Console and Conventional Call Processing Features on page 71 describes conventional operations features and call processing.
- Conventional Simulcast/Voting on page 159, describes conventional simulcast and voting operation in the ASTRO® 25 system.
- Other Conventional Operations and Topologies on page 175, provides an overview of various Centralized Conventional topologies that can be connected to an ASTRO® 25 K core, L core, or M core.
- Conventional Channels at Trunked Sites on page 229, provides a description of conventional channels at trunked sites.
- Configuration of Conventional Channels on page 233, describes the configuration of conventional channels.
- Optimization for Conventional Operations on page 253 details optimization procedures and recommended settings relating to conventional operations.
- Fault Management and Troubleshooting for Conventional Operations on page 267 provides fault management and troubleshooting information relating to conventional operations.
- Service Laptop and Software Setup on page 277, provides information on setting up the service laptop.
- Conventional System K1 to K2 Expansion on page 283, contains information supporting expanding your existing K core system from K1 (non-redundant) to K2 (redundant).
- Advanced SECURENET on page 287, describes the functioning of Advanced SECURENET in the context of Conventional Operation.

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

For more information, see the following manuals.

Related Information	Purpose
Standards and Guidelines for Communication Sites	Provides standards and guidelines that should be followed when setting up a Motorola Solutions communications site. This manual may be purchased on CD 9880384V83, by calling the North America Parts Organization at 800-422-4210 (or the international number: 302-444-9842).
System Overview and Documentation	Provides an 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.
Dynamic System Resilience	Provides all the information required to understand, operate, maintain, and troubleshoot the Dynamic System Resilience feature.
For architecture information, see:	
K Core Conventional Architecture Engineer Guide	Provides a description of the K Core system architecture supporting the Conventional Hub Sites and Conventional Base Radio Sites in ASTRO® 25 Conventional and Integrated Data systems.
L and M Core Conventional Architectures Engineer Guide	Describes the centralized conventional architecture and distributed conventional architecture supported by L or M Core ASTRO® 25 systems.
Master Site Infrastructure Reference Guide	Covers site-level information required to install and maintain equipment at the ASTRO® 25 system master sites.
For other related information, see:	
Audio Logging	Provides information on the installation, configuration, and management of the MCC 7500 Archiving Interface Server (AIS) and console logging system components in an ASTRO® 25 system.
CAI Data Encryption Module User Guide	Describes data encryption services provided by the CAI Data Encryption Module (CDEM) for ASTRO® 25 Conventional IV&D applications. The CDEM is a optional component of the Conventional IV&D feature, located with the Conventional IV&D PDG.
Configuration Manager for Conventional Systems User Guide	Covers the use of the Configuration Manager application to set up the Conventional system parameters for consoles, channels, user objects, and integrated data services in K Core ASTRO® 25 systems.
Conventional Data Services	Provides descriptive and procedural content relating to the ASTRO® 25 conventional data feature and its components, as well as information regarding data call and data messages processing, including installation, configuration, operation, and troubleshooting procedures.
GGM 8000 Hardware User Guide	Available on the Motorola Online website (https://businessonline.motorolasolutions.com). To access the manual, select **Re-**

Table continued…

Related Information	Purpose
	source Center → Product Information → Manuals → Network Infrastructure → Routers and Gateways.
K Core Setup Guide	Provides basic installation, configuration, and optimization content to support the initial setup of equipment at the K Core Conventional Hub Site (Hub Site location of the Conventional Site Controller) for either a non-redundant (K1) or redundant (K2) system.
K Core Remote Site Setup Guide	Provides basic installation, configuration, and optimization content to support the initial setup of the essential equipment at the remotes sites in ASTRO® 25 systems.
MOSCAD Network Fault Management	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).
Secure Communications Feature Guide	Provides descriptive information about the Secure Communications features found in an ASTRO® 25 Trunked & Conventional and ASTRO® 25 Conventional systems. The manual should be used with the ASTRO® 25 system documentation and the *Key Management Facility User Guide* manual.
SNMPv3	Provides information relating to the implementation and management of the SNMPv3 protocol in an ASTRO® 25 system Simple Network Management Protocol (SNMP) is a set of protocols used for managing complex networks.
S6000 and S2500 Routers	Provides information relating to the installation, configuration, and management of the S6000 and S2500 routers as used in various network locations.
Virtual Management Server Hardware	Provides information for implementing, maintaining, and replacing common Hewlett-Packard hardware for servers in ASTRO® 25 systems.
Virtual Management Server Software	Provides procedures for implementing and managing VMware ESXi-based virtual server hosts on the common Hewlett-Packard hardware platform in an ASTRO® 25 system. Includes common procedures for virtual machines/virtual appliances on the virtual server host.
Voice Processor Module	Describes the hardware that serves as the foundation for the Voice Processor Module (VPM) used in MCC 7500 console subsystem, the SmartX Site Converter at remote sites, and the Telephone Media Gateway (TMG) in the zone core for the Enhanced Telephone Interconnect subsystem.
Windows Supplemental Configuration	Provides additional procedures that must be performed on all Microsoft Windows-based devices in an ASTRO® 25 system, and additional procedures that are performed only for specific Windows-based devices.
Vote Scan Feature Guide	Introduces the subscriber vote scan feature and describes its implementation in ASTRO® 25 systems. This manual supports system managers, system technicians, and system administrators and requires a thorough understanding of ASTRO® 25 systems con-

Related Information	Purpose
	cepts and topologies, as well as experience in implementing and configuring such systems.

NOTICE: For device installation manuals, see the list in Conventional Devices on page 37 of this manual.

For ASTRO® 3.1 System Release documentation, see the following:

Related Information	Part Number
Documentation Overview	68P81000Y11
Manager's Overview	68P81000Y12
System Overview	68P81000Y13
System Administration	68P81000Y14
Upgrade Installation	68P81000Y15
User Management	68P81000Y16
Performance Management	68P81000Y17
Routine Maintenance	68P81000Y22
Troubleshooting	68P81000Y23
Faulty Hardware Replacement	68P81000Y24
Optimization	68P81000Y25

Chapter 1

Conventional Operations Overview

This chapter provides an overview of conventional operations.

1.1 Conventional Basics

Conventional communication requires that only one subscriber radio operator may talk at a time, and that all other subscriber radio users who are tuned to the conventional channel within the coverage area receive the spoken message. The console operator also hears the subscriber radio operator speak.

Operators can select the conventional channel on their subscriber radios. In a trunked radio system that also includes conventional channels, subscriber radio operators may not transmit or receive on the trunked radio system while they are tuned to a conventional channel.

1.2 Conventional Operations and Architectures

The following conventional operations and architectures are supported in the ASTRO® 25 system:

- Circuit-based and IP-based transport
- Core and non-core architectures

Conventional architectures include subsystems and sites that support a zone core or are established as “standalone” (a zone core is not supported) subsystems or sites.

Core site architectures are detailed in other manuals. See the *K Core Conventional Architecture Engineer Guide* manual or the *L and M Core Conventional Architectures Engineer Guide* manual.

These manuals provide examples of these configurations.

1.3 Conventional Channel Configuration Terminology

This table provides conventional channel terminology for the conventional configurations listed.

Table 1: Conventional Channel Terminology

Conventional configuration of:	Conventional channel terminology:
Zone Controller and/or site controller MCC 7500 Dispatch Console and MCC 7100 IP Dispatch Console	**Universal Resource ID (URID)** Conventional channels are mapped to an embedded unique audio resource URID to relate consoles to defined channels for call routing, console interaction evaluations, and rule enforcement .
GGM 8000 or S2500 Conventional Channel Gateway (CCGW), al-	**Conventional RF Resource** The interface to an RF resource is defined as conventional in the CCGW. The CCGW may be mapped to a physical I/O or an Ethernet-based RF resource.

Table continued…

Conventional configuration of:	Conventional channel terminology:
so known as the Conventional Channel Interface Conventional Packet Data Gateway (PDG)	**Conventional Channel Group ID** This ID associates channels to subscriber ID and alias spaces when subscriber IDs and aliases are not unique across multiple user groups on the same system. All packet data users must be in the same channel group. **Frequency Alias and IDs** An alias and IDs are defined to select conventional channel definitions in base radios. **Conventional Site ID and Alias** An alias and ID are assigned to a CCGW at a site. Each CCGW at a single site is defined as its own “Conventional Site”. **Conventional Subsystem Number and Location Number** These numbers identify where the CCGW is located in a conventional subsystem architecture (these parameters do not apply to other architectures). • GGM 8000 Base Unit • GGM 8000 with Analog/V.24 Interface Kit • GGM 8000 with High-Density Enhanced Conventional Gateway • GGM 8000 with Low-Density Enhanced Conventional Gateway For details of the CCGW hardware configurations, see the *GGM 8000 System Gateway* manual.
ASTRO-TAC™ 3000 Comparator	**Comparator Channel Number** This unique channel number is assigned to a group of base radios or receiver sub-sites belonging to the same multicast, simulcast, or voting channel.
GCM 8000 IP-based Comparator	A GCM 8000 comparator supports a group of base radios or receiver sub-sites belonging to the same multicast, simulcast, or voting channel. **BR_CM Pairing Number** This number is used to: • Identify which Base Radios (BRs) logically connect to which comparator (CM). • Create the multicast IP address which facilitates communication between the paired base radios and comparators over the physical Ethernet connection used to connect all the base radios and comparators in the system. A BR/CM pair supports multiple conventional channels. **Site ID** For infrastructure links, the Site ID defines the ID of the CCGW that services the conventional channel.
GTR 8000 Base Radio GPW 8000 Receiver	A channel (frequency) selection precedes every console outbound voice or supplementary data transmission to ensure that the base radio uses the intended channel definition. The GTR 8000/GPW 8000 Configuration/Service Software (CSS) provides a set of choices for each conventional channel feature and the user selects the operation for each feature. **BR_CM Pairing Number** For multi-site, simulcast, and voting channels, this number is used to: • Identify which BRs logically connect to which CM

Table continued…

Conventional configuration of:	Conventional channel terminology:
	• Create the multicast IP address which facilitates communication between the paired base radios and comparators over the physical Ethernet connection used to connect all the BRs and CMs in the system. A BR/CM pair supports multiple conventional channels. **Sub-site ID** A unique sub-site ID is assigned to each BR attached to a CM. The sub-site ID cannot be duplicated within a comparator-based channel.
IP Link Converter (IPLC)	A GGM 8000 with IPLC functionality connects prior releases consoles to new base stations and/or comparator to allow migration to: • Voted channels • IP transport between the Digital Interface Unit (DIU) and the RF site IPLC devices provide end-to-end channel types to upstream and downstream CPort types for standalone device or as a paired topology. When deployed as a standalone device, the IPLC is at either the site or the core and connects the DIU at the core to the IP base station. If the IPLC is at the core, the IPLC is connected to the base station over an IP backhaul. In a paired IPLC topology: • One IPLC device is co-located with the console at the core and the core IPLC device is connected to the DIU. • One IPLC is at the site and connected to the base station or comparator. • Two IPLC devices (IPLC peers) are connected over an IP backhaul. The IPLC can be configured manually by entering Command-Line Interface (CLI) commands line by line or create and load an ASCII configuration (`boot.cfg`) file. For details on IPLC topologies and configuration, see the*GGM 8000 with IPLC Functionality User Guide*.
MLC 8000 Analog Comparator	**Channel Cluster** The MLC 8000 Configuration Tool uses this term for a group of devices supporting the same simulcast or non-simulcast voting channel or channels. In the cluster, base radio ports on MLC 8000s at sub-sites can be associated with an MLC 8000 Comparator, or with an IP-based GCM 8000 Comparator (for digital conventional IP-based channels).
Subscribers	**Personality** This term is used for subscriber configuration data that can include conventional “channel” configuration.

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Chapter 2

Conventional Devices

This chapter provides a functional description of system components supporting conventional voice, signaling, and station control operations in an ASTRO® 25 radio communication system.

For details about conventional data operations, see the *Conventional Data Services* manual.

2.1 Conventional Operation Hardware Components

The hardware components supporting Conventional Operations in an ASTRO® 25 Radio Communication system include the following:

- Conventional GCP 8000 Site Controller on page 50
- Conventional Base Radios on page 50
- Site Gateway on page 54
- MCC 7500/7100 Dispatch Console (Conventional Overview) on page 64
- Conventional Comparators on page 66

The hardware components listed and presented here play a significant role in supporting conventional channel operation and may vary from your system configuration.

2.1.1 Hardware Functions and Locations for Conventional Operation

This table describes the function of devices that support conventional operation, and the conventional architectures where the devices can be located.

Table 2: Hardware Functions and Locations for Conventional Operation

Device and Related Documentation	Description/Capabilities	Locations*
Conventional GTR 8000 Base Radio **GPW 8000 Receiver** See the *GTR 8000 Base Radio* manual and *GPW 8000 Receiver* manual.	The GTR 8000 Base Radio and GPW 8000 Receiver are available with a conventional feature set similar to QUANTAR®. Both are configurable for digital Project 25 (P25) Frequency Division Multiple Access (FDMA) operation, analog conventional operation, and mixed mode (digital P25 and analog) operation. Both support digital IP, digital V.24, analog 4-wire, and mixed mode 4-wire/V.24	**Distributed Conventional:** Base Radio sites Hub sites with consoles and colocated conventional channels K1 and K2 core hub sites with colocated conventional channels **Centralized Conventional and Trunked:** Remote RF sites (conventional only, or conventional channels added to a trunked site)

Table continued…

Device and Related Documentation	Description/Capabilities	Locations*
	hybrid circuit wireline link interfaces. Each channel can be configured for base station, repeater, simplex, or receive only operation.	Core sites with colocated conventional channels Console sites with colocated conventional channels **Standalone Conventional:** RF sites
Conventional GCM 8000 Comparator See the *GCM 8000 Comparator* manual.	The GCM 8000 Comparator provides voting capability for up to 64 sub-sites in an IP-based system with conventional digital-only (v.24 interface) or mixed mode channels. For conventional mixed mode channels (v.24 and analog interfaces), the GCM 8000 Comparator provides the voting capability for the conventional digital channels and the MLC 8000 Comparator provides the voting capability for the analog channels.	**Distributed Conventional:** Hub sites that serve as multisite/simulcast/voting prime sites. **Centralized Conventional:** Multisite/simulcast/voting prime sites **Standalone Conventional:** Multisite/simulcast/voting prime sites
Conventional MLC 8000 Comparator See the ASTRO® 25: *MLC 8000 Comparator* manual *MLC 8000 Setup Guide* *MLC 8000 Configuration Tool with Analog Voting and Display* manual	The MLC 8000 Comparator provides voting capability in an IP-based system with conventional analog-only (4-wire) or mixed mode channels. For conventional mixed mode channels (v.24 and analog interfaces), the GCM 8000 Comparator provides the voting capability for the conventional digital channels and the MLC 8000 Comparator provides the voting capability for the analog channels. When an MLC 8000 Comparator is implemented, MLC 8000 Link Converter devices must be connected to the base radios using 4-wire and/or v.24 interfaces.	**Distributed Conventional:** Hub sites that serve as multisite/simulcast/voting prime sites. **Centralized Conventional:** Multisite/simulcast/voting prime sites. **Standalone Conventional:** Multisite/simulcast/voting prime sites.

Table continued…

Device and Related Documentation	Description/Capabilities	Locations*
Conventional GCP 8000 Site Controller (CSC) See the *GCP 8000 Site Controller* manual and *CSS Online Help*.	Control interface that manages the voice call setup and signaling between consoles and conventional channels, when supported by a colocated Conventional Channel Gateway (CCGW) device. Also arbitrates console priorities.	**Distributed Conventional hub sites** K1 core: one CSC K2 core: two CSCs Remote hub sites with consoles **Centralized Conventional:** Various IP-based “prime site” topologies for multisite/simulcast/voting
Network Time Protocol (NTP) Server See the *Network Time Protocol Server* manual.	A server which provides synchronized time to the clients in an Ethernet network.	**Distributed Conventional:** K1 and K2 core hub sites (if the option for the NTP server is implemented) **Centralized Conventional:** L1, L2, M1, M2, and M3 cores
Simulcast Site Reference See the *Simulcast Site Reference* manual.	A Global Navigation Satellite System (GNSS) receiver, which supplies stratum 1 frequency and time reference for equipment at simulcast sites.	**Distributed Conventional:** Hub sites that serve as simulcast prime sites (comparator locations) and simulcast sub-sites **Centralized Conventional:** Simulcast prime sites (comparator locations) and simulcast sub-sites **Standalone Conventional:** Simulcast prime sites (comparator locations) and simulcast sub-sites
Site Gateway and Conventional Channel Gateway (CCGW) See the *GGM 8000 Hardware User Guide* and the *GGM 8000 System Gateway* manual.	Transport device that provides: • IP link between sites • Conventional channel gateway with an Ear and Mouth (E&M) interface that supports analog, circuit digital (v.24)	**Distributed Conventional hub sites** K1 core: one core gateway K2 core: two core gateways Remote hub sites: site gateways and conven-

Table continued…

Device and Related Documentation	Description/Capabilities	Locations*
	and mixed mode channels. Also referred to as "Conventional Channel Interface"	tional channel gateways **Distributed Conventional Base Radio sites** **Centralized Conventional:** Various topologies
Conventional Packet Data Gateway (PDG) See the *Packet Data Gateways* manual and *Conventional Data Services* manual.	Supports integrated data by providing a link between the data network for your organization and the ASTRO® 25 Radio Network Infrastructure (RNI).	If integrated data is implemented: **Distributed Conventional:** K1 and K2 core hub sites **Centralized Conventional:** M1, M2, and M3 cores
GGSN See the *S6000 Hardware User Guide* and the *S6000 and S2500 Routers* manual.	A router device that supports integrated data by providing a link between the data network for your organization and the ASTRO® 25 Radio Network Infrastructure (RNI).	If integrated data is implemented: **Distributed Conventional:** K1 and K2 core hub sites **Centralized Conventional:** M1, M2, and M3 cores
Border Gateway and **Peripheral Network Router** See the *GGM 8000 Hardware User Guide* and the *GGM 8000 System Gateway* manual, or when an S6000 is used, see the *S6000 Hardware User Guide* and the *S6000 and S2500 Routers* manual.	A transport routing device supporting the network traffic interface between the data network for your organization, referred to here as the Customer Enterprise Network (CEN), and the ASTRO® 25 Radio Network Infrastructure (RNI). If a CEN is geographically separated from the RNI, the border gateway backhaul LAN/WAN connection is terminated at a peripheral network router colocated with the RNI. The peripheral network router terminates at the De-Militarized Zone (DMZ) provided by the RNI/DMZ firewall. If a CEN is geographically colocated with the RNI, the	If a link is implemented between the data network for your organization and the ASTRO® 25 network: **Distributed Conventional:** K1 and K2 core hub sites **Centralized Conventional:** M1, M2, and M3 cores

Table continued…

Device and Related Documentation	Description/Capabilities	Locations*
	border gateway backhaul LAN connection is directly terminated at the DMZ provided by the RNI/DMZ firewall. No peripheral network router is required for this scenario.	
Firewall See the appropriate *Fortinet Firewall* manual.	A network security device providing firewall services to monitor and control network traffic.	If a link is implemented between the ASTRO® 25 network and the data network for your organization or Motorola Solutions Support Center (SSC): **Distributed Conventional:** K1 and K2 core hub sites **Centralized Conventional** M1, M2, and M3 cores
HP 2610 / 2620-24 Switch See the *System LAN Switches* manual.	An Ethernet switch that supports Local Area Networks (LANs).	**Distributed Conventional hub sites** K1 core: one core switch K2 core: two core switches Remote hub sites: site switches **Distributed Conventional Base Radio sites** For example, multisite/simulcast/voting sites using MLC 8000 devices **Centralized Conventional:** Various IP-based topologies If only one digital only GTR 8000 Base Radio is installed at the conventional site, the site LAN switch is not required. The GTR 8000 Base Radio can be connected directly to the site gateway using an Ethernet crossover

Table continued…

Device and Related Documentation	Description/Capabilities	Locations*
		cable. The Ethernet interface for the GTR 8000 Base Radio must be configured for 100 Mbps full-duplex.
Backhaul Switch See the documentation for the manufacturer and the *Flexible Site and InterZone Links* for information regarding implementation of Ethernet site links.	Ethernet-capable switch that supports connection between sites.	**Distributed Conventional hub sites:** K1 core: one backhaul switch K2 core: two backhaul switches Remote hub sites **Distributed Conventional base radio sites** **Centralized Conventional:** Various topologies A backhaul switch is not included for systems without remote sites, with one remote site, or when some other Layer 3 router interface is used, but can be provided if/when needed
Terminal Server See the *Terminal Servers LX Series* manual.	Supports remote access to system components through a serial interface. Also, in the DMZ between the RNI and other networks, a terminal server can provide a Virtual Private Network (VPN) tunnel to the RNI core for specific purposes such as service access or remote key loading for Radio Authentication. Also, when adding GTR 8000 Base Radios to an ASTRO® 3.x Conventional System, a terminal server is used to link between Non-IP remote sites and the Centralized Management Location, when a MOSCAD Network Fault Man-	**Distributed Conventional:** K1 and K2 core hub sites (if the option for s terminal server serial interface to core equipment is implemented) **Centralized Conventional:** L1, L2, M1, and M2 cores (if the option to include a terminal server is implemented) and M3 cores **ASTRO® 3.x Conventional with GTR 8000 Base Radios:** Base radio sites and centralized management location (if the MOSCAD NFM Non-IP link is implemented)

Table continued…

Device and Related Documentation	Description/Capabilities	Locations*
	agement (NFM) is implemented.	
MCC 7500/7100 Dispatch Console See the ASTRO® 25: *MCC 7500 Dispatch Console with Voice Processor Module* manual. *MCC 7500/7100 Elite Admin User Guide.* *MCC 7500/7100 Elite Dispatch User's Guide.* *Provisioning Manager* manual and online help (for systems with an M or L core). See the *Configuration Manager for Conventional Systems User Guide* manual and online help (for systems with a K core).	A dispatch console or "operator position" interfaces directly to the IP network to support communication and administration activities for trunked and conventional radios. For analog (2-wire or 4-wire) interfaces, a CCGW E&M module must provide the connection to the MCC 7500/7100 dispatch console (see the GGM 8000 row of this table).	**Distributed Conventional:** K1 and K2 core hub sites with consoles Remote hub sites with consoles **Centralized Conventional:** L1, L2, M1, M2, and M3 cores with colocated console sites Remote console sites
MCC 7500 Console Site Audio Logging devices See the ASTRO® 25: *MCC 7500 Dispatch Console with Voice Processor Module* manual *Audio Logging* manual	At MCC 7500 consoles sites with Audio Logging subsystems, include a logging recorder and a replay (playback) station. An Archiving Interface Server (AIS) connects the Audio Logging subsystem to the rest of the radio network infrastructure.	**Distributed Conventional:** K1 and K2 core hub sites with consoles Remote hub sites with consoles **Centralized Conventional:** L1, L2, M1, M2 and M3 cores with colocated console sites Remote console sites
MCC 7500 Aux I/O Server See the ASTRO® 25: *MCC 7500 Dispatch Console with Voice Processor Module* manual *Provisioning Manager* manual and online help (for systems with an M or L core) *Configuration Manager for Conventional Systems User Guide* manual and online help (for systems with a K core)	Auxiliary Input/Output device for console control of auxiliary devices. For example, the SDM3000-hardware-based MCC 7500 Aux I/O Server is required in order for the MCC 7500 to display and control voting for simulcast and other voting systems.	IP-based console sites for multisite/simulcast/voting systems, including: **Distributed Conventional:** K1 and K2 core hub sites Remote hub sites (including console sites and comparator sites) Base Radio sites **Centralized Conventional:** L1, L2, M1, M2, and M3 cores Remote RF sites Remote console sites

Table continued…

Device and Related Documentation	Description/Capabilities	Locations*
MKM 7000 Console Alias Manager (CAM) Server See the *MKM 7000 Console Alias Manager* manual and online help	The optional MKM 7000 CAM solution defines unique Unit ID aliases displayed on the MCC 7500/7100 Consoles. These aliases are independent of the aliases defined in the network manager.	IP-based console sites in systems including: **Distributed Conventional:** Only at MCC 7500/7100 Console Sites **Centralized Conventional:** Only at MCC 7500/7100 Console Sites
Motorola Solutions Consolettes *Console Sites* manual *GGM 8000 System Gateway* manual	XTL 5000 and APX 7500 consolettes enable MCC 7500/7100 Consoles to have access to resources when the link to the network core has failed. The consolettes also enable wireless connection to systems utilizing various over-the-air protocols (such as analog, analog with MDC-1200, ASTRO® 25 Conventional, and 3600 Trunking).	**Distributed Conventional:** K1 and K2 core hub sites with consoles (the consoles do not have to be at the hub site) Remote hub sites with consoles Base Radio sites **Centralized Conventional:** L1, L2, M1, M2, and M3 cores with colocated console sites Remote console sites **Standalone Conventional:** Various topologies
Unified Event Manager (UEM) Network Fault Management (NFM) application: See the *Unified Event Manager* manual.	The UEM is an optional NFM application that provides reliable fault management services for the ASTRO® 25 system. The main functions of UEM are device discovery, fault management, supervision, and synchronization. **NOTICE:** Either UEM or MOSCAD NFM can be used, but not both.	**Distributed Conventional:** K1 and K2 core hub sites Remote hub sites (including console sites and comparator sites) Base Radio sites **Centralized Conventional:** L1, L2, M1, M2, and M3 cores Remote RF sites Remote console sites

Table continued…

Device and Related Documentation	Description/Capabilities	Locations*
		Standalone Conventional: K1, K2, L1, L2, M1, M2, and M3 cores NM/Dispatch site
MOSCAD Network Fault Management (NFM) equipment: See the *MOSCAD Network Fault Management* manual.	MOSCAD NFM is an optional ASTRO® 25 system solution that provides tools to configure, monitor, and control auxiliary system devices (such as tower lights, power, and environmental equipment) in communication sites. **NOTICE:** Either UEM or MOSCAD NFM can be used, but not both.	**Distributed Conventional:** K1 and K2 core hub sites Remote hub sites (including console sites and comparator sites) Base Radio sites **Centralized Conventional:** L1, L2, M1, M2, and M3 cores Remote RF sites Remote console sites **Standalone Conventional:** NM/Dispatch site **ASTRO® 3.x Conventional:** Centralized Management Locations Dispatch Sites Base Radio Sites **NOTICE:** MOSCAD NFM requires that the system includes at least one centralized management location where personnel are available to operate the application. In a standalone system, the system could be a dispatch site.
MOSCAD NFM Graphical Master Computer (GMC) See the ASTRO® 25 *GMC/GWS for MOSCAD NFM Operator Manual*.	MOSCAD NFM GMC is a Windows-based server providing graphical alarm display, alarm logging, alarm	**Distributed Conventional:** K1 and K2 core hub sites

Table continued…

Device and Related Documentation	Description/Capabilities	Locations*
	reporting, and (optionally) alarm paging of information received from the SDM3000 .	Base Radio sites **Centralized Conventional:** L1, L2, M1, M2, and M3 cores **Standalone Conventional:** NM/Dispatch site **ASTRO® 3.x Conventional:** Centralized Management Locations Dispatch Sites Base Radio Sites MOSCAD NFM requires that the system includes at least one centralized management location where personnel are available to operate the application. In a Standalone system, the system could be a dispatch site.
MOSCAD NFM Graphical Workstation (GWS) See the ASTRO® 25 *GMC/GWS for MOSCAD NFM Operator Manual*.	The MOSCAD NFM GWS is a Windows-based client of the GMC providing graphical alarm display, alarm reporting, and (optionally) alarm paging.	**Distributed Conventional:** K1 and K2 core hub sites Remote hub sites (including console sites and comparator sites) Base Radio sites **Centralized Conventional:** L1, L2, M1, M2, and M3 cores Remote console sites **Standalone Conventional:** Network Management (NM)/Dispatch site **ASTRO® 3.x Conventional:** Centralized Management Locations Dispatch Sites Base Radio Sites

Table continued…

Device and Related Documentation	Description/Capabilities	Locations*
		If GTR 8000 Base Radios and MOSCAD NFM are implemented, the MOSCAD NFM components listed are used in base radio and centralized management locations. (Legacy MOSCAD NFM components not listed here are used for QUANTAR®, if present.)
MOSCAD NFM SDM3000 Network Translator (SNT) See the ASTRO® 25 *SDM3000 (Site Device Manager) Owner's Manual* and the *SDM3000 Builder User Guide* manual.	SDM3000 Network Translator (SNT) acts as a proxy device between SDM3000 , GMC, and UEM. The SDM3000 Builder software configures the SNT.	**Distributed Conventional:** K1 and K2 core hub sites Base Radio sites **Centralized Conventional:** L1, L2, M1, M2 and M3 cores **Standalone Conventional:** NM/Dispatch site **ASTRO® 3.x Conventional:** Centralized Management Locations Dispatch Sites Base Radio Sites MOSCAD NFM requires that the system includes at least one centralized management location where personnel are available to operate the application. In a Standalone system, the system could be a dispatch site.
MOSCAD NFM SDM3000 See the ASTRO® 25 *SDM3000 (Site Device Manager) Owner's Manual* and the *SDM3000 Builder User Guide* manual.	SDM3000 is a device monitoring core, co-located and remote site equipment, and microwave radios via digital and analog I/Os, serial communications protocols, and IP communications protocols (including Field Service Protocol (FSP) and Simple Network Manage-	**Distributed Conventional:** K1 and K2 core hub sites Remote hub sites (including console sites and comparator sites) Base Radio sites

Table continued…

Device and Related Documentation	Description/Capabilities	Locations*
	ment Protocol (SNMPv3, SNMPv1). The SDM3000 Builder software configures the SNT.	**Centralized Conventional:** L1, L2, M1, M2, and M3 cores Remote RF sites Remote console sites **Standalone Conventional:** NM/Dispatch site **ASTRO® 3.x Conventional:** Centralized Management Locations Dispatch Sites Base Radio Sites MOSCAD NFM requires that the system includes at least one centralized management location where personnel are available to operate the application. In a Standalone system, the system could be a dispatch site.
IP Link Converter See the *GGM 8000 with IPLC Functionality User Guide*.	The IP Link Converter (IPLC) is based on the GGM 8000 hardware platform equipped with either a High-Density Enhanced Conventional Gateway module (provides 8 analog ports and 8 V.24 ports) or a Low Density Enhanced Conventional Gateway module (provides 4 analog ports and 4 V.24 ports) and running Enterprise OS (EOS) software version 16.6 or higher. The IPLC feature uses the IP transport capabilities of the GGM 8000 gateway to position users to migrate to ASTRO® 25 IP-based systems. In addition, the IPLC uses the following CCGW functionality supported on the GGM 8000:	**ASTRO® 3.x Conventional:** ASTRO® 3.x Core/ Multisite/simulcast/ voting prime sites/base radio sites to support the use of G-Series and MLC 8000 devices with prior releases dispatch consoles in an ASTRO® 3.x system through the DIU.

Device and Related Documentation	Description/Capabilities	Locations*
	• V.24 plus 4-wire interface to the Digital Interface Unit (DIU). • Signaling conversion. • Support for IP transport. • Conversion from 4-wire analog to G.728 packets to transport audio over IP. • Support for the MLC 8000 and/or GCM 8000 comparators in a mixed mode (both comparator are used) or digital only (GCM 8000 only comparator) voting configuration. • Integrated Voice and Data (IV&D) to support data applications.	

* For information about the equipment and architecture in the Locations column of this table, see the following:

- Subsequent chapters of this *Conventional Operations* manual
- *K Core Conventional Architecture Engineer Guide* manual
- *L and M Core Conventional Architectures Engineer Guide* manual

Table 2: Hardware Functions and Locations for Conventional Operation on page 37 does not include optional components that can be located in the enterprise network for your organization for optional features. For example:

- Key Management Facility (KMF) server (see the ASTRO® 25 system *Key Management Facility User Guide* manual and other documentation that ships with KVLs)
- POP25 server (see the *Unified Network Services Feature* manual)
- Messaging Service server and client

Also, Table 2: Hardware Functions and Locations for Conventional Operation on page 37 does not include handheld devices or components that Motorola Solutions no longer sells but may be a part of the conventional system for your organization for example:

- Key Variable Loader (KVL) handheld devices
- Subscriber units
- QUANTAR®
- ASTRO-TAC™ 3000 comparator

See the manual for the specific model of handheld unit or latest update of the manual that shipped with the specific component.

2.1.2
Conventional GCP 8000 Site Controller

The primary role of the GCP 8000 Conventional Site Controller (CSC) is to support redundant conventional dispatch call operations.

Subsystems and/or sites that interface with a zone core where the CSC supports redundant conventional dispatch call operations include, but may not be limited to, the following:

- Dispatch Console Sites (Centralized Conventional Architecture)
- Conventional Subsystem (Conventional Hub Site)

At an MCC 7500 console site with colocated conventional channels, the CSC supports the dispatch console by enabling the dispatch console and radio users to maintain communications over conventional resources local to the console site, should a link failure occur between the console site and zone core.

The CSC supports a voice, signaling, and station control, but does not perform any functions associated with packet data service. CSC is required only for redundant site mode operation of a remote MCC 7500 console site. If site mode operation is not required, or there are no remote MCC 7500 consoles, a CSC is not required.

In a centralized architecture, a CSC can be colocated only at the dispatch site and used in the event when the link to the zone core is lost.

For details about the GCP 8000 Site Controller, see the *GCP 8000 Site Controller* manual.

2.1.3
Conventional Base Radios

The following Conventional Base Radios employed in the system include, but are not limited to:

- GTR 8000 Base Radio
- GPW 8000 Receiver
- QUANTAR®
- ASTRO-TAC Receiver
- MTR 2000/3000 Base Radio

NOTICE: Conventional GTR 8000 Base Radios can be used to replace a conventional QUANTAR®. See the *Conventional QUANTAR Replacement Guide* for details. The mixed mode conventional GTR 8000 Base Radio is configurable for digital Project 25 Frequency Division Multiple Access (FDMA) operation, analog conventional operation, and mixed mode (digital P25 and analog) operation. The conventional GTR 8000 Base Radio supports digital IP, digital V.24, analog 4-wire, and mixed mode 4-wire/V.24 hybrid circuit wireline link interfaces for details, see the Hardware Functions and Locations for Conventional Operation on page 37 section. The conventional GTR 8000 Base Radio supports 16 sets of programmable channel configurations. Each channel configuration can be configured for base station, repeater, simplex, or receive only operation.

The GTR 8000 Base Radio is available as a standalone base radio or in the GTR 8000 Expandable Site Subsystem (ESS). The ESS supports trunking channels and/or conventional channels. Up to six conventional base radios of the same band can be housed in an ESS cabinet/rack at a conventional only site. See the *GTR 8000 Base Radio* manual or *GTR 8000 Expandable Site Subsystem* manual for details.

For information on adding conventional base radios and/or conventional GPW 8000 Receivers to an ESS with trunked channels, see Conventional Channels at Trunked Sites on page 229 and/or GPW 8000 Receivers on page 51.

2.1.3.1

GTR 8000 Transceiver Option Card with Internal Frequency Reference

The Transceiver Option Card (TOC) within a base radio provides an internal 10 MHz frequency reference. The internal frequency reference has sufficient stability for multicast operation and may also be used as a backup for simulcast operation. The TOC also provides the analog interfaces and WildCard I/Os. The primary frequency reference for simulcast operation must be from an external GNSS disciplined oscillator or an atomic reference oscillator. The TOC requires an internal frequency reference oscillator alignment at different intervals mandated by its category and frequency band.

NOTICE: VHF systems do not require alignment after initial installation.

For the alignment procedures, in the *CSS Online Help*, see **Base Radio Service Help** → **Service Screens** → **Alignment Screens** .

2.1.3.2

Conventional Base Radios WildCard Capability

WildCard capability for analog conventional GTR 8000 Base Radios facilitates the modification of station operation based upon station states and external inputs.

- Tone Remote Control (TRC) WildCards:
  - TRC is integrated into the WildCard Tables which are automatically created when the station type is set to analog.
- Input and output are available through the 50-pin system connector on the GTR 8000 Base Radio, programmable from the WildCard Table window in Configuration/Service Software (CSS).
  - Individual inputs and outputs are available as WildCard states.
  - Individual outputs are set and cleared using WildCard commands.

For the WildCard configuration, see “WildCard Tables Window“ in *CSS Online Help*. For input and output pins, see “System Connector Ports (Conventional)” in the *GTR 8000 Base Radio* manual.

2.1.3.3

GPW 8000 Receivers

The conventional GPW 8000 Receiver operates in a voting environment with connection to a conventional comparator providing additional receive-only stations in areas where it would otherwise be difficult to receive a signal from low-power subscriber units. The receiver also operates as a monitor receiver in a non-voting environment with a connection to a console.

2.1.3.4
Base Radio Interface Links

Depending on the base radio used in the system, different types of interface links (analog, digital, mixed mode, IP) are available.

Table 3: Conventional Base Radios/Control Stations and Interface (Link) Types

This table shows the various interface links and the type of base radios supported for conventional channels in the system.

	Interface (Link) Type				
Base Radio Type	**Analog-Only (4-wire)**	**Digital-Only (V.24)**	**Hybrid (4w/V.24)**	**Digital-Only (IP)**	**ACIM (Analog 4-wire and Digital V.24)**
GTR 8000 Base Radio	Analog GTR 8000 Base Radio	Digital (V.24) GTR 8000 Base Radio	Mixed Mode GTR 8000 Base Radio	IP Conventional GTR 8000 Base Radio	N/A
GPW 8000 Receiver	Analog GPW 8000 Receiver	Digital (V.24) GPW 8000 Receiver	Mixed Mode GPW 8000 Receiver	IP Conventional GPW 8000 Receiver	N/A
QUANTAR®	Analog QUANTAR®	Digital QUANTAR®	Mixed Mode QUANTAR®	N/A	N/A
ASTRO-TAC Receiver	Analog ASTRO-TAC Receiver	Digital ASTRO-TAC Receiver	Mixed Mode ASTRO-TAC Receiver	N/A	N/A
MTR 2000/3000 Base Radio	MDC 1200 MTR Base Radio	N/A	N/A	N/A	N/A
Motorola Solutions Consolette	XTL5000 Consolette APX 7500 Consolette	N/A	N/A	N/A	XTL5000 Consolette APX 7500 Consolette

2.1.3.5
Conventional Channel Types

The base radio is the physical device that provides subscriber communication channels using various types of interface links. However, a base radio, supporting a given type of interface, may be referred to as an analog channel, digital channel, mixed mode channel, and others. The following sections provide a brief description of the various types of conventional channels used in the system.

2.1.3.5.1
Analog Channels and MDC 1200Conventional Channels

The GTR 8000 Base Radio, GPW 8000 Receiver, QUANTAR®, ASTRO-TAC Receiver, and MTR 2000 and MTR 3000 base radios support Analog (4-wire) and MDC 1200 analog conventional channel operations.

Analog conventional calls use the Conventional Channel Gateway, the zone controller, and the MCC 7500/7100 Dispatch Console to process subscriber analog or MDC 1200 analog calls. With the MCC 7500/7100 Dispatch Consoles affiliated to the conventional channel, the call information (unit ID, Line Operated Busy Light (LOBL), and console transmission) gets routed between the Conventional Channel Gateway.

Station equipment that provides analog signaling using the 4-Wire interface can use that interface to connect to an MLC 8000 Link Converter. The MLC 8000 Link Converter supports IP signaling to the analog MLC 8000 Comparator. The MLC 8000 Comparator is then connected to a GGM 8000 Conventional Channel Interface module, also known as a Conventional Channel Gateway (CCGW), using a 2-Wire or 4-Wire interface to complete the analog transmission path to the dispatch console. The CCGW sums the receive and transmit audio, removes the high- and low-level guard tones, and routes the resulting audio to the audio logging output interface.

2.1.3.5.2
Digital (V.24) Conventional Channels

The GTR 8000 Base Radio (V.24), GPW 8000 Receiver (V.24), QUANTAR®, and ASTRO-TAC Receiver support digital conventional channel operations in the system.

The Conventional Channel Gateway (CCGW) provides a V.24 input to interface the digital conventional channel to the MCC 7500/7100 Dispatch Console to support digital conventional calls.

Signaling capabilities for digital conventional channels include Unit IDs, Emergency, Call Alert, and other functions. For detailed information about these features, see MCC 7500/7100 Dispatch Console and Conventional Call Processing Features on page 71.

For secure digital conventional calls, encryption key management and provisioning is accomplished at the MCC 7500/7100 Dispatch Console and Archiving Interface Server (AIS), and is no longer implemented on a per channel basis which allows for flexible and easy key provisioning per operator position, not per physical digital conventional channel.

Station equipment that provides digital signaling using the V.24 interface can use that interface to connect to an MLC 8000 Link Converter. The MLC 8000 Link Converter supports IP signaling to the GCM 8000 Comparator. The GCM 8000 Comparator is then connected to a CCGW using an IP interface.

2.1.3.5.3
Digital (IP) Conventional Channels

The IP Conventional GTR 8000 Base Radio and IP Conventional GPW 8000 Receiver provide digital conventional channels through an IP interface for digital conventional channel operations in the system.

Digital IP conventional channels interface directly to IP-based network transport equipment (Ethernet LAN Switch, or Ethernet ports on the Site Gateway).

An IP-based GCM 8000 Comparator also adds the capability to support voting, multicast, and simulcast topologies with IP connectivity between the zone core, prime sites, and remote sub-sites. See the *GCM 8000 Comparator* manual.

For digital conventional secure calls in an ASTRO® 25 system, encryption key management and provisioning is accomplished at the MCC 7500/7100 Dispatch Console and Archiving Interface Server (AIS), and is no longer implemented on a per channel basis. This implementation allows for flexible and easy key provisioning per operator position, not per physical digital conventional channel.

A phone patch interface is not supported for IP-based digital conventional channels.

2.1.3.5.4
Mixed Mode Channels

Mixed Mode refers to the type of channel the base radio uses to support subscriber calls. When an analog subscriber call is made using a base radio that supports mixed mode, the 4-Wire link carries the analog voice, and the V.24 link carries the signaling. When a digital subscriber call is made using a base radio that supports mixed mode, the V.24 link carries a digital voice and digital signaling.

The GTR 8000 Base Radio, GPW 8000 Receiver, QUANTAR®, and ASTRO-TAC Receiver support mixed mode conventional channel operations in the system.

Mixed mode channels use a hybrid (4-Wire/V.24) link. The GTR 8000 Base Radio, GPW 8000 Receiver, QUANTAR®, and ASTRO-TAC Receiver all use hybrid mixed mode (4-Wire/V.24) links, while GCM 8000 Comparators and MLC 8000 Comparators support IP-based links.

Voted IP-based Mixed Mode channels are provided using MLC 8000 Link Converters working with the MLC 8000 Comparator supporting analog calls, and the GCM 8000 Comparator for digital calls.

A mixed mode channel requires the use of the GGM 8000 Conventional Channel Gateway supporting the interface between the base radio and console.

Conventional mixed mode channels, operating in digital mode, support digital conventional features. Conventional Mixed Mode channels operating in analog mode do not support any signaling functions (such as Unit ID, Emergency, Call Alert, and others).

Base radios that support conventional mixed mode use an analog 4-Wire channel interface for analog and an ASTRO® 25 V.24 digital channel interface for digital.

2.1.3.5.5
ACIM Conventional Channels

The MCC 7500/7100 Dispatch Console and the XTL 5000 or APX 7500 Motorola Solutions consolettes support ASTRO® 25 Control Interface Module (ACIM) conventional channel operations in the system. The consolette allows the MCC 7500/7100 Dispatch Console to access talkgroups even if the zone core is not available (for example, due to a link failure). It also allows the MCC 7500/7100 Dispatch Console to access the trunked subscribers in a trunked site in site trunked or site failsoft mode. Additionally, the consolette enables the MCC 7500/7100 Dispatch Console to use over-the-air protocols which may not be accessible otherwise.

For IP Simulcast remote sites, local failsoft capability is also available. For details, see the *IP Simulcast Remote Site* manual.

Each ACIM conventional channel is unique and needs one analog 4-Wire connection and one digital V.24 link between up to eight consolettes and a Conventional Channel Gateway at a console site to allow communication to the MCC 7500/7100 Dispatch Console.

The ACIM conventional channel requires the use of a GGM 8000 Conventional Channel Gateway supporting the interface between the consolettes and the MCC 7500/7100 Dispatch Console.

For more information, see ACIM Conventional Channel on page 143 and the *GGM 8000 System Gateway* manual.

ACIM signaling on MCC 5500 consoles is maintained with the IP Link Converter (IPLC) feature. The IPLC feature allows non-IP-based consoles that interface with a Digital Interface Unit (DIU) to interface to RF site devices such as G-series, MLC 8000, and/or QUANTAR devices via the DIU to support conventional channels (digital or mixed mode channels) in an ASTRO® 3.x system. See ASTRO 3.1 Coexistence Topology on page 175 for details.

2.1.4
Site Gateway

The GGM 8000 Site Gateway is an essential network element for IP conventional, mixed mode, MDC 1200 and ASTRO® 25 Control Interface Module (ACIM) conventional channels, and functions as a WAN interface device and a conventional channel gateway.

The GGM 8000 Site Gateway comes with four Ethernet ports to support IP digital conventional channels or Ethernet site links. Sites that require redundant Ethernet site links must use a separate pair of GGM 8000 platforms as site gateways, and another GGM 8000 as a conventional channel gateway.

2.1.4.1

Hybrid Site Link Overview

The Hybrid Site Links configuration is a flexible way of connecting a redundant zone core to redundant remote sites in ASTRO® 25 systems. The Hybrid Site Links configuration allows redundant connections between the zone core and a remote site by using different connection types. Before the introduction of this configuration, the primary and redundant site links had to be of the same type, either E1/T1 or Ethernet links. This configuration enables mixing of E1/T1 and Ethernet site links, where the primary could be an E1/T1 and the secondary could be an Ethernet link, or an Ethernet link as the primary or E1/T1 as the secondary link.

Hybrid site links are available in the M2 and M3 system configurations with Dynamic System Resilience (DSR), and M3 system configuration without DSR. The Hybrid Site Links configuration connects redundant zone cores to the following remote sites:

- ASTRO® 25 Repeater Site (ISR)
- IP Simulcast Prime Site
- Network Manager/Dispatch Console Site (MCC 7500/7100 Dispatch Console only)
- Conventional-only Site (Centralized Conventional Architecture)

The hybrid links support flexible transport types by employing transport devices such as redundant GGM 8000 site gateways and S6000 core routers. The transport between a primary core router and primary site gateway, or a secondary core router and secondary site gateway within the same site must be either of the T1/E1-to-T1/E1 or Ethernet-to-Ethernet transport type. For sites that require more than one T1/E bandwidth, the Hybrid Site Links configuration supports up to two T1/E1 links bundled together.

A site gateway supports one connection type, either redundant Ethernet or T1/E1 WAN terminations. A core router can support T1/E1 terminations for some sites and Ethernet terminations for other sites.

NOTICE: The GGM 8000 replaces the MNR S6000 for all Ethernet configurations; all T1/E1 configurations require an MNR S6000.

For more information regarding S6000 core routers, see the *S6000 and S2500 Routers* manual.

For more information about GGM 8000 site gateway transport devices, see the *GGM 8000 System Gateway* manual.

2.1.4.2

Site Gateway (WAN Interface)

The Site Gateway (WAN Interface) device supports T1/E1 or Ethernet site links. Two ports on the front of the Site Gateway are dedicated to providing the T1/E1 site links, and four Ethernet ports on the front of the Site Gateway provide Ethernet site links or can be used in some configurations to provide an interface for IP-based conventional channels.

2.1.4.3

Conventional Channel Gateway

The GGM 8000 is available in four conventional channel gateway module configurations for analog, MDC 1200, digital, IP, mixed mode (V.24 and IP), and ASTRO® 25 Control Interface Module (ACIM) conventional channel types:

For details on Conventional Channel Gateway (CCGW) interface types (analog and digital) supported on the S2500 platform, see “Conventional Channel Gateway (CCGW)” in the *S6000 and S2500 Routers* manual.

For details on all CCGW interface types supported on the GGM 8000 platform, see “CCGW Utilization” in the *GGM 8000 System Gateway* manual.

For details about implementation of the GGM Site Gateway as a CCGW or site link transport device, see the *GGM 8000 System Gateway* manual.

2.1.4.4
ASTRO 25 Conventional Wireline Configurations

The digital Conventional Channel Gateway (CCGW) supports only digital keying of stations and comparators through an V.24 interface. ASTRO-TAC™ 3000 comparators support parallel MCC 7500/7100 Dispatch Console operation through the CCGW to connect multiple console systems to the same RF channels. The 3.1 Coexistence feature supports parallel operation. ASTRO® 25 conventional channels support parallel console operations only for these modes of operation. The digital CCGW provides V.24 interface for:

- Hard wires
- V.24 with or without external V.32 modems
- Phone lines
- Microwave links, analog, or digital
- RF interface:
  - Base Station, colocated, or remote (with/from the CCGW)
  - Receiver, colocated, or remote (with/from the CCGW)
  - Comparator, colocated, or remote (with/from the CCGW), for:
    + Receiver voting channel
    + Simulcast channel
    + Multicast

2.1.4.4.1
Voting Subsystem Using ASTRO Modem

The Conventional Channel Gateway does not support the ASTRO® 25 modem. However, ASTRO-TAC 3000™ sub site links support the ASTRO® 25 modem.

2.1.4.5
Links to the Conventional Channel Gateway

Different types of circuit-based link connections can be used for the conventional channel gateway: external CCITT V.32 modems, direct wired connection, and digital multiplex with sub-rate data cards. When using external modems or digital multiplex, the V.24 link interface is required.

2.1.4.5.1
Local Wire Line (Twisted Pair Cable, Analog, or Digital)

For RF equipment (station or receiver) colocated to the Conventional Channel Gateway (CCGW), a cable run of no greater than 50 ft (RS-232C) for V.24 twisted pair may be used. Analog links are also supported.

2.1.4.5.2
Hybrid Link Operation

For mixed analog/ASTRO® systems, hybrid links may be used. A hybrid link consists of two paths, each having a 4-wire termination. The first path is an analog path; the second is the digital path.

When used in an IP conventional mixed mode (analog/digital) voting system configuration, the Conventional Channel Gateway (CCGW) is connected to the analog MLC 8000 Comparator using the

analog 4-wire interface and connected to the digital GCM 8000 Comparator using the digital IP-based link described in IP-Based Links to the CCGW on page 58.

2.1.4.5.3

Leased Telephone Lines (Analog or Digital)

If two products are not co-located, your organization can choose from several interconnection alternatives, the first of which is leased telephone lines. The scenario is similar to the same case in an analog system. However, what is true in the implementation of the local wire lines in an ASTRO® 25 system, is true of leased telephone lines in an ASTRO® 25 system. If 9.6 Kbps ASTRO® 25 signals are to pass down a narrow-band wireline path, modems are required. The Conventional Channel Gateway (CCGW) supports only an external modem.

To assure the proper operation of the 9.6 Kbps modems, the leased telephone lines are 4-wire connections and meet a set of specifications on the order of the specifications for AT&T Service Type 5 or Type 3002 lines, as listed in this table.

Table 4: Voice Grade Channel Requirements for ASTRO 25 Applications

This table cites several specifications which service providers guarantee as minimum specifications.

Parameter	Type 3002	Service Type 5	M1020
Insertion Loss	16 dB	0 dB to 16 dB (depends on network interface)	
Loss Variation (at 1000 Hz):			
Long-Term Modem Tolerance	+/- 4 dB	+/- 4 dB	+/- 4 dB
Short-Term Modem Tolerance	+/- 3 dB		+/- 4 dB
Bandwidth	2700 Hz (300 - 3000 Hz)	2700 Hz (300 - 3000 Hz)	
Frequency Response (Ref.: 1000 Hz):			
400 - 2800 Hz		loss, -2 dB to +10 dB	
500 - 2500 Hz	loss, -2 dB to +8 dB	loss, -2 dB to +8 dB	
300 - 3000 Hz	loss, -2 dB to +12 dB	loss, -2 dB to +12 dB	
Delay Distortion	1750 microseconds	1750 microseconds	1500 microseconds
	@800 - 2600 Hz	@800 - 2600 Hz	@600-2600 Hz
Maximum Average	0 dBm	0 dBm	
Input Signal Level	at Network Interface	at Network Interface	
Maximum	0 dBm	0 dBm	
Test Tone Level	at Network Interface	at Network Interface	
Signal to C-Message Noise Level	>24 dB	>24 dB	
Frequency Shift	+/- 5 Hz	+/- 3 Hz	+/- 5 Hz
Phase Jitter	Less than 10º	Less than 10º (20 - 300 Hz)	Less than 10º

Phone line performance varies between the various local common carriers (phone company) service providers. Typical operation is often far superior to these specifications. However, at times, actual

performance may be worse than these guaranteed specifications. In this case, the service provider most likely can remedy these faults as soon as they are identified. To assure proper operation, D1 conditioning with a 28 dB signal to C-message noise level can be ordered. Most of the 3002 or Type 5 ordered lines have more than 24 dB. This recommended system design caution is based on systems already installed.

When using phone lines to interconnect ASTRO® 25 equipment, follow the above guidelines. In addition, subject lines to a series of simple tests as published in the product installation manuals to ensure proper modem performance, and timely assessment of any further corrective action required by the service provider.

2.1.4.5.4
Analog Microwave Links

Another method of interconnecting equipment within an ASTRO® 25 system (as in an analog system) is through an analog microwave link. Because such a link is a narrowband path, the same rules apply as with a leased telephone line:

- Modems are required at each end when 9.6 Kbps signals are to cross the analog microwave link.
- The interface to the analog microwave link at each end must be 4-wire.
- The analog microwave multiplex channel must meet a set of specifications on the order of the specifications for Type 5 or Type 3002 lines. Normally, a properly loaded base band easily meets the minimum modem requirements.

2.1.4.5.5
Digital Microwave Links

Direct digital microwave interfaces for ASTRO® 25 infrastructure devices are available as the V.24 link interface. This interface provides an ASTRO® 25 only, 9.6 Kbps, RS-232 connection to a Data Service Unit (DSU) or data card in a multiplex which is the interface to the digital microwave system.

2.1.4.5.6
IP-Based Links to the CCGW

The connection between the Conventional Channel Gateway (CCGW) and the devices it is proxying for can use the IP network that services all traffic at and between the conventional locations (conventional hubs and conventional base radio sites) in a distributed conventional configuration rather than using separate serial-type connections. For IP-based conventional equipment, the CCGW may be co-located at the conventional base radio site residing on the site gateway. Or if there is a direct connection or IP tunnel between a conventional base radio site and a conventional hub, the CCGW may be remote from its GTR 8000 Base Radio and be at the conventional hub. When the CCGW is co-located with the GTR 8000 Base Radio or GPW 8000 Receiver at conventional base radio sites, the CCGW and the GTR 8000 Base Radio or GPW 8000 Receiver have local Ethernet LAN connections to an Ethernet LAN switch also at the site. The GCM 8000 Comparator at a conventional hub or conventional conduit hub also connect to the co-located CCGW through Ethernet LAN connections to an Ethernet LAN switch at the conventional BR site.

See the *Console Site Bandwidth Management* manual for information on provisioning bandwidth for Conventional-capable sites. Also see the *Flexible Site and InterZone Links* manual for information on link delays, differential link delay constraints, jitter constraints, and so on, related to Ethernet-based site links for conventional capable sites.

See Connection of CCGW to IP-Based Digital Conventional Base Stations and GCM 8000 Comparator on page 63.

2.1.4.6

Links Between ASTRO-TAC 3000 Comparator and Mixed Mode Receiver or Base Station

Different types of link connections can be used:

- Internal ASTRO® 25 9.6 Kbps modems
- External CCITT V.32 modems
- Direct wired connection
- Digital multiplex with sub-rate data cards
- Hybrid links (analog without modem; V.24 for digital)

When using external modems or digital multiplex, the V.24 link interface option is required in all infrastructure devices within the system, that is, comparator, stations/receivers. When using external modems or digital multiplex, the link to the colocated station must go through the same type links as the remote sites. Use back-to-back modems (or back-to-back multiplex). The reason for this requirement is the time delay difference through the modems compared to the direct V.24 cable connection. The ASTRO-TAC 3000™ Comparator is sensitive to time delays in the receive path and cannot deal with signal delay differences larger than 100 ms. The V.24 termination requires an external modem or multiplex. The external modem must be set up for 9.6 Kbps synchronous operation and must provide an error rate not greater than 0.000001.

For links to the MLC 8000 Comparator, see Links Between MLC 8000 Comparator and Mixed Mode Receiver or Base Station on page 60.

2.1.4.6.1

Local Wire Line (Twisted Pair Cable)

For colocated equipment (comparator-and-station or comparator-and-receiver), a cable run of no greater than 50 ft, twisted pair, may be used.

2.1.4.6.2

Hybrid Link Operation

For conventional mixed mode (analog/digital) systems, hybrid links may be used. A hybrid link consists of two paths, each with a 4-wire termination. The first path is an analog path and the second is the digital path. The digital path requires external V.32 modems.

The connection between ASTRO-TAC™ 3000 comparator/base radio/receiver to a Conventional Channel Gateway (CCGW) can use either V.24-only interface or a hybrid link. In this case, external V. 32 modems are not required.

When using a conventional mixed mode (analog/digital) system using the analog MLC 8000 Comparator and MLC 8000 Link Converter, the hybrid link at the base repeater is connected to the MLC 8000 Link Converter, without a need for using external modems.

2.1.4.6.3

ASTRO Modem Link Operation

ASTRO® 25 modems can be used to provide analog and digital communication between two devices using a 4-wire phone line connection. ASTRO® 25 modems are installed as daughter boards on an I/O port of a QUANTAR® and an ASTRO-TAC™ Comparator. Two items to note on the modems:

- The modems provide balanced 600 Ohm terminations.
- They require a 4-wire circuit between them, regardless of whether the audio flow between them is one-way or two-way.

2.1.4.6.4
Leased Telephone Lines

If two ASTRO® 25 products are not colocated, your organization can choose from several interconnection alternatives, the first of which is leased telephone lines. The scenario is similar to the same case in an analog system. Moreover, what is true in the implementation of the local wire lines in an ASTRO® 25 system, is true of leased telephone lines in an ASTRO® 25 system. If 9.6 Kbps signals are to pass down a narrow-band wireline path, modems are required.

To assure the proper operation of the 9.6 Kbps modems, the leased telephone lines are 4-wire connections and meet a set of specifications on the order of the specifications for Type 5 or Type 3002 lines. See Table 4: Voice Grade Channel Requirements for ASTRO 25 Applications on page 57.

Phone line performance varies between the various local common carrier service providers (phone companies). Typical operation is often far superior to these specifications. However, at times, actual performance may be worse than these guaranteed specifications. In this case, the service provider most likely can remedy these faults as soon as they are identified. To assure proper operation, D1 conditioning with a 28 dB signal to C-message noise level can be ordered. Most of the 3002 or Type 5 ordered lines have more than 24 dB. This system design caution is recommended based on previous systems already installed.

When using phone lines to interconnect ASTRO® 25 equipment, follow the above guidelines. In addition, subject lines to a series of simple tests as published in the product installation manuals to ensure proper modem performance and the timely assessment of any further corrective action required by the service provider.

2.1.4.6.5
Analog Microwave Links

For details, see Analog Microwave Links on page 58.

2.1.4.6.6
Digital Microwave Links

For details, see Digital Microwave Links on page 58.

2.1.4.7
Links Between MLC 8000 Comparator and Mixed Mode Receiver or Base Station

When in an Analog IP Simulcast or Analog IP Voting system configuration that uses the analog MLC 8000 Comparator and MLC 8000 Link Converter, the base receiver is connected to the MLC 8000 Link Converter using the analog 4-wire interface without a need for using external modems.

See the *MLC 8000 Setup Guide*.

2.1.4.8
Links Between GCM 8000 Comparator and G-Series Station/Receiver

The GCM 8000 Comparators at the multi-site prime site are remotely connected to the GTR 8000 Base Radios or GPW 8000 Receivers at the sub-site through the backhaul (T1, E1, FT1, or FE1 link; or redundant T1, E1, FT1, or FE1 links). The sub-site access routers at the prime site route traffic to each sub-site through the sub-site T1/E1/FT1/FE1 link. For sub-sites co-located with the prime site, the GCM 8000 Comparators are connected to the GTR 8000 Base Radios or GPW 8000 Receivers through a T1/E1/FT1/FE1 link from the co-located remote site router connected directly to a Cooperative WAN Routing (CWR) patch panel. The sub-site access routers are still used to route IP traffic between the prime site and the co-located sub-site.

The connection between the GCM 8000 Comparators at the multi-site prime site and the GTR 8000 Base Radios or GPW 8000 Receivers at the sub-site can also be through a flexible site Ethernet link. See the *Flexible Site and InterZone Links* manual for further information.

Whichever link is used between the prime site and the sub-sites, both ends of the site link must be of the same type (for example, cannot use Ethernet on the prime site side and T1/E1 on the sub-site side).

Distributed conventional configurations, or conventional subsystems, use only GGM 8000 Gateways and Ethernet site links. In a conventional subsystem, the GCM 8000 Comparator may be remote from the GTR 8000 Base Radios or GPW 8000 Receivers. This layout means that the GCM 8000 Comparator and the GTR 8000 Base Radio are in different conventional locations within the same conventional subsystem. The two locations must have an Ethernet IP tunnel configured between the two conventional locations. When the GCM 8000 Comparator and the GTR 8000 Base Radio are co-located, the GCM 8000 Comparators and the GTR 8000 Base Radios or GPW 8000 Receivers are IP connected directly to the Ethernet switch at the conventional location. The site gateways are used to route IP traffic to other conventional locations within the conventional subsystem and to the zone core. See the *Flexible Site and InterZone Links* manual.

NOTICE: The GCM 8000 Comparator interfaces to the MLC 8000 Link Converter when the system is using MLC 8000s to provide IP backhaul. See the *MLC 8000 Setup Guide*.

2.1.4.9
Conventional Channel Capacities (GGM 8000 or S2500 platform)

The following reflect capacities for the Conventional Channel Gateway (CCGW):

- Up to ten per conventional only site
- Up to ten per console site
- Up to three per ASTRO® 25 repeater site
- Up to three per simulcast site
- Up to three per High Performance Data (HPD) site
- Up to a total of 255 per zone (in a multi-zone capable system)
- The GGM 8000 with an analog/V.24 interface kit supports 14 channels using 10 IP channels plus four channels used in any combination of analog, V.24 digital, mixed mode, and ASTRO® 25 Control Interface Module (ACIM) channels.
- The GGM 8000 with a Low Density Enhanced Conventional Gateway supports 24 channels using 16 IP channels, plus four channels using analog interfaces and four channels using V.24 digital interfaces to be used in any combination of analog, V.24 digital, mixed mode, and ACIM channels.
- The GGM 8000 with a High Density Enhanced Conventional Gateway supports 32 channels using 16 IP channels, plus eight channels using analog interfaces and eight channels using V.24 digital interfaces to be used in any combination of analog, V.24 digital, mixed mode, and ACIM channels.

See the *GGM 8000 System Gateway* manual.

2.1.4.10
Analog Conventional Wireline Configurations

The type II E&M (E-Lead and M-Lead) signaling used by the Conventional Channel Gateway (CCGW) allows for the following:

-
- E&M signals: Carrier Operated Relay (COR) and external Push-to-Talk (PTT) are used to interface between the base station and the CCGW. The MLC 8000 can provide an indication of audio/voice on an analog conventional channel to the console using the COR method. With the MLC 8000

Analog Comparator, the console can detect the presence of audio/voice on a conventional channel using the COR method. The COR method has an advantage over the Voice Operated eXchange (VOX) method because regardless of any audio/voice interruption on the channel, the COR method sustains the indication of audio/voice on a conventional channel by using a carrier signal. For information on the COR method, see Analog COR Detect Inbound Calls on page 62.

- Remote connection to a base station through a TeNSr channel bank. The CCGW connects to the analog audio ports on a base station. The ports are connected either directly using simple cabling, or indirectly through pairs of channel banks that are interconnected through lease lines.

The following devices only use Tone Remote Control and do not need E&M keying:

- DIGITAC Comparator
- Spectra-TAC Comparator

The CCGW provides a 600 Ohm or high impedance (10K-Ohms) 4-wire E&M interface for:

- Hard wires
- Phone lines
- Microwave that supports 4-wire or 4-wire E&M
- RF interface:
  - Analog base station, colocated with or remote from the CCGW
  - Analog receiver, colocated with or remote from the CCGW
  - Analog comparator, colocated with or remote from the CCGW, for:
    + Analog receiver voting channel
    + Analog simulcast channel
    + Multicast
- Wireline interface for non-MCC 7500 Dispatch Console parallel operations in analog conventional:
  - Non-MCC 7500 Dispatch Console parallel operation and Line Operated Busy Light (LOBL) for parallel operation status indications. An external analog bridge is needed for this configuration.
  - Supervisory takeover with external relay (must occur through MCC 7500 Dispatch Console Aux I/O Server).

NOTICE:

- A 2-wire interface to an analog base station is supported.
- The 4-wire interface between the CCGW and a connected device may be remote over a number of different analog 4 wires.

2.1.4.10.1
Analog COR Detect Inbound Calls

With the MLC 8000 Analog Comparator, the console can detect the presence of audio/voice on a conventional channel using the Carrier Operated Relay (COR) method. The COR method has an advantage over the Voice Operated eXchange (VOX) method because regardless of any audio/voice interruption on the channel, the COR method sustains the indication of audio/voice on a conventional channel by using a carrier signal.

2.1.4.11
Connection of CCGW to Analog Conventional Base Stations

Each Conventional Channel Gateway (CCGW) port contains the following inputs and outputs:

- 4-wire Rx interface for 600 or 10K Ohm, balanced analog audio output

- 2-wire Tx/Rx interface for 600, 900, or 10K Ohm, balanced analog audio input
- Coded/clear input
- Input buffer – Used to detect Carrier Operated Relay (COR) closure in the base station
- 1 A, 24 VDC relay output – used for relay keying of the base station

Each port is an RJ-45 connector.

The 4-wire interface for the mixed mode (part of V.24 hybrid link) is the same as the 4-wire interface for analog only operation.

NOTICE: With the MLC 8000 Analog Comparator, the console can detect the presence of audio/voice on a conventional channel using the COR method. The COR method has an advantage over the Voice Operated eXchange (VOX) method because regardless of any audio/voice interruption on the channel, the COR method sustains the indication of audio/voice on a conventional channel by using a carrier signal.

2.1.4.12

Connection of CCGW to V.24-based Digital Conventional Base Stations

The Conventional Channel Gateway (CCGW) provides up to eight RJ-45 connectors, depending on hardware, for standard network cables to connect to digital conventional RF equipment.

2.1.4.13

Connection of CCGW to IP-Based Digital Conventional Base Stations and GCM 8000 Comparator

For IP-based conventional site equipment, the Conventional Channel Gateway (CCGW) is a GGM 8000 Gateway and is co-located at the site with the site equipment. For site types in which the CCGW is co-located with the GTR 8000 Base Radio or GPW 8000 Receiver, including standalone conventional-only sites, trunked ISR sites, dispatch sites, and multi-site prime sites or subsites, the CCGW and the GTR 8000 Base Radio or GPW 8000 Receiver have local Ethernet LAN connections to an Ethernet LAN switch also at the site. This connection scheme includes sites with standalone GTR 8000 Base Radios or GPW 8000 Receivers as well as trunked sites with conventional channels added to an Expandable Site Subsystem. The GCM 8000 Comparator at a multi-site prime site also connects to the co-located CCGW through Ethernet LAN connections to an Ethernet LAN switch at the prime site.

NOTICE: For MLC 8000 connection to CCGW, see the *MLC 8000 Setup Guide*

2.1.4.14

Connection of CCGW to a Motorola Solutions Consolette for ACIM Channel

To connect a Conventional Channel Gateway (CCGW) to a Motorola Solutions consolette for ASTRO® 25 Control Interface Module (ACIM) channel, see the “ACIM Interface on GGM 8000” section in the *GGM 8000 System Gateway* manual.

2.1.4.15

Connection of CCGW to Advanced Securenet CIU

To connect a Conventional Channel Gateway (CCGW) to an Advanced Securenet Console Interface Unit (CIU), see information on Advanced Securenet in the *GGM 8000 Hardware User Guide* manual. Also, see the *GGM 8000 Hardware User Guide*.

2.1.5
MCC 7500/7100 Dispatch Console (Conventional Overview)

To use conventional dispatch call operations and services, the dispatch console must be in service and affiliated with the zone controller or site controller. The console affiliates specific conventional resources with the zone controller or site controller, and this affiliation allows the controller to recognize which consoles are monitoring each specific conventional channel.

For a detailed description of the MCC 7500/7100 Dispatch Console features, see MCC 7500/7100 Dispatch Console and Conventional Call Processing Features on page 71.

When a console operator logs on to a console registered with the system with conventional channel resources assigned to the console position, control paths are set up (logical links). These paths facilitate reliable communications between a zone controller or site controller and various system elements, including console sites and Conventional Channel Gateways.

2.1.5.1
MCC 7500/7100 and MDC 1200 IDs

For conventional channel groups configured to use the MDC 1200 signaling protocol, the console displays the subscriber radio unit ID in hexadecimal format on the GUI of the Voice Processor Module (VPM)-based MCC 7500 and the MCC 7100 Dispatch Consoles. This display provides the dispatcher the ability to view the ID in the same manner as it appears on the display of the subscriber radios communicating on the conventional MDC 1200 channel. The display of the hexadecimal unit IDs is available for outbound signaling. Previously, the MCC 7500/7100 Dispatch Console would display only unit IDs in decimal format, including MDC 1200 unit IDs.

For MDC 1200 channels and ASTRO® 25 Control Interface Module (ACIM) channels configured to be MDC 1200 signaling-capable, the channels are associated to a conventional channel group configured for either the standard or non-standard MDC ID range.

Channels configured for the standard MDC ID range do not support the group and WildCard MDC 1200 addresses. The unit IDs starting with E or containing F, respectively, and are not used by the MCC 7500/7100 Dispatch Console for outbound signaling as it does not support group or WildCard addressing. Channels configured for the non-standard MDC ID range support unit IDs starting with E or containing F. The MCC 7500/7100 Dispatch Console treats these IDs as additional unit IDs that can be assigned to MDC subscriber radios and MCC consoles. Outbound signaling to unit IDs on MDC 1200 channels part of a non-standard channel group support unit IDs starting with E or containing F.

2.1.5.1.1
Standard and Non-Standard ID Space Range

For conventional channel groups, the console must determine whether conventional channels are configured for standard ID space range or non-standard ID range.

Table 5: ID Space Range

Parameter	Value	Description
MDC ID Range	Standard	The console enforces the restriction of the MDC 1200 Unit IDs with a range of 1–DEEE (no leading Es, no Fs) and can be used for outbound signaling.
	Non-Standard	The console allows the full use of the MDC 1200 Unit ID range from 1–FFFF for outbound signaling, including the use of the IDs that contain “F” or start with an “E” in the Unit ID definition. MDC 1200 Channels configured for a Non-Standard Conventional Channel Group allow Call Alerts and Voice Selective Calls to be sent

Parameter	Value	Description
		from the MCC 7500/7100 Dispatch Console to Unit IDs which contain “F” or start with an “E”. However, Motorola Solutions radios configured for this extended MDC ID Range do not support Call Alert and Voice Selective Call. Non-Motorola Solutions radios may support this capability with the extended MDC ID Range.

For configuration of the ID Space Range for L and M Conventional Systems, see the *Provisioning Manager* manual. For K1 or K2 core conventional systems, see the *Configuration Manager for Conventional Systems User Guide* manual.

2.1.5.2

MCC 7500/7100 Dispatch Console Control Paths and Affiliation

For each system element, two control paths are created for redundancy: an active path and a standby path. After the control paths are set up, affiliation information for a console site is sent to the zone controller and/or site controller. The first dispatch console at a console site that registers with the system and assigns a resource is known as the Link Op. The Link Op refers to the console in control of the active link between the site and the zone controller or site controller.

The console sends an out-of-service command to the zone controller when any of the following occurs:

- The MCC 7500/7100 Dispatch Console is no longer monitoring any conventional resources.
- The console operator logs out of the console application.
- The console is shut down.

The console de-affiliates a conventional channel when any of the following occurs:

- The Elite Admin software is used to de-affiliate a conventional channel to the dispatch position, and the zone controller or site controller is notified of the update.
- The console operator logs out of the console application.
- The console de-affiliates a conventional channel.

The console de-affiliates with a conventional channel when the Elite Admin software is used to de-affiliate the conventional channel to the console (operator) position, and the affiliation information is passed to the zone controller (or site controller). If the de-affiliation is implemented while the console operator is logged on to the console, the console operator must log out and log back in to ensure the de-affiliation is executed.

For details about the MCC 7500/7100 Dispatch Console, see the *MCC 7500/7100 Elite Admin User Guide*.

2.1.5.3

Non-MCC 7500/7100 Dispatch Console Parallel Operations

When both MCC 7500/7100 Dispatch Consoles and non-MCC 7500/7100 Dispatch Consoles are connected to the same conventional station, dispatchers on both types of console must know when a dispatcher on the other type of console is transmitting, and must be able to hear what is being said. This ability is supported on analog and MDC 1200 conventional channels through the Line Operated Busy Light (LOBL) functionality and an audio bridge. For V.24 digital channels on ASTRO-TAC™ 3000, the ASTRO-TAC™ 3000 parallel audio feature duplicates inbound and outbound audio for attached console systems.

2.1.5.4

Role of the MCC 7500 Archiving Interface Server

The MCC 7500 Dispatch Console Archiving Interface Server (AIS) collects audio and related information for call logging and audio archiving at a dispatch console site. The MCC 7500 Dispatch Console AIS passes the conventional operation call events and audio for radio, console, and parallel console transmissions to the logging recorder. Calls and events may be later retrieved and played out on a replay station. The MCC 7500 Dispatch Console AIS logs clear audio. If the call to be logged is a coded call, the MCC 7500 Dispatch Console AIS decrypts the audio before logging it. See the *Audio Logging* manual.

See the *MCC 7500 Dispatch Console with Voice Processor Module* manual for:

- “Configuring Localhosts File for ASTRO 25® Conventional System (K Core)”
- “Configuring External NTP Time Source on Console in ASTRO® 25 System (K Core)”

NOTICE: For more information on NTP, see Spectracom NetClock 9383 Time Server on page 66.

2.1.5.4.1

Spectracom NetClock 9383 Time Server

The Spectracom NetClock 9383 Time Server provides a Network Time Protocol (NTP) source signal to the system when Audio Logging features are deployed.

Your system shipped with a cable matrix that identifies cable connections for the equipment in your system. See that cable matrix for cable connection information relating to components in your system. For the IP address of the NetClock® server, see the IP plan established for your system.

To install the Spectracom NetClock 9383 Time Server, connect and power the device. For additional configuration and product information including product documentation, see the 9300 Series QuickStart Guide at http://www.spectracomcorp.com.

2.1.6

Conventional Comparators

The following comparators support conventional simulcast, multicast, and voting operations:

- GCM 8000 Comparator
- MLC 8000 Comparator
- ASTRO-TAC™ 3000
- DIGITAC
- Spectra-TAC

A conventional comparator aggregates signals from a number of conventional base radios into a single interface to a Conventional Channel Gateway (CCGW). The comparator evaluates the signals from the base radios and establishes the best quality signal to send to the CCGW.

The conventional comparators connect to the CCGW through one of the following interfaces:

- 4-wire analog (Spectra-TAC and DIGITAC and MLC 8000 only)
- ASTRO® 25 (V.24) digital ASTRO-TAC™ 3000 only
- IP conventional (GCM 8000 Comparator only)

NOTICE: The ASTRO-TAC™ 3000 supports mixed mode (not analog only), however, the ASTRO-TAC Receiver supports mixed mode and analog only.

The conventional IP GCM 8000 Comparator can be set up with an MCC 7500 Dispatch Console Aux I/O Server so that voting display and control indicators (Voted, Disabled, Failed, and others) are

displayed at the console. An MCC 7500 Dispatch Console Aux I/O Server can support up to 15 sub-sites (1-15) per comparator (a single MCC 7500 Dispatch Console Aux I/O Server supports up to 16 sub-sites overall).

A 64-port comparator supports up to 64 sub-sites. However, only the first 15 sub-sites are displayed on an MCC 7500 Dispatch Console. Voting for up to 64 sub-sites can be displayed for the GCM 8000 Comparator in Configuration/Service Software (CSS). For more information, see the comparator section of the *CSS Online Help*. Voting for up to 64 sub-sites can be displayed for the GCM 8000 Comparator in MCN Server 8000™ Remote Comparator Display Software. Voting for the MLC 8000 Comparator can also be displayed in MCN Server 8000™ Remote Comparator Display Software. See *MCN Server 8000™ Remote Comparator Display Software for Motorola Solutions IP Comparators*.

To display the GCM 8000 Comparator receive and control indications on an MCC 7500 Dispatch Console, an MCC 7500 Dispatch Console Aux I/O Server (auxiliary input and output device based on the SDM3000 hardware) provides an interface between the dispatch console and the GCM 8000 Comparator. To the dispatch console, the GCM 8000 Comparator appears as a collection of related auxiliary inputs and outputs (Aux I/Os). Configure these MCC 7500 Dispatch Console Aux I/O Servers to contain the comparator functions and remote site (sub-site) information to give the console operator the ability to associate the MCC 7500 Dispatch Console Aux I/O Server with a comparator or another device.

For details about the Voting Display and Control feature involving the conventional IP GCM 8000 Comparator, see the MCC 7500 Dispatch Console Aux I/O Server content in the *MCC 7500 Dispatch Console with VPM* manual.

For details about the GCM 8000 Comparator, see the *GCM 8000 Comparator* manual.

For details about the Voting Display and Control feature involving the MLC 8000 Comparator, see the *MLC 8000 Configuration Tool with Analog Display and Control* manual.

For details about the Voting Display and Control feature for both the GCM 8000 and the MLC 8000 Comparators, see the *MCN Server 8000™ Remote Comparator Display Software for Motorola Solutions IP Comparators* manual.

2.1.7
IP Link Converter

The IP Link Converter (IPLC) can be located in the ASTRO® 3.x Core or at various RF sites in the ASTRO® 3.x system to support the use of digital (V.24 or IP) or mixed-mode conventional channels. Depending on the conventional channel architecture, a standalone or paired IPLC topology supports one or more conventional channels providing simulcast/voting, multicast/voting, and/or standalone nonvoting operation where the ASTRO® 3.x system employs either circuit-based (channel banks) or Ethernet (routers and switches) transport devices.

The IPLC allows operators with fielded MCC 5500 Consoles to replace circuit connectivity with IP connectivity, and transition prior releases digital/mixed mode conventional channel site devices (stations and comparators) to G series and MLC 8000 devices. Operators can also retain existing circuit backhaul networks (T1s/E1s).

The IPLC uses GTR 8000 Base Radios with dispatch console subsystems in an ASTRO® 3.x system. The IPLC is in the ASTRO® 3.x Core or at various base radio sites in the ASTRO® 3.x system that support digital (V.24 or IP) or mixed-mode GTR 8000 Base Radios for simulcast, voting. and or multicast operation. The ASTRO® 3.x system employs either circuit-based channel banks or transport devices (Ethernet routers and switches).

IPLC functionality requires a GGM 8000 gateway equipped with either a Low Density Enhanced Conventional Gateway module or a High Density Enhanced Conventional Gateway module, and running Enterprise OS (EOS) software version 16.6 or higher.

GGM 8000 devices with IPLC functionality may be deployed as standalone devices or in pairs:

- When deployed as a standalone device, the GGM 8000 with IPLC functionality is at either the site or the core and single-handedly connects the Digital Interface Unit (DIU) at the core to the IP base station. When at the core, the GGM 8000 with IPLC functionality is connected to the base station over IP backhaul.
- When deployed in a paired IPLC topology, one GGM 8000 with IPLC functionality is co-located with the console at the core. The core GGM 8000 with IPLC functionality is connected to the DIU and one GGM 8000 with IPLC functionality is at the site. The site GGM 8000 with IPLC functionality is connected to the base station or comparator. The two GGM 8000 devices with IPLC functionality (IPLC peers) are connected over IP backhaul.

When providing IP backhaul connectivity between the ASTRO® 3.x core through the DIU devices to base radio sites, the IPLC uses an IP plan similar to the plan used to support the network transport used in a K core system. Contact the Motorola Solutions Support Center (SSC) for details.

For details about the IP to Circuit-Based Link Converter, see the *GGM 8000 with IP Link Converter (IPLC)* manual.

2.1.7.1
Configuring the IP Link Converter

The IP Link Converter (IPLC) can be configured manually from the Command Line Interface (CLI), or provisioned with a configuration (`boot.cfg`) file. For details regarding configuration of the IPLC, see the *GGM 8000 with IPLC Functionality User Guide*.

2.1.7.2
Troubleshooting the IP Link Converter

The IP to Link Converter (IPLC) has a log file to aid in servicing and troubleshooting. Information in the log file may include Status of Link Interfaces (Up/Down), Lost Packets Count on an Interface (packets with Cyclic Redundancy Check (CRC) errors), Configuration Changes, Users Login, and other troubleshooting data.

Procedure:

1. Connect the service laptop to the IPLC (GGM 8000) console port using the serial cable.
2. Connect the service laptop Ethernet card to port 4 (!4) on the GGM 8000 by using the Ethernet cable.
3. Log on to the device by using the username (root) and appropriate password.
4. To access the log file from the IPLC (GGM 8000) command line, enter: `sh -auditlog locallog`

2.2
Conventional Device Capabilities

This section outlines the capabilities of conventional devices.

Base Radios

GTR 8000
ASTRO ® 25 digital voice, signaling, and data; mixed mode analog voice; analog only

QUANTAR ®
ASTRO ® 25 digital voice, signaling, and data; mixed mode analog voice; MDC1200 analog and analog only

MSF 5000, and older
MDC1200 analog and analog only

XTL 5000 Consolette
ASTRO ® Control Interface Module (ACIM) control signaling, analog and digital voice over the air

APX 7500 Consolette
ACIM control signaling, analog and digital voice over the air, MDC 1200 signaling

Comparators

GCM 8000
Digital

MLC 8000
Analog only and mixed mode

ATAC 3000
Digital, mixed mode

Spectra-TAC and DIGITAC
Analog only and MDC1200 analog

Receivers

GPW 8000
ASTRO ® 25 digital voice, signaling, and data; mixed mode analog voice; analog only

ASTRO-TAC Receiver
ASTRO ® 25 digital voice, signaling, and data; mixed Mode analog voice; MDC1200 analog and analog only

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Chapter 3

MCC 7500/7100 Dispatch Console and Conventional Call Processing Features

This chapter describes various MCC 7500/7100 Dispatch Console and conventional call processing features used to manage and control conventional channel resources.

3.1 Station Control Commands

The console generates station control commands with support from the zone controller and Conventional Channel Gateway (CCGW). A dispatch console operator uses station control commands to command a base station or other device to perform a function. Typically, station control commands are issued to control analog conventional resources through the CCGW interface to analog stations. Some station control commands can be issued to command ASTRO® 25 conventional stations.

Station control refers to the dispatch console capability to command an entity, such as a base station, to perform some function. A station control command requested by the dispatch console is sent through the IP network to the zone controller. If granted by the zone controller, the station control command is forwarded to the CCGW and communicated to the base station (or other attached device).

A CCGW (GGM 8000 or S2500 platform) can communicate station control commands to digital conventional channels through a V.24 digital interface. It can also communicate station control commands to analog conventional channels through an analog interface using a sequence of tones providing tone remote control over a 4-wire analog interface to the stations.

A CCGW (GGM 8000) can communicate station control commands to ASTRO® 25 Control Interface Module (ACIM) conventional channels through an ACIM interface.

Station control commands can also be communicated over an IP interface for the GTR 8000 Base Radio.

The analog CCGW generates Tone Remote Control (TRC) signals as an interface to analog stations. An analog base station configured for a relay keying (Ear and Mouth (E&M) signaling) cannot perform station control commands; however, key-up/de-key can be accomplished through the E&M circuit. If the analog base station is configured for TRC or tone and relay, station control commands are supported.

Consoles may support functions not supported by all stations or comparators. If a command is not supported, it is ignored.

3.1.1 Frequency Select

Certain types of conventional resources can transmit/receive on multiple frequencies. Only one frequency definition is active at any time. Frequency Select is a console feature which allows a dispatch console user to choose a mode or channel definition with which to communicate with radios.

3.1.2
Monitor Mode

The Monitor feature disables the squelch on the currently selected conventional resources so that all voice activity of the resources is heard, regardless of private line or any other qualifiers.

When a dispatch console transmits on a conventional resource, it overrides existing transmissions when a base radio is configured for wireline priority. This override interrupts conversations between radio users. To prevent this override, the dispatch console user can use the Monitor feature before transmitting on the resource to ensure no one else is using the resource.

Only the console that initiates the mode can display the Monitor mode or state of a channel. The console does not forward the state of the channel to parallel positions or the audio recorder. A user playing audio from the logging recorder cannot determine whether the channel was in Monitor mode when the audio was sourced.

3.1.3
Private Line Select

Private Line Select allows a dispatch console user to select the private line code for an analog conventional resource. This feature enables the dispatch console to communicate with a subset of radios programmed to transmit/receive on the same frequency.

Private Line Select is supported on analog and MDC 1200 channels only.

The digital channel Network Access Codes (NACs) are not selectable directly by consoles. To select different NACs, a console can use the Frequency Select feature to pick a base radio mode defined to use a different NAC code.

3.1.4
Repeat Mode

As a base station, the conventional base radio provides communication over the conventional channel between the dispatch console and subscriber radio.

As a repeater, the conventional base radio provides repeated audio over the conventional channel, where the communication is available to dispatch consoles and conventional subscriber radios monitoring the conventional channel.

The Repeat Mode feature (also known as Repeat Control, Repeat Enable/Disable, or Repeat On/Off) allows a dispatch console user to enable and disable the internal repeat functionality of a repeater base station. When the feature is enabled, the inbound audio from a radio is repeated to all radios using the same base station. If the feature is disabled, the inbound audio from a radio is not repeated.

Repeat Mode is supported on all channels, except ASTRO® 25 Control Interface Module (ACIM) conventional channel.

3.1.5
Second Receiver Mute

The Second Receiver Mute feature allows a dispatch console user to mute the secondary receiver on a conventional resource that has talkaround conversations. Talkaround conversations are transmissions from radios sent directly to other radios and bypassing the repeater. Dispatch consoles monitor these conversations by receiving the audio through a secondary base station receiver, which receives audio on the same frequency as the radios. By muting the second receiver, the dispatch consoles do not hear the talkaround conversations.

Second Receiver Mute is not supported on the ASTRO® 25 Control Interface Module (ACIM) conventional channels.

3.1.6
Inhibit WildCard I Refresh and Inhibit WildCard II Refresh

When a main/alt switchover occurs (that is, when a channel that is part of a main/alt pair is switched over from being the inactive channel to the “newly active” channel), a console refreshes the station control settings so that the newly active channel has the same settings as the previously active channel. The station control settings refreshed include the WildCard I and WildCard II features. Wildcard I and Wildcard II commands can be used to initiate configurable events at the station such as starting a wireline test. However, upon main/alt switchover, the console refresh of WildCard I and WildCard II commands can be inhibited to avoid initiating the configurable events on the newly active station upon a main/alt switchover by using the **Inhibit WildCard I Refresh** and **Inhibit WildCard II Refresh** parameters.

The **Inhibit WildCard I Refresh** and **Inhibit WildCard II Refresh** parameter configured to **Yes** (also known as inhibit) inhibits the console refresh of that channel WildCard I or WildCard II station control command upon a main/alt channel switchover which activates the channel. The default setting of both parameters is **No**, meaning the WildCard I and WildCard II station control commands are refreshed upon a main/alt switchover which activates the channel.

The WildCard I or WildCard II parameter must be **enabled** to configure the **Inhibit Wildcard Refresh** parameter. Also, the use of predefined Tone Remote Control (TRC) tables provides specified TRC tone patterns to support specific channel functions and may not allow changes to certain functions unless a different TRC table is established.

3.1.7
Interzone Station Control Commands

The console operator initiates a non-voice station control command on an affiliated conventional channel. If the selected channel is an analog conventional channel, the console issues a request to the serving zone controller. Otherwise, a request is sent to the console serving zone controller.

If the conventional channel is in another zone and is in service, the station control command, depending on the channel signaling type, is sent to the home zone.

If the interzone link between the originating console serving zone and the home zone is not available when the console operator initiates the command, the serving zone controller denies the command by sending a reject message, and the console operator is informed of the denial.

A console operator can initiate the following Station Control Commands:

- Transmit
- Frequency Select
- Monitor On/Off
- Private Line Select
- Repeat On/Off
- WildCard I/II
- Mute Second Receiver
- Select Key

3.2
Tone Remote Control

The Tone Remote Control (TRC) generates an analog tone sequence and sends it through a 4-wire analog interface to an analog-based device, such as an analog base station.

The TRC mechanism is used to send Station Control Commands (such as Frequency Select, Monitor, Repeat Control, and more) to an analog base station using a tone sequence.

TRC is not supported on ASTRO® 25 Control Interface Module (ACIM) conventional channels.

3.2.1
Tone Sequence

A tone sequence sent to a base station as a station control command contains a Function Tone segment to identify the type of station control command being sent to the base station. A Tone Sequence may consist of other tone segments.

3.2.2
Tone Segments

The following Tone Segments are configured to create a tone sequence sent to a base station:

High Level Guard Tone (HLGT) segment
Used as a "wake-up" tone to inform the base station (or other receiving device) that other tone segments are to follow.

Function Tone (FT) segment
Used to identify the type Station Control Command (or function) being sent to the base station (configurable in the station). The FT is associated with one of the Station Control Commands (for example, Frequency Select, Monitor, Repeat Control, and others).

Low Level Guard Tone (LLGT) segment
Not required for sending a Station Control Command (or function) to a base station, but is used to convey the duration of a voice call to the station.

The tone segments required to execute a command define a tone remote control sequence. The sequence contains the order in which the tones are established for a command.

Each tone segment is configured with parameters for various tone segment objects.

3.2.2.1
Tone Segment Objects

Each of these tone objects is configured for each tone segment:

- Tone Frequency - Identifies the frequency of the tone in Hertz (Hz)
- Tone Duration - Identifies the duration of the tone in milliseconds (ms)
- Tone Level or Offset - Identifies the level of the tone in Decibels (dB)

3.2.3
Tone Remote Control Tone Sequence Configuration

Tone Remote Control (TRC) sequences used with analog conventional channels can be modified and configured to meet the needs of the dispatch console operator. The following aspects of the TRC sequences are configurable:

- Function Tone (FT) segment
- Tone Frequency – identifies the frequency of the tone in Hertz (Hz)
- Tone Duration – identifies the duration of the tone in milliseconds (ms)
- Tone Level or Offset – identifies the level of the tone in Decibels (dB)

All portions of the TRC sequence (High-Level Guard Tone, Function Tone, and Low-Level Guard Tone) are modified, but not all aspects (frequency, level, and duration) of each portion are user

configurable. Each conventional channel uses its own set of TRC sequences, and these sets are modified independently of each other.

Modification of the user-configurable aspects of the TRC sequences is performed in the Provisioning Manager. For the applicable procedures, see the *Provisioning Manager* manual.

NOTICE: While the Provisioning Manager allows the user to configure dual-function tone sequences, dual-function tones are not supported, except by the GTR 8000 Base Radio and QUANTAR®. Any dual-function tone sequences created by the user is not recognized, except by the GTR 8000 Base Radio and QUANTAR®.

The TRC Sequence used to define a Singletone consists of the following information:

- Type of Tone Segment
  - High Level Guard Tone
  - Function Tone
  - Low Level Guard Tone
- Tone Frequency
- Tone Duration
- Tone Level or Offset

3.2.3.1 Tone Remote Control Table Object

The Tone Remote Control (TRC) Table Object is used to define the tone sequences used for each station control command. The TRC Table maps the station command alias to the tone sequence used by the Conventional Channel Gateway (CCGW) to execute that command on a channel.

Your system ships with a set of pre-configured TRC Tables. They cannot be modified, although it is possible to make copies of them and modify the copies.

IMPORTANT: Ensure that the correct TRC Table is associated with the right channel.

3.3 Supplementary Data Features

This section provides information on the Supplementary Data features. Supplementary Data messages are short, non-voice messages sent between the console and radio. These channels support Supplementary Data features:

- Digital Conventional
- Mixed Mode (Digital) Conventional
- MDC 1200 Conventional
- ASTRO® 25 Control Interface Module (ACIM) Conventional

3.3.1 Interzone Supplementary Data

Conventional Interzone extends the following capabilities and allows Supplementary Data messages to be delivered across zones.

3.3.1.1
Radio Initiated Supplementary Data

A radio user can initiate these Supplementary Data messages:

- Emergency Alarm
- Call Alert
- Status Update
- Message Update

When a subscriber unit initiates a non-voice Supplementary Data message on a conventional channel, a corresponding Supplementary Data message is sent to the home zone controller.

If the home zone controller determines that consoles are in other zones affiliated to the channel, an appropriate notification for the specific Supplementary Data message is sent to any affiliated consoles in the other zones and any local affiliated consoles.

If the interzone link between the home zone and a serving zone is not available when the Supplementary Data message is initiated, any consoles in the serving zone with the failed interzone link do not receive the Supplementary Data message. Consoles local to the home zone and any other zone that has an operational interzone link receive the Supplementary Data message.

When the home zone controller receives an acknowledgement response, a corresponding acknowledgement response is sent to any intrazone-affiliated consoles and any interzone-affiliated consoles.

3.3.1.2
Console Initiated Supplementary Data

A console operator can initiate the following Supplementary Data messages:

- Call Alert
- Status Request
- Radio Check
- Radio Disable/Enable
- Remote Monitor

When a console operator initiates a non-voice Supplementary Data message on a conventional channel, a corresponding Supplementary Data request message is sent to the console serving zone controller. If the conventional channel is in another zone and is available to receive the Supplementary Data message, the corresponding supplementary data request is sent to the home zone.

If the interzone link between the originating console serving zone and the home zone is not available when the console operator initiates the Supplementary Data message, the serving zone controller denies the Supplementary Data message by sending a reject message. The console operator is then informed of the access denial.

The Supplementary Data response is sent to any intrazone affiliated consoles and any interzone affiliated consoles, including the console that originated the Supplementary Data message.

When the subscriber unit acknowledges receipt of the Supplementary Data message, a corresponding Supplementary Data acknowledgement notification is sent to any intrazone affiliated consoles and any interzone affiliated consoles, including the console that originated the Supplementary Data message.

3.3.2
Call Alert

Mobile radio systems require a means for a system user to contact someone who is out of their car or away from their dispatch position. A Call Alert gives the sender the ability to notify the recipient that the

sender wishes to speak with them. Both the subscriber unit and dispatch console can send Call Alerts. A console user configured with outbound Call Alert capability can alert any other unit ID in the system. The console user can select from a list of user aliases that the console user has rights to access. The console user can also manually enter the ID of the Call Alert recipient.

The console-integrated paging encoder can send system pages using the Call Alert feature. System paging is supported on MDC 1200, ASTRO® 25 digital conventional, ASTRO® 25 Control Interface Module (ACIM) conventional, and mixed mode channels.

The Conventional Talkgroups feature does not support Call Alert/System Pages through Integrated Paging.

3.3.2.1
Console Initiated Call Alert

When a console operator initiates a Call Alert (originating console), it is sent to the subscriber unit through the zone controller (or conventional site controller in site conventional mode) and the Conventional Channel Gateway (CCGW). After the subscriber unit acknowledges receipt of the Call Alert, the acknowledgement is passed back to the originating console through the same path. When the originating console receives an acknowledgement of the Call Alert, indication of acknowledgement of the Call Alert is given to the dispatch console user.

If a console initiates a Call Alert on a channel busy with a voice transmission, the Call Alert is rejected and the console retries the Call Alert at a later time.

3.3.2.2
Subscriber Initiated Call Alert (to Dispatch Console)

After a subscriber unit initiates a Call Alert, the originating subscriber unit initiates the Call Alert by sending a Call Alert to the console through the Conventional Channel Gateway (CCGW) and zone controller (or conventional site controller in site conventional mode). After the console acknowledges receipt of the Call Alert, this acknowledgement is passed back to the originating subscriber unit through the same path.

When the originating subscriber unit receives an acknowledgement of the Call Alert, indication of the acknowledgement of the Call Alert is given to the radio user. The console displays Call Alerts destined to itself. For Call Alerts destined to a different console to be presented to the console user, the **Ignore Call to Other** configuration parameter on the ASTRO® 25 conventional channel must be disabled.

3.3.2.3
Subscriber Initiated Call Alert (to Subscriber Unit)

When a subscriber unit initiates a Call Alert, the originating subscriber unit initiates the Call Alert by sending a Call Alert to the other subscriber unit through a standalone repeater or a voting system. After the target subscriber unit acknowledges receipt of the Call Alert, this acknowledgement is passed back to the originating subscriber unit through the same path. When the originating subscriber unit receives an acknowledgement of the Call Alert, indication of an acknowledgement of the Call Alert is given to the radio user. The Conventional Channel Gateway (CCGW) also passes the subscriber-initiated Call Alert to the MCC 7500 Archiving Interface Server (AIS) to log the event.

3.3.3
Emergency Call/Emergency Alarm

Conventional systems support emergency call and emergency alarm features on Digital, Mixed Mode (Digital), MDC 1200, and ASTRO® 25 Control Interface Module (ACIM) conventional channels.

Emergency Call

An emergency call provides a visual indication of elevated call priority, displayed on the console and Push-to-Talk (PTT) log. This indication is used as a basis for preemption of low-priority audio at the console to accommodate audio for the emergency call. A state in over-the-air protocol identifies emergency calls. This emergency state is included repeatedly (every 360 milliseconds) in emergency calls.

Emergency Alarm

An emergency alarm is a non-voice message sent by the subscriber unit to the fixed network equipment. It typically is used to inform dispatch of a life-threatening situation. Although sent to a group address, the fixed network equipment still acknowledges the emergency alarm message.

If the bit error rate of a digital call is high enough, in which case the audio is un-decodable or unintelligible, the call can be misinterpreted as an emergency call. To ensure that the emergency state of a call is reliable and to avoid cases in which a call with a high error rate is misinterpreted as an emergency call, a configurable error detection threshold has been implemented on the Conventional Channel Interface.

NOTICE: A call always starts as a non-emergency call. When the emergency state is determined to be reliable, the call is updated on the console display and PTT log as an emergency PTT.

When a subscriber radio initiates an emergency alarm, all consoles affiliated to the conventional channel which receives the emergency alarm show an emergency alarm indication. The subscriber radio that issued the emergency alarm waits (if configured) for an emergency acknowledge message from the infrastructure.

For an ASTRO® 25 and MDC 1200-capable conventional channel, the zone controller or conventional site controller acknowledges the emergency alarm notification. The acknowledgement (that the system infrastructure received the emergency alarm) is sent to the radio initiating the emergency alarm and stops the radio from resending it.

The Emergency Alarm Acknowledgement is treated differently than other supplementary data acknowledgements. Most notably, if an outbound voice or data call exists when the system has received an emergency alarm, it queues the Emergency Alarm Acknowledgement until the outbound voice call has ended. After the call has completed, the Emergency Alarm Acknowledgement is sent. This scheme is different from other acknowledgements, where if outbound traffic exists when the acknowledgement is to be sent, it is rejected.

When a console operator acknowledges an emergency, it stops the emergency from being indicated as "new" on all other consoles affiliated to the channel. This situation is also true when the console operator ends the emergency. When the console operator ends the emergency state on a channel, the emergency is cleared on all consoles affiliated to the channel.

The behavior of how subscriber radios handle emergency alarms also differs depending on how the Emergency mode of the subscriber radio is configured. When configured for emergency alarm, the radio enters Emergency mode when the Emergency button is pressed and remains in that mode only until the alarm is acknowledged or retries are completed.

An emergency call is a PTT voice transmission with the "Emergency" bit set in the link control word embedded in the audio stream. Until the Emergency state is cleared, Emergency Call is sent with every voice transmission from the subscriber.

MDC 1200 radios can have different options for how they handle the Emergency PTT ID. This option can be enabled or disabled on each radio. When it is disabled, the radio sends no Emergency PTT ID when it initiates a PTT following either an emergency alarm or emergency call. When the Emergency PTT ID is enabled, the handling of the PTT ID is similar to how the radio is configured for regular PTT ID. Any combination of Leading or Trailing PTT ID can be used in this configuration. Depending on the configuration, the Emergency PTT ID may be sent at the start of the PTT, the end of the PTT, or at the start and end.

Emergency alarms can be sent only from a subscriber radio to the consoles (not from a console). Emergency alarms do not work reliably on channels configured for the cross busy/cross mute feature, because no mechanism is available to prevent the signaling message (like the Emergency Alarm Acknowledgement) from colliding with voice transmission on cross busy channel pair.

On an ASTRO® 25 Control Interface Module (ACIM) conventional channel, a trunked consolette may potentially miss an emergency alarm if it is operating on the voice channel when the alarm occurs. To avoid this situation, when an emergency call is received, an alarm tone can be emitted in addition to emergency alarm indications displayed on the GUI. This feature is called Simulate Emergency Alarms for Emergency Calls and can be enabled on a conventional and trunking channel resource using the Elite Admin capability. When disabled, no sounding of emergency tones is available for the emergency calls.

3.3.3.1
Interzone Emergency Alarm and Call

Conventional Interzone extends the following capabilities, and allows emergency alarms and calls to be delivered across zones.

3.3.3.1.1
Radio-Initiated Interzone Emergency Alarm

When a subscriber unit initiates an emergency alarm, an Emergency Alarm Notification is sent to the home zone controller. If the zone controller determines consoles are in other zones affiliated to the channel, an Emergency Alarm Notification is sent to the interzone-affiliated consoles and the intrazone-affiliated consoles. The zone controller proceeds with the current intrazone processing of the emergency alarm (for example, sending an Emergency Alarm Acknowledgement back to the subscriber unit).

After the subscriber unit receives the acknowledgment to the emergency alarm, a subsequent call request that occurs before the subscriber clears the emergency state is considered an emergency voice call, and is treated as such. Interzone call setup for an emergency call is similar to a non-emergency call except that the Emergency indicator is included in the link control word the subscriber unit transmits. The Emergency indicator is included in the interzone messaging associated with the call setup and forwarded to any consoles affiliated to the channel.

3.3.3.1.2
Console-Initiated Interzone Emergency Acknowledgement

A console operator acknowledges a previously received Conventional Emergency Alarm Notification that has not yet been acknowledged, and sends a Conventional Console Emergency Acknowledge Request message to the zone controller.

A Conventional Console Emergency Acknowledge Response is sent to any intrazone-affiliated consoles and any interzone-affiliated consoles, including the console that acknowledged the emergency alarm.

3.3.3.1.3
Console-Initiated Interzone Emergency Knockdown

A console operator in the serving zone decides to terminate the emergency condition and sends a Conventional Emergency Knockdown Request message to the zone controller.

A Conventional Emergency Knockdown Response is sent to any intrazone-affiliated consoles and any interzone-affiliated consoles, including the console that terminated the emergency.

3.3.3.2

Emergency Call/Emergency Alarm Configuration

ASTRO® 25 or MDC 1200-capable conventional channels are configured with channel level parameters that control emergency call/alarm capabilities of all console operator positions affiliated to the channel:

Inbound Emergency
The ability to receive emergency calls. If it is disabled, the emergency call comes across as a normal call.

Emergency Alarm
The ability to receive emergency alarms. If it is disabled, no emergency alarm tones or other indications of the alarm occur.

Emergency Recognize
The ability to acknowledge an emergency. If it is disabled, this ability is taken away from a console operator. This capability does not control sending acknowledgement to the radio, which the infrastructure performs automatically.

Emergency End
The ability to knockdown an emergency. If it is disabled, this ability is removed.

The Acknowledge delay timer applies to Mobile Data Communication (MDC) conventional, ASTRO® 25 Control Interface Module (ACIM) conventional, digital conventional, and mixed mode channels. It is not applicable for the analog conventional channel. The zone controller or conventional site controller (site conventional mode) uses this timer value to determine how long to wait before sending an acknowledgement to the radio for the received emergency alarm. The radio that initiated the emergency alarm uses this delay to prepare for the Acknowledgement (ACK). The radio must switch from transmit to receive to receive the ACK. When configuring the Acknowledgment Delay timer, channel link delays must be considered. The channel link delays may be long enough to make introducing additional delay unnecessary.

In addition to Emergency Alarm, the Acknowledgement Delay timer applies to Message Update and Status Update. Moreover, the console uses the Acknowledgement Delay timer for its acknowledgements to call alerts directed to its unit ID. The consoles may also acknowledge status update or message update when these messages are directed to it is unit ID.

For MDC 1200 channels that have the Line Operated Busy Light (LOBL) capability enabled and when parallel audio is needed for non-MCC 7500/7100 digital-capable parallel Dispatch Consoles (for digital and mixed-mode channels), users may need to increase the value of the Acknowledgement Delay Timer. This increase is required to allow the non-MCC 7500/7100 Dispatch Consoles the ability to acknowledge the Emergency Alarm coming from a radio. By extending the timer value parameter (Provisioning Manager), the controller is delayed long enough to allow the non-MCC 7500/7100 Dispatch Console to send the ACK and prevent collisions either on the 2-wire or 4-wire interface at the LOBL audio bridge (for LOBL configurations), or on the air interface for the digital-capable parallel consoles. The controller still acknowledges the Emergency Alarm and sends an Emergency Alarm ACK to the sending radio, but the radio ignores the second ACK message if it successfully received one from the non-MCC 7500/7100 Dispatch Console. Also, a configuration parameter allows silent emergency, with no emergency alarm sounded.

The Treat Emergency Calls as Normal Push-to-Talk (PTT) feature provides, on a per resource basis, the ability to configure MCC 7100 and MCC 7500 Dispatch Consoles to suppress the audible and visual indications associated with subscriber-initiated emergency alarms and calls, and parallel console initiated emergency calls. Separate configuration is provided for audible and visual indications when the resource is designated as a “primary” resource and when the resource is designated as a “non-primary” resource. The default setting provides both audible and visual emergency indications.

When visual and audible emergency indications are suppressed for a resource and an emergency alarm is received, the console ignores the emergency alarm and does not display information associated with it or sound the emergency alert tones. When the resource receives an emergency call,

the console presents the emergency call to the dispatcher as a normal PTT call. If visual indications are configured to be suppressed, audible indications are also suppressed.

When only audible emergency indications are suppressed (and visual indications are not suppressed) and an emergency alarm is received, the audible emergency alert tones are suppressed. For configuration details, see the *MCC 7500/7100 Elite Admin User Guide*.

NOTICE: LOBL capability is not available to ACIM conventional, mixed mode, digital V.24, and digital IP channels. When the call is made from other subscribers, the channel is handled as an ASTRO® 25 conventional channel.

3.3.4
Message Update

The Message Update feature enables a radio user to send a Message Update to all console operators monitoring the conventional channel. This message provides the dispatchers a short text from the radio user by seeing a short text message on the console display.

When the subscriber radio user decides to send a Message Update, it selects the appropriate message text from a list stored in the radio. After the desired text is found, the user pushes the Push-to-Talk (PTT) on the radio and send the Message Update to the system.

For MDC1200-capable channels not configured for Limited ID Space, if the radio is programmed with a Unit ID greater than 9, the console operator sees an ID displayed on the console that does not appear the same as it does on the display for a Gold Series console. It is not the same to other subscriber radio users that have ID display-capable radios either. Only if the system is configured in the Network Manager for the Limited Address Space option and the subscriber radios are programmed with an ID using digits 0-9 are the IDs the same across the MCC 7500 Console, the Gold Series Console, and other subscriber radios with display capability.

After the system receives the Message Update, it sends an acknowledgement to the radio signifying that the Message Update was successfully received. The radio then gives the user a positive indication that the system received the message. If the radio does not get an acknowledgement, and after exhausting all of its retries, the radio user is given an indication that the system did not receive the Message Update.

Use of supplementary data messages (non-voice communications from radio users to dispatchers) can reduce voice traffic on a conventional channel resource. Using data messages reduces loading on the channel to allow more users to effectively use the channel and to reduce interruptions for other radio users who do not need the information being sent to the dispatcher.

Message Update signaling is supported in site conventional mode; however, if messages in a message set contain aliases for the numeric message or status values, those alias references are not available in the conventional site controller (cannot be referenced from the zone controller). In site conventional mode, the zone controller is unavailable so the console only receives the Unit ID and numeric value for the message or status information. Aliasing of Unit IDs is not supported in site conventional mode.

Radio Initiated Message Update

Upon the radio user initiation of a Message Update, the originating radio sends a Message Update to the dispatch consoles monitoring the conventional channel via the Conventional Channel Gateway (CCGW) and zone controller. After the dispatch consoles receive the Message Update message, zone controller automatically sends an acknowledgement message back to the originating radio using the same path. When the originating radio receives the Message Update acknowledgement, the radio shows that the dispatch console received the Message Update The console user gives no manual acknowledgement of the Message Update.

When a site is operating in site conventional mode, the conventional site controller takes the place of the zone controller.

3.3.5
Radio Enable/Disable

The Radio Enable/Disable (also knows as Radio Inhibit/Uninhibit or Selective Inhibit) signaling feature allows the console operator to enable or disable a subscriber radio.

Lost or stolen subscriber radios must not be used for unauthorized purposes. The radio enable/disable feature can prevent unauthorized people from listening to or interrupting communications using a lost or stolen radio by the console operator who renders the radio inoperable (radio disable). After the radio is recovered, the console operator can enable the radio and return it to normal operation.

3.3.6
Radio Check

The Radio Check signaling feature allows a console operator to signal a subscriber unit to determine if it is powered up, identify what channel it is using, identify whether it is in range, or verify whether a radio is available.

The Radio Check feature allows console operators to determine if a particular radio is within the coverage of a conventional channel resource without disturbing other radio users on the channel and without unnecessarily increasing the traffic load on the channel.

This capability supports system management for systems employing multiple conventional RF sites to provide coverage for large geographic areas where radio users regularly travel between the different sites in the coverage areas.

3.3.7
Remote Monitor

The Remote Monitor signaling feature allows a console operator to remotely monitor a subscriber radio audio transmission. The Remote Monitor command causes the subscriber radio to acknowledge the command, begin transmitting a Group Call, and activate its microphone as if the user pressed the Push-to-Talk (PTT) button.

This feature provides the on-demand ability to listen to the ambient audio around a particular radio when a particular radio user is in a dangerous situation, and it is important for the dispatcher to hear what is going on around the radio user to better understand the situation.

3.3.8
Status Request

The Status Request signaling feature allows a console operator to signal a subscriber unit to request the current radio state (status) of a subscriber radio. A console operator can request this status from the radio at any time. The status value is stored persistently in the radio so a dispatch console can query it at any time.

After the target radio receives the Status Request, it sends its status value to the system. The console user then either sees a positive indication showing the radio status, or, after exhausting all of its retries, is given an indication that the target radio did not receive the Status Request.

3.3.9
Status Update

The Status Update feature enables a radio user to send a status message to all console operators monitoring the conventional channel. This message informs the dispatchers about the status of the radio user by seeing a short text message provided to the console display. The status selected by the radio user is stored in the radio such that at a later time, the dispatch operator can send a Status Request message to the radio requesting a re-sending of the status message.

If a dispatch console goes offline and then back online, which results in the state of the radio user being lost, the dispatcher can query the radios for their status. This capability is useful to track the status of various radio users to more effectively manage radio system users.

The Status Update signaling feature is supported in site conventional mode; however, if messages in a message set contain aliases for the numeric message or status values, those alias references are not available in the conventional site controller (cannot be referenced from the zone controller). In site conventional mode, the zone controller is unavailable so the console receives only the Unit ID and numeric value for the message or status information. Aliasing of Unit IDs is not supported in site conventional mode.

Radio-Initiated Status Update

Upon the radio user initiation of a Status Update, the originating radio sends a status message to the dispatch consoles monitoring the conventional channel via the Conventional Channel Gateway (CCGW) and zone controller. After the dispatch consoles receive the Status Update message, the zone controller automatically sends an acknowledgement message back to the originating radio using the same path. When the originating radio receives the Status Update acknowledgement, the radio shows the Status Update message as being received by the dispatch console. The console user gives no manual acknowledgement of the Status Update.

When a site is operating in site conventional mode, the conventional site controller takes the place of the zone controller. A Status Update message can be received only by dispatch console positions which have been affiliated to the conventional channel which carries the message from the radio to the system.

3.4 MCC 7500/7100 Dispatch Console Other Features

This section provides information about other console features used to manage and control conventional console resources.

3.4.1 Select Audio Speaker Enable

Select Audio Speaker Enable is available on Voice Processor Module (VPM) types of the MCC 7500 Dispatch Consoles and MCC 7100 Dispatch Consoles.

Select Audio Speaker Enable enables a console operator to let other people (supervisors, administrators, or trainers) listen to the audio being played in a dispatcher headset through a select speaker interface on the dispatch console. Previously, the console could be configured to place select audio in the speaker or the headset. This feature adds a third possibility, the ability to configure the console to place select audio in the speaker and headset.

3.4.2 Enhanced Alert Tones

The Enhanced Alert Tones feature supports the MCC 7500 Voice Processor Module (VPM) consoles and MCC 7100 Dispatch Consoles in M1, M2, M3, K1, K2, L1, and L2 core system configurations. MCC 7500 Dispatch Consoles are not supported. Enhanced Alert Tones give the operator the ability to send unique tones to a radio and/or the console. The user can override the three default tones with up to 15 custom tones provided in a WAV file format. The MCC 7500/7100 Dispatch Console installs 15 default alert tones on the console computer and can be overridden with 15 customizable alert tones. The WAV file must have the following characteristics:

- 16-bit Pulse Code Modulation (PCM)
- 8 ksps (kilo-samples per second)

- Single Channel
- 20 msec up to 5 minutes

The customized tone files are stored in the user alert tone directory under the MCC 7500/7100 Dispatch Console installation folder and given a name of the format `AlertTone<#>.wav` where # is 1-15.

Enhanced Alert Tones provides a consistent means of notifying the radio/consoles of a certain condition. For each Enhanced Alert Tone audio file configured on the console, the user can create customized tool tip to be displayed on the GUI. The tool tip appears when the user hovers the mouse over any one of Alert Tones 1 - 15 on the console GUI. Processing of the Alert Tones in which the selected channel is located in another zone proceeds similarly to a normal interzone voice call. See Console-Initiated Interzone Voice Call on page 156.

Based on the Elite Admin configuration, the dispatch console GUI displays the appropriate Enhanced Alert Tones selections to the dispatch console user. The dispatch console uses either single select or multi-select to select the resources to receive the Enhanced Alert Tones. After the resources are selected, the console user selects one of the Enhanced Alert Tones which causes the specific tone to be sent to the selected resources.

The console user then sends a Momentary Alert Tone. The tone length time plays for as long as the user presses the button. The console user sends a Latched Alert Tone which plays for a configurable tone-length, and is not dependent on how long the user presses the button.

The selected calls remain active for a configurable talk-extend time. The talk-extend time is the time all the calls remain active after the tones have been generated to allow the operator to transmit a voice message. During the talk-extend time, the dispatch console user can use the General Transmit function to initiate a voice transmission.

When the voice transmission has ended or the talk-extend time has expired (and no voice transmission has been initiated), the calls on the selected resources end.

Users responsible for configuring the audio files by the consoles for Enhanced Alert Tones require commercially available sound recorders and editors to create and modify the audio files. See the *MCC 7100 Console Dispatch Console Setup and User Guide* and *MCC 7500 Dispatch Console with Voice Processor Module* manuals.

3.4.3
Analog LOBL Interoperability

Line Operated Busy Light (LOBL) inhibits transmission by parallel consoles on a shared conventional radio resource. Parallel consoles interpret the LOBL signal as an indication that another console is transmitting on the resource and, as a result, do not allow simultaneous transmissions on the resource.

The visual indication, provided for MCC 7500/7100 Dispatch Consoles, provides the means for a dispatch console user to know if a particular resource is available for use.

Enable the guard tone notch on the base station cabled to the analog conventional channel through an analog Conventional Channel Gateway. This action is necessary for more precise tone LOBL operation when a non-MCC 7500/7100 Dispatch Console is cabled to the conventional channel through the audio bridge.

Examples of analog bridges in conventional topologies are provided in Other Topologies Using the Analog Bridge on page 191.

3.4.3.1
I/O LOBL Input

The I/O Line Operated Busy Light (LOBL) is an indication to the MCC 7500/7100 Dispatch Console that a parallel console is using the resource.

The GGM 8000 Enhanced Conventional Channel Gateway (CCGW) for both low density and high density perform the same processing for the I/O LOBL as it does for the Tone LOBL. The GGM 8000 Enhanced CCGW receives an LOBL indication through an I/O input. The I/O LOBL and the Tone LOBL can be used together. The I/O LOBL input can be configured to use voltage or contact closure per analog channel.

When the I/O LOBL input is configured for voltage, the GGM 8000 Enhanced CCGW indicates that a parallel console or controller is using the channel when the voltage on the second analog connector (9A to 9D and 13A to 13D), pin 2 has gone above +7.3 VDC with reference to pin 1. When the voltage goes below +3.0 VDC, the GGM 8000 Enhanced CCGW indicates that a parallel console or controller is no longer using the channel.

When the I/O LOBL input is configured for a contact closure, the GGM 8000 Enhanced CCGW indicates that a parallel console or controller is using the channel when the contacts on the second analog connector (9A to 9D and 13A to 13D) pin 2 goes to a shorted connection to pin 1. When the connection on the second analog connector (9A to 9D and 13A to 13D) pin 2 goes open, the GGM 8000 Enhanced CCGW indicates that a parallel console or controller is no longer using the channel.

The GGM 8000 Enhanced CCGW provides the hysteresis when reporting a change in state to the MCC 7500/7100 Dispatch Console to account for contact bouncing and voltage bounce.

3.4.3.2
Tone LOBL

The Tone Line Operated Busy Light (LOBL) option allows the MCC 7500/7100 Dispatch Console operator to monitor any base station control key-up activity performed by a parallel console or controller.

The Tone LOBL can be used on a 2-wire/4-wire, 4-wire, or 2-wire configuration. For a tone-operated base station, the presence of a guard tone on the transmit audio lines connected to the station (Line 1) keys the base station. A tone-controlled base station transmission is initiated by a high-level guard tone (between +11 dBm and -25 dBm) followed by function tone pulses, followed by the low-level guard tone (between-20 and -55 dBm) which accompanies the voice transmission. When a parallel console or controller is transmitting, a high-level and low-level guard tone is generated on the 2-wire receive audio path (Line 1), where the GGM 8000 Enhanced Conventional Channel Gateway (CCGW) sends a message to the MCC 7500/7100 Dispatch Consoles to indicate that the channel is busy and perform receive audio functionality.

3.4.3.3
Interzone Analog LOBL Interoperability

The Line Operated Busy Light (LOBL) transmission capability by a non-Motorola Solutions (LOBL) console is supported on analog and MDC-1200 conventional channels. The following describes the scenario for a LOBL voice call on an MDC-1200 channel.

A non-Motorola Solutions MDC-1200 capable (LOBL) console at an analog RF site initiates a voice call on the conventional channel by sending the LOBL tone sequence which prompts the Conventional Channel Gateway (CCGW) to send a conventional LOBL Call Request Inbound Control Packet (ICP) to the home zone controller.

The home zone controller allocates a multicast IP address for the call and responds to the CCGW with a conventional LOBL Call Grant Outbound Control Packet (OCP) containing the multicast IP destination for the call. This message contains a new indicator that specifies whether the call is delivered to any other zones. The CCGW uses this information to determine whether to extend the packet transmission holdoff time with the configured incremental interzone packet transmission holdoff time before transmitting audio to the multicast IP address.

A Conventional Begin LOBL Tx is also sent to any intrazone-affiliated consoles. As in the subscriber-initiated voice call, if the home zone controller determines that consoles are in other zones affiliated to the channel, a Conventional Begin LOBL Tx is sent to any interzone-affiliated consoles. The consoles

join the multicast group identified by the multicast IP address and begin processing G.728 audio as it arrives from the home zone over the interzone links.

The LOBL console transmits an MDC-1200 Leading Push-to-Talk (PTT)-ID message. The CCGW converts the Leading PTT-ID and sends a Digital Conventional Radio Call Request ICP message to the home zone controller. A Conventional Beginning of Mobile Transmit (BOMT) is sent to any intrazone-affiliated consoles and any interzone-affiliated consoles containing the PTT-ID information.

When the LOBL console dekeys, the CCGW detects the dekey and sends a Conventional LOBL Dekey Detected ICP to the home zone controller which responds with the Conventional LOBL End Of TX OCP. A Conventional End-of-LOBL Tx is sent to any intrazone- and interzone-affiliated consoles.

When the CCGW no longer detects audio, it stops sending G.728 audio packets to the console subsystem. The remainder of the call termination proceeds like a radio initiated call termination.

3.4.4
Analog VOX Detect Inbound Calls

When a subscriber user initiates the Push-To-Talk (PTT) (or "keys") feature on a specific conventional channel frequency, the conventional base radio detects the presence of a carrier at the receiver. And the presence of the subscriber transmission can be communicated to the Conventional Channel Gateway (CCGW) configured to use Voice Activity Detection (VOX) method to detect subscriber transmission.

With the VOX method, the CCGW continuously buffers linear Pulse Code Modulation (PCM) audio packets. These packets are obtained through analog/digital conversion of the analog signal received over the analog interface to the conventional base radio to detect the presence of voice. The voice detection serves to indicate the beginning of subscriber transmission.

3.4.5
Channel Marker

The Channel Marker feature enhances existing system products to enable the Channel Marker capability. A Channel Marker is a distinct, short-duration, audible tone heard over the Mobile/Portable Subscriber and/or console speakers. A dispatch console user initiates and cancels the tone. After initiation, the Channel Marker tone is generated periodically when no voice activity is on the resource. The primary purpose of the Channel Marker is to inform radio/console users that the conventional channel is involved in a high-priority situation.

The Channel Marker feature on the MCC 7500/7100 Dispatch Console has the following characteristics:

- The MCC 7500/7100 Dispatch Console has a button on each resource configured with the Channel Marker capability.
- The dispatcher can choose to activate/deactivate the Channel Marker feature on any resource that has the Channel Marker capability, regardless of the current selected resource on the console.
- All MCC 7500/7100 Dispatch Consoles share the status and control of the Channel Marker. So when one dispatcher activates Channel Marker on a resource, all parallel consoles see that the Channel Marker has been enabled. The parallel console positions also can turn off the Channel Marker.

For MDC 1200-capable channels, if the controlling console position is configured to send its Push-to-Talk (PTT)-ID for outbound transmissions, when a Channel Marker tone is sent, the PTT-ID is not transmitted with the tone. See Conventional PTT ID and Alias Display on page 135.

Configuration of the pre-time parameter to a low value may not enable the MDC 1200 repeaters for operation, which in turn results in a failure of the MDC 1200 signaling operations.

The Channel Marker tones are transmitted as analog audio. Each Channel marker tone is 500 ms in duration, a fraction of the pre-time, when set to a higher than default value.

3.4.5.1

Interzone Channel Marker

Conventional Interzone extends the following capabilities and allows a Channel Marker to be delivered across zones.

Console Initiated Channel Marker Enable

The console user activates a Channel Marker on an affiliated conventional channel that is home to a different zone. The console issues a conventional Channel Marker Enable to the serving zone controller of the console.

If the Channel Marker can be granted in the home zone of the conventional channel, a conventional Channel Marker Enable Grant is sent to any intrazone-affiliated consoles and any interzone affiliated consoles, including the console that enabled the channel marker.

The Channel Marker controlling console begins to transmit the Channel Marker tone and issues a conventional Push-to-Talk (PTT) request to the serving zone controller with a Channel Marker indication. From this point on, the call proceeds like a console initiated interzone voice call. See Console-Initiated Interzone Voice Call on page 156. The console ends the call when the Channel Marker tone ceases.

Console Initiated Channel Marker Disable

The console operator deactivates the Channel Marker on the conventional channel. The console issues a Conventional Channel Marker Disable to the serving zone controller of the console.

The Channel Marker is disabled in the home zone of the conventional channel, and a Conventional Channel Marker Disable Grant is sent to any intrazone-affiliated consoles and any interzone-affiliated console, including the console that deactivated the Channel Marker.

Interzone Link Failure and Recovery

If the interzone link between the serving zone of the originating console and the home zone is not available when the console initiates the Channel Marker Enable or Channel Marker Disable message, the serving zone controller denies the request by sending the Inbound Signaling Word (ISW) Reject message and the console operator is informed of the denial.

If the interzone link between the conventional channel home zone and a non-originating console serving zone is not available when the Channel Marker Enable or Channel Marker Disable message is initiated, none of the consoles in the serving zone with the failed interzone link can receive the Conventional Channel Marker Enable Grant or Conventional Channel Marker Disable Grant. If an interzone link fails between the home zone of a conventional channel that has the channel marker enabled and the serving zone of the console that enabled the channel marker, the channel marker is disabled and both zones inform the affiliated consoles.

If an interzone link fails between the home zone of a conventional channel that has the Channel Marker enabled and the serving zone of affiliated consoles that did not enable the Channel Marker, the Channel Marker is disabled in the serving zone with the failed interzone link and the affiliated consoles are informed of the Channel Marker Disable.

When an interzone link recovers, the home zone updates the serving zone with the status of any conventional channels with the Channel Marker Enabled in the home zone. A Conventional Channel Marker Enable Grant is sent to any affiliated consoles in the serving zone with the recovered interzone link. Because multiple conventional channels may be in the home zone with the Channel Marker Enabled, the serving zone controls the rate at which the Channel Marker Enable Grant messages are sent to the affiliated consoles.

3.4.6
Console Interrupt/Takeover

The Console Interrupt feature allows one console to interrupt transmission of another console already transmitting on the channel, based on transmission priority.

3.4.7
Console Priority

Console Priority is a configuration of a comparator or a base radio to have Wireline Priority over Repeater Priority.

3.4.8
Duplex Patch

Duplex Patch makes it possible to configure analog conventional channels and MDC 1200 analog conventional channels so that they can operate in a duplex mode when patched together or with a console telephone resource.

The standard operation is that when a dispatcher patches two analog conventional channels, they switch to the simplex mode which means that the radio users in the patch can hear only one radio transmitting at a time. With the Duplex Patch, all non-transmitting radio users on both patched channels can hear the sum of the audio from the transmitting radio users on both resources.

Duplex Patch Combinations

The maximum number of parties in a duplex is two analog conventional channels or one analog conventional channel and a telephone call. See the list of all the possible combinations in a Duplex Patch:

- Two Duplex-Patch-capable analog conventional channels
- Two Duplex-Patch-capable MDC 1200 analog conventional channels
- One Duplex-Patch-capable analog conventional channel and one Duplex-Patch-capable MDC 1200 analog conventional channel
- One Duplex-Patch-capable analog conventional channel and one telephone call
- One Duplex-Patch-capable MDC 1200 analog conventional channel and one telephone call

NOTICE: It is not possible to set up a Duplex Patch between two channels when one of them is not Duplex-Patch enabled. The limit of parties in a Duplex Patch is two.

3.4.8.1
Duplex Patch Operation

This section provides information on how to set up and knock down a Duplex Patch, and other details about the Duplex Patch operation.

Duplex Patch Setup

Usually, two Duplex-Patch-capable channels or one Duplex-Patch-capable channel and one telephone call start operating in the Duplex Patch mode as soon as a dispatcher patches them together. The exception is when one of patched channels is not functioning or the patched phone call is on hold. As soon as the channel or phone call state changes to being available, the patched parties start hearing all audio.

Duplex Patch Knockdown

The channels or the channel with phone call stop operating in the Duplex Patch mode under the following circumstances:

- When the dispatcher adds a third member to the patch that is any radio or phone resource. As soon as the dispatcher reduces the number of patch members to two Duplex-Patch-capable radios or one Duplex-Patch-capable radio and one telephone call, the patch stops operating in simplex mode and changes to duplex operation.
- When the dispatcher who created the patchgroup, or any other parallel dispatcher, begins transmitting on one of the channels in the Duplex Patch. The Duplex Patch is no longer active and the radio users on the patched channels now hear only the dispatch transmission. When the dispatcher ends their transmission, the duplex patch is brought up again and the radio users on the patched channels hear all audio on both channels.
- When the dispatcher puts the telephone call on hold which causes the console to stop the Duplex Patch outbound transmissions on the patched channel until the dispatcher disables the put on hold option.
- When the dispatcher knocks down the Duplex Patch by removing the patched parties from it. The channels revert to their normal non-patched mode of operation.
- Both radio users stop transmitting long enough that the Duplex Patch Timeout timer expires. After the timer expires, the controlling console stops the Duplex Patch outbound transmissions on both patched channels.

Subscriber-Sourced MDC 1200 Signaling in Duplex Patch

When a radio user on one of the channels in a Duplex Patch sends the MDC-1200 signaling with their transmission, the MDC-1200 signaling is not repeated on the channel on which the user transmits. Therefore, during an active Duplex Patch when both channels are transmitting due to the Duplex Patch, no MDC-1200 signaling is repeated. The MDC-1200 signaling includes among others PTTID, Call Alerts, and Emergency Alarms.

Console Initiated Duplex Patch Calls

The console controls the following:

- Patch type
- Changing from duplex to simplex
- Changing from simplex to duplex

The dispatch console controls the patch type through which resources it places in its patchgroups. When two Duplex Patch-capable resources are placed in a patchgroup, that patchgroup operates in Duplex Patch mode.

Changing from duplex to simplex and simplex to duplex is based on patchgroups changing from two Duplex Patch capable members to three members or three members to two Duplex Patch-capable members. The console indicates Duplex Patch in its patch transmit request, and that information gets forwarded to the Conventional Channel Gateway (CCGW).

The Duplex Patch starts when at least one active audio source is available on either of the two resources in the patchgroup. The console keys both channels when Duplex Patch starts.

When Duplex Patch is active, the CCGW creates transmit audio by summing its receive audio with the console patch audio. Received MDC control tones are not summed.

When a parallel, Motorola Solutions or Line Operated Busy Light (LOBL), or local dispatcher transmits on a channel in a Duplex Patch, the Duplex Patch is no longer active and the radio users hear only the transmitting console audio. The Duplex Patch is re-established when the parallel/local dispatcher transmission ends.

Both Duplex Patch transmissions can end upon:

- Expiration of the console Duplex Patch drop out delay timer
- Change in patchgroup membership
- Console transmit upon a resource in the patchgroup

3.4.8.2
Duplex Patch Configuration

To configure an analog conventional channel or an MDC-1200 analog conventional channel for the Duplex Patch feature, modify objects in Provisioning Manager.

To enable the Duplex Patch feature for an analog conventional channel, modify the console capabilities for the Analog Conventional Channel object.

To enable the Duplex Patch feature for an MDC-1200 analog conventional channel, modify the console capabilities for the MDC Conventional Channel object.

To customize the Duplex Patch Timeout timer, modify the console configuration for the Console User Capabilities Profile.

For detailed instructions on how to configure the Duplex Patch feature, see the *Provisioning Manager* manual.

3.4.9
Console Repeat

Console Repeat is a feature that enables the non-RF related infrastructure to perform the repeat function instead of the repeater or comparator.

The feature is available for analog conventional channels and MDC-1200 analog conventional channels, in systems with GGM 8000 Enhanced Conventional Channel Gateways, and on both MCC 7500 Dispatch Consoles with Voice Processor Module (VPM) and MCC 7100 IP Dispatch Consoles. It cannot be used or configured on the following channel types:

- Digital Conventional
- Conventional Mixed Mode
- ASTRO® 25 Control Interface Module (ACIM)
- Conventional Talkgroup

Console Repeat Variants

You can configure Console Repeat to operate in two different variants: Latched or Non-Latched.

Latched Console Repeat

This variant of the Console Repeat feature makes it possible for a dispatcher to use an analog conventional channel for coordination during an incident. After the dispatcher activates the feature for the channel by using the Elite Dispatch interface, the dispatch console automatically keys the station and any inbound audio is routed to the transmitter and repeated. The console leaves the station keyed even when there is no inbound radio audio on the channel. The continuous channel carrier causes a set of scanners that monitor a number of channels to lock onto the channel. The people near the scanner hear all the activity on that channel without interruption due to scanning other channels. After the incident is over, the Console Repeat feature can be disabled from the dispatch position on which it was turned on, or from any other properly configured dispatch position.

Non-Latched Console Repeat

This variant of the Console Repeat feature makes it possible for a dispatcher to enable radio users on a certain analog conventional non-repeat capable channel to hear transmissions of one another. After the dispatcher activates the feature for the channel by using the Elite Dispatch interface, the

dispatch console keys the channel and indicates to the Conventional Channel Gateway (CCGW) that it should retransmit incoming radio audio on that channel. The dispatch console keys the station whenever an inbound radio call is on the channel, and causes the inbound audio to be routed to the transmitter and repeated. In this way, the other radio users on that channel can hear the radio audio.

Console Repeat Deactivation

Both Console Repeat variants can be disabled from the dispatch position on which they were enabled or from any other properly configured dispatch position.

In the case of Latched Console Repeat, disabling the feature by a dispatcher causes the channel to dekey and the carrier is no longer present on the channel.

In the case of Non-Latched Repeat, disabling the feature by a dispatcher causes the console to stop keying the channel and instructing the CCGW to retransmit incoming radio audio on that channel, and the radio users can no longer hear transmissions of one another.

Both variants of the feature can be pre-configured so they are automatically disabled after a predefined time. Before it disables, a timeout warning appears in the status line at the bottom of the Elite Dispatch window. The automatic disablement is postponed if an inbound radio call is active when the feature is about to be disabled. In this case, the feature is disabled when the inbound radio call ends.

Console Repeat Calls Logging

The logging subsystem tracks when and on which dispatch console the Console Repeat function was turned on or turned off for the particular channel. The logging subsystem also indicates that the Console Repeat transmission does not have console sourced audio associated with it.

3.4.9.1
Console Repeat Interaction with Other Features

Console General Transmits and console Instant Transmits are of higher priority than Console Repeat which means that any console transmissions other than another Console Repeat are higher priority than the Console Repeat except for console Patch Transmit.

These priority settings force the Console Repeat to stop when a dispatcher console performs a higher priority transmit on the resource with the Console Repeat enabled. After the higher priority transmission ends, the dispatch console in control of the Console Repeat automatically re-starts the Console Repeat transmission. This re-start takes a while and results in a 500-800 milliseconds of break in the carrier and audio transmission.

RF Cross Busy Interaction

As console General Transmits and console Instant Transmits are of higher priority than Console Repeat, a console granted a higher priority transmit on another resource that is RF crossbusied with the resource doing Console Repeat causes the resource doing Console Repeat to go off the air.

Main/Alternate Interaction

The Console Repeat feature rides through the main/alt transitions. If the console is on the active resource with Console Repeat turned on and the Conventional Channel Gateway (CCGW) used by this active resource fails, the inactive resource in the pair becomes active with Console Repeat turned on. This change takes place automatically. No action on the part of the dispatcher is required in this event.

Patch Interaction

A channel can be a member of a patchgroup (Simplex or Duplex) and be in Console Repeat mode at the same time. As Patch Transmit is lower console transmit priority than Console Repeat transmit, a

patch transmission cannot take over a channel transmitting in the Console Repeat mode. The Zone Controller denies attempts to start a Patch Transmit on a channel with an active Console Repeat. The Zone Controller allows for starting a Console Repeat transmission on a channel with an active patch transmission which means that the Console Repeat transmission takes over the patch transmission.

Outbound Console Repeat transmissions are never a patch audio source. Therefore, a latched console repeat transmission is never the patch audio source, but an inbound radio call on a channel in latched console repeat mode can be used as a patch audio source.

Emergency Alarm Interaction

When an Emergency Alarm is received on an MDC channel that has an active Console Repeat transmission, the Zone Controller requests that the CCGW send the Emergency Alarm Ack. The CCGW stops repeating received audio to transmit the Emergency Alarm Ack. In most cases, the channel remains keyed. The CCGW resumes the Console Repeat transmission as soon as the Emergency Alarm Ack is sent.

Non-Emergency Supplementary Data Feature Interaction

A console cannot send a supplementary data message, for example Call Alerts or Status Requests, on an MDC channel with an active Console Repeat transmission. The system rejects the request because of the active outbound voice transmission. The same restrictions apply to the non-emergency supplementary data acknowledgements sent by the system, for example Status Update Ack or Call Alert Ack.

3.4.9.2
Console Repeat Configuration

To configure an analog conventional channel or an MDC-1200 analog conventional channel for the Console Repeat feature, modify objects in the Provisioning Manager.

To enable the Console Repeat feature for an analog conventional channel, modify the console capabilities for the Analog Conventional Channel object.

To enable the Console Repeat feature for an MDC-1200 analog conventional channel, modify the console capabilities for the MDC Conventional Channel object.

To employ the Console Repeat deactivation timer, modify the console configuration for the Console User Capabilities Profile.

For detailed instructions on how to configure the Console Repeat feature, see the *Provisioning Manager* manual.

3.4.10
Console Unit ID

The send Console Unit ID feature allows a dispatch console to send its Unit ID when it is transmitting on an ASTRO® 25 conventional channel, analog MDC channel, or an ASTRO® 25 Control Interface Module (ACIM) conventional channel. Unit IDs are unique numbers assigned to each radio and dispatch console in ASTRO® 25 conventional radio systems. The Console Unit ID allows the radios to display the ID of the dispatch console that is the source of the transmission.

3.4.11
Conventional Audio/Event/Message Logging

Both console and radio source audio can be recorded and played back later. The call information is also logged, so information such as the source and mode of the call is available. Signaling messages such as Call Alert and Emergency Alarm are also logged.

The Audio Logging Server (AIS) affiliates with conventional channels similarly to console operator positions. Calls and signaling messages are forwarded to the AIS. The AIS forwards the audio, call information, and signaling messages to the logging device. If the AIS is configured to decrypt secure calls, the audio is decrypted before being sent on to the logging device.

The monitor station control command is not logged. Audio associated with monitor still gets logged, but appears as audio from a normal radio voice call. When the station is in monitor mode it does not validate the Network Access Code (NAC), so the call may be from different users of the same frequency.

Audio and message logging to a voice logging recorder is performed for voice and non-voice related activities on interzone conventional channels. An AIS and associated logging recorder can be at dispatch sites or at the zone core in any zone of a multizone system. Therefore, you can log the audio and control information on logging equipment in any zone involved in the call, whether it is the home zone of the conventional channel or a serving zone containing consoles monitoring the conventional channel. As long as the AIS is affiliated to a conventional channel located in another zone, the home zone controller includes it in any voice and non-voice related activity on the conventional channel, and the AIS logs the audio and messages to the recorder.

3.4.12
Call Activity Logging

Each zone controller involved in an interzone conventional call related or non-call related activity sends the appropriate Radio Application Programming Interface (RAPI) message to the local Air Traffic Router (ATR) containing information pertinent to the activity. These activities include the Flexible Conventional Call Activity Update, the Flexible Conventional End of Call, and the Flexible Conventional Radio Status Traffic messages. In addition, for conventional calls, the home zone controller of the conventional channel sends a new Flexible Conventional Controlling Zone Update message to the ATR containing system level-specific information for the conventional call.

3.4.13
Conventional Mixed Mode

ASTRO® 25 conventional channel operation enables the use of analog and digital modes on a conventional channel. The mixed mode channel supports any combination of analog, digital clear, and digital encryption modes.

Conventional mixed mode channels use a Conventional Channel Gateway (Site Gateway with Conventional Channel Interface module) for the conventional base radio interface that provides the correct signaling and audio formats for analog and digital mode calls. For conventional mixed mode base radios, analog voice uses the analog voice interface (analog over 4-wire) and digital voice uses the digital voice interface (Improved Multi-Band Encoder (IMBE)/Advanced Multi-Band Excitation (AMBE) (full rate) over V.24) supported by the Conventional Channel Gateway (CCGW).

The CCGW is responsible for assigning the correct signaling interface to the channel request. This interface is either V.24 for digital conventional (which combines audio and call control), or V.24 which supports digital call control and 4-wire interface for analog audio when using analog mode on a conventional mixed mode channel.

MDC 1200 signaling is not supported on mixed mode channels in the system. Mixed mode channels can support either analog or ASTRO® 25 digital transmission and ASTRO® 25 signaling when radios transmit in the digital mode.

For details on the conventional mixed mode channel states, see Analog Link Monitor Tone on page 273.

3.4.14

Conventional Talkgroups

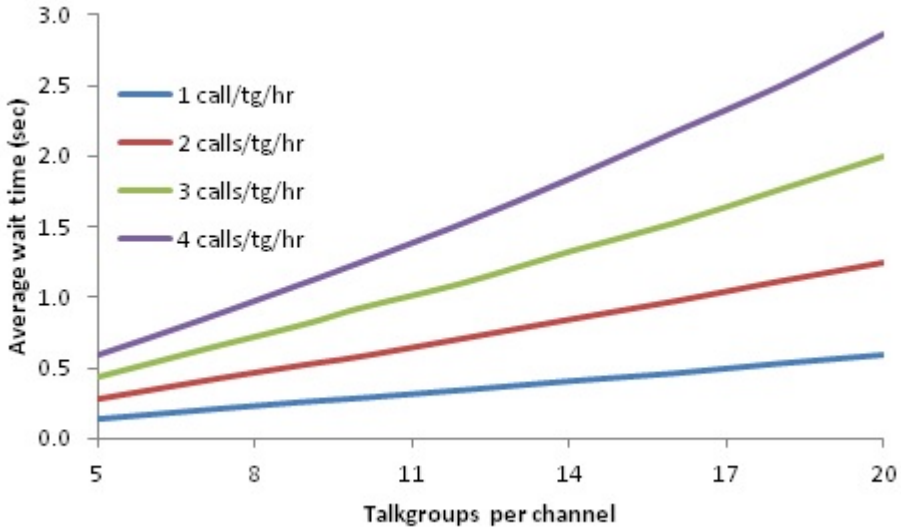
A Conventional Talkgroup provides group separation of voice communications on digital-only conventional channels. Subscribers and console operators using the same talkgroup can communicate with each other and users of other talkgroups do not hear them. When a transmission is made to a certain talkgroup, only users monitoring that talkgroup hear the transmission. Also, talkgroups provide for separation of emergency alarms. After a talkgroup is assigned to a conventional channel, it cannot be used on a different channel or be used for trunked operation.

An MCC 7500/7100 Dispatch Console operator or subscriber user can initiate a conventional talkgroup call. The subscriber LED is illuminated if activity from a different talkgroup is on the channel. The console shows a talkgroup Cross Busy indication due to a subscriber radio Push-to-Talk (PTT), subscriber radio emergency PTT, or a console PTT on a different talkgroup on the Conventional Talkgroup channel.

The maximum number of conventional talkgroups that can be configured per channel is 20. However, to prevent over-use of the channel, use a lower limit depending on the call rates of the talkgroups. Configuring a channel to capacity with talkgroups that have high call rates results in a busy channel which might provide few opportunities for PTTs. Furthermore, the dispatcher also sees the resource busy most of the time, and radio users might key up on top of each other causing unintelligible audio. And finally, a busy channel leaves little, if any, bandwidth for data transactions.

Figure 1: Expected Wait Time for Users

This figure shows the expected “wait time” for users. Wait time is meant to indicate the expected time a talkgroup user would be delayed on average before being able to initiate a call. Since Conventional Talkgroup calls are not busied, this time is an indication only of how active the channel is.



All Conventional Talkgroup IDs must be home IDs, and cannot be used as Trunked Talkgroup IDs. Radio IDs used on a Conventional Talkgroup channel use the same Radio ID range as trunked Radio IDs. Conventional Unit IDs programmed into a subscriber or dispatch console are less than 10,000,000.

When a Conventional Talkgroup is disabled using Network Manager (NM), radio transmission does not stop, but console transmission does stop.

For inbound calls, the console indicates cross busy for the activity of other conventional talkgroups on that conventional talkgroup channel. The indications are cross busy due to subscriber and subscriber

emergency. The console operator is not shown the Unit ID of these transmitting subscribers. A console transmit results in taking over the outbound audio path from the subscriber.

For outbound calls, the console indicates with cross busy the activity of other conventional talkgroups on that conventional talkgroup channel. The indication is cross busy due to console. The console operator is not shown the Unit ID of these transmitting consoles. An attempted console transmit results in busy/queuing.

The console operator is unaware subscribers are in voice-selective calls on the conventional talkgroup channel because cross busy indications are not shown for them. A console talkgroup transmit takes the outbound path from a subscriber in a voice-selective call.

When a subscriber transmits a talkgroup not configured for that conventional talkgroup channel, fault management is notified of an invalid talkgroup. The console operator is unaware subscribers are using invalid talkgroups because cross busy indications are not shown for them. A console talkgroup transmit takes the outbound path from a subscriber using an invalid talkgroup.

Before ending a call, the call controller must wait 500 ms for a new start and for audio in transit to be received at consoles.

Comparator voting status/control at the console is not talkgroup-based; it remains channel-based. If the site is disabled, the site is disabled for all talkgroups.

With Tactical Normal with Conventional Site Controller (CSC), the last state is retained and the next time consoles connect, the state of tactical could cause confusion. If switching between the zone controller and CSC, the console operator may need to reinstate tactical.

The following conventional features are compatible with Conventional Talkgroups:

- Talkgroup Call
- Emergency Alarm
- Emergency Call
- Patch
- Multiselect (MSEL)
- Repeat Disable (per talkgroup)
- Channel Marker
- Paging - Internal
- Paging - External
- Alert Tones
- Keyset Display and Keyset Selection
- Auto Key within the Keysets used by a Common Key Reference (CKR)
- Tactical Priority
- Cross Busy

A Conventional Talkgroup does not support the following conventional features:

- RF Cross Mute
- Customized Paging Formats
- Encryption Key Selection
- Main/Alternate
- Radio Message
- Radio Status
- Status Request

- Voice Selective Call
- Call Alert
- Remote Monitor
- Radio Check
- Radio Disable
- Station Channel Selection
- Second Receiver Control (Mute R2)
- Station WildCard Control Functions at Console
- Multi-Network Access Codes (NAC)

Conventional talkgroups do not support STR3000 Base Radios.

Because it does not operate on mixed mode channels, Conventional Talkgroup is not compatible with Dual Comparator Mixed Mode Simulcast operation.

Cross mute between a Conventional Talkgroup channel and a classic conventional channel is not supported. Cross mute between Conventional Talkgroup channels is also not supported. Other channel receivers may receive other transmitters. When both channels are Conventional Talkgroup channels using channel-wide talkgroups, these calls may be heard on the other channel. If the receiving channel is a conventional talkgroup channel, other talkgroups are detected as invalid talkgroups. To mitigate these effects, use different NACs for each channel, or if that is not possible, use a headset for audio issues.

Conventional talkgroup-related Air Traffic Information Activity (ATIA) messages are trunked format ATIA messages.

3.4.14.1
Converting a Channel to Conventional Talkgroups

Perform this procedure to convert a channel to a digital Conventional Talkgroup.

The channel must be configured as a Conventional Talkgroup channel in the infrastructure along with up to 20 talkgroups for use on that channel. After a talkgroup is used as a Conventional Talkgroup, it cannot be used on another Conventional Talkgroup channel or be used for trunked operation. The subscribers must also be digital. The subscribers use selective squelch for receive to their talkgroup or the Everyone Talkgroup.

After it is determined which talkgroups and how many to use on which channel, the configuration in the infrastructure and in the subscriber can occur. Both cannot be instantaneously configured or some loss of communication occurs between the subscribers and consoles. Configuring the subscribers takes much more time than configuring the infrastructure. The following procedure for a classic to talkgroup channel transition minimizes the communication downtime.

Prerequisites:
If the channel to convert is analog, Securenet, or mixed mode, the channel must be changed to have digital-only capability.

Tune base stations accurately. The qualifications to start a call are more stringent for Conventional Talkgroups than classic conventional channels.

If the console was using station channel selection, reprogram the base radio because cleanup of which receive frequency was last used does not occur.

If possible, use G-Series equipment with the Conventional Talkgroup feature instead of QUANTAR® and ASTRO-TAC™ equipment. However, a QUANTAR® station used with a Conventional Talkgroup channel must have A7.15 or later software.

Procedure:

1. In the subscribers, update the talkgroup ID to the ID to be used on the Conventional Talkgroup channel. This channel selector position is used until the consoles are updated with the talkgroup. See the *Provisioning Manager* and *Radio Features* manuals.

   Unit IDs programmed into a subscriber or dispatch console are less than 10,000,000.

2. In the subscribers, using Customer Programming Software (CPS), add another personality identical to the one with the new talkgroup ID, change it from normal squelch to selective squelch.

   This channel selector position is used after the consoles are fully functional with the talkgroup. If it is used immediately, the subscriber does not hear the console, but the console hears the subscriber. Subscribers on different talkgroups do not hear each other.

3. Enter the Conventional Talkgroups into the infrastructure. See the *Provisioning Manager* manual.

4. To stop its use by the consoles, delete the classic conventional channel and distribute to the consoles. See the *Provisioning Manager* manual.

   The console operator is not able to communicate with the subscribers. Subscribers can still communicate with other subscribers regardless of talkgroup.

5. Add the Conventional Talkgroup channel and assign the talkgroups to it. Distribute changes to the consoles. See the *Provisioning Manager* manual.

6. Console operators must restart their application. After a few minutes, the talkgroup becomes accessible.

   Console operators can only hear their talkgroup and the classic channel is gone. All subscribers regardless of talkgroup still hear each other and the console. The console hears only subscribers using the talkgroup.

7. The console operator instructs the subscriber to change their channel selector to the position using selective squelch.

Talkgroup separation is complete. All subscribers and consoles transmit and receive on that talkgroup.

3.4.14.2
Conventional Talkgroup Call Processing

This section provides a basic description of call processing for Conventional Talkgroup calls using digital conventional talkgroup channel resources.

3.4.14.2.1
Conventional Talkgroup Dispatch Console Monitoring

Multiple dispatch console positions can monitor each conventional talkgroup. The dispatch console operator positions that monitor so a given conventional talkgroup are only the positions that must hear audio, receive indications from this group, and must respond to this activity. Dispatch console operator positions that do not monitor this group but monitor other groups on the same conventional talkgroup channel are only aware that there is an activity on the channel but do not hear the audio, receive the indications, and are not able to respond to the activity.

These restrictions prevent consoles monitoring one agency from responding to calls and emergencies that must be handled by other dispatch console operation positions, and permit sharing of the same conventional talkgroup channel. To better understand the functionality, see the following example.

Example: The operators of Consoles A and B monitor a POLICE1 conventional talkgroup. The operator of Console C monitors a FIRE1 conventional talkgroup. The POLICE1 and FIRE1 conventional talkgroups are on the same conventional talkgroup channel. The operator of

Console A transmits on the POLICE1 talkgroup. The operator of Console B can hear the transmission and sees that Console A is the source of the audio. The subscriber radios monitoring POLICE1 talkgroup can hear the audio. The operator of Console C can see activity on the conventional talkgroup channel by the Cross Busy indication, but can neither hear the audio nor see the source of the audio. The subscriber radios monitoring the FIRE1 see an activity that interferes with transmitting on FIRE1, but cannot hear the audio.

3.4.14.2.2

Conventional Talkgroup Channel-Wide Call Processing

A channel-wide talkgroup call provides the console operator the capability to transmit to all subscribers on a Conventional Talkgroup channel. This console Conventional Talkgroup does not receive all subscriber activity on the channel. This Conventional Talkgroup receives audio from a subscriber using the Everyone Talkgroup $FFFF. Although not usual operation, this console Conventional Talkgroup also receives audio from a subscriber directly transmitting with a channel-wide talkgroup (not $FFFF). A Conventional Talkgroup channel can have up to one channel-wide talkgroup. Channel-wide talkgroups on different Conventional Talkgroup channels have different talkgroup IDs.

The console and call controller are not aware that the Conventional Talkgroup is a channel-wide talkgroup. On outbound, the Conventional Channel Gateway (CCGW) converts the channel-wide Conventional Talkgroup call to an Everyone Talkgroup ($FFFF) call so that all subscribers on the Conventional Talkgroup channel can hear the call. On inbound, the CCGW converts the Everyone Talkgroup call to a Conventional Talkgroup call. This Conventional Talkgroup call has the talkgroup ID of the channel-wide talkgroup for that Conventional Talkgroup channel.

Figure 2: Inbound Channel Wide Talkgroup

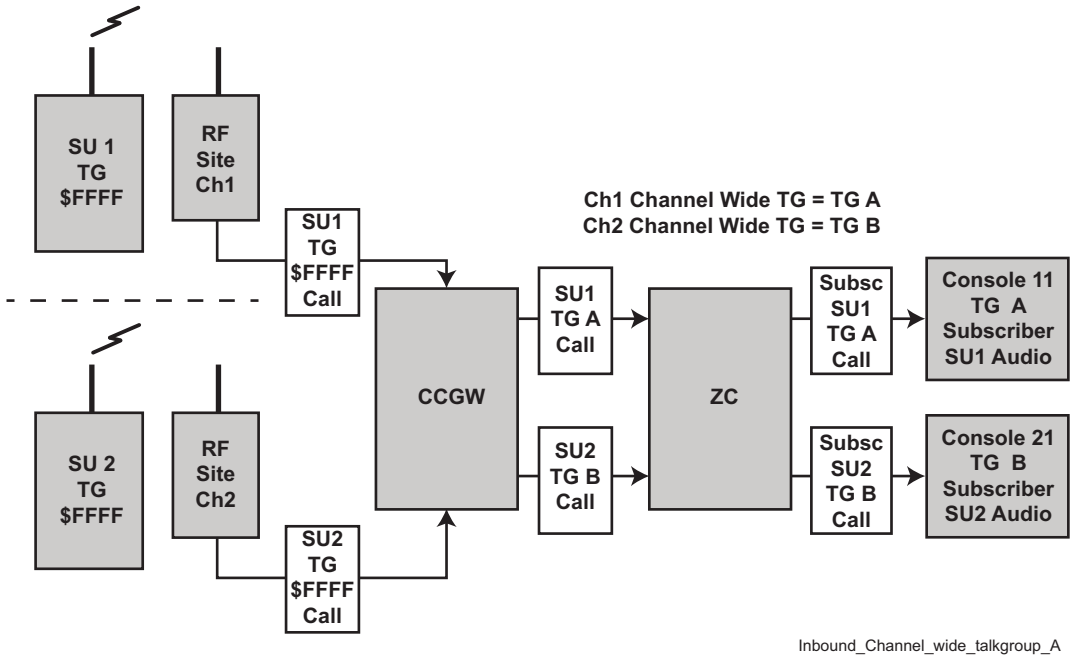
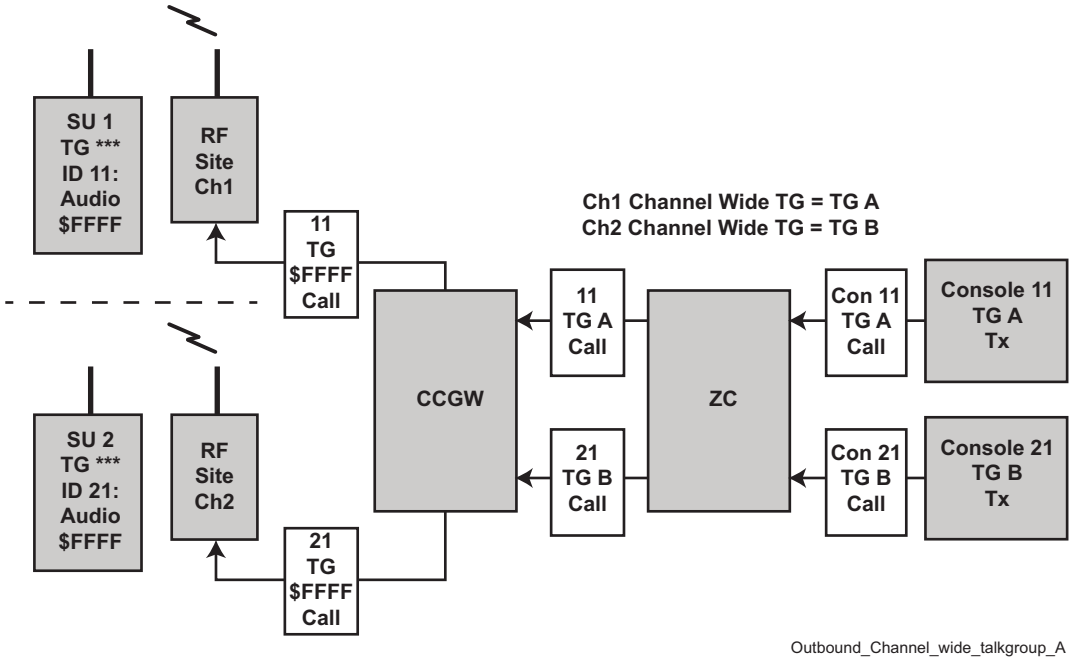


Figure 3: Outbound Channel Wide Talkgroup



The subscriber in selective squelch unmutes to its selected talkgroup or the Everyone Talkgroup. If the subscriber has been programmed with a system-wide talkgroup hang time, it can respond within the hang time to an Everyone Talkgroup call using the Everyone Talkgroup.

CAUTION: Using channel marker on a channel-wide talkgroup at the console can interact with the system-wide talkgroup hang time in the subscriber. The channel marker has a repeat interval defined the infrastructure. This interval and the hang time can be programmed to overlap which would cause the subscriber to be able to transmit only on the Everyone Talkgroup.

3.4.14.2.3
Conventional Talkgroup Channel Transmit Status Indicators

On a Conventional Talkgroup channel, only one outbound transmission can take place at a time. Elite Dispatch transmit status indicators displayed for Conventional Talkgroup channels with multiple talkgroups inform dispatchers about the availability of the channel. Similarly, radio users can see indications that the Conventional Talkgroup channel is in use.

For more information about the types of Conventional Talkgroup channel transmit status indications that appear in the Elite Dispatch interface, see the *MCC 7500/7100 Elite Dispatch User Guide* manual.

3.4.14.2.4
Conventional Talkgroup Configuration

To configure the Conventional Talkgroup feature, use Provisioning Manager. For more information, see the *Provisioning Manager* manual. Also the system must meet the hardware and software requirements. For more information, see the *Conventional Operations* manual.

It is important to monitor the activity on a Conventional Talkgroup channel shared by multiple conventional talkgroups. If too much traffic occurs, the communication becomes inefficient because radio users must often repeat what they transmit. By monitoring the traffic and looking at historical reports, you are able to notice the issue and plan a new, more efficient configuration. For more information on Push-to-Talk (PTT) rates, see the *Conventional Operations* manual.

3.4.14.2.5

Conventional Talkgroups Operation and Priorities

See the following descriptions and examples to better understand the Conventional Talkgroups feature and the rules and restrictions that apply to this feature. Ensure that you understand the priority rules used for the Conventional Talkgroups transmissions. The priority rules determine who can transmit at a specific moment or who is first in the queue for transmission.

Transmission Priorities on the Same Conventional Talkgroup

If two different console operators want to transmit on the same Conventional Talkgroup at the same time, one console can take priority over the other console. The priority rules that apply to transmitting on the same Conventional Talkgroup are similar to the rules that apply to sharing a single conventional channel. The priority is given based on the operator role and transmission type. A dispatch console has priority over a subscriber.

Table 6: Priority Levels for Various Operator Roles and Transmission Types

Priority Level	Primary Supervisor	Secondary Supervisor	Operator (Non-Supervisor)
1	Instant Transmit, APB		
2		Instant Transmit, APB	
3			Instant Transmit, APB
4	General Transmit	General Transmit	General Transmit
5	Patch Transmit	Patch Transmit	Patch Transmit

Example: The operator of Console A monitors the WORKS Conventional Talkgroup. The operator of Console A wants to urgently transmit on WORKS talkgroup but an activity is on the Conventional Talkgroup channel because the operator of Console B is transmitting on WORKS. The operator of Console A decides to override the transmitting Console B. As Console A has higher priority, the subscriber radios monitoring the WORKS talkgroup start hearing Console A.

Example: The operator of Console A monitors the WORKS Conventional Talkgroup. The operator of Console A wants to urgently transmit on WORKS talkgroup but an activity is on the Conventional Talkgroup channel because the operator of Console B is transmitting on WORKS. The operator of Console A decides to override the transmitting Console B. As Console B has higher priority, the subscriber radios monitoring the WORKS talkgroup continue hearing Console B.

Transmission Priorities on Different Conventional Talkgroups on Same Conventional Talkgroup Channel

If two different console operators want to transmit on two different talkgroups on the same Conventional Talkgroup channel, the calls are queued. The sequence in which the queued transmissions exit the queue depends on the talkgroup priority. Operator role priorities do not apply here. If a talkgroup is tactical, it is the highest priority in the queue.

Example:
The following Conventional Talkgroups are listed from the highest to the lowest talkgroup priority: POLICE, FIRE, WORKS, and TRANS. The Conventional Talkgroups are on the same Conventional Talkgroup channel. The operator of Console A transmits on the POLICE talkgroup. The operator of Console B tries to transmit on the FIRE talkgroup even though they

see an activity on the Conventional Talkgroup channel and can see their transmit is pending. The operator of Console C tries to transmit on the WORKS talkgroup even though they see an activity on the Conventional Talkgroup channel and can see their transmit is pending. The operator of Console D tries to transmit on the TRANS talkgroup even though they see an activity on the Conventional Talkgroup channel and can see their transmit is pending.

The operator of Console A stops transmitting on the POLICE talkgroup. The operator of Console B receives an indication they can transmit on the FIRE talkgroup. The operator of Console B stops transmitting on the FIRE talkgroup, and the operator of Console C receives an indication they can transmit on the WORKS talkgroup. The operator of Console C stops transmitting on the WORKS talkgroup, and the operator of Console D receives an indication they can transmit on the TRANS talkgroup.

Patch Groups and MultiSelect Groups

If a console operator wants to transmit to multiple talkgroups on different Conventional Talkgroup channels, they can put them into a MultiSelect group. If a console operator wants multiple talkgroups on different Conventional Talkgroup channels to hear one another, they can put them into a patchgroup.

Example: The operator of Console A monitors FIRE, POLICE, and TRANS Conventional Talkgroups. The Conventional Talkgroups are on different Conventional Talkgroup channels. The operator must pass important information to the all radio users monitoring these three talkgroups. The operator puts all the three talkgroups into a MultiSelect (MSEL) group, verifies the MSEL transmit does not interfere with other activity on the Conventional Talkgroup channel, and transmits on MSEL. Subscribers that use FIRE, POLICE, and TRANS talkgroups can hear the information.

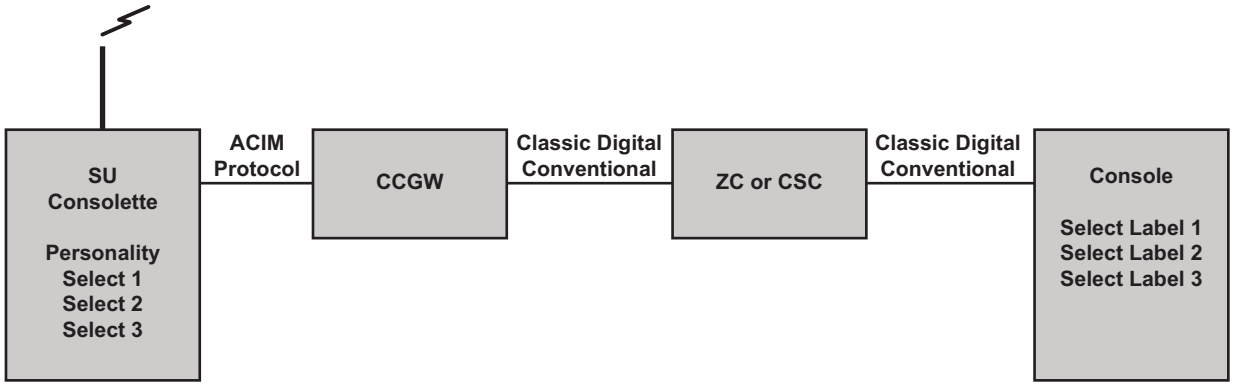
Example: The operator of Console A monitors FIRE, POLICE, and TRANS Conventional Talkgroups. The Conventional Talkgroups are on different Conventional Talkgroup channels. The operator wants all radio users monitoring these three talkgroups to hear one another. The operator patches all the three talkgroups, verifies the patch transmit does not interfere with other activity on the Conventional Talkgroup channel, and transmits on the patch to inform the radio users about the patch. All the radio users in the patch can hear one another. The dispatcher can hear all the radio users.

3.4.14.3

ACIM Consolettes for Conventional Talkgroups

The advantage of using an ASTRO® 25 Control Interface Module (ACIM) is that a different system does not allow wireline access to it, but allows for subscriber access. An ACIM is used to allow the console operator to monitor and transmit on the other system by using a consolette connected to the consoles system. A consolette used in this manner can also be referred to as a control station.

Figure 4: ACIM Consolette Configuration



ACIM_Consolette_Configuration_A

The console uses a Digital Conventional Channel (not a Conventional Talkgroup channel) to select labels which select a personality in the consolette (which is basically a subscriber personality). The personality uses selective squelch to provide talkgroup separation. This separation allows the console access another system Conventional Talkgroups through an ACIM consolette that it would otherwise not be able to access. However, no cross busy indications are given to the console operator.

3.4.14.4
Group-Enabled Conventional Talkgroups

A group-enabled Conventional Talkgroup in Network Manager (NM) enables the consoles and subscribers to transmit on the call. A Conventional Talkgroup that is not group enabled does not allow the consoles to transmit, but allows the subscribers to transmit. No control channel exists to notify the subscriber that they are not allowed to transmit. The operation is that the console is able to hear the subscriber, but is blocked from transmitting.

3.4.14.5
Cross Busy and 4K Association Limit per Console for Conventional Talkgroups

A console associates a Conventional Talkgroup to receive cross busy information. A Conventional Talkgroup has cross busy indications showing activity by other talkgroups on the same Conventional Talkgroup channel, or an RF cross busy Conventional Talkgroup channel. When a cross busy due to a console with another talkgroup on the same channel occurs, an attempted console transmit results in busy/queuing by the call controller. When there is a cross busy due to a console with another talkgroup RF cross busy Conventional Talkgroup channel, an attempted console transmit results in the lower priority console backing off. When there is a cross busy due to subscriber or cross busy due to subscriber emergency, a console transmit results in taking over the outbound audio path from the subscriber.

Associations are limited to 4000 per console. If the associations exceed the limit, the console operator is notified. It is not possible to exceed the limit when no RF cross busy Conventional Talkgroup channels exist. If more than 48 RF cross busy Conventional Talkgroup channel pairs are entered into Network Manager, conditions start to exist where a console could exceed 4000 associations.

3.4.14.6
Encrypted Link Control for Conventional Talkgroups

The Project 25 Standard defines the capability to encrypt the Link Control (LC) in Project 25 voice. Motorola Solutions equipment does not implement this capability. For conventional operation, if another vendor subscriber encrypts the LC, the Fixed Network Equipment (FNE) is unable to

determine the unit ID of the subscriber. The console is unable to show the unit ID of the subscriber. For Conventional Talkgroup operation, late entry receive is not possible because the Conventional Channel Gateway (CCGW) is not able to determine the talkgroup ID.

The MCC 7500 Dispatch Console receives Common Key Reference (CKR) bindings from the Network Manager. The MCC 7500 Dispatch Console supports the binding of CKRs to Conventional Talkgroup resources. The dispatch console operator cannot select a different CKR.

3.4.14.7
Conventional Talkgroup Patching

Conventional Talkgroups are not regroupable. A Conventional Talkgroup cannot be part of a super-group. A system-wide Common Key Reference (CKR) common encryption/decryption algorithm and key for patches is not used with a Conventional Talkgroup.

To allow communication in a patch, each Conventional Talkgroup is encrypted according to its own parameters, defined at the Network Manager. Conventional Talkgroups can be patched with a super-group, formed of regroupable trunked talkgroups, whose secure parameters are defined at the system level.

Because the console blocks a channel-wide talkgroup from being placed into a patch, use an Interop talkgroup to include all subscribers on the conventional talkgroup channel in a patch. An Interop talkgroup is conventional talkgroup that is not a channel-wide talkgroup on the conventional talkgroup channel. All subscribers using the conventional talkgroup channel are also programmed with the Interop talkgroup. The console operator places the Interop talkgroup into the patch and transmits using the channel-wide talkgroup to inform all subscribers on the channel to select the Interop talkgroup for the channel. When the Interop talkgroup is removed from the patch, the console operation informs the subscribers to select their non-Interop talkgroups.

3.4.14.8
Home Location Register for Conventional Talkgroups

The Home Zone Map object is used in Provisioning Manager to configure the home zone for each Conventional Talkgroup.

Configuration information is distributed throughout the system based on the home zone assignment of the IDs. A zone stores configuration information only for the individual and group IDs that are home to that zone. This information is stored in the Home Location Register (HLR) for that zone.

The Conventional Talkgroup HLR must be in the zone where the Conventional Talkgroup channel is for that Conventional Talkgroup.

See the *Provisioning Manager* manual.

3.4.14.9
Conventional Talkgroup Repeat Enable/Disable

Repeat Enable

Upon receiving a console operator request for a Conventional Talkgroup repeat enable of a particular talkgroup audio, the dispatch console sends a Talkgroup Repeat Enable Request command to the Zone Controller (ZC) to enable the conventional repeat audio path.

The dispatch console verifies that the talkgroup is affiliated with the ZC before sending the Repeat Enable command to the ZC. The console does not send Repeat Enable commands to the ZC when it knows that the talkgroup is not affiliated with the ZC.

Upon receiving the Talkgroup Repeat Enable Grant command from the ZC, the dispatch console indicates to the operator that the talkgroup has been repeat enabled.

Repeat Disable

Upon receiving a console operator request for a Conventional Talkgroup repeat disable of a particular talkgroup audio, the dispatch console sends a Talkgroup Repeat Disable Request command to the Zone Controller (ZC) to disable the conventional repeat audio path.

The console verifies that the talkgroup is affiliated with the ZC before sending the Repeat Disable command to the ZC. The dispatch console does not send Repeat Disable commands to the ZC when it knows that the talkgroup is not affiliated with the ZC.

Upon receiving the Talkgroup Repeat Disable Grant command from the ZC, the dispatch console indicates to the operator that the talkgroup has been repeat disabled.

When the console loses connection to the controller, the console defaults to repeat enable for the talkgroup. If the console initiated the repeat disable, the talkgroup is repeated on the conventional talkgroup channel. This reaction is different than repeat disable for the classic conventional channel where if the console loses connection to the controller, it maintains repeat disable and the channel continues to have repeat disabled.

Force In-Cabinet Repeat

In the standalone configuration, forced in-cabinet repeat does not functionally override conventional talkgroup repeat disabled. Repeat-disabled conventional talkgroups are not repeated.

In the voting configuration, the talkgroup is repeated. Forced in-cabinet repeat functionally overrides talkgroup repeat disabled without changing the conventional talkgroup repeat state.

Fallback

In the standalone configuration, fallback is disabled.

In the voting configuration, the talkgroup is repeated when fallback is enabled during link failure. Functionally overrides talkgroup repeat disabled without changing the conventional talkgroup repeat state. Do not use the fallback timer.

Repeater Knockdown

In both the standalone and voting configurations, repeat is disabled. Functionally overrides talkgroup repeat enabled without changing the conventional talkgroup repeat state.

Repeater Setup

In both the standalone and voting configurations, repeater setup enables repeat but its functionally does not override conventional talkgroup repeat disable. Repeat disabled conventional talkgroups are not repeated

Subscriber RF Contention

While in repeat disabled, if the receiver using the Conventional Talkgroup picks up an on-going transmission, the audio may be heard. In addition, while in repeat disabled, if a subscriber is talking on a Conventional Talkgroup, and another subscriber starts talking while the first subscriber is still talking, and either subscriber finishes the call, all other users of the Conventional Talkgroup hear a piece of audio.

Single RF Controlled Repeater

Even though Repeat Enable/Disable is supported for Conventional Talkgroups, it is not supported (does not function) in Single RF Controlled Repeater Topology.

3.4.14.10

Talkgroup Changes Between Trunked and Conventional, and a Conventional Talkgroup Channel

A talkgroup is either trunked or conventional; it cannot be both. Changing a talkgroup ID from trunked to conventional or from conventional to trunked is not a typical change in the system. A change of a conventional talkgroup channel for a conventional talkgroup is also not a typical change in the system, but could need to occur due to performance loading on a conventional talkgroup channel. In these cases, subscribers also must be programmed. Procedures must be performed in the infrastructure because a deletion of a conventional talkgroup can take longer than an addition of a conventional talkgroup, and the consoles do not automatically pick up some network management changes without a restart of the console dispatch application.

3.4.14.10.1

Converting a Conventional Talkgroup to a Trunked Talkgroup for the Same Talkgroup ID

Perform this procedure to convert a Conventional Talkgroup to a Trunked Talkgroup for the same talkgroup ID.

Prerequisites: Ensure console, Conventional Channel Gateway (CCGW), and Zone Controller (ZC) links are up during these infrastructure changes, and that each network management distribution was successful.

Procedure:

1. Delete the Conventional Talkgroup in network management.
2. Distribute the changes. See the *Provisioning Manager* manual.
3. If the Convention Talkgroup was in a different zone than the Trunked Talkgroup should be, change the home zone map in network management so the talkgroup is in the correct zone.
4. Distribute the changes. See the *Provisioning Manager* manual for Home Zone Map distribution warnings.
5. Add the Trunked Talkgroup in network management.
6. Distribute the changes. See the *Provisioning Manager* manual.
7. Restart console dispatch application.
8. Verify a Conventional Talkgroup call does not get received by the console. This step must be successful before moving to the next step.
9. Verify a Trunked Talkgroup call does get received by the console.

3.4.14.10.2

Converting a Trunked Talkgroup to a Conventional Talkgroup for the Same Talkgroup ID

Perform this procedure to convert a Trunked Talkgroup to a Conventional Talkgroup for the same talkgroup ID.

Prerequisites: Ensure console, Conventional Channel Gateway (CCGW), and Zone Controller (ZC) links are up during these infrastructure changes, and that each network management distribution was successful.

Procedure:

1. Delete the Trunked Talkgroup in network management.
2. Distribute the changes. See the *Provisioning Manager* manual.

3 If the Convention Talkgroup was in a different zone than the Trunked Talkgroup was, change the home zone map in network management so the talkgroup is in the zone where the Conventional Talkgroup channel is.

4 Distribute the changes. See the *Provisioning Manager* manual for Home Zone Map distribution warnings.

5 Add the Convention Talkgroup in network management.

6 Distribute the changes. See the *Provisioning Manager* manual.

7 Restart console dispatch application.

8 Verify that the console receives a Conventional Talkgroup call.

3.4.14.10.3
Changing a Conventional Talkgroup Channel for the Same Conventional Talkgroup ID

Perform this procedure to change a Conventional Talkgroup channel for the same Conventional Talkgroup ID.

Prerequisites: Ensure console, Conventional Channel Gateway (CCGW), and Zone Controller (ZC) links are up during these infrastructure changes, and that each network management distribution was successful.

Procedure:

1 If the Conventional Talkgroup channel changes to a different zone for the talkgroup, change the home zone map in network management to the new zone for the talkgroup.

2 Distribute the changes. See the *Provisioning Manager* manual for Home Zone Map distribution warnings.

3 Assign the Conventional Talkgroup to the new Conventional Talkgroup channel in network management.

4 Distribute the changes. See the *Provisioning Manager* manual.

5 Restart console dispatch application.

6 Verify a Conventional Talkgroup call does not get received by the console from the previous channel. This step must be successful before moving to the next step.

7 Verify that the console receives a Conventional Talkgroup call from the new channel.

3.4.14.11
Conventional Talkgroups Via ISSI 8000/CSSI 8000

InterSubsystem Interface (ISSI) 8000/Console Subsystem Interface (CSSI) 8000 provides the ability for console and radio devices in foreign systems to interface with a conventional talkgroup home to an ASTRO® 25 system using the P25 ISSI standards. The foreign consoles and radio devices can be located in another ASTRO® 25 system, a third-party P25 system, or other third-party system that is compliant with the P25 ISSI standard. If the P25 system is a third-party console subsystem, the interface is CSSI 8000. The home conventional talkgroup can be associated with a conventional talkgroup channel local to the ASTRO® 25 system, or an external conventional talkgroup channel interfacing to the ASTRO® 25 system through ISSI 8000.

Conventional talkgroup operations over ISSI/CSSI are limited to operations supported by the P25 ISSI standard. Limitations to conventional talkgroup over ISSI support include:

- Only radio users at the conventional talkgroup channel hear consoles using the configured channel-wide talkgroup. Foreign radios can hear these transmissions if they are affiliated to the channel-wide talkgroup.

- Cross busy indications are displayed only on consoles in the home ASTRO® 25 system.
- If a local conventional talkgroup channel is out of service, foreign console and radio devices are not permitted to initiate calls.
- During radio Takeunder, if the secure mode of a foreign radio does not match the current source on the same talkgroup, the foreign radio call is denied. The radio must change secure modes and retry.
- Radios at local conventional talkgroup channels cannot display Push-to-Talk (PTT) ID information for a transmission initiated by a radio that is home to the foreign system.

Foreign (External) Conventional Talkgroup Operation – Licensed Feature

Conventional Talkgroup operation over ISSI/CSSI is available with the purchase of the Conventional Talkgroup Operation over ISSI/CSSI license. The license is required if external console or radio operation on conventional talkgroups is desired, or if external conventional talkgroup channel operation is desired.

To activate the feature after the appropriate license is acquired, the appropriate configuration parameter (flag) associated with this feature must be enabled in the Unified Configuration Server (UCS). If the flag is not enabled, the Zone Controller prevents any call with a Conventional Talkgroup via ISSI/CSSI.

To enable the Conventional Talkgroup operation over ISSI/CSSI license, see the *Provisioning Manager* manual.

NOTICE: Foreign radios can hear these transmissions if they are affiliated to the channel-wide talkgroup.

NOTICE: If a dispatcher on a third-party console sets up a patch including a conventional talkgroup, patch audio granted/sourced to the conventional talkgroup causes cross busy indications on Motorola Solutions dispatch consoles in the home system that indicate a console sourced patch call (even if the patch audio source is a radio source).

3.4.15 Conventional Patch

The Conventional Patch feature allows users of different system resources (Trunked Talkgroup, Conventional Talkgroup, Trunked Private Call, and Analog/ASTRO® 25/MDC1200 Conventional Channel/ASTRO® 25 Control Interface Module (ACIM) Conventional Channel) to communicate with each other. A patchgroup is a group of resources “patched” together to allow communication between all users of the resources. For a channel to become a part of a patchgroup at a dispatch console, it must be in-service and affiliated to the dispatch console.

The controlling dispatch console is responsible for a patch reservation/un-reservation, determination of the audio source of the patchgroup, and set-up/tear-down of the audio patch calls on the patched resources. The zone controller is responsible for patch reservation arbitration, determination of the audio source for an individual resource, and patch call request arbitration.

When patch audio is transmitted on an MDC 1200 channel and the channel has been configured for Outbound Push-to-Talk (PTT)-ID, the patching console transmits the Unit ID of the console and not the Unit ID of the initiating radio. Unit ID is only transmitted if the channel is in the same Channel Group as the initiating radio.

Patch Reservation

When directed to add a conventional channel to a patchgroup by the dispatch console user, the dispatch console sends a request to patch reserve the channel to the zone controller. After successfully processing the request, the zone controller grants the patch reservation. The dispatch console then marks the channel “patch reserved” and the convention channel becomes a part of the patchgroup. A conventional channel can be a part of only one patchgroup at a time.

Interzone Audio Patch Reserve

A console operator at a console site in the serving zone initiates a patch reserve request for an affiliated conventional channel that is home to a different zone. If the patch reserve request can be granted in the home zone of the conventional channel, a Conventional Patch Reserve Grant is sent to any intrazone-affiliated consoles and any interzone-affiliated consoles, including the console that requested to patch reserve the conventional channel. If the requesting console cannot reserve the conventional channel due to another console having reserved the conventional channel, the Conventional Patch Reserve Grant identifies the controlling console for the patch.

Interzone Affiliation to an Existing Patch Reserved Conventional Channel

A console at a console site in the serving zone affiliates to a patch reserved conventional channel that is home to a different zone. Upon the affiliation being acknowledged, the affiliated console in the serving zone is notified that the conventional channel is patched reserved through a Conventional Patch Reserve Grant message.

Patch Call Setup

A patch call is initiated when call activity occurs on a resource that is a part of a patchgroup. The dispatch console sends a request to set up the call on the conventional channel. After successfully processing the request, the zone controller grants the call setup.

Patch Transmit

When the dispatch operator initiates a Patch Transmit to communicate to the patchgroup. The dispatch console then sends requests to set up a call on each of the resources that are a part of the patchgroup.

Patch Audio

When an audio source is present on a patch resource in the patchgroup, the controlling dispatch console routes audio to the conventional members in the patchgroup according to its rules for audio source priority. For a detailed breakdown of the audio source priorities, see the Patch section of ASTRO® 25 System *MCC 7500/7100 Elite Dispatch User Guide*.

Patch Unreservation

When directed to remove a conventional channel from a patchgroup, the dispatch console sends a request to patch unreserve the channel to the zone controller. The Zone controller grants the patch unreservation and the dispatch then marks the channel “patch unreserved”; the conventional channel no longer receives audio destined for resources in the patchgroup.

Interzone Patch Unreservation

A console operator at a console site in the serving zone initiates a patch unreserve request for an affiliated conventional channel that is home to a different zone by issuing a patch unreserved request to the serving zone controller. When the home zone patch unreserves the conventional channel, a Conventional Patch Unreserve Grant is sent to any intrazone affiliated consoles and any interzone affiliated consoles, including the console that requested to patch unreserve the conventional channel.

If the conventional channel is in another zone, a console can also issue a patch unreserve request before deaffiliating from a conventional channel which results in an interzone patch unreserve.

Interzone Link Failure and Recovery

A patching console in a serving zone that has patch reserved a conventional channel home to a different zone. If an interzone link failure occurs between the home zone of the patched conventional channel and the serving zone of the patching console, the conventional channel is patch unreserved in

the serving zone and the home zone and each notify their local affiliated consoles that the conventional channel is patch unreserved.

If an interzone link fails between the home zone of the patched conventional channel and the serving zone of affiliated consoles that did not patch reserve the channel, the conventional channel is patch unreserved in the serving zone and the local affiliated consoles are informed that the channel is patch unreserved.

When an interzone link recovers, the home zone updates the serving zone with the status of any conventional channels with patch reservations in the home zone. A Conventional Patch Reserve Grant is sent to any affiliated consoles in the serving zone with the recovered interzone link. Because multiple conventional channels may in the home zone with patch reservations, the serving zone controls the rate at which the Conventional Patch Reserve Grant messages are sent to the affiliated consoles.

Additionally, the original patching console in the serving zone re-initiates a patch reservation for the conventional channel in the home zone. If another console has reserved the conventional channel while the interzone link was down, the Change of State (CoS) field in the patch reserve grant is cleared and the console Universal Resource IDentifier (URID) indicates the URID of the controlling console. See the Interzone Audio Patch Reserve subsection for detail on initiating an interzone audio patch reservation.

Patch and Secure Audio

The dispatch console assigns both secure and clear conventional resources to the same patchgroup. When a mix of secure and clear channels occurs in a patchgroup, the dispatch console user is notified of the conflict in secure mode of the patchgroup resources. In this case, secure resources always receive secure audio and clear resources always receive clear audio. If during the patch, no capability to either encrypt or decrypt the audio exists, the patching console ends the call. A lack of secure resources causes the lack of secure capabilities.

Patch and ASTRO® 3.1 Coexistence

When an A7.X system coexists with an ASTRO® 3.1 system, the Parallel Audio feature could allow channels of each portion of the system to participate in patch groups. If each portion of the system setup patch groups, different entities (zone controller in ASTRO® 25 7.x and the Console BIM in ASTRO® 3.1) handle the arbitration of the patch reservations and call setup requests. If a patch is created on an ASTRO® 3.1 dispatch console and the audio is patched through to an MCC 7500 Dispatch Console, the audio might be heard on other conventional resources than the consoles expect. In some cases, echoing of audio can occur. When using the Patch feature in a coexistence environment, the system must be carefully configured (ATAC port priorities and channel patch capabilities) to minimize the undesirable effects of audio echo and audio takeovers.

Patch and MDC1200

If the console is enabled for Outbound PTT-ID and the subscriber radio can display the received ID, when an MDC1200 channel is involved in a patch scenario, subscriber radios receiving the patched audio see the unit ID of the patching console. This patch is different than in other patch scenarios on digital channels where the ID of the initiating user (radio or console) is transmitted to the receiving radios on digital-capable channels. If the system is configured to send the outbound ID, MDC1200 users always see the ID of the patching console. Otherwise, MDC1200 users do not see the ID of the patching console.

3.4.15.1

Radio-Initiated Interzone Audio Patch Call

This section describes a radio-initiated audio call on a conventional channel where the conventional channel is a member of a patchgroup. Other variations of this interzone scenario are dependent on the zone locations of the patched channels and the consoles affiliated to those conventional channels.

A console at a console site within its serving zone is the patching console for a patchgroup. A radio at an RF site which is home to a different zone initiates a voice call on a conventional channel (CCH 1) in the patchgroup along with another conventional channel (CCH 2). Both conventional channels are home to the same home zone.

After the patching console receives the conventional Beginning of Mobile Transmit (BOMT) for the audio call on CCH 2, the patching console joins the multicast group and initiates a conventional audio patch Push-to-Talk (PTT) request for CCH 1. When the home zone grants the request, a PTT grant is sent to any intrazone affiliated consoles and any interzone affiliated consoles, including the patching console that initiated the audio patch PTT request.

When the audio call is no longer required, the radio user ends the audio call by performing a de-key operation. The patching console and all participating consoles are notified of the call termination on CCH 2 via a conventional End of Mobile Transmission (EOMT).

When the patching console receives the conventional EOMT for CCH 2, the patching console ends the audio call on CCH 1 by sending a Conventional End of Transmission (EOT) Request. A Conventional EOT Acknowledgment is then sent to any intrazone affiliated consoles and any interzone affiliated consoles. Additionally, when the hang time expires, affiliated consoles in the home zone and any other serving zone with affiliated consoles are notified of the End of Call Grant.

3.4.15.2
Console-Initiated Interzone Audio Patch Call

This section contains the description for a patch console interzone audio patch call initiated by a non-patch console keying on a conventional channel which is part of the patchgroup. Other variations of this interzone scenario are dependent on the zone locations of the patched channels and the consoles affiliated to those conventional channels.

A console at a console site within the serving zone is the patching console for a patchgroup. A console operator at a different console site but in the same serving zone initiates an audio call on an affiliated conventional channel (CCH 2) home to a different zone. The conventional channel (CCH 2) is a member of the patchgroup along with another conventional channel (CCH 1) which is also home to the same home zone. The home zone is responsible for setting up the call that allows the console transmitted audio to be delivered to radios and local consoles monitoring CCH 2, as well as any other affiliated consoles in other zones.

After the patching console receives the call grant for the audio call on CCH2, the patching console initiates a conventional audio patch Push-to-Talk (PTT) request for CCH 1. When the home zone grants the request, a PTT grant is sent to any intrazone affiliated consoles and any interzone affiliated console, including the patching console that initiated the audio patch PTT request.

When the audio call is no longer required, the non-patch console operator ends the audio call by performing a de-key operation. The patching console and all participating consoles are notified of the call termination on CCH 2 through a Conventional End of Transmission (EOT) Acknowledgement.

When the patching console receives the EOT Acknowledgement for CCH 2, the patching console ends the audio call on CCH 1 by sending a Conventional EOT Request. A Conventional EOT Acknowledgment is then sent to any intrazone affiliated consoles and any interzone affiliated console. Additionally, when the hang time expires, affiliated consoles in the home zone and any other serving zone with affiliated consoles are notified of the End of Call Grant.

3.4.16
Cross Busy/Cross Mute

The Cross Busy/Cross Mute feature allows dispatch consoles to control transmission and reception of audio for conventional resources that have interfering frequency settings. These conventional resources are configured to have the same frequencies, transmit, or receive, while sharing an overlapping coverage area. Cross Busy/Cross Mute provides the following benefits:

- Provides a way to specify which transmitter frequency pairs should be busied or muted when another transmitter frequency pair is keyed
- Minimizes the chances of receiving unintelligible audio due to:
  - Multiple transmissions on the same frequency
  - Overlapping conventional channels with shared Tx/Rx frequencies
  - Other poor RF planning scenarios
- Prioritizes console transmissions and audio receiving in situations where these RF Cross Busy and RF Cross Mute conditions are present.

NOTICE: The **RF Cross Mute Hang Time** parameter is a timer to delay the un-muting of a muted channel when that channel RF Cross Mute condition has ended. If necessary, use the **RF Cross Mute Hang Time** parameter in Provisioning Manager and Configuration Manager - Conventional to extend the mute time after the call control indicates the RF Cross Mute condition has ended. Dispatch positions configured to use this timer continue to mute the received audio on the cross muted channel for the duration of the timer after the call control indicates it no longer has an RF Cross Mute condition. When the timer expires, the audio associated with calls in progress appear in the appropriate destinations.

Cross Busy

Cross Busy prevents two stations with the same transmit frequencies in overlapping coverage areas from transmitting at the same time. Cross Busy condition exists when two repeaters or conventional channel stations with the same transmit frequency are physically too close to each other, and one of them has a transmission in progress. If both stations transmit at the same time, their transmissions interfere and the subscribers receive unintelligible audio. To support signaling messages reliably on a first try or on a retry in a busy system, carefully consider which channels to configure in a Cross Busy pair relation.

Cross Mute

Cross Mute provides the capability for the system to determine which receive frequencies to mute at an operator position when a transmit frequency on another conventional channel is the same as the receive frequency of the conventional channel being listened to, and the coverage area of the two conventional channels overlap.

Previously, only the audio in the console speaker, not the headset, was muted for Cross Mute. The Dispatch Application parameter “Acoustic Cross Mute and RF Cross Mute Scope” defines the Cross Mute (and Acoustic Cross Mute) muting. The console can be configured to mute either the speaker or the speaker and headset when Cross Mute is used to mute the audio. Muting of the headset (and speaker) for Cross Mute might be desired to prevent the dispatcher from hearing two versions of the same audio, one in the headset and one from an adjacent transmitting dispatcher, which would have enough delay between them to be annoying.

The RF Cross Mute feature on MCC 7500 and MCC 7100 consoles includes a user-configurable hang time timer to delay the unmuting of a muted channel when that channel RF Cross Mute condition ends. Dispatch positions configured to use this timer continue to mute the received audio on the cross muted channel for the duration of the timer after the call control indicates that it no longer has an RF Cross Mute condition. When the timer expires, the audio associated with calls in progress appear in the appropriate destinations.

This timer is useful because, due to the nature of the IP packet switched network, a residual amount of the previously muted audio may be present even though call control indicates the RF Cross Mute condition has ceased. This hang time timer can be used to ensure that the residual audio remains muted.

This feature is configurable on a per-dispatch position basis from the Network Manager. The operator can enable and disable the timer. If the timer is enabled, the operator can configure the time period

from 100 milliseconds to 5 seconds in 100-millisecond increments. The default is to not enable the timer.

3.4.16.1

Interzone Cross Busy

The interzone conventional voice feature extends the RF Cross Busy functionality to operate across interzone boundaries. The RF Cross Busy mappings include conventional channels from different zones and consoles to use the mapping to determine cross busy operation across interzone boundaries.

Console PTT Request On Conventional Channel in a Cross Busy Pair

A console at a console site in zone 1 affiliates to a conventional channel which is home to zone 1. The conventional channel is in RF Cross Busy with a conventional channel that is home to zone 2 in which an affiliation does not exist. The zone 1 console associates to the zone 2 conventional channel. The console operator initiates a voice call on the affiliated conventional channel. The console through its association to the zone 2 conventional channel determines that the conventional channel is busy. The Push-to-Talk (PTT) grant for the console call request is forwarded to all affiliated/associated consoles across zones in which an affiliation exists. The requesting console in zone 1 begins to transmit audio only if its transmit priority is higher than the console transmitting on the conventional channel in Cross Busy conflicts with the requested conventional channel. Otherwise, the console sends a conventional End of Transmission (EOT) to end the call.

Console Transmitting On Conventional Channel In a Cross Busy Pair

A console at a console site in zone 1 is transmitting audio on an affiliated conventional channel that is home to zone 2 and is configured in a Cross Busy pair with another conventional channel in zone 2. A PTT grant is received for a parallel console requesting to transmit on the other conventional channel in the Cross Busy pair. The console currently transmitting continues to transmit audio on the conventional channel only if the transmit priority is higher (or equal) than the console requesting to transmit on the conventional channel in Cross Busy conflict. Otherwise, the console sends a Conventional EOT request.

Variations of interzone scenarios are determined by the zone locations of cross busy conventional channels, as well as the consoles affiliated to those conventional channels.

3.4.16.2

Interzone RF Cross Mute

The interzone conventional voice RF Cross Mute feature extends prior releases functionality to operate across interzone boundaries. The following scenario describes the interzone RF Cross Mute functionality.

A console at a console site in zone 1 affiliates to a conventional channel in zone 1. The console determines through its RF Cross Mute mapping that the conventional channel in zone 1 is in an RF Cross Mute with a conventional channel residing in zone 2. The console in zone 1 performs an association to the conventional channel located in zone 2. When a subsequent grant is received, the console uses existing RF cross mute functionality to determine whether to allow the received audio to be played on the speaker or to mute the audio.

Afterwards, the console deaffiliates to the conventional channel in zone 1. Because the conventional channel in zone 1 is cross muted to a conventional channel in residing in zone 2, the console performs a de-association with the conventional channel in zone 2 using existing functionality.

NOTICE: The RF Cross Mute Hang Time parameter is a timer to delay the un-muting of a muted channel when that channel RF Cross Mute condition has ended. If necessary, use the RF Cross Mute Hang Time parameter in Provisioning Manager and Configuration Manager - Conventional to extend the mute time after the call control indicates the RF Cross Mute condition has ended. Dispatch positions configured to use this timer continue to mute the received audio on the cross muted channel for the duration of the timer after the call control indicates it no longer has an RF Cross Mute condition. When the timer expires, the audio associated with calls in progress appear in the appropriate destinations.

3.4.17
Echo Cancellation

Echo Cancellation provides delay echo cancellation for up to 2 seconds (in 10 millisecond increments) on an outbound operator transmission from a dispatch console that uses an ASTRO® 25 conventional simplex voting channel resource. This feature enables better communication and eliminates feedback at the console speaker when the operator is transmitting on the simplex (voting) channel.

Dispatchers routinely communicate with field personnel via digital conventional radio channels connected to their dispatch consoles. When a dispatcher transmits, the receiver on the same frequency as the transmitter picks up the dispatcher transmitted audio and sends it back through the ASTRO-TAC™ 3000 comparator to the dispatch consoles, which may cause echo. Echo Cancellation eliminates this problem by muting the returned audio stream for a specific time interval. This time interval can be adjusted to account for the delays in the radio system and thus ensure the return audio is not heard at the transmitting dispatch console.

Echo Cancellation on a dispatch console is implemented on the ASTRO-TAC™ 3000 comparator and is enabled on a per-channel basis for simplex voting channels only. In this configuration, the ASTRO-TAC™ 3000 comparator that transmits an outbound voice transmission associated with an operator key-up operation blocks the return voted audio echo from being forwarded to the console.

Echo Cancellation on a dispatch console affects the routing of the following signal types:

- ASTRO® 25 Voice signaling (clear and encrypted)
- Analog voice signaling

For details on how GTR 8000 Base Radio provides Echo Cancellation, see Echo Cancellation Configuration on page 241.

3.4.18
Fast Unmute

Fast Unmute on a console is used only with conventional channels with digital unencrypted voice transmissions. Fast Unmute functions only on late entry calls where audio is detected but the voice call header information is not received either due to RF conditions, or weaker transmission being detected already in progress after a stronger transmission ends. In these conditions, Fast Unmute allows decoding of audio without adding 180 msec delay to detect if a transmission is encrypted over the air. Disabling Fast Unmute adds 180 msec of delay to allow decoding late entry transmissions to determine if they are encrypted.

CAUTION: Do not use Fast Unmute on channels where encrypted transmissions may be received. Receiving late entry encrypted transmissions with Fast Unmute enabled causes garbled audio to be played by the console.

3.4.19
Frequency Select

Certain resources are capable of transmitting/receiving on multiple frequencies. Only one set of transmit/receive frequencies is active at any time. The Frequency Select console feature allows a

console position to select the active transmit/receive frequency of a resource. Changing the transmit/receive frequency of a resource causes all console positions to be updated with the new frequency selection. The MCC 7500/7100 Dispatch Console supports base stations with up to 16 frequencies.

Multi-frequency base stations are used to allow access to many frequencies when access to only one frequency at a time is needed. Because only one set of frequencies is active at a time, the console position cannot monitor the other frequencies on the resource. A single base station is used to access the multiple frequencies to reduce the hardware expenses. Frequency Select allows a console position to choose a set of transmit/receive frequencies on a resource to communicate with the radios using these frequencies.

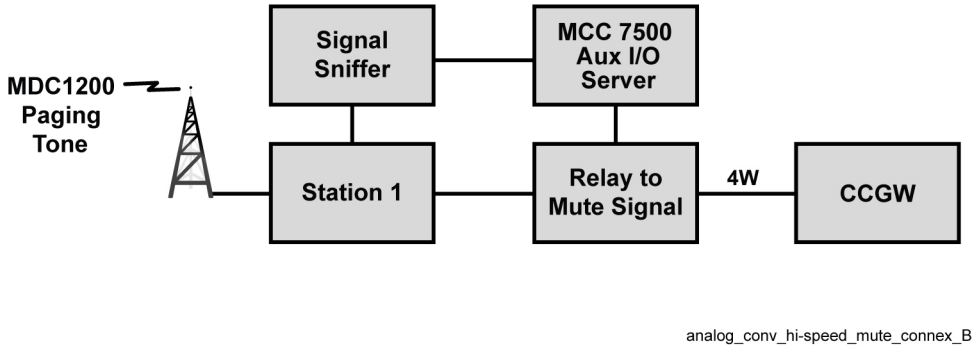
Up to 255 frequency modes are available on the ASTRO® 25 Control Interface Module (ACIM) conventional channels.

3.4.20
High-Speed Mute

High-Speed Mute provides the means to control what audio is heard at the dispatch consoles for a given conventional radio resource. For example, hearing incoming paging tones at the console is undesirable. Using an MCC 7500 Aux I/O Server, external hardware detects incoming paging tones and mutes the receive signal for these tones, so they are not heard at the console.

Figure 5: Connections for High-Speed Mute

This figure shows the connections required to support High-Speed Mute.



3.4.21
Late Entry

Late Entry is an exception case where the system infrastructure starts to receive a radio call in the middle of the radio transmission as opposed to the start of the call. One scenario is where the radio is in an RF coverage hole when initiating a call, and then moves into RF coverage while in the call. This scenario is the typical "driving under a bridge" scenario. Another scenario often leading to Late Entry is using the monitor control command.

For MDC1200 channels, the Late Entry scenario works differently in that the MCC 7500/7100 Dispatch Console can be updated with new information about the inbound voice transmission, when the Unit ID of the subscriber radio and alias change from a known value to "Unknown". This change can occur when an inbound call successfully provides the Conventional Channel Interface and MCC 7500/7100 Dispatch Console with the Unit ID and alias of the transmitting radio and then fades long enough such that the Conventional Channel Interface starts a new inbound call for the same inbound radio transmission. In this case, the MCC 7500/7100 Dispatch Console displays the "Unknown" alias for the inbound call as if it were a new analog-only call, though it is for the originally known Unit ID and alias.

In a late entry situation on an ASTRO® 25 Control Interface Module (ACIM) conventional channel, information used to decode the call is missed. The system infrastructure must then wait for this information to be repeated to process the call. Late Entry is handled similarly to the normal radio voice

call; with the exception that the initial processing of the call is delayed. For this reason, the call information such as the radio unit ID is received by a console a little further behind the voice as compared to non-late entry scenario.

Late Entry may affect the time it takes a console to unmute a voice call. The console must first determine whether that call is encrypted or clear. Because no voice header exists, the console must determine it from collecting the information embedded in the voice stream, adding additional 500 ms to the time it takes the console to begin playing audio.

On an ACIM Conventional Channel, the secure mode can be received much later in the call. The Conventional Channel Gateway (CCGW) sends the initial call request to the zone controller and with the later received secure mode information for the call, a follow-up call request is sent with the updated secure mode information. The follow-up call request message on the ACIM conventional channel may have the Push-to-Talk (PTT) ID, the type of Call (Group Call or Individual Call). With Mobile Data Communications Subscribers, the PTT ID information can come in as late as 800 ms after call start. After the updated information is processed, the dispatch console and the Archiving Interface Server (AIS) update the ongoing call with the updated information.

3.4.22
Common Key Reference Select

Outbound Secure Key, also know as Common Key Reference (CKR) Select, permits the dispatch operator to select the desired outbound secure key from the Secure Key drop-down list on a channel resource for the purpose of secure transmissions. The feature is available for digital conventional resources only.

3.4.23
Main/Alternate Channel Pairing

Main/Alternate Channel Pairing provides an alternative station interface for a conventional channel. The console shows one logical control window for the channel, but physically includes a main and an alternative interface. The user can choose which interface is active and when the active interface fails the system switches to the other interface (as long as it is operational). Additionally, Main/Alternate Channel Pairing provides the ability to have a main and alternate base station.

The channels comprising the Main/Alternate Channel Pair may be at the same or different RF or console sites, but must be members of the same zone.

Main/Alternate Channel Type Pairing Configuration on page 244 shows the valid Main/Alternate Pair Channel pairing configurations.

3.4.23.1
Interzone Main/Alternate Channel Operation

For Interzone, the Main/Alternate Channel Pair must reside in a single zone, but consoles from another zone may be configured with and have access to the channels of the Main/Alternate Channel Pair.

3.4.23.1.1
Console Affiliations

The console affiliates to each of the channels associated with a Main/Alternate Channel Pair, issuing two affiliations to the serving zone controller, one for the main and one for the alternate channel. When the console affiliates to a channel that is part of a Main/Alternate Channel Pair, the serving zone controller responds with which interface (Main or Alt) is active.

If the Main/Alternate Channel Pair is in another zone, and an interzone affiliation occurs (see Interzone Console Affiliation/Deaffiliation on page 127), the active/inactive status of the channels is returned from the home zone to the serving zone in the Affiliation Acknowledgement for each channel of the

Main/Alternate Channel Pair. A Main/Alternate Channel Switch Grant is sent to the affiliating console for the active channel in the Main/Alternate Channel Pair.

3.4.23.1.2
Console Requests Interzone Main/Alternate Channel Switch

The console user requests a change of the active channel of an affiliated main alternate conventional channel pair in a different zone of the same ASTRO® 25 system. The console issues a Main/Alternate Channel Switch Request to serving zone controller of the console.

If the Main/Alternate Channel Switch can be granted in the home zone, as determined using current procedures (for example, the inactive channel is in service), a Main/Alternate Channel Switch Grant is sent to any intrazone affiliated consoles and any interzone affiliated consoles, including the console that requested the channel switch.

3.4.23.1.3
Interzone Main/Alternate Channel Switch Due to Active Channel Failure

When the active channel of a conventional Main/Alternate Channel Pair fails in the home zone, and if a Main/Alternate Channel Switch can take place, a Main/Alternate Channel Switch Grant is sent to any intrazone affiliated consoles and any interzone affiliated consoles. A console responsible for refreshing the station control command for the active/inactive channels is identified. Precedence is given to a local console in the home zone for this task. If no local home zone console affiliations exist, the serving zones with console affiliations are queried to identify a refreshing console. This query results in a single refreshing console being chosen from among the interzone affiliated consoles. The identified refreshing console is communicated to all interzone affiliated consoles in the Main/Alternate Channel Switch Grant.

3.4.23.1.4
Console Initiated Interzone Voice Call or Supplementary Data on an Active/ Inactive Channel

The console operator initiates a voice call or supplementary data message on the active channel of a Main/Alternate Channel Pair in another zone. If the active/inactive status of the Main/Alternate Channels in the console serving zone indicate that the requested channel is active, the request is processed like a normal interzone console initiated voice call or supplementary data message (see Console-Initiated Interzone Voice Call on page 156 and Console Initiated Supplementary Data on page 76). Otherwise, if the requested channel is inactive, the console request is rejected with an indication that the channel is not active. The console process rejects for Push-to-Talk (PTT) or supplementary data requests on the inactive channel and display an error to the dispatcher indicating the channel is inactive.

3.4.23.1.5
Interzone Station Control on Active/Inactive Channels

The console operator initiates a station control command on the active channel of a Main/Alternate Channel Pair in another zone. The station control command is processed regardless of the active/ inactive status of the Main/Alternate Channels (see Interzone Station Control Commands on page 73). If a subsequent console initiated Main/Alternate Channel Switch occurs, the console may initiate new station control commands to update the settings of the new active/inactive channels.

3.4.23.1.6
Interzone Link Failure and Recovery

If the interzone link between the requesting console serving zone and the home zone is not available when the console initiates a Main/Alternate Channel Switch request, the console serving zone

controller denies the request by sending the Inbound Signaling Word (ISW) Reject message and the console operator is informed of the denial.

If the interzone link between the home zone and a serving zone, other than the requesting console serving zone, is not available when the console initiates a Main/Alternate Channel Switch request, a Main/Alternate Channel Switch Grant is not sent to affiliated consoles in the serving zone with the failed interzone link.

If the interzone link between the home zone and a serving zone with affiliated consoles is not available when the active channel of a conventional Main/Alternate Channel Pair fails, a Main Alternate Channel Switch Grant is not sent to affiliated consoles in the serving zone with the failed interzone link.

If an interzone link fails between the home zone of a conventional channel and the serving zone of the consoles affiliated to the channel, the serving zone considers each channel in the other zone as out-of-service. A Conventional Channel Update is sent to affiliated consoles for each channel (main and alternate) that had been in service before the link failure.

When an interzone link recovers, the home zone updates the serving zone with the active/inactive status of each conventional channel in a Main/Alternate Channel Pair in the home zone. A Main/Alternate Channel Switch Grant is sent to any affiliated consoles in the serving zone with the recovered interzone link for each active channel in the Main/Alternate Channel Pair. Because multiple conventional channels may be active in the home zone in a Main/Alternate Channel Pair, the serving zone controls the rate at which the Main/Alternate Channel Switch Grant messages are sent to the affiliated consoles.

3.4.24
Interzone Shuttle Packet

A console equipped with an Inbound Event Display (IED) receives an inbound event (such as an emergency alarm notification) on a conventional channel displayed on the IED. If the conventional channel is in another zone, the console operator notifies other consoles affiliated to the conventional channel that it has acknowledged the event by initiating a Shuttle Packet request to the zone controller.

A Conventional Shuttle Packet Response is sent to any intrazone affiliated consoles and any interzone-affiliated consoles, including the console that initiated the Shuttle Packet request.

3.4.25
Main/Standby

The Main/Standby channel operation allows two stations to operate as a redundant pair. If the Main station fails (due to hardware or software malfunction), the Standby station takes over.

3.4.26
Multiselect

Multiselect (MSEL) allows a dispatch console to define groups of selected radio resources (either trunked or conventional), so multiple resources are selected simultaneously. Simultaneously, the resources of MSEL groups are easily transmitted. A dispatch console supports up to 16 MSEL groups.

For details, see the *MCC 7500/7100 Elite Dispatch User Guide*.

3.4.26.1
Interzone Multiselect Call

When the console operator activates the multiselect group and invokes the Push-to-Talk (PTT) function, the console issues a conventional PTT request to the serving zone controller for each conventional channel included in the multiselect group. Each conventional PTT request is handled separately and an interzone voice call is initiated for any channel in another zone. The call setup

procedure for each channel in the multiselect group is identical to a normal voice call setup on a single conventional channel.

If the console operator adds a conventional channel to a multiselect group that currently has an active voice call, a voice call is initiated on the conventional channel. If the channel is in another zone, an interzone voice call takes place.

3.4.27
External Paging Encoder

The MCC 7500 Dispatch Console supports the external paging encoder, a device connected to the dispatch console. It enables the transmission of single or multiple pages from the dispatch console to a paging decoder device. The paging sequence may be played audibly or the paging decoder device may use the tone sequence to trigger an action.

For External Paging to be valuable, a paging decoder device must be used to decode the packets received from the analog or digital channel. If no paging decoder device is used, any device monitoring the conventional channel can hear the paging tones.

Signaling (like an Emergency Acknowledgement or Call Alert) is prioritized over audio on a channel for a fraction of a second and can disrupt a pre-existing paging tone.

Analog External Paging

Paging tones generated by the external pager are detected at the dispatch console. The dispatch console encodes the paging tones into G.728 packets and sends them to the Conventional Channel Gateway (CCGW). The CCGW converts the packets from G.728 audio to analog audio. The analog audio is sent to the analog stations over the 4-wire interface.

Digital External Paging

Paging tones generated by the external pager are detected at the dispatch console. The dispatch console encodes the paging tones into Improved Multi-Band Encoder (IMBE)/Advanced Multi Band Excitation (AMBE) (full rate) packets and sends them to the digital CCGW. Some degradation of tone may occur during translation into IMBE/AMBE (full rate) due to the nature of the IMBE/AMBE (full rate) encoding. The digital CCGW copies the packets from IMBE/AMBE (full rate) to digital V.24 format. The digital audio is then sent to the digital stations over the V.24 interface.

3.4.28
Integrated Paging Encoder

A page is an attempt to send an alert message to a destination receiver. Traditionally, pages have been used to convey an alarm or alert indication to the user of a pager, but pages have also been used to send control messages to specialized receivers (that is, turn on sirens, open gates, and unlock key-containing boxes).

Integrated Paging supports sending analog tone pages from the MCC 7500 Dispatch Console. Tone pages specify the target of the page through one or more analog tones sent over a specified radio resource. Tone pages supported by Integrated Paging are unidirectional and do not include a response mechanism by which the target of the page can confirm receipt of the page. The success of a tone page is determined only by whether that tone page was successfully sent, not by whether the target received it. Unlike the case with External Paging, the tones associated with tone pages sent using Integrated Paging are generated inside the dispatch console and do not require an external paging encoder device.

Integrated Paging uses the existing infrastructure capabilities to support tone paging. Tone pages can be sent using any of several different tone paging formats, and they can be sent over both analog conventional radio resources and trunked group resources (talkgroups, announcement groups).

Integrated Paging is a signaling feature which enables a console to send paging tones in analog without requiring an external paging encoder on all conventional channels. With this feature, tones sent from the console are sent only in analog mode, regardless of the mode selected. The mode switches back to the selected mode when the analog paging tone transmission is completed. On ASTRO® 25 conventional system, tones are sent in analog mode only on mixed mode channels. If the channel is a digital channel, the tones are sent using Improved Multi-Band Encoder (IMBE)/Advanced Multi Band Excitation (AMBE) with possible degradation due to vocoding of the tone.

Integrated Paging also supports the ability to send system pages (call alerts) along with tone pages in the MCC 7500 Dispatch Console.

Conventional Talkgroups does not support call alert/system pages through Integrated Paging.

3.4.29
Private Line Select

Private Line Select on the console allows a console position to select the private line code for a resource. This feature enables the console position to communicate with a subset of radios programmed to transmit/receive on the same frequency. Selecting a private line on a resource causes the console position to transmit/receive audio only to the subgroups of radios using the selected private line code.

The MCC 7500/7100 Dispatch Console supports resources with up to eight private lines per resource. Changing the transmit/receive private line of a resource causes all console positions to be updated with the new private line selection.

If different groups share the radio system, unique private line codes are assigned to each group. Private Line Select allows a console position to choose which group it communicates with.

3.4.30
Secure Key Select

Secure Key Select allows a console position to select the secure key to be used for coded (secure) transmissions on a resource. Up to 255 non-sequential secure keys in the range 1 - 4096 can be configured on ASTRO® 25 Conventional Signaling. The secure key is used to encrypt all subsequent coded transmissions on that resource. Regardless of the secure keyset, a console position receives audio from inbound calls using any secure key. The console position receives an indication of which secure key was used for the inbound transmissions on ASTRO® 25 Conventional Signaling resources.

One of the secure key selections may place a resource into “auto-key” mode. When a resource is in auto-key mode, coded transmissions from a console position use the last secure key received from a coded transmission on that resource.

A console position uses Transmit Mode Select to specify that transmissions on a resource must be coded. If the transmit mode of a resource is coded, this feature selects the key used to encrypt all transmissions on that resource. If the transmit mode of a resource is clear, this feature has no effect on transmissions on that resource.

Changing the selected secure key of a resource affects only the console making the change request; changes to secure key selection do not affect other console positions. The number of secure keys available for each resource is configured through the system Network Manager (NM).

Secure Key Select allows a console position to use several different secure keys for encrypting coded transmissions on a resource. The different keys are typically used as a way to group radio users. Each user group uses a different secure key so they cannot hear conversations of other groups. When a console position transmits on a resource with a specific secure key selected, only radios with that same secure key selected are able to decrypt the transmission.

When a resource is in auto-key mode, the console position can transmit to the last radio to call in with a coded transmission, without knowledge of the selected secure key of that radio.

3.4.31
PTT ID Display and Alias Display

The Push-to-Talk (PTT) ID capability displays a radio unit ID on the console and to other units on a channel. The unit ID is displayed due to the radio voice transmission or an inbound signaling message such as emergency alarm or call alert. It allows the console operator to identify the transmitting radio and provides a means to log radio activity statistics. The radio unit ID can also be mapped to an alias defined by the system operator. The system is also capable of displaying a console unit ID or alias on a radio display.

ID or alias is displayed on channel resources and in the call log and in the ZoneWatch raw log. MDC 1200 and digital mode PTTs support PTT ID.

3.4.32
Refresh

The Refresh mechanism provides the status of each console feature to ensure that a dispatch application reflects the correct status of the MCC 7500/7100 Dispatch Console. A Declarative User Interface (DUI) client may want to request a refresh under the following conditions:

- When a dispatch application registers with the Console Dispatch Interface (CDI), a refresh request may be sent from the DUI client to the dispatch services. Dispatch services then initiates a refresh.
- Under certain rare circumstances, the call processing support client may restart. When it restarts, an ACTIVATE message is sent to the DUI client. The DUI client may then send a refresh request, after it is ready, to get the status of the radio resources it is monitoring.

An application may manually request a refresh at any time. When a refresh occurs, the status of the MCC 7500/7100 Dispatch Console is reported using the Application Programming Interface (API) status messages defined for each feature. These messages are sent to all registered applications in the following order:

1 A message indicating that a refresh sequence has begun.

2 Messages indicating which resources are assigned on this console position.

3 Messages indicating the state of each feature on each resource.

4 Messages indicating the state of the console position general features.

5 Messages indicating the state of each assigned Aux I/O.

6 A message indicating that a refresh sequence has ended.

The time a refresh takes to complete depends on the number of resources assigned, the number of Aux I/Os assigned, the number of general features used by that console position, and what type of console equipment is used. Under normal circumstances, on a console with 100 assigned resources each having 10 features, and 100 Aux I/Os, a refresh should complete within 1 minute.

The purpose of refresh is to update dispatch applications with the current state of all console features. This update ensures that all registered applications have the status of the MCC 7500/7100 Dispatch Console. Refresh is initiated by a refresh request from the DUI client to the dispatch services when a console position becomes operational. Any registered application may also request a refresh.

3.4.33
Site Conventional Mode and Conventional Subsystems

If the link to the zone controller at the zone core is lost, Site Conventional Mode supports dispatching operations on conventional channels. Under this condition, Site Conventional Mode is useful to support critical conventional dispatch operations. Additionally, M core conventional systems may be designed in Conventional subsystem (C-sub) groupings, where each C-sub contains a conventional site controller. If the link to the M core is lost, the C-sub continued to function as its own system.

The ASTRO® 25 system has an IP-based core network that provides for the communication resources and users to be distributed across the wide area network. The zone core includes a zone controller, which manages communication across the system. The MCC 7500/7100 Dispatch Console sites, which include hub sites with consoles in conventional subsystems, are connected to the core via a wide area network.

A link failure between the console site or conventional subsystem and the core leaves the consoles and radio users at the site or conventional subsystem without the ability to use the communications resources. Site Conventional Mode provides for limited communications at the site by enabling console and radio users at the MCC 7500/7100 Dispatch Console site or hub to maintain communications over conventional resources local to that site or conventional subsystem. If and when the zone controller is unavailable, the Conventional Site Controller (CSC) supports the Site Conventional Mode of operation.

An MCC 7500/7100 Dispatch Console site or conventional subsystem is capable of Site Conventional Mode operation when equipped with:

- Co-located MCC 7500/7100 Dispatch Console
- Conventional Channel Gateways (CCGWs)
- A CSC

The Site Mode applies to colocated MCC 7500/7100 Dispatch Console sites and conventional subsystems, where any hub and base radio sites with consoles, CSC, and channels have network connectivity.

The function of the CSC in Site Conventional Mode is essentially the same as the zone controller in normal wide-area mode operation. The scope of the CSC operation is limited. Only those conventional resources colocated with the MCC 7500/7100 Dispatch Console or in a conventional subsystem can be used. MCC 7500/7100 Dispatch Console sites without local or conventional subsystem conventional resources are unable to provide local or conventional subsystem communications capability to users at the site.

The MCC 7500/7100 Dispatch Console site is capable of the following functions in the Site Conventional Mode:

- Conventional calls on local or conventional subsystem conventional channels
- Station control commands on local or conventional subsystem conventional channels
- Logging conventional resources at the site (local connectivity to the Archiving Interface Server (AIS) is required)
- Patched calls among local or conventional subsystem conventional channels
- Channel Marker, Enhanced Alert Tones, Alert Tones, Integrated Paging among local or conventional subsystem conventional channels

The features NOT supported in Site Conventional Mode are:

- Flex Air Traffic Information Access (ATIA) information stream for call activity at the MCC 7500/7100 Dispatch Console site
- Conventional Site Controller redundancy
- Communications with the network management system
- Fault manager (channel failures are indicated on consoles monitoring the channels)
- Parallel console and radio alias in call control information and logging information

3.4.34
Supervisory Takeover

Supervisory Takeover allows a supervisor in a dispatch room to control whether a non-MCC 7500 Dispatch Console (for example, a desk set) accesses a conventional base station controlled by an

MCC 7500 Dispatch Console. This feature allows a supervisor to prevent unauthorized individuals from using parallel non-MCC 7500 Dispatch Consoles to transmit on conventional stations.

The dispatched controls Supervisory Takeover using MCC 7500 Aux I/O servers from the dispatch application GUI. The feature is supported by the use of external double-pole relays connected to the single-pole relays in the Aux I/O.

The ASTRO® 25 Control Interface Module (ACIM) conventional channel does not support Supervisory Takeover.

3.4.35
Takeover and Interrupt

Console Takeover and Interrupt allows the console to take over existing mobile subscriber audio such that all destination devices receive console audio when both a console and a Mobile Subscriber (MS) are transmitting. Console Takeover and Interrupt allows one console to interrupt transmission of another console already transmitting on the channel, based on transmission priority.

These cases are managed by controlling the multicast address that destination devices use to obtain receive audio. In a console takeover scenario in which two valid audio streams are present (console and MS), the system allocates two separate multicast addresses to route the two valid audio streams. Two separate multicast addresses are needed because the destinations that receive audio are different based on the type of audio (that is, RF sites only receive console audio; all consoles receive MS audio and console audio, bandwidth permitting). By using two multicast addresses, bandwidth to the destinations is saved because only the audio necessary for the destination is routed to the destination. The zone controller is responsible for determining the particular audio takeover/resumption case and distributing the appropriate multicast address to the receiving devices.

For ASTRO® 25 Control Interface Module (ACIM) channels, the Motorola Solutions consolettes can only of transmit or receive at any given time. If an ongoing subscriber-initiated call is occurring, and if a console keys up on the same channel, the consolette stops the incoming call. It then handles the request for the console-initiated outbound call. However, although the consolette allows the dispatcher to key up the consolette while the subscriber is transmitting on an inbound call, there is no guarantee that any other radio user or wireline dispatcher hears the dispatcher audio from the console-initiated call. In the system, it depends on whether the subscriber call or the console-initiated call captures the station receiver and cannot be controlled as such or driven by this feature.

Takeover and Interrupt requires no specific user configuration. However, the consoles still must be configured for Primary Supervisor, Secondary Supervisor, and others.

3.4.35.1
Interzone Console Takeover

For interzone conventional, Interzone Console Takeover expands the operation to a multizone conventional system. The call request types may originate at a console that is part of a console site in a serving zone. The steps for initiating an interzone audio call are similar to Radio Initiated Interzone Voice Call and Console Initiated Interzone Voice Call.

3.4.35.2
Interzone Radio Takeunder

Radio Takeunder allows a console to grant a radio call request during a console/audio patch transmission. The console/audio patch continues to be transmitted on the conventional channel and to all affiliated consoles. Affiliated consoles hear both the console and Mobile Subscriber (MS) audio. The MS audio is not transmitted back on the conventional channel unless the station is configured for Repeat Priority.

For interzone conventional, Radio Takeunder expands the operation to a multizone conventional system. The call request types may originate at a console that is part of a console site in a serving zone and the conventional channel the console is affiliated to is home to a different zone.

3.4.36
Transmit Mode

The Transmit Mode Select feature (also known as Transmit Control) allows an MCC 7500/7100 Dispatch Console user to select the mode in which console transmissions are sent on an ASTRO® 25 conventional channel. Four modes are available:

- Analog Clear
- Analog Secure (ASTRO® 25 Control Interface Module (ACIM) conventional channel only)
- Digital Clear
- Digital Secure

This feature is compatible only with ASTRO® 25 conventional channels that support mixed mode (analog and digital) operation and ACIM channels. When set to **analog**, the dispatch console commands the conventional channel to transmit the dispatch console user voice over-the-air in analog mode. This scheme allows non-digital capable radios on that channel to hear the transmission.

3.4.37
Voice Selective Call

Voice Selective Call allows you to make a radio call to a specific individual on a digital conventional channel without involving other members of the user group.

The signal from a Voice Selective Call contains a user ID code, and only that user radio un-mutes when the call is received. Although only the single user radio un-mutes, other users can listen to the conversation by pressing the monitor button on their radios, just as they can to hear the conversations of other talkgroups using their channel and frequency, or through configuration of their squelch mode. The call is addressed to a single person, but it is not private.

It is a special type of Push-to-Talk (PTT) capability initiated only on a transmit-by-transmit basis. Therefore, after a user sends a Voice Selective Call to another user, if they wish to replicate the alerting and unmuting of the audio by the target radio or console, the sending user must re-select the Voice Selective Call function and repeat the transmission.

This function is also a unidirectional exchange between the sending user and the receiving user. The sending user receives no feedback regarding whether the receiving user successfully received the Voice Selective Call and was alerted. Only by the receiving user talking back to the sender with a voice call does the sending user know the relative success of the Voice Selective Call. If the targeted user is not within the coverage area of the system, no feedback is given to the sender of the Voice Selective Call.

Voice Selective Call is supported between consoles and subscriber units, and between subscriber units on conventional mixed mode channels in digital mode and digital conventional channels (V.24 and IP).

On MDC 1200-capable channels, Voice Selective Call can be configured in the radio to transmit the unit ID of the sending radio and the target radio as a separate signaling packet that precedes the analog voice transmission. After the Conventional Channel Gateway (CCGW) decodes the MDC 1200 signaling packet, it follows the same actions by the zone controller and console positions as for a digital Voice Selective Call.

On an ASTRO® 25 Control Interface Module (ACIM) channel, Voice Selective Call comes in as group call. The console receives the inbound call and keys up within the hang time of the private call session. Although the console requests an outbound group call, it still appears like a private call at the initiating radio.

3.4.37.1
Interzone Voice Selective Call

Interzone conventional supports Voice Selective Calls between subscriber units and consoles located in different zones. Outbound Voice Selective Calls allow console operators to enter a specific Unit ID and place the equivalent of a private call to that unit. Inbound Voice Selective Calls allow users to place a unit to unit call to a specified console.

Console-Initiated Interzone Voice Selective Call

The console operator initiates a Voice Selective Call on a digital or an MDC 1200 conventional channel by invoking the Push-to-Talk (PTT) function, identifying the ID of the target subscriber unit. The processing of a Voice Selective Call where the channel is located in another zone proceeds similar to a normal interzone voice call.

The zone controller sets up the Voice Selective Call on the conventional channel and includes any intrazone and interzone affiliated consoles in the call as in a normal interzone voice call. An Ignore Call to Others functionality is used to prevent consoles monitoring the conventional channel from hearing the audio.

Radio-Initiated Interzone Voice Selective Call

A subscriber user initiates a Voice Selective Call on a digital or an MDC 1200 conventional channel by invoking the PTT function on the subscriber unit, identifying the ID of the target console. The processing of a Voice Selective Call where the target console is located in another zone proceeds similar to a normal interzone voice call.

The zone controller includes any intrazone and interzone affiliated consoles in the call as in a normal interzone voice call. Ignore Call to Others functionality is used to prevent consoles monitoring the conventional channel but are not the target console from hearing the audio.

3.4.38
Interzone Conventional Channel Status Updates

Conventional Interzone extends certain console capabilities and allows Channel Status Updates to be delivered across zones.

3.4.38.1
Interzone Console Affiliations

When consoles affiliate to a conventional channel located in another zone, an interzone affiliation may result (see Interzone Console Affiliation/Deaffiliation on page 127). If an interzone affiliation is necessary, the Affiliation Acknowledgement is initially returned to the affiliating console indicating that the conventional channel is out of service. When the home zone responds to the interzone affiliation, if the response indicates that the conventional channel is in service, a Conventional Channel Update is sent to the affiliating console to update the status of the conventional channel to In Service.

3.4.38.2
Interzone Conventional Channel In-Service

When a conventional channel transitions to an In-Service state, the Conventional Channel Gateway (CCGW) sends a Conventional Channel In Service Request Inbound Control Packet (ICP) to the home zone controller. The Conventional Channel Update is sent to any intrazone affiliated consoles and any interzone affiliated consoles to update the status of the conventional channel.

If the channel is part of a main alternate channel pair, the home and serving zones may need to update the active/inactive status of the main/alternate channels using current channel in-service processing.

3.4.38.3
Interzone Conventional Channel Out-of-Service

When a conventional channel transitions to an out-of-service state, the Conventional Channel Gateway (CCGW) sends a Conventional Channel Out of Service Request Inbound Control Packet (ICP) to the home zone controller. The Conventional Channel Update is sent to any intrazone-affiliated consoles and any interzone-affiliated consoles to update the status of the conventional channel.

If an active call is occurring on the conventional channel that has gone out of service, the home zone controller initiates the call teardown procedures. A Conventional End of Call (EOC) Grant is sent to any intrazone-affiliated consoles and any interzone-affiliated consoles.

3.4.38.4
Interzone Conventional RF Site Failure (CCGW Failure)

When the home zone controller detects that it has lost communication with a Conventional Channel Gateway (CCGW), it considers all conventional channels associated with the CCGW as out of service. The Conventional Channel Update is sent to any intrazone- and interzone-affiliated consoles for each channel to update the status of the conventional channel.

If an active call is occurring on any of the conventional channels that have gone out of service, the home zone controller initiates the call teardown procedures on each channel with an active call. A Conventional End of Call (EOC) Grant is sent to any intrazone and interzone affiliated consoles.

3.4.38.5
Interzone Link Failure and Recovery

If an interzone link fails between the home zone of a conventional channel and the serving zone of consoles affiliated to the channel, the serving zone controller considers each channel in the other zone as out-of-service, and a Conventional Channel Update is sent to affiliated consoles for each channel that had been in-service before the link failure.

When an interzone link recovers, because the affiliation information in the home zone has been cleared upon interzone link failure, the serving zone initiates an interzone affiliation for any conventional channel in the home zone that has local console affiliations. When the home zone responds to the interzone affiliation, if the response indicates that the conventional channel is in service, a Conventional Channel Update is sent to any affiliated consoles in the serving zone with the recovered interzone link. Because multiple in-service conventional channels may exist in the home zone with serving the zone of console affiliations, the serving zone controls the rate at which the Conventional Channel Update messages are sent to the affiliated consoles.

3.5
Conventional Call Processing

This section provides a description of conventional call processing.

For conventional data services and conventional data call processing, see the *Conventional Data Services* manual.

3.5.1
Conventional Interzone Calling

NOTICE: Conventional Interzone Calling is supported only in M3 zone cores with or without Dynamic System Resilience (DSR) configuration. The zones must be connected together with interzone communication links (T1 or Ethernet).

Console operators monitor and communicate with subscribers on conventional channels. With conventional interzone calling, console operators can access conventional channels located in zones other than the zone where the console is located.

Conventional Interzone Calling is supported in all console site types using MCC 7500/7100 Dispatch Console as long as the RF subsystem and console subsystem is connected to an M3 zone core with zone controllers. Conventional Interzone Calling is compatible with voting, simulcast, multicast, and single repeater RF sites with conventional topologies. Conventional Interzone Calling also supports analog, digital, mixed mode, MDC 1200, ASTRO 25 ® Control Interface Module (ACIM), and Advanced SECURNET conventional channel types supported by a Conventional Channel Gateway (CCGW).

The zone controller is responsible for call processing associated with console and radio initiated interzone conventional call setup. Each zone controller within an M3 zone core of an interzone call communicates with each other across zones. The consoles affiliate/de-affiliate to conventional channels and the home zone controller tracks other zones with affiliated consoles.

The zone in which the conventional channel is located is referred to as the home zone, and the zone in which the console is located is referred to as the serving zone.

The home zone of a conventional channel performs arbitration when multiple access requests for a conventional channel are received from local and or remote consoles. Interzone conventional for voice features are extended to cover interzone access requests from consoles in different zones.

The maximum number of conventional channels in an M3 zone core is 2,000. However, only 1,000 conventional channels are allowed per zone. Therefore, in a multizone system, each zone can support up to 1,000 conventional channels as long as the system level capacity of 2,000 conventional channels is not exceeded.

3.5.1.1
Conventional Channel Home Zone Determination

Each zone controller in a multizone system must have information about the conventional channels in its zone and the other zones. This conventional channel information is contained in the conventional channel object, and is distributed to all zone controllers in the system by the network manager when conventional channels are added to and deleted from the system.

Whenever a console operator initiates an operation involving a conventional channel that requires the zone controller to determine the zone where the channel is located, the zone controller uses the zone ID of the conventional channel object to determine the channel home zone to which interzone communication related to the operation is established.

3.5.1.2
Tracking Interzone Console Affiliations to Local Conventional Channels

Each zone controller in a multizone system must have information about the other zones that have consoles affiliated to the conventional channels in its zone. The zone ID of another zone with affiliated consoles is kept dynamically per conventional channel basis by the conventional channel home zone controller when interzone affiliations/associations or de-affiliations/de-associations occur.

Whenever an operation occurs on a conventional channel (for example, a subscriber unit initiates a voice call) that requires the zone controller to determine the zones where affiliated/associated consoles are located, the zone ID of the zones with affiliated consoles are determined for that channel Universal Resource IDentifier (URID). The conventional channel home zone controller uses this information to determine the serving zones to which interzone communication related to the operation are established.

3.5.1.3
Tracking Local Console Affiliations to Interzone Conventional Channels

Each zone controller in a multizone system must have information about the conventional channels in other zones that local consoles are affiliated to/associated with. The console-serving zone controller dynamically keeps this information when interzone affiliations/associations or de-affiliations/de-associations occur.

Whenever an operation occurs on a conventional channel (for example, a subscriber unit initiates a voice call) and is delivered from another zone, the serving zone controller determines the local console sites with consoles affiliated/associated to the interzone conventional channel. The zone controller uses this information to determine which local console sites to include in the conventional operation.

3.5.1.4
Interzone Console Affiliation/Deaffiliation

An MCC 7500/7100 Dispatch Console can be configured to affiliate/deaffiliate to a conventional channel home in a different zone of the same ASTRO® 25 system.

3.5.1.4.1
Interzone Console Affiliation

Zones track interzone console affiliations to set up an interzone voice call on a conventional channel that may be home to a different zone. However, the home zone of a conventional channel tracks only other zones that have consoles affiliated to their conventional channels. The home zone does not need to track individual console affiliations from another zone (see Tracking Interzone Console Affiliations to Local Conventional Channels on page 126 and Tracking Local Console Affiliations to Interzone Conventional Channels on page 127).

3.5.1.4.2
Interzone Console De-affiliation

A console may de-affiliate from a conventional channel home in a different zone when monitoring the conventional channel resource is no longer necessary or transitions to an out-of-service state.

The home zone of a conventional channel tracks only other zones that have consoles affiliated to their conventional channels. It is necessary only to notify the home zone of a console de-affiliation for a conventional channel resource upon the last console de-affiliating from a conventional channel resource.

For normal operation, the console performs all interzone end-of-call operations or unreserves an existing patch reservation before initiating the de-affiliation request for the conventional channel. In the process, the console initiates the de-affililiation before performing the mentioned steps, and the zone controller subsystem performs the cleanup work mentioned (if necessary).

3.5.1.4.3
Interzone Link Failure and Recovery – Affiliation

In this scenario, the interzone link between a serving zone and home zone is out-of-service, and no console in the serving zone is affiliated to conventional channel (CCH-1) in the home zone. If a console in the serving zone attempts to affiliate to CCH-1, the serving zone acknowledges the affiliation directly with an indication the conventional channel is out-of-service. If consoles in the serving zone are affiliated to the conventional channel (CCH-1) in the home zone when the interzone link fails, the affiliation information in the home zone is cleared.

After the interzone link recovers, the serving zone notifies the home zone of the affiliation if any local consoles are affiliated to the conventional channel (CCH-1) in the home zone.

3.5.1.4.4
Interzone Link Failure and Recovery – De-affiliation

In this scenario, the interzone link between a serving zone and home zone is out-of-service, and only a single console in the serving zone is affiliated to a conventional channel (CCH-1) in the home zone. When the console in the serving zone attempts to de-affiliate from CCH-1, the serving zone acknowledges the de-affiliation directly.

3.5.1.5
Interzone Console Association/De-Association

An MCC 7500/7100 Dispatch Console in a serving zone is affiliated/de-affiliated to conventional channel 1 within its zone. The conventional channel is in a cross-busy or cross-mute pair with conventional channel 2 that is home to a different zone. The serving zone does not have an existing affiliation to the conventional channel 2 resource.

3.5.1.5.1
Interzone Console Association

In this scenario, the MCC 7500/7100 Dispatch Console requests an association to the conventional channel 2 resource. Zones track only affiliation across zone boundaries. The home zone considers the console association request to be an affiliation request for conventional channel 2. The serving zone controller notifies the MCC 7500/7100 Dispatch Console through an association acknowledgement. After the association is established, the console operator does not receive and is not able to transmit any audio on conventional channel 2, but receives all supplementary data and call control messages on the channel.

If additional consoles in a serving zone attempt to associate to the conventional channel 2 resource thereafter, the serving zone acknowledges the local association request directly. The home zone does not need to be aware of subsequent requests, as long as at least a single console is associated/ affiliated to the conventional channel resource before the request.

3.5.1.5.2
Upgrading an Association to Affiliation

An MCC 7500/7100 Dispatch Console position is associated to a conventional channel that is home to a different zone. The MCC 7500/7100 Dispatch Console upgrades the association to an affiliation to allow audio to be heard. In this scenario, existing operation for upgrading an association to affiliation is followed. The home zone tracks only affiliations (for example, an interzone association is processed as an affiliation in the home zone). Because an affiliation between the two zones exists, the home zones are not involved in the upgrade request. An association for a conventional channel resource between zones is treated as an affiliation.

3.5.1.5.3
Downgrading an Affiliation to Association

An MCC 7500/7100 Dispatch Console position is affiliated to a conventional channel that is home to a different zone. The MCC 7500/7100 Dispatch Console downgrades the affiliation to an association. In this scenario, existing operation for downgrading an affiliation to association is followed. The home zone tracks only affiliations (for example, an interzone association is processed as an affiliation in the home zone). Because an affiliation between the two zones exists, the home zone is not involved in the downgrade request. An association for a conventional channel resource between zones is treated as an affiliation.

3.5.1.5.4
Interzone Console De-association

An MCC 7500/7100 Dispatch Console in a serving zone is associated to a conventional channel home to a different zone, and no other interzone affiliation exists between the two zones for the channel resource. When the MCC 7500/7100 Dispatch Console determines the association to the conventional channel is no longer needed, the MCC 7500/7100 Dispatch Console notifies the serving zone controller of its intent to de-associate.

The home zone of a conventional channel monitors if an affiliation exists with another zone for a conventional channel resource in its zone. In this scenario, because no other affiliation exists between the two zones for the conventional channel resource, the home zone is notified of the de-association/de-affiliation. The notification prevents the home zone from routing control and voice packets back to the serving zone once completed.

The serving zones follow existing operation in which a single message is used for tracking de-association and de-affiliation. The serving zone tracks whether the original request for the conventional channel was for an association or affiliation. The tracking is dependent on whether the association flag is set or not set in the affiliation request message.

3.5.1.6
Interzone Conventional Channel Access Failure

A console operator initiates a request to access a conventional channel located in a different zone. The request may be an affiliation, Push-to-Talk (PTT) request, supplementary data message, station control, or patch request.

The request may be denied in the home zone for several reasons such as:

- Conventional channel is out-of-service
- Conventional channel is busy with a higher priority transmission
- Conventional Channel Gateway (CCGW) rejects the station control command
- Line Operated Busy Light (LOBL) transmission taking place
- Conventional channel is not the active channel of a main alternate pair

An Inbound Signaling Word (ISW) reject is sent to the originating console and the console operator is informed of the access denial.

3.5.1.7
Interzone Console Out-of-Service Handling

Conventional Interzone extends the following capabilities and allows delivery of Console Out-of-Service Handling across zones.

3.5.1.7.1
Normal Interzone Console Out-of-Service Handling

In a normal scenario, when the console application goes out-of-service because a dispatch console operator no longer needs a channel resource, or the dispatch console operator logs out of the console application, the zone (serving) in which the console is located takes the following interzone conventional related actions. The console may be using resources in the same zone as the console (previous release functionality), the resources may be in different zones, or a combination of the two. See MCC 7500/7100 Dispatch Console Control Paths and Affiliation on page 65 for details.

- Performs interzone end-of-call treatment if the out-of-service console was transmitting on a conventional channel in another zone.

- Unreserves any conventional channels in other zones that are patch reserved by the out-of-service console.
- Sends interzone de-affiliations/de-associations for conventional channels in other zones that have no other consoles in this zone affiliated to them.
- The zone controller ends any active channel markers owned by the out-of-service console operator.

For normal operation, the interzone console out-of-service handling operation is similar to previous release operation and follows existing algorithms in both the console and zone (serving) controller. The console sends the conventional console application out-of-service message to its serving zone controller when the console receives a de-affilation acknowledgement from the console serving zone controller.

3.5.1.7.2
Interzone Console Out-of-Service Handling For a Console Shutdown Exception

In this scenario, a console application is shut down before a channel access failure (could be performed see Interzone Conventional Channel Access Failure on page 129). When an ungraceful shutdown occurs, the console follows existing previous release operation and notifies its serving zone controller that it is out-of-service. The serving zone controller performs the steps mentioned in Normal Interzone Console Out-of-Service Handling on page 129 if necessary for any conventional channel that the console was affiliated to.

3.5.2
Analog Conventional Call Processing

Analog Conventional calls use the Conventional Channel Gateway (CCGW), zone controller, and the MCC 7500/7100 Dispatch Console to perform call processing in the system. When the MCC 7500/7100 Dispatch Console successfully affiliates with the channel, the zone controller routes radio, Line Operated Busy Light (LOBL), and console transmissions between the CCGW and the MCC 7500/7100 Dispatch Consoles. All analog conventional calls are controlled intrazone (or interzone in M3 zone cores) in the system. The system creates an active control path between the zone controller and the CCGW to enable analog conventional calls. The zone controller assigns a unique identifying number to the call just as it does with trunked calls, ensuring that all calls (trunked and conventional) are identifiable in the system.

3.5.2.1
Inbound Call Detection and Processing at the Conventional Channel Gateway

Transmission indications from the conventional channel (that is, from subscriber units) are detected through one of the following:

- Voice Activity Detection (VOX)
- Carrier Operated Relay (COR)

Detection through COR requires the E-lead ("ear" lead) of the Ear and Mouth (E&M) module. Detection through VOX does not require the E-lead.

The figures show detection through VOX and detection through COR.

Figure 6: Call Detection by VOX

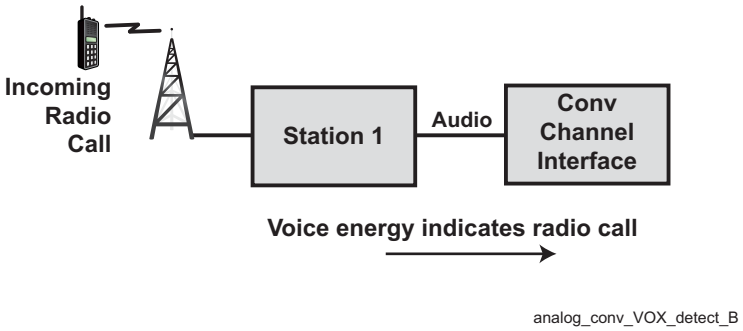


Figure 7: Call Detection by COR

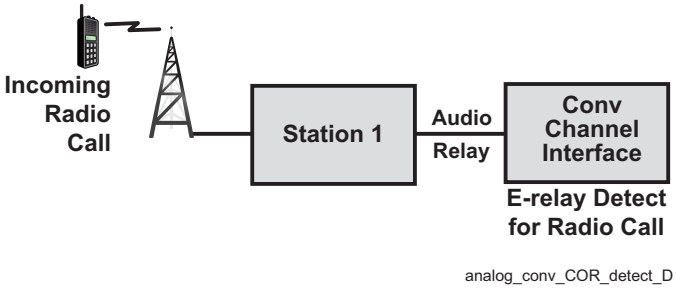


Figure 8: Inbound Call Processing Process at the Conventional Channel Gateway

This figure shows the call processing process for conventional transmissions that are inbound to the Conventional Channel Gateway (CCGW).

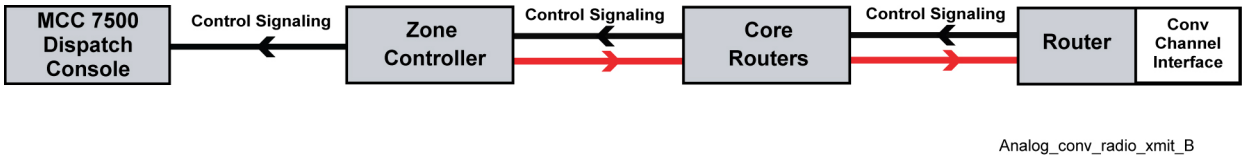
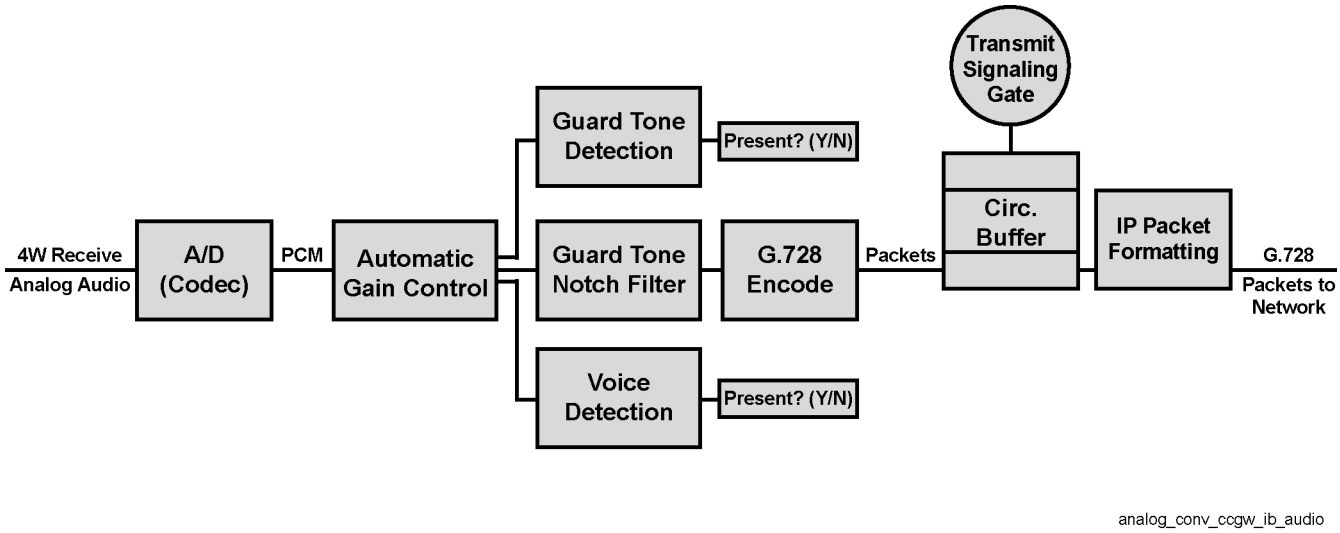


Figure 9: Inbound Call Processing Procedure at the Conventional Channel Gateway

This figure shows the call processing procedure for conventional transmissions that are inbound to the CCGW.



When a subscriber unit keys up, the conventional subscriber audio may be repeated over the RF interface by the conventional base station (in the absence of MCC 7500/7100 or non-MCC 7500/7100 Dispatch Console audio). The default wireline priority in the conventional base station is set such that if a transmission is present on the wireline from the CCGW, the station repeats the audio received on the wireline over the RF interface. If the conventional base station is receive-only, no audio is repeated/ transmitted.

Call detection signifies the beginning of a conventional subscriber transmission.

With COR, the detection of the call is triggered by closing of the E-lead relay. The Hardware Interface Type parameter defines the enhanced conventional channel gateway hardware interface type for its COR input. The enhanced conventional channel gateway detects the closing of the E-Lead relay in the shortest time when the Hardware Interface Type parameter is set to Current Detection Interface (default) or Voltage Detection Interface. When the enhanced conventional channel gateway is a long distance from the source of the E-lead signal, configuring the Hardware Interface Type to Distance Input Buffer results in the enhanced conventional channel gateway using a transformer-coupled detection circuit to ensure the correct state of the E-lead signal is detected.

With VOX, the presence of voice on an associated 2W or 4W interface triggers call detection. The CCGW continuously buffers linear Pulse Code Modulation audio packets obtained through A/D conversion of analog signal received over the analog interface to the conventional base station to detect the presence of voice. A simplified VOX scheme or activity detection is used by the CCGW whereby a 2W or 4W interface is considered to have voice present when analog signal on the interface exceeds the configured value of the signal threshold.

The detection at the CCGW of the analog signal from the station (either by COR or by VOX) is followed by signaling with the zone controller to request the resources to route audio in the system. When the zone controller grants the request, the packetized audio is forwarded on the network to the monitoring dispatch console or consoles affiliated to the channel.

3.5.2.2
Outbound Call Processing at the Conventional Channel Gateway

Transmission indications to the conventional channel (that is, from consoles) are initiated through any of the following:

- Tone Remote Control (TRC)
- Ear and Mouth (E&M)
- Both TRC and E&M

Station keying through E&M requires the M-lead ("mouth" lead) of the E&M module. Station keying through TRC do not require the M-lead.

Figure 10: Outbound Call Processing Process at the Conventional Channel Gateway

This figure shows the call processing process for conventional transmissions that are outbound from the Conventional Channel Gateway (CCGW).

Analog_conv_console_xmit_B

Figure 11: Station Control Command Process at the Conventional Channel Gateway

This figure shows the process for transmissions of station control commands that are outbound from the CCGW.

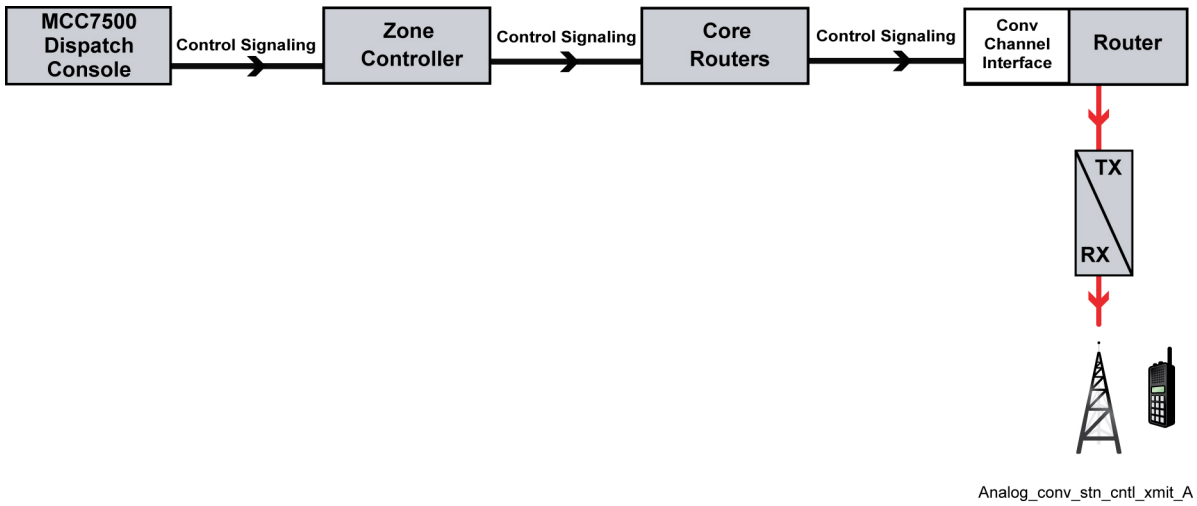
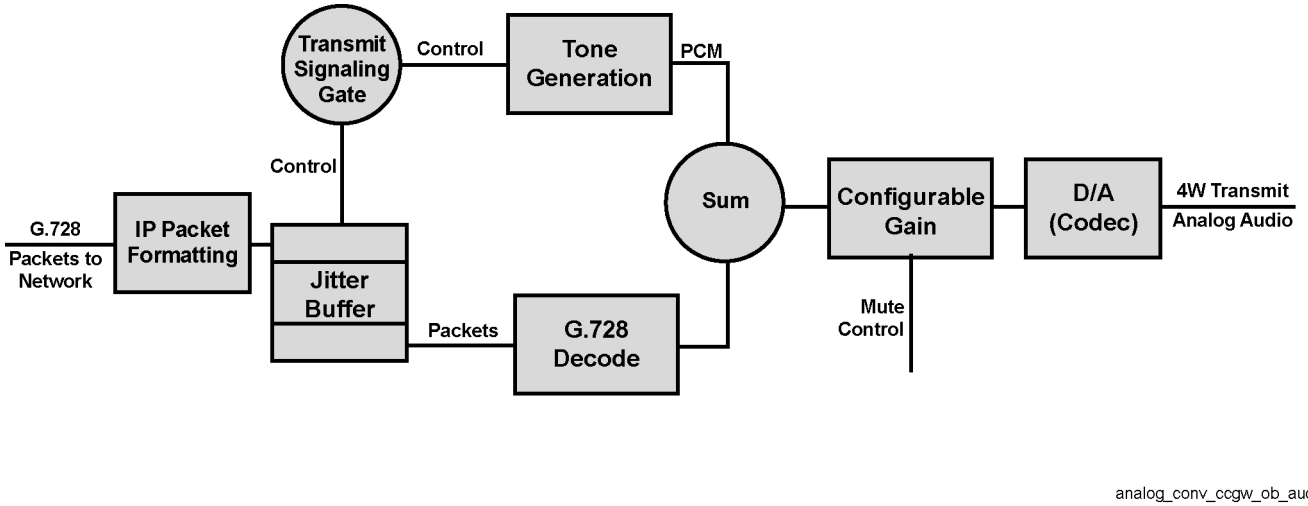


Figure 12: Outbound Call Processing Procedure at the Conventional Channel Gateway

This figure shows the call processing procedure for conventional transmissions that are outbound from the CCGW.



When a dispatch console receives an indication from an operator to initiate a conventional transmission, the console requests setup of the conventional call to the controller. The controller performs required processing to set up the call, and after determining that the transmission can proceed, informs all console sites with affiliated dispatch consoles and the CCGW associated with the conventional channel.

The CCGW, on receiving the grant from the controller, keys the conventional base station and begins forwarding analog audio to the conventional base station. The CCGW keys the station either by tone sequences or by the closing of the M-lead relay. Encoded audio received from the console is converted to analog audio, transmitted to the conventional base station. The conventional base station in turn transmits the audio over the RF interface.

On detecting the Push-to-Talk (PTT) release from the operator, the console informs the controller. The controller terminates the call and communicates termination of the call to the involved dispatch consoles and the CCGW. The CCGW in turn de-keys the station.

3.5.2.3
MDC 1200 Call Processing

For MDC 1200-capable channels, analog radio transmissions can be configured in the radio to transmit the unit ID of the radio as a separate signaling packet which can either precede (Leading Push-to-Talk (PTT) ID) or follow (Trailing PTT ID) the analog voice transmission, or both. If the radio sends the Leading PTT-ID, the ID and alias appears on the console at the beginning of the voice transmission. If the radio sends the PTT-ID after the user de-keys the radio, the ID and alias do not appear until after all audio is sent to the console speakers.

In the Trailing PTT-ID case, while the audio is playing out for the inbound call, the MCC 7500/7100 Dispatch Console displays "Unknown" on the console GUI until the console receives indication at the end of the call containing the radio Unit ID. At this time, the console displays the radio ID and alias (if configured).

For MDC 1200 radios, the radio unit ID is only available if the Leading or Trailing PTT-ID has been enabled in the radio codeplug. Similar to the digital radios, the MDC 1200 radio alias is available if it has been configured in the system.

Unlike digital radios, no concept of sending the unit ID and alias to the console after the audio starts playing is available. The radio unit ID is either present at the start of the call (Leading PTT-ID) or is not available until the end of the call (Trailing PTT-ID). If the radio is configured for Trailing PTT-ID, the console displays "Unknown" to the console operator until the ID and alias is available.

For MDC 1200-capable channels, when a Channel Marker tone is sent, if the controlling console position is configured to send its PTT-ID for outbound transmissions, the PTT-ID is not transmitted with the tone.

3.5.2.4
Logging of Conventional Audio and Events

Both console and radio source audio can be recorded and played back later. The call information is also logged, so information such as the source and mode of the call is available. Signaling messages such as Call Alert and Emergency Alarm are also logged.

The Logging Server, Archiving Interface Server (AIS), affiliates with conventional channels similarly to console operator positions. Calls and signaling messages are forwarded to the AIS. The AIS forwards the audio, call information, and signaling messages to your logging device. If the AIS is configured to decrypt secure calls, the audio is decrypted before being sent on to the logging device.

Audio associated with the monitor is logged, but appears as audio from normal radio voice call. When the station is in monitor mode, it does not validate the Network Access Code, so the call may be from a different system radio.

3.5.3
Digital Conventional Call Processing

ASTRO® 25 Conventional calls use the Mobile Subscriber (MS), Conventional Channel Gateway (CCGW), controller, and the MCC 7500/7100 Dispatch Console to perform call processing in the system. When the MCC 7500/7100 Dispatch Console successfully affiliates with the channel, the controller routes radio and console transmissions between the CCGW and the MCC 7500/7100 Dispatch Consoles. All digital Conventional calls are controlled intrazone (or interzone in M3 zone cores) in the system. When operating in site conventional mode, the conventional site controller performs the functions of the controller.

3.5.3.1

ASTRO 25 Conventional Call Inbound and Outbound

For an ASTRO® 25 conventional call, call control flows between relevant network elements within the infrastructure. These network elements include the Conventional Channel Gateway (CCGW), zone controller (or conventional site controller), and MCC 7500/7100 Dispatch Console. When a subscriber uses Push-to-Talk (PTT) on an ASTRO® 25 conventional channel, the conventional base station senses the presence of a carrier at the receiver. Embedded with the digital audio is a stream of control information about the call. If the call matches the programmed station call qualifiers (or the station is in monitor mode with less selective qualifiers), and the station has an active link to a CCGW or comparator, the audio and embedded call control information is sent up the link. Similarly, when a digital call is made by a console, and the CCGW has an active link with a station or comparator, the CCGW first sends a channel selection command followed immediately by digital audio and call control information to the station or comparator for transmission on the selected frequency.

When a CCGW detects digital audio from a station, receiver, or comparator, it immediately initiates the call setup request with the controller. The controller informs all MCC 7500/7100 Dispatch Console sites with MCC 7500/7100 Dispatch Consoles affiliated to the conventional channel. As more audio and call control information is received over the first few hundred milliseconds of the transmission, the CCGW transmits updated call information to the controller to update displays and call logging with complete information.

For outbound transmissions, the CCGW receives a call setup from the controller and call control information and digital audio sourced from the console, and sends this information to the station or comparator.

After detecting the digital audio has stopped from a station, receiver, or comparator, the CCGW informs the controller. The controller terminates the call (after the truncation delay time is elapsed) and communicates the end of the conventional call to the involved MCC 7500/7100 Dispatch Consoles and the CCGW. When a console stops sourcing audio, the CCGW stops supplying digital audio to the station or comparator and the call ends. Silence is not generated. If enough bandwidth is not available at a given MCC 7500/7100 Dispatch Console site, the radio call goes on without the dispatch console site. An indication is given to the dispatch console user that the call occurred with no audio.

3.5.3.2

Conventional PTT ID and Alias Display

The Push-to-Talk (PTT) ID feature enables a radio unit ID to be displayed on the console or to other subscriber radios on a channel. The unit ID is displayed as a result of a radio voice transmission or inbound signaling message such as an emergency alarm or call alert.

The PTT ID feature allows the console operator to identify the transmitting radio and provides a means for logging statistics relating to radio activities.

In conjunction with the PTT ID feature, the Alias Display feature enables a radio unit ID to be mapped to an alias (or name associated with the radio unit ID) as defined by the system operator. The alias display provides a more meaningful identification of the radio unit ID for the console operator.

A digital radio transmission carries information including the radio unit ID which is decoded by the Conventional Channel Gateway (CCGW) and sent to consoles through control messages. With support from the zone controller, any alias associated with the radio unit ID is included with the control message. The console position and console logging subsystem can receive the radio unit ID and alias for display at the console or for logging by the logging subsystem, depending on how the system is configured.

If the subscriber radio sends in a PTT-ID that contains a Unit ID, but does not have an associated alias, the MCC 7500 Dispatch Console displays `Undefined` for the alias of that radio. In some instances on digital and mixed-mode channels, the MCC 7500 Dispatch Console display may show a unit ID and alias as `Unknown` if the CCGW is unable to decode the call control information from the

inbound voice stream. This display can also appear on MDC 1200 channels and happens for all calls on an analog channel.

As the CCGW decodes more call information, it provides this information to the MCC 7500/7100 Dispatch Console for displaying on the console GUI. An Unknown alias is also displayed when a subscriber radio makes an analog call on a mixed mode channel.

3.5.3.2.1
Conventional PTT ID and Alias Display Characteristics

Because it is sent by the radio, the radio unit Push-to-Talk (PTT) ID is always sent with digital transmission, but a radio unit ID alias is available when configured for the radio in the system.

The radio unit ID and alias are sent over the control plane when the voice call payload is sent over the audio plane.

The Conventional Channel Gateway immediately starts sending audio and the initial call control to the console, and complete call control information is sent to the console when it becomes available. Therefore, the console starts playing audio and the unit ID and alias is display approximately 500 ms later. When operating in site conventional mode, alias display is not fully supported. The console continues to display aliases cached by the console triggered on previous inbound calls when in wide mode.

3.5.3.2.2
Unknown ID/Alias Display (Digital Conventional Channels)

The MCC 7500/7100 Dispatch Console interprets any voice activity detected by a base radio, repeater, or comparator as channel activity and notifies the user of the activity. This application may be different than how other consoles indicate activity. Specific squelch features, such as selective call, are supported on the base radio, repeater, and comparator; however, the MCC 7500/7100 Dispatch Console has no channel-wide general squelch mechanism. As a result, calls with low signal strength or high interference can be detected, but call control information (such as source IDs) may not be recoverable due to excessive errors in the signal.

The source IDs for these calls may be displayed on the MCC 7500/7100 Dispatch Console as Unknown or, rarely, as a random source ID. In addition, the type of call (group or selective), destination ID, secure mode, and other control information may be in error for as long as the call experiences a high error rate. In cases such as these, the MCC 7500/7100 Dispatch Console:

- Interprets the calls as group calls and routes any decodable audio as a normal group call. However, if the error rate of the call is high enough to make the source ID unrecoverable, the audio itself is most often not decodable or is noise.
- Indicates that the call is non-encrypted on the channel resource display but attempts secure call decoding on the call, so if any audio was encrypted, it is heard.

After the error rate of a call is reduced (signal strength improves or interference is removed), call information is updated on the channel resource display, and the call is reflected as a new Push-to-Talk (PTT) in the PTT log.

If a call starts with recoverable call control information and signal strength decreases or interference is introduced to the extent that the audio becomes undecodable, the channel resource display continues to display the call with its initial good control information until the call is no longer detected by the base radio, repeater, or comparator. If the base radio, repeater, or comparator detects the call again, it is treated as a new call.

In normal operation, Unknowns (calls with source ID Unknown) displayed on the console for a particular channel should be calls that start with undetectable call control information. This situation is caused by RF conditions or data integrity issues between the RF equipment and the Conventional Channel Gateway (CCGW). The CCGW supports an inbound call unknown start count that reports the number of times calls start with undetectable call control information for a particular channel. You can

compare this count to the number of Unknowns displayed on the MCC 7500/7100 Dispatch Console for the same channel to determine whether the Unknown status is being displayed appropriately and under the right conditions. See Conventional Channel Gateway Inbound Call Unknown Start Count (Digital Conventional Channels) on page 137.

NOTICE: An Unknown displayed on the console may also be caused by site link failures not measured by the CCGW and, at a low level, by normal network congestion.

3.5.3.2.3

Conventional Channel Gateway Inbound Call Unknown Start Count (Digital Conventional Channels)

For calls with low signal strength or high interference, call control information may not be recoverable due to excessive errors in the signal. The source IDs for these calls may be displayed on the MCC 7500/7100 Dispatch Console channel resource display as Unknown or, rarely, as a random source ID. In addition, the type of call (group or selective), destination ID, secure mode, and other control information may be in error for as long as the call experiences a high error rate. On V.24 digital conventional channels, IP conventional channels, and mixed mode channels with digital calls, the Conventional Channel Gateway counts the number of calls per channel that start with undetectable call control information. This count is called the inbound call unknown start count.

Inbound analog voice calls received on mixed mode channels are also displayed with source ID Unknown on the MCC 7500/7100 Dispatch Console channel resource display and are included in the inbound call unknown start count. IP conventional and mixed mode channels are supported only on the GGM 8000 gateway. The MNR S2500 does not support IP conventional or mixed mode channels.

Comparing the CCGW Inbound Call Unknown Start Count to Console Unknowns (Digital Conventional Channels) on page 137 describes how to compare the inbound call Unknown start count to the number of Unknowns on the MCC 7500/7100 Dispatch Console.

3.5.3.2.4

Comparing the CCGW Inbound Call Unknown Start Count to Console Unknowns (Digital Conventional Channels)

This procedure compares the Unknowns displayed on the MCC 7500/7100 Dispatch Console to the inbound call unknown start count on a Conventional Channel Gateway (CCGW) (MNR S2500 router or GGM 8000 gateway).

Prerequisites:

CAUTION: Consult a Motorola Solutions field service engineer before performing the following procedure. The procedure was developed for system fine-tuning and troubleshooting purposes only and should not be performed as a part of normal system operation.

When following the procedure, consider the following:

- The inbound call Unknown start count does not wrap and may be high if it has not been reset recently, so flush the counts before beginning the data collection.
- Mixed mode and IP conventional channels are supported only on the GGM 8000 gateway; the MNR S2500 router supports only V.24 digital channels.
- In a properly installed system, statistically accurate data requires days of data collection at average call rates. Heavily used channels require hours to days of data collection; lightly used channels require weeks of data collection.

Procedure:

1 From the MNR S2500 router or GGM 8000 gateway command-line interface, issue the following command to reset the inbound call Unknown start count for the channel in question: `FLush ! c<channel_ID>-CCGW UnkCallStartCnt`

Where ***<channel_ID>*** is the channel identifier (1-4 for V.24 digital or mixed mode channels; 21-30 for IP conventional channels) of the channel for which you want to view the inbound call unknown start count. If you do not know the channel identifier for a channel, issue the `SHow -CCGW ChID` command to display a list of channel identifiers for all conventional channels configured on the device.

For example:

- To reset the inbound call Unknown start count for V.24 digital conventional channel 2, enter the following command: `FLush !c2 -CCGW UnkCallStartCnt`
- To reset the inbound call Unknown start count for IP conventional channel 23, enter the following command: `FLush !c23 -CCGW UnkCallStartCnt`

2. Allow time for data collection, then issue the following command to view the inbound call uUnknown start count for the channel in question: `SHow !c`***<channel_ID>***`-CCGW UnkCallStartCnt`

   The “where” definition from step 1 applies to this step.
3. Compare the inbound call Unknown start count to the number of Unknowns displayed on the MCC 7500/7100 Dispatch Console since the inbound call unknown start count was reset.
4. If necessary, repeat through for any other channels you wish to investigate.

3.5.3.2.5
Unknown ID/Alias Display (MDC 1200 Conventional Channels)

Unlike with digital call processing, the source ID for an MDC 1200 voice call is not always present at the MDC 1200 channel. When a source ID is present, it may be included either at the beginning or the end of the call, depending on the subscriber configuration.

In certain situations, the source ID may be legitimately displayed as `Unknown` on the MCC 7500/7100 Dispatch Console channel resource display; however, in other situations, the console Unknown is the result of an error in detecting the correct source ID.

The following conditions result in an Unknown source ID on the MCC 7500/7100 Dispatch Console:

- The source ID for any MDC 1200 voice call with a trailing source ID is displayed as `Unknown`. After dekeying, the source ID is displayed on the console as a separate event in the PTT log.
- The source ID for an MDC 1200 voice call with leading source IDs is typically displayed on the MCC 7500/7100 Dispatch Console channel resource display as an alias or a source ID. However, poor signal conditions or interruption of the call during transmission of the leading source ID may result in the source ID being displayed as `Unknown`.
- The source ID for an analog-only call is unavailable on an MDC 1200 channel and therefore is displayed as `Unknown`.
- The source ID for an MDC 1200 voice call with a Line Operated Busy Light (LOBL) signal is unavailable and therefore is displayed as `Unknown`.

An `Unknown` displayed on the console may also be caused by site link failures not measured by the GGM 8000 gateway and, at a low level, by normal network congestion.

The Conventional Channel Gateway supports inbound call start event statistics per MDC 1200 channel that may help you to characterize why an Unknown" source ID is displayed on the MCC 7500/7100 Dispatch Console. You can compare these counts to the number of Unknowns displayed on the MCC 7500/7100 Dispatch Console for the same channel to determine whether the Unknown status is being displayed appropriately and under the right conditions. See Comparing The CCGW Inbound Call Start Event Counts To Console Unknowns (MDC 1200 Conventional Channels) on page 139.

3.5.3.2.6

Conventional Channel Gateway MDC 1200 Inbound Call Start Event Counts

The GGM 8000 **SHow -CCGW StatisticsCM** display reports the following inbound call start event counts per MDC 1200 channel:

LOBL CallStart Cnt
The number of calls for which a Line Operated Busy Light (LOBL) signal was detected.

UnkID CallStart Cnt
The number of calls for which no source ID was detected.

Decode Error Cnt
The number of MDC 1200 signaling decode errors. This count includes the number of calls for which MDC 1200 signaling was detected but the signaling was undecodable plus the number of undecodable supplementary signaling messages.

MDC 1200 channels are supported only on the GGM 8000 gateway. The MNR S2500 does not support MDC 1200 channels.

Unknown ID/Alias Display (Digital Conventional Channels) on page 136 describes how to compare the inbound call start event counts to the number of Unknowns on the MCC 7500/7100 Dispatch Console.

3.5.3.2.7

Comparing The CCGW Inbound Call Start Event Counts To Console Unknowns (MDC 1200 Conventional Channels)

Perform this procedure to compare the Unknowns displayed on the MCC 7500/7100 Dispatch Console to the MDC 1200 inbound call event counts on a Conventional Channel Gateway (CCGW).

Prerequisites:

CAUTION: Consult a Motorola Solutions field service engineer before performing the following procedure. The procedure was developed for system fine-tuning and troubleshooting purposes only and should not be performed as a part of normal system operation.

Consider the following:

- The inbound call event counts may be high if they have not been reset recently, so flush the counts before beginning the data collection.
- In a properly installed system, statistically accurate data requires days of data collection at average call rates. Heavily used channels require hours to days of data collection; lightly used channels require weeks of data collection.

Procedure:

1. From the GGM 8000 gateway command-line interface, issue the following command to reset the call manager statistics: `FLush -CCGW StatisticsCM`
2. Allow time for data collection, then issue the following command to view the call manager statistics: `SHow -CCGW StatisticsCM`
3. The MDC 1200 inbound call event counts are listed at the end of the call manager statistics display, in a format like the following:

```
INBOUND CALL EVENTS
LOBL CallStart Cnt0 0 0 0
UnkID CallStart Cnt0 0 0 0
Decode Error Cnt0 0 0 0
```

NOTICE: The four columns provide the counts for channel IDs 1, 2, 3, and 4, respectively.

4 Compare the inbound call event counts on the channel you are investigating to the number of Unknowns displayed on the MCC 7500/7100 Dispatch Console for that channel since the call manager statistics were reset.

- A high **LOBL CallStart Cnt** may indicate an unusually high number of calls with a Line Operated Busy Light (LOBL) signal.
- A high **UnkID CallStart Cnt** or **Decode Error Cnt** may indicate analog calls without MDC 1200 signaling; trailing MDC 1200 calls; RF site problems that are reducing coverage or signal strength; or unexpected interference on the channel.

NOTICE: The **Decode Error Cnt** statistic counts both MDC 1200 voice calls for which MDC 1200 signaling was detected but the Push-to-Talk (PTT) ID failed to decode and undecodable supplementary signaling messages. MDC 1200 voice calls for which the PTT ID fails to decode are logged as Unknowns on the MCC 7500/7100 Dispatch Console. Undecodable supplementary signaling messages, on the other hand, are not logged on the console since they are not passed up to the zone core by the Conventional Channel Gateway. Consider this situation when you are comparing the **Decode Error Cnt** with the console Unknowns. The MCC 7500/7100 Dispatch Console logs an Unknown for each voice call initiated by a radio subscriber that does not have PTT ID enabled. However, these calls are not included in the **Decode Error Cnt** because the radio transmits no MDC 1200 signaling in these cases.

3.5.4
Conventional Mixed Mode Operation

Conventional mixed mode channels use the physical interfaces between the station and the Conventional Channel Gateway (CCGW) to provide the correct signaling and audio formats for analog and digital mode calls. Analog voice uses the analog voice interface (analog over 4-Wire) and digital voice uses the digital voice interface (Improved Multi-Band Encoder (IMBE)/Advanced Multi Band Excitation (AMBE) over V.24).

The CCGW is responsible for assigning the correct signaling interface to the channel request; either V.24 for digital conventional (combining the audio and call control), or V.24 to support digital call control and 4-Wire interface for analog audio when using analog mode on a conventional mixed mode channel.

3.5.4.1
Incoming Analog Mixed Mode Call Processing

Mixed mode operation depends on the GTR 8000 Base Radio and QUANTAR® sending the Conventional Channel Gateway (CCGW) an indication that this call is an analog call that has a digital call control component. The analog transmission from the radio is sent to the CCGW at the same time that an analog start of call message is sent on the V.24 digital interface. The CCGW verifies that configuration of the channel is mixed mode and is responsible for converting the analog voice so the ASTRO® 25 infrastructure and console can handle it.

When the CCGW receives the analog start of call message, the station removes the Analog Link Monitor Tone (ALMT) (if configured on the channel from the side of the 4-Wire interface used to receive analog audio (the GTR 8000 Base Radio and the QUANTAR® removes the ALMT from the transmit side before sending audio).

IMPORTANT: When using the MLC 8000 to support mixed mode voting systems, ALMT is used only at the 4-Wire interface between the base radio and the MLC 8000 Link Converter. The ALMT option at the CCGW must be disabled when used with the MLC 8000 mixed mode channels.

3.5.4.2
Outgoing Analog Mixed Mode Call Processing

In Outgoing Mixed Mode operation, the console can select a conventional mixed mode channel using the Analog Transmission Mode. When the Conventional Channel Gateway (CCGW) receives a call start message, it translates the audio it receives to analog. The CCGW removes the Analog Link Monitor Tone (ALMT) (if configured) from the transmit side of the mixed mode channel before sending any audio over the 4-wire interface.

When the console ends the call, the messaging follows similarly to the call start and culminates in the channel returning to idle and the ALMT (if configured) is again started on the transmit paths.

3.5.4.3
Conventional Mixed Mode Simulcast

Conventional Mixed Mode Simulcast operation provides a simulcast infrastructure solution that can support both analog and digital calls. See Conventional Mixed Mode Simulcast Operation on page 170 for details.

3.5.5
Secure Voice Communications

Secure voice communication for ASTRO® 25 conventional calls is accomplished through audio encryption. Secure voice allows radios or consoles on properly equipped systems to transmit and receive digitally protected (encrypted) audio using either a standard or proprietary encryption algorithm and a Common Key Reference (CKR).

NOTICE: These CKRs can be the same CKRs used for conventional IV&D.

A CKR is a number-key identifier created by the encryption key management system which is paired with an encryption algorithm. Consoles and subscriber units use the CKR to enable secure mode communication between subscriber radios and between subscribers and consoles. When a secure call is made, the appropriate key is selected for the transmission of the call.

For secure voice communication on a conventional channel resource, a default CKR is established each conventional channel resources.

The Provisioning Manager can configure lists of CKRs to support encryption and decryption for secure communication on conventional resources to map CKRs to conventional channels. See RF Site objects \Conventional menu\(Common Key Reference in the *Provisioning Manager* manual).

For more information, see Advanced SECURENET on page 287.

For details about secure communication for conventional calls, see the *Provisioning Manager*, *Configuration Manager for Conventional Systems User Guide*, *Key Management Facility User Guide*, and *Secure Communications Feature Guide* manuals.

3.5.5.1
AutoKey Select

A dispatch console operator may manually select Common Key References (CKRs) from a list of CKRs for transmission on a channel or use the AutoKey Select feature to transmit using the last received encryption key on a channel.

The encryption key provided by AutoKey Select is persistent and changes only after reception of a different encryption key. If no calls have been received before transmission and AutoKey Select is invoked, the channel default CKR is used to transmit. For secure conventional calls, the Archiving Interface Server (AIS) performs an Autokey Receive using any CKR provisioned in its crypto module.

3.5.5.2
Key and Keyset Selection

A keyset is a collection of encryption keys. The ASTRO® 25 system supports two keysets, an active keyset and an inactive keyset. Both the active keyset and the inactive keyset allow you to activate a group of keys as a single entity so that you can change from one keyset to another without disrupting communications. During the changeover, radio users can receive on either active or inactive keys. The radio responds on the active key.

The Over-the-Ethernet Key Management (OTEK) feature provides the ability to distribute encryption keys to MCC 7500/7100 Dispatch Consoles or Archiving Interface Servers (AISs). This feature is designed to work with an ASTRO® 25 trunked or digital conventional system. OTEK supports end-to-end encryption by enabling remote, centralized key management and re-keying of dispatch consoles and the AIS over the network using the Key Management Facility (KMF).

After encryption key distribution is complete, the KMF displays confirmation and a keyset changeover can be initiated. During the changeover period, radio users can receive on either active or inactive keys. The radio responds on the active key. When the keyset changeover is completed, the KMF instructs the consoles and/or AIS servers to activate the previously inactive keyset and the new keys become currently active.

Several methods can be used to activate the active keyset and the inactive keyset including either operator selection, Key Variable Loader (KVL) command, or an over-the-air command from the KMF. For systems that have both conventional channel and trunked channel users, changeover is coordinated between the conventional and trunked sides of the radio. Whatever keyset is active on one side must also be active on the other side. Therefore, any key changeover applies to both modes. The radio, MCC 7500/7100 Dispatch Console, Radio Network Controller (RNC), and Digital Interface Unit (DIU) support keyset changeover using the KVL user interface. The radio and DIU also support keyset changeover using its keypad. The MCC 7500/7100 Dispatch Console supports a keyset changeover using the Elite Admin. CRYPTR 2 products, such as the PDEG Encryption Unit, also support manual keyset changeover.

A parameter in the Elite Dispatch software can be set to enable a console operator to change the active keyset. After enabled, a console operator can use the Elite Admin software to change to a different keyset by selecting the desired keyset from a drop-down list box.

3.5.5.3
Momentary Override

The Momentary Override feature provides a quick way for a console operator to perform a secure transmission on selected channel resources using a specified secure key without permanently changing the transmit settings of the channel resource.

From the console position, the **Momentary Override** option provides the operator the ability to quickly but temporarily override the current transmission mode (clear or secure) and the currently selected encryption key of a channel resource. Momentary override also overrides the default encryption key selected for secure transmission on a channel. At the end of the transmission, the dispatch position automatically reverts to the previously existing channel configuration.

The Console User Profile Momentary Override capability allows the console user to select a key from a list of Common Key References (CKRs) where the key is used for transmissions when Momentary Override is activated at the console. See “Console Objects\Dispatch System menu\Console User Capabilities Profile” in the *Provisioning Manager* manual.

3.5.5.4
Momentary Override AutoKey

The Momentary Override AutoKey is used to enable an auto key operational mode for Momentary Override where the key is selected automatically based on the last received secure calls encryption

key. Momentary Override AutoKey provides the same capabilities of AutoKey Select through a Momentary Override selection.

When AutoKey is chosen as the Momentary Override Key, coded transmissions from a console use the last Secure Key received from a coded transmission on that resource. The system administrator specifies Auto-key.

3.5.5.5
Other Secure Voice Communication Features

See Advanced SECURENET on page 287 for additional Secure Voice Communication features.

3.5.6
ACIM Conventional Channel

This section describes the ASTRO® 25 Control Interface Module (ACIM) Conventional Channel. See the “ACIM Interface on GGM 8000” section in the *GGM 8000 System Gateway* manual.

3.5.6.1
ACIM Channel Architecture

The ASTRO® 25 Control Interface Module (ACIM) conventional channel enables connection of the Motorola Solutions consolette (APX 7500 Multi-Band or ASTRO® 25 Digital XTL 5000) to the Conventional Channel Gateway (CCGW) via the ACIM link prior releases protocol interface, enabling an exchange of control information between an MCC 7500/7100 Dispatch Console and a Solutions Motorola consolette. It is used for two reasons:

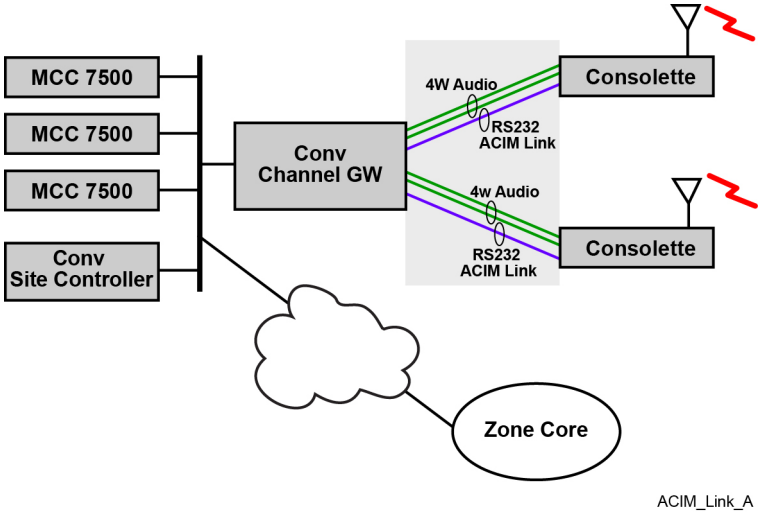
- The consolette can provide communications to the console if the zone core is not available (for example, due to a link failure).
- The consolette can provide wireless access to systems utilizing a variety of over-the-air protocols (Analog Conventional, ASTRO® 3.1 Conventional, MDC1200 Conventional, SmartZone® / SMARTNET®, SmartZone ASTRO® 25 Trunking, and ASTRO® 25).

The Motorola Solutions consolette can either transmit or receive at any given time since the transceiver on the consolette is not full-duplex. The consolette is connected to the CCGW with V.24 (RS-232) and 4-wire connectors, constituting an ACIM interface.

NOTICE: The ACIM interface uses asynchronous V.24 over the RS-232 connection.

The CCGW must be a GGM 8000 equipped with V.24 ports. The S2500 does not support ACIM conventional channel.

Figure 13: ACIM Conventional Channel



The ACIM conventional channel is supported on the following Motorola Solutions consolettes:

- APX™ 7500 Multi-Band consolette
- ASTRO® 25 Digital XTL 5000 consolette

IMPORTANT: The ACIM conventional channel for the MCC 7500/7100 Dispatch Console is certified only to operate with an APX or XTL consolette. Operation of a Digital Interface Unit (DIU) with the MCC 7500 ACIM conventional channel is not supported.

NOTICE: The XTL 5000 consolette operates on all the air interfaces with the exception of MDC 1200 Conventional air interface.

3.5.6.2 ACIM Consolette

The APX 7500 Multi-Band Motorola Solutions consolette and the ASTRO® 25 Digital XTL 5000 Consolette can connect to the MCC 7500 through the GGM 8000 Conventional Channel Gateway (CCGW). This capability provides the high tier set of features such as Console Initiated Calls, Subscriber Initiated Calls and Extended Messaging features such as Call Alert, Radio Disable/Enable, Remote Monitor, Status Query/Response, and Message Update. The Extended Messaging feature set is available only with the Motorola Solutions 7500 Consolette and not with the ASTRO® 25 Digital XTL 5000 Consolettes. The consolette connects to the GGM 8000 CCGW, using both the 4-wire interface for audio and the V.24 link interface for control messaging.

3.5.6.3 ACIM Channel Features

The channel using V.24 and 4-Wire interface between a Conventional Channel Gateway (CCGW) and the consolette is called an ASTRO® 25 Control Interface Module (ACIM) conventional channel. The infrastructure treats the ACIM conventional channels as if they were regular ASTRO® 25 conventional channels, except the audio is always vocoded with G.728, even when the over-the-air mode is digital or analog and clear or encrypted. The consolette, not the MCC 7500 /7100 Dispatch Console, handles encryption and decryption of encoded audio.

The operator can configure the ACIM channel in the Provisioning Manager in L core and M core, Configuration Manager in K core, in the same way any conventional channel is configured. The CCGW reports the status of the ACIM conventional channel to network management using the same method that it uses for ASTRO® 25 conventional channels.

See one of the following tables for a list of functions available to ACIM conventional channels, depending on which interface is used.

Table 7: Capabilities on Conventional Air Interfaces

Function	Analog Conventional		MDC Conventional		ASTRO® 25 Conventional	
	XTL	APX	XTL	APX	XTL	APX
Console Receive Analog Clear Call	✓	✓	✓	✓	✗	✗
Console Receive Digital Clear Call	✗	✗	✗	✗	✓	✓
Console Receive Digital Secure Call	✗	✗	✗	✗	✓	✓
Console Receive Analog (12 kb) Secure Call with Encryption Key	✓ 1	✓	✓ 1	✓	✗	✗
Console Receive Digital Secure Call with Encryption Key	✗	✗	✗	✗	✗	✓
Console Radio Unit ID display and Receive Individual Calls	✗	✗	✗	✗ 10	✗ 10	✗ 10
Console Radio Unit ID display for Receive Group Calls	✗	✗	✗	✓	✓	✓
Console Radio Unit ID display for Receive Emergency Calls	✗	✗	✗	✓	✓	✓
Console Transmit of Digital Clear Call	✗ 4	✗ 4	✗ 4	✗ 4	✓	✓
Console Transmit of Digital Secure Call	✗ 5	✗ 5	✗ 5	✗ 5	✓	✓
Console Transmit of Digital Secure Call with Encryption Key	✗	✗ 5	✗	✗ 5	✗	✓
Console Transmit of Analog (12 kb) Secure Call with Encryption Key	✗	✓	✗	✓	✗	✗
Console Transmit of Analog Clear Call	✓	✓	✓	✓	✗ 6	✗ 6
Console Initiated Monitor Select Command	✓	✓	✓	✓	✓	✓
Console Initiated Channel Select Command	✓	✓	✓	✓	✓	✓
Console Initiated Encryption Key Select Command	✗	✗	✗	✗ 2	✗	✗ 2
Console Initiated Individual Call Alert	✗	✗	✗	✓	✗	✓
Console Initiated Group Call Alert	✗	✗	✗	✗ 16	✗	✗ 16
Console Receive of Individual Call Alert targeting Console Unit ID	✗	✗	✗	✓ 17/21	✗	✓ 21
Console Acknowledge of Individual Call Alert targeting Console Unit ID	✗	✗	✗	✓ 7	✗	✓ 7
Console Receive of Individual Call Alert targeting consolette unit ID	✗	✗	✗	✓ 17/21	✓ 9	✓ 21

Table continued…

Function	Analog Conventional		MDC Conventional		ASTRO® 25 Conventional	
	XTL	APX	XTL	APX	XTL	APX
Console Acknowledge of Individual Call Alert targeting consolette unit ID	✗	✗	✗	✓ 8	✓ 8	✓ 8
Console Receive of Group Call Alert	✗	✗	✗	✗ 18	✗ 9	✗ 19
Console Receive of Emergency Alarm	✗	✗	✗	✓	✓	✓
Console Acknowledge of Emergency Alarm	✗	✗	✗	✓	✗	✓
Console Receive of Radio Status Update	✗	✗	✗	✓ 15 / 22	✗	✓ 22
Console Receive of Radio Message Update	✗	✗	✗	✓ 15/ 22	✗	✓ 22
Console Initiated Radio Status Query	✗	✗	✗	✓	✗	✓
Console Initiated Remote Monitor request	✗	✗	✗	✓	✗	✓
Console Initiated Radio Check request	✗	✗	✗	✓	✗	✓
Console Initiated Radio Inhibit request	✗	✗	✗	✓	✗	✓
Console Initiated Radio Uninhibit Request	✗	✗	✗	✓	✗	✓

Table 8: Capabilities on Trunking Air Interfaces

Function	ASTRO® 25		SmartZone® ASTRO® 25 Trunking system		SmartZone® or SMARTNET®	
	XTL	APX	XTL	APX	XTL	APX
Console Receive Analog Clear Call	✗	✗	✗	✗	✓	✓
Console Receive Digital Clear Call	✓	✓	✓	✓	✗	✗
Console Receive Digital Secure Call	✓	✓	✓	✓	✗	✗
Console Receive Analog (12 kb) Secure Call with Encryption Key	✗	✗	✗	✗	✓ 1	✓
Console Receive Digital Secure Call with Encryption Key	✗	✓	✗	✓	✗	✗
Console Radio Unit ID display and Receive Individual Calls	✗ 14	✗ 14	✗ 14	✗ 14	✗ 14	✗ 14
Console Radio Unit ID display for Receive Group Calls	✓	✓	✓	✓	✓	✓
Console Radio Unit ID display for Receive Emergency Calls	✓	✓	✓	✓	✓	✓

Table continued…

Function	ASTRO® 25		SmartZone® ASTRO® 25 Trunking system		SmartZone® or SMARTNET®	
	XTL	APX	XTL	APX	XTL	APX
Console Transmit of Digital Clear Call	✓	✓	✓	✓	✗ 4	✗ 4
Console Transmit of Digital Secure Call	✓	✓	✓	✓	✗ 5	✗ 5
Console Transmit of Digital Secure Call with Encryption Key	✗	✓ 3	✗	✓ 3	✗	✗ 3, 5
Console Transmit of Analog (12 kb) Secure Call with Encryption Key	✗	✗ 3, 6a	✗	✗ 3, 6a	✗	✓ 3
Console Transmit of Analog Clear Call	✗ 6	✗ 6	✗ 6	✗ 6	✓	✓
Console Initiated Monitor Select Command	N/A	N/A	N/A	N/A	N/A	N/A
Console Initiated Channel Select Command	✓	✓	✓	✓	✓	✓
Console Initiated Encryption Key Select Command	✗	✓ 2, 3	✗	✓ 2, 3	✗	✓ 2, 3
Console Initiated Individual Call Alert	✗	✗ 16a	✗	✗ 16a	✗	✗ 16a
Console Initiated Group Call Alert	✗	✗ 16b	✗	✗ 16b	✗	✗ 16b
Console Receive of Individual Call Alert targeting Console Unit ID	✗	✓ 12	✗	✗	✗	✗
Console Acknowledge of Individual Call Alert	✗	✗ 16a	✗	✗ 16a	✗	✗ 16a
Console Receive of Individual Call Alert targeting consolette unit ID	✓ 9	✓ 12/ 21	✓ 9	✓ 12/ 21	✓ 9	✓ 12/ 21
Console Acknowledge of Individual Call Alert	✗ 8	✗ 8	✗ 8	✗ 8	✗ 8	✗ 8
Console Receive of Group Call Alert	✗	✗ 20	✗	✗ 20	✗	✗ 20
Console Receive of Emergency Alarm	✓	✓	✓	✓	✓	✓
Console Acknowledge of Emergency Alarm	✗ 11	✗ 11	✗ 11	✗ 11	✗ 11	✗ 11
Console Receive of Radio Status Update	✗	✗	✗	✗	✗	✗
Console Receive of Radio Message Update	✗	✗	✗	✗	✗	✗
Console Initiated Radio Status Query	✗	✗	✗	✗	✗	✗
Console Initiated Radio Monitor Request	✗	✗	✗	✗	✗	✗

Table continued…

Function	ASTRO® 25		SmartZone® ASTRO® 25 Trunking system		SmartZone® or SMARTNET®	
	XTL	APX	XTL	APX	XTL	APX
Console Initiated Radio Check Request	✗	✗	✗	✗	✗	✗
Console Initiated Radio Inhibit Request	✗	✗	✗	✗	✗	✗
Console Initiated Radio Uninhibit Request	✗	✗	✗	✗	✗	✗

[1] The Motorola Solutions XTL consolette does not support the capability to report Analog Encrypted (secure) mode calls and instead, reports the call as Digital Encrypted. Additionally, the XTL consolette does NOT report the Encryption Key to the console.

[2] The Motorola Solutions APX consolette supports the capability to handle the command but the Console cannot actually send a 'standalone' Encryption Key Selection command.

[3] The Motorola Solutions APX consolette keysup on Trunking Channels with the default key strapped to the talkgroup. It is recommended that this function to be not used with the Trunking air interfaces.

NOTICE: The key requested in the Encryption Key field of the call request must match the strapped key, or the APX consolette "bonks".

[4] On Analog channels, the transmit mode selection of “Digital Clear” disables encryption, then keyup “ANALOG”. This selection should not be used but if the dispatch operator selects Digital Clear transmit mode on an Analog frequency, then the consolette keysup the radio in Analog mode.

[5] On Analog channels, the transmit mode selection of “Digital Secure” enables encryption, then keyup ANALOG. This selection should not be used but if the dispatch operator selects Digital Secure transmit mode on an analog frequency, then the consolette keysup the radio in Analog mode.

[6] On Digital channels, the transmit mode selection of “Analog Clear” disables encryption, then keyup DIGITAL.

[6a] On Digital channels, the transmit mode selection of “Analog Secure” enables encryption, then keyup “DIGITAL”.

[7] In this case, the console acknowledges Call Alert, the consolette passes the console acknowledgement through to the subscriber.

[8] In this case, the radio handles the acknowledgement of the Call Alert directly - the console is not involved.

[9] Motorola Solutions XTL consolette always reports the Call Alert as Individual Call Alert with default ID (1) as the target. Conventional Group Call Alerts get converted to Individual Call Alerts.

[10] Motorola Solutions XTL and APX consolettes always reports the Unit ID of a Group Call with default TGID (0001). An Individual call is not reported for Conventional Select Call. If a Trunking Private Call is received, there is no mechanism to respond to the call from the Console on the ACIM Conventional Channel resource.

[11] For trunked channels, the system acknowledges the Emergency Alarm. On the ACIM conventional Channel, the Zone Controller attempts to acknowledge the Alarm, but the consolette does not transmit this acknowledge over the air to the subscriber.

[12] On trunked air interfaces, there are often duplicate messages reported - due to redundant traffic on the control channel.

[13] In case of Private Call trunked, Motorola Solutions XTL consolette is reporting Receive Call indication as Group Call with no Unit ID. Motorola Solutions APX consolette does not report the call as a Group Call, with the Unit ID of the Group Call with default TGID (0001).

[14] In case of Private Call trunked, Motorola Solutions XTL consolette is reporting Receive Call indication as Group Call with no Unit ID. Motorola Solutions APX consolette reports the call as a Group Call, with the Unit ID of the Group Call with default TGID (0001).

[15] These MDC 1200 messages do not have a destination ID - the consolette reports the destination ID as 0 on the ACIM conventional channel.

[16] MCC 7500/7100 Dispatch Consoles do not support Outbound Conventional Group Call Alert.

[16a] The Motorola Solutions APX consolette passes the messages to the radio but the radio does not support these messages on the trunking channels.

[16b] The Motorola Solutions APX consolette passes the messages to the radio, but the radio does not support the messages on the trunking channels.

[17] The destination ID for MDC Individual Call Alert is the destination of the Call Alert, not zeroes.

[18] The operator request of MDC Group Call Alerts is sent as Individual Call Alerts on the ACIM Conventional Channel. The destination ID is the destination ID of the Call Alert, not zeroes. In case of Group Call Alerts or one that uses WildCards, it is either in the form of "Exxx" or have an "F" somewhere in it.

[19] Motorola Solutions consolette supports Group Call Alert messages. However, the MCC 7500 Consoles do not support the handling of Group Call Alerts. So, the function is not supported from an end to end perspective.

[20] Group Call Alerts are not supported on the trunking channels. The console blocks Outbound Group Call Alert on the ACIM resources on trunking channels. They are also blocked at the CCGW.

[21] APX7500 consolettes can be configured to pass any/all Call Alerts it receives to the Console or the consolette can be configured to prohibit the Call Alert indication to the Console for only when the Call Alert it targeted to the consolette ID. By prohibiting the sending of any/all Call Alerts to the console, it eliminates any/all Call Alerts not intended for the console from being displayed on the console.

[22] APX7500 consolettes can be configured to either pass or prohibit Status and Message Updates from being sent to the console. This configuration would eliminate Status or Message Update messages not intended for the ACIM channel from being displayed on the console.

NOTICE:

- Group Call Alerts from the consolette are not supported at the system level. Although the consolettes support them for conventional interfaces, the consoles do not.
- The radio acknowledges Individual Call Alerts targeted to the radio. The console, using an ACIM Channel resource, acknowledges Call Alerts targeted to a console ID.
- The Individual calls are Voice Selective Calls on the conventional air interfaces and Private Calls on the Trunked Air Interfaces. However, they are requested as Group Calls on the ACIM channels and directed to all consoles that are part of Group ID 1.
- For the Supplementary Data features marked with an “X” in the previous tables, indicating that the feature is not supported, if the dispatch operators request for the specific capability is sent from the console to the consolette, and if the capability is not supported on the particular frequency for which the request was made, the feature does not work and the Console indicates `No Acknowledgement` on its User interface.

The following table provides the information for the ACIM channels when the consolettes are operating on the Trunking air interface, with the Trunking site in wide trunking. In scenarios when the trunked site is in Site Failsoft or Site Trunked, some of the capabilities as the ones listed in the following table are not available due to the control channel absence. The decode of the incoming radio transmit does not have the information for the consolettes to pass on to the consoles on the ACIM channel.

Table 9: ACIM Trunking Scenarios

System Function over ACIM Channels using APX or XTL Consolettes	ASTRO® 25		SmartZone® ASTRO® 25 Trunking system		SmartZone® or SMARTNET®	
	Site Failsoft	Site Trunking	Site Failsoft	Site Trunking	Site Failsoft	Site Trunking
Console Radio Unit ID display for Receive Group Calls	✓ 1	✓ 1	✓	✓	✗	✓
Console Radio Unit ID display for Receive Emergency Calls	✓ 1	✓ 1	✓	✓	✗	✓
Console Receive of Individual Call Alert targeting consolette unit ID	✗	✓	✗	✓	✗	✓
Console Acknowledge of Individual Call Alert	✗	✓	✗	✓	✗	✓
Console Receive of Emergency Alarm	✗	✓	✗	✓	✗	✓

[1] When operating on ASTRO® 25 trunking interface, the transmitting subscriber sends the SUID when in Site Failsoft condition and WU ID in case of Site and Wide Trunking.

The following table lists console capability for ACIM Conventional Channel resources with Motorola Solutions XTL or APX consolette in the conventional air interfaces.

Table 10: Console Capabilities for ACIM Conventional Channel – Conventional Air Interfaces

	Analog Conventional		MDC Conventional		ASTRO® 25 Conventional	
	Direct	Repeater[2]	Direct	Repeater[2]	Direct	Repeater[2]
Channel Marker Tones	✓	✓	✓	✓	✓	✓
Tone Page – Quick Call I	✓	✓	✓	✓	✓	✓
Tone Page – Quick Call II B	✓	✓	✓	✓	✓	✓
Tone Page – Quick Call II C	✓	✓	✓	✓	✓	✓
Tone Page – Quick Call II D	✓	✓	✓	✓	✓	✓
Tone Page – Quick Call II E	✓	✓	✓	✓	✓	✓
Tone Page – DTMF Touch Code	✓	✓	✓	✓	✓	✓

Table continued…

	Analog Conventional		MDC Conventional		ASTRO® 25 Conventional	
	Direct	Repeater[2]	Direct	Repeater[2]	Direct	Repeater[2]
Tone Page – KNOX Touch Code	✓	✓	✓	✓	✓	✓
Tone Page – Singletone 0.5	✓	✓	✓	✓	✓	✓
Tone Page – Singletone 1.5	✓	✓	✓	✓	✓	✓
Tone Page – Motorola 5/6 Tone	✓	✓	✓	✓	✓	✓
Tone Page – Digital Dial 1	✓	✓	✓		✓	✓
Tone Page – Digital Dial 2	✓	✓	✓	✓	✓	✓
Tone Page – Digital Dial 3	✓	✓	✓	✓	✓	✓
Enhanced Alert tones 1-15	✓	✓	✓	✓	✓	✓
System Pages	✗	✗	✓[1]	✓[1]	✓	✓
Call Alert	✗	✗	✓	✓	✓	✓
Main/Alternate	✓	✓	✓	✓[2]	✓	✓
Cross Busy/Cross Mute	✓	✓	✓	✓	✓	✓
Audio Patch	✓	✓	✓	✓	✓	✓
External Paging	✓	✓	✓	✓	✓	✓
Simulate Emergency Alarm for an Emergency Call	✗	✗	✓[3]	✓[3]	✓	✓
Console Receive of Feedback Tones from consolette	✓	✓	✓	✓	✓	✓

[1] Retry Delay Timer and Acknowledgement Delay Timer must be long enough for successful acknowledgement. Configure the values d based on the MDC Ack Pre-time value applicable for the system setup.

[2] Functional Limitation: Secure Capability may not be supported on the Repeaters that do not support 12 kb.

[3] If a consolette is listening on a different channel, it could miss receiving the leading PTT-IDs which also have the emergency indication. The Emergency alarm sounding is not simulated at the console.

Table 11: Console Capabilities for ACIM Conventional Channel – Trunking Air Interfaces for SmartZone/SMARTNET and SmartZone ASTRO Trunking

	SmartZone®/SMARTNET®			SmartZone® ASTRO® 25 Trunking system		
	Site Failsoft	Site Trunking	Wide Trunking	Site Failsoft	Site Trunking	Wide Trunking
Channel Marker Tones	✗	✓1	✓1	✓1	✓1	✓1
Tone Page – Quick Call I	✓1	✓1	✓1	✓1	✓1	✓
Tone Page – Quick Call II B	✓1	✓1	✓1	✓1	✓1	✓1
Tone Page – Quick Call II C	✓1	✓1	✓1	✓1	✓1	✓1
Tone Page – Quick Call II D	✓1	✓1	✓1	✓1	✓1	✓1
Tone Page – Quick Call II E	✓1	✓1	✓1	✓1	✓1	✓1
Tone Page – DTMF Touch Code	✓1	✓1	✓1	✓1	✓1	✓1
Tone Page – KNOX Touch Code	✓1	✓1	✓1	✓1	✓1	✓1
Tone Page – Singletone 0.5	✓	✓	✓	✓	✓	✓
Tone Page – Singletone 1.5	✓	✓	✓	✓	✓	✓
Tone Page – Motorola 5/6 Tone	✓	✓	✓	✓	✓	✓
Tone Page – Digital Dial 1	✓	✓	✓	✓	✓	✓
Tone Page – Digital Dial 2	✓	✓	✓	✓	✓	✓
Tone Page – Digital Dial 3	✓	✓	✓	✓	✓	✓
Enhanced Alert tones 1-15	✓	✓	✓	✓	✓	✓
System Pages	✗	✗	✗	✗	✗	✗
Call Alert	✗	✗	✗	✗	✗	✗
Main/Alternate	✓	✓	✓	✓	✓	✓

Table continued...

	SmartZone®/SMARTNET®			SmartZone® ASTRO® 25 Trunking system		
	Site Failsoft	Site Trunk-ing	Wide Trunk-ing	Site Fail-soft	Site Trunking	Wide Trunking
Cross Busy/ Cross Mute	✗	✗	✗	✗	✗	✗
Audio Patch	✓ 2	✓	✓	✓	✓	✓
External Paging	✗	✓	✓	✗	✓	✓
Simulate Emer-gency Alarm for an Emergency Call	✗	✓	✓	✓	✓	✓
Console Re-ceive of Feed-back Tones from consolette	✓	✓	✓	✓	✓	✓

Table 12: Console Capabilities for ACIM Conventional Channel Trunking Air Interfaces for ASTRO 25

	ASTRO® 25		
	Site Failsoft	Site Trunking	Wide Trunking
Channel Marker Tones	✓ 1	✓ 1	✓ 1
Tone Page – Quick Call I	✓ 1	✓ 1	✓ 1
Tone Page – Quick Call II B	✓ 1	✓ 1	✓ 1
Tone Page – Quick Call II C	✓ 1	✓ 1	✓ 1
Tone Page – Quick Call II D	✓ 1	✓ 1	✓ 1
Tone Page – Quick Call II E	✓ 1	✓ 1	✓ 1
Tone Page – DTMF Touch Code	✓ 1	✓ 1	✓ 1
Tone Page – KNOX Touch Code	✓ 1	✓ 1	✓ 1
Tone Page – Singletone 0.5	✓	✓	✓
Tone Page – Singletone 1.5	✓	✓	✓
Tone Page – Motorola 5/6 Tone	✓	✓	✓
Tone Page – Digital Dial 1	✓	✓	✓
Tone Page – Digital Dial 2	✓	✓	✓
Tone Page – Digital Dial 3	✓	✓	✓
Enhanced Alert tones 1-15	✓	✓	✓

Table continued…

	ASTRO® 25		
	Site Failsoft	Site Trunking	Wide Trunking
System Pages	✗	✗	✗
Call Alert	✗	✗	✗
Main/Alternate	✓	✓	✓
Cross Busy/Cross Mute	✗	✗	✗
Audio Patch	✓	✓	✓
External Paging	✓	✓	✓
Simulate Emergency Alarm for an Emergency Call	✓	✓	✓
Console Receive of Feed-back Tones from consolette	✓	✓	✓

[1] Some tones may not be faithfully reproduced. For some tones, the entire tone may be heard if preceded by a short duration tone since it must make a request on the control channel and rest of the tones follow on the voice channel after the control channel grant. If the “Alert Tones” are disabled at the consolette, tones are also audible at the Subscriber. Alert tones on the consolette are meant for ergonomic feedback. If enabled, the radio talk permit tones drown the tones from the console at the Subscriber. Corresponding alert tones accompany all the site trunking and site failsoft scenarios.

[2] Functional Limitation – A repeater in failsoft is always keyed. Because a Motorola Solutions consolette is half duplex, when a channel in failsoft is patched with an ACIM channel, the ACIM consolette is locked in transmit mode, unable to receive any traffic from the receive side of the ACIM channel.

3.5.6.4
ACIM Channel Reference

For device-specific information on the ASTRO® 25 Control Interface Module (ACIM) conventional channel, as well as detailed installation and configuration instructions, see the following manuals:

- *MCC 7500 Dispatch Console with Voice Processor Module*
- *GGM 8000 System Gateway*
- *APX 7500 Multi-Band Consolette Detailed Service Manual*
- *ASTRO Digital XTL 5000 Consolette Detailed Service Manual*

3.5.6.5
ACIM Inbound and Outbound Call Processing

ASTRO® 25 Control Interface Module (ACIM) conventional channels use the physical interfaces between the Motorola Solutions Consolette and the Conventional Channel Gateway (CCGW) to provide the correct signaling and audio formats for both analog and digital mode calls. The audio is always transported over the analog voice interface (analog over 4-Wire) and control signaling uses the ACIM interface (ASTRO® 25 Console Interface Module over RS-232) between the CCGW and the Consolette. The interfaces for audio and control remain the same for both the analog and digital calls over the ACIM Channels.

All encryption and decryption functions are at the Consolette. The console does not perform any of the secure services other than the provisioning of the transmit mode and the key selection from the user. The call specifics are sent as control commands to the Consolette which then applies the necessary

encryption services for a console-originated call. For inbound calls, the Consolette sends the decrypted audio to the CCGW and the key in the control commands. The console on processing of the call, would display the key alias to the dispatch operator.

3.5.7
Radio-Initiated Interzone Voice Call

When a subscriber unit activates a Push-to-Talk (PTT) function, it initiates a conventional voice transmission. During activation, the subscriber unit begins transmitting user voice on the selected conventional channel. The conventional channel RF base station detects the inbound transmission and notifies the associated Conventional Channel Gateway (CCGW). Depending on the type of conventional channel (analog, P25 digital, mixed mode, MDC 1200, ASTRO® 25 Control Interface Module (ACIM), or Advanced SECURNET) the voice call originated on, the CCGW processes the signaling according to procedures associated with the channel type. The CCGW sends either a conventional call request Inbound Control Packet (ICP) or a digital conventional call request ICP to the home zone controller.

3.5.7.1
Radio-Initiated Interzone Call Setup

The home zone controller allocates a multicast IP address for the call and responds to the Conventional Channel Gateway (CCGW) with either a Conventional Radio Call Grant Outbound Control Packet (OCP) or a Digital Conventional Radio Call Grant OCP containing the multicast IP destination for the call. This message contains a new indicator that specifies whether the call is delivered to other zones. The CCGW uses this information to determine whether to extend the packet transmission holdoff time with the configured incremental interzone packet transmission holdoff time before transmitting audio to the multicast IP address.

The home zone controller determines if any consoles in other zones are affiliated or associated to the conventional channel. If consoles are located in other zones affiliated to the channel, a conventional Beginning of Mobile Transmit (BOMT) is sent to the interzone-affiliated consoles and the intrazone-affiliated consoles.

When the zone controller allocates the multicast IP address, it sets up the multicast tree for delivery of the audio to all intrazone and interzone consoles. The call is set up and the audio is delivered over interzone T1 or Ethernet links in a similar way interzone trunking currently works.

Delivery of a radio-initiated voice call to consoles in other zones is not guaranteed, and if the call cannot be completed in another zone with affiliated consoles, no attempt is made to deny the call. For example, if console site bandwidth cannot be allocated for the audio, the call proceeds without that console site receiving the audio.

Depending on the type of conventional channel that the call originated on, additional information may be received from the subscriber unit following the initial Push-to-Talk (PTT) request. For example, if the call is on a digital conventional channel, the link control fields in the received Improved Multi-Band Encoder (IMBE) frames contain additional call attributes (for example, conventional unit ID). Another example is when the subscriber unit sends a trailing PTT ID after dekeying on an MDC 12000 channel. The CCGW sends a second Digital Conventional Call Request ICP to the zone controller containing the link control information. For an interzone conventional voice call, a second conventional BOMT is sent to any intrazone and interzone affiliated consoles containing the additional call attributes. The console updates the display with the information received.

3.5.7.2
Radio-Initiated Interzone Call Termination

When subscriber unit dekeys, the RF base station notifies the Conventional Channel Gateway (CCGW) and sends a Conventional Radio Dekey Detected Inbound Control Packet (ICP) to the zone controller, which responds with the Conventional Radio End Of TX Outbound Control Packet (OCP). A

conventional End of Mobile Transmission (EOMT) is sent to any intrazone and interzone affiliated consoles.

After hang time, the zone controller sends a conventional End of Call (EOC) Grant OCP to the CCGW, releases audio processing resources allocated to the call, and sends a conventional EOC Grant to any intrazone and interzone affiliated consoles. Upon receiving the conventional EOC Grant, participating console and logging subsystems release local audio processing resources supporting the call and leave the multicast group.

3.5.7.3
Radio-Initiated Interzone Link Failure and Recovery

If the interzone link between the home zone of a conventional channel and a console serving zone is not available when the call is initiated, any consoles in the serving zone with the failed interzone link are not included in the call. The call includes only consoles local to the home zone and any other zone that has an operational interzone link.

If an interzone link fails while radio-initiated interzone voice calls are active, the console serving zone controller ends the call and release resources associated with any local consoles involved with the call on the conventional channel located in the other zone.

When an interzone link recovers, interzone call setup resumes for new radio initiated voice calls. If an active call is on the conventional channel when the interzone link recovers, affiliated consoles in the serving zone are added to the call using current procedures for adding newly affiliated consoles to a call.

3.5.8
Console-Initiated Interzone Voice Call

When the console operator invokes the Push-to-Talk (PTT) function of the conventional channel to be transmitted upon, the console issues a conventional PTT request (analog channel) or a digital conventional PTT request (digital channel) to the zone controller in the consoles zone.

3.5.8.1
Console-Initiated Interzone Call Setup

The zone controller determines the home zone that the conventional channel is located in. For interzone conventional, each zone controller in a multi-zone system has the conventional channel information for all channels in the system (see Conventional Channel Home Zone Determination on page 126). This information includes the zone ID of the home zone the channel is located in. If the conventional channel is in another zone and is available, the conventional console call grant Outbound Control Packet (OCP) (analog channel) or the digital conventional Console Call Grant OCP (digital channel) is sent to the Conventional Channel Gateway (CCGW) in the home zone.

Additionally, a conventional PTT grant or digital conventional PTT grant is sent to any intrazone and interzone affiliated consoles, including the console that originated the call.

All non-originating consoles affiliated to the conventional channel in the channel home zone or other zones, and the CCGW associated with the conventional channel, join the multicast group. Audio from the originating console is delivered to the multicast IP address and any consoles or radios monitoring the channel hear the originating console transmitted audio as it arrives from the console serving zone over the interzone links.

3.5.8.2
Console-Initiated Interzone Call Termination

When the console operator deactivates the transmit function for the channel, the transmitting console issues a conventional End of Transmission (EOT) request to the zone controller. A conventional

console End-of-TX Outbound Control Packet (OCP) is sent to the channel Conventional Channel Gateway (CCGW) and a conventional EOT acknowledgment is sent to all intrazone and interzone affiliated consoles.

Following hang time, a conventional EOC grant OCP is sent to the CCGW, which causes it to leave the multicast IP address assigned to the call. A conventional EOC grant is sent to all affiliated consoles.

Upon receiving the conventional EOC grant, participating console and logging subsystems release local audio processing resources supporting the call.

3.5.8.3

Console-Initiated Interzone Link Failure and Recovery

If the interzone link between the originating console serving zone and the conventional channel home zone is not available when the console initiates the call, the console serving zone controller denies the Push-to-Talk (PTT) request by sending the Inbound Signaling Word (ISW) reject message, and the console operator is informed of the access denial. Otherwise, if the interzone link between the conventional channel home zone and a non-originating console serving zone is not available when the call is initiated, any consoles in the serving zone with the failed interzone link are not included in the call. The call only includes consoles local to the home zone and any other zone that has an operational interzone link.

If an interzone link fails while any console-initiated interzone voice calls are active, the console transmission in the console serving zone is discontinued. The call enters call hang time in the home zone. Following hang time, the call terminates in the home zone and any affiliated consoles in other zones with operational interzone links are also informed of the call termination.

When an interzone link recovers, interzone call setup resumes for new console initiated voice calls.

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Chapter 4

Conventional Simulcast/Voting

This chapter describes conventional simulcast and voting operation in the ASTRO® 25 system.

4.1 Overview of Simulcast, Multicast, and Voting

An IP simulcast channel is a multi-site RF channel consisting of a comparator at a prime site and up to 64 subsites to provide radio coverage to a large area. A prime site may be an IP simulcast prime site for conventional, or trunked and conventional, or a distributed conventional hub site.

Simulcast operation is a radio system topology that uses multiple transmitters on the same frequency in separate locations to transmit the same signal. Simulcast operation is desirable in areas where frequencies are scarce and in areas where physical barriers (for example, mountains and buildings) can cause deficiencies in signal coverage.

Multicast function (conventional only) is performed when multiple base radios can transmit and receive, operating on different frequencies, and can still receive copies of the same voice or data from the comparator. To implement multicast function, the site requires a voting operation to establish the best quality signal for transmission.

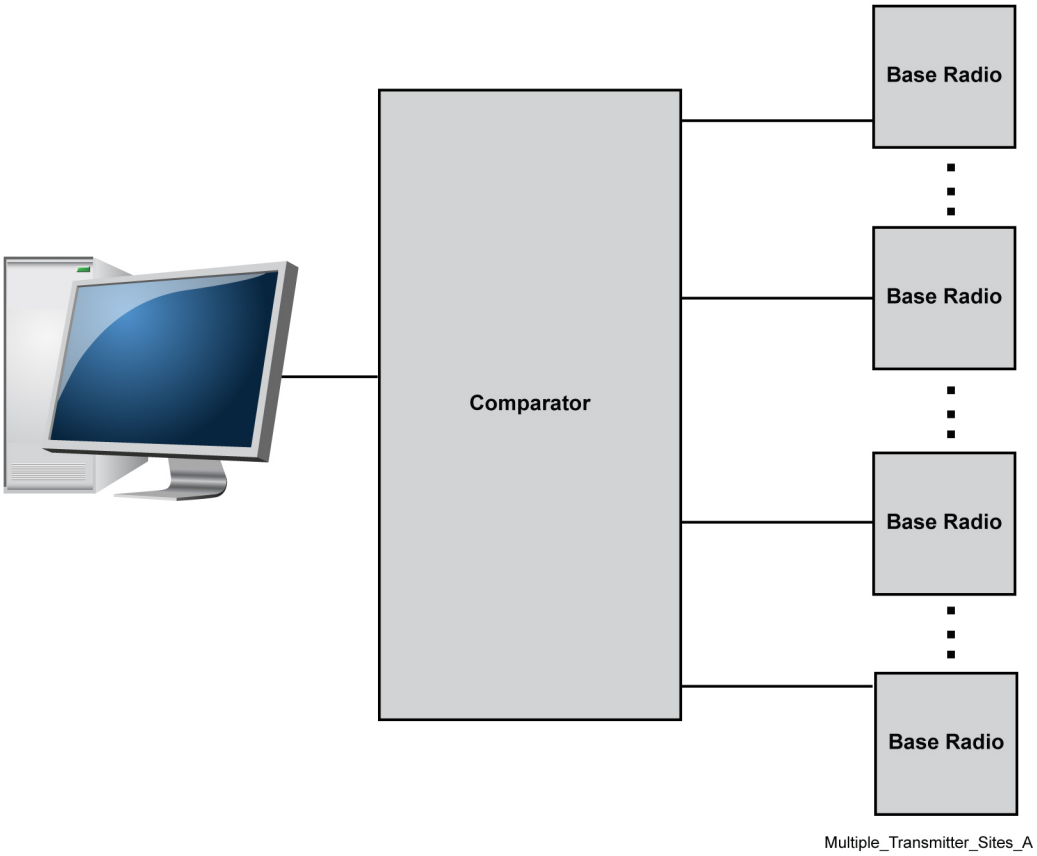
Voting operation in a radio system topology employs multiple receivers on the same frequency in separate locations to support a “receive” coverage area equal to the “transmit” coverage area for the subsystem.

With the voting operation, multiple receivers may receive the signal transmission from a subscriber radio. Comparator devices process the signals and perform a voting operation to produce the best composite signal (best quality signal) that can be transmitted through the system (routed through the base radio transmitters).

4.2 Site Steering Through Channel Selection

For systems that require wide-area coverage and simulcast is a cost prohibitive solution, a site steering mechanism can be used. Site steering requires that the console operator knows which transmitter site can be used to reach the desired subscribers. The site last selected by the console operator is the transmit site. Site selection is accomplished using the channel select feature available on consoles and the multi-channel configuration feature available on the GTR 8000 Base Station. For repeater systems, the last site selected by the console operator is the site that transmits the comparator repeated audio. If the selected site does not provide proper coverage for the subscribers, subscriber users can ask the console operator to change the site used for repeater. This site selection mechanism can be used in analog only systems and in ASTRO® 25 Common Air Interface (CAI) capable systems.

Figure 14: Multiple Transmitter Sites



Site selection using Channel Selection is achieved by configuring only one channel with T/R capability at each site and all the other channels as RX only by setting Tx Freq = 0 on the channel configured.

Example:
Configure the GTR 8000 Base Radio at site 1: channel 1 with T/R, all other channels are RX only.

Configure the GTR 8000 Base Radio at site 2: channel 2 with T/R, all other channels are RX only.

Continue with site 3 through 16 for channels 3 through 16.

The total number of channels depends on the number of sites used. The limit is 16 channels and 16 sites.

Operationally, when the console sends a command requesting transmit on a particular channel, only the assigned site can transmit.

Example:
Channel 1 - selects channel 1 at all sites but only site 1 is configured to transmit.

Channel 2 - selects channel 2 at all sites but only site 2 is configured to transmit.

4.3

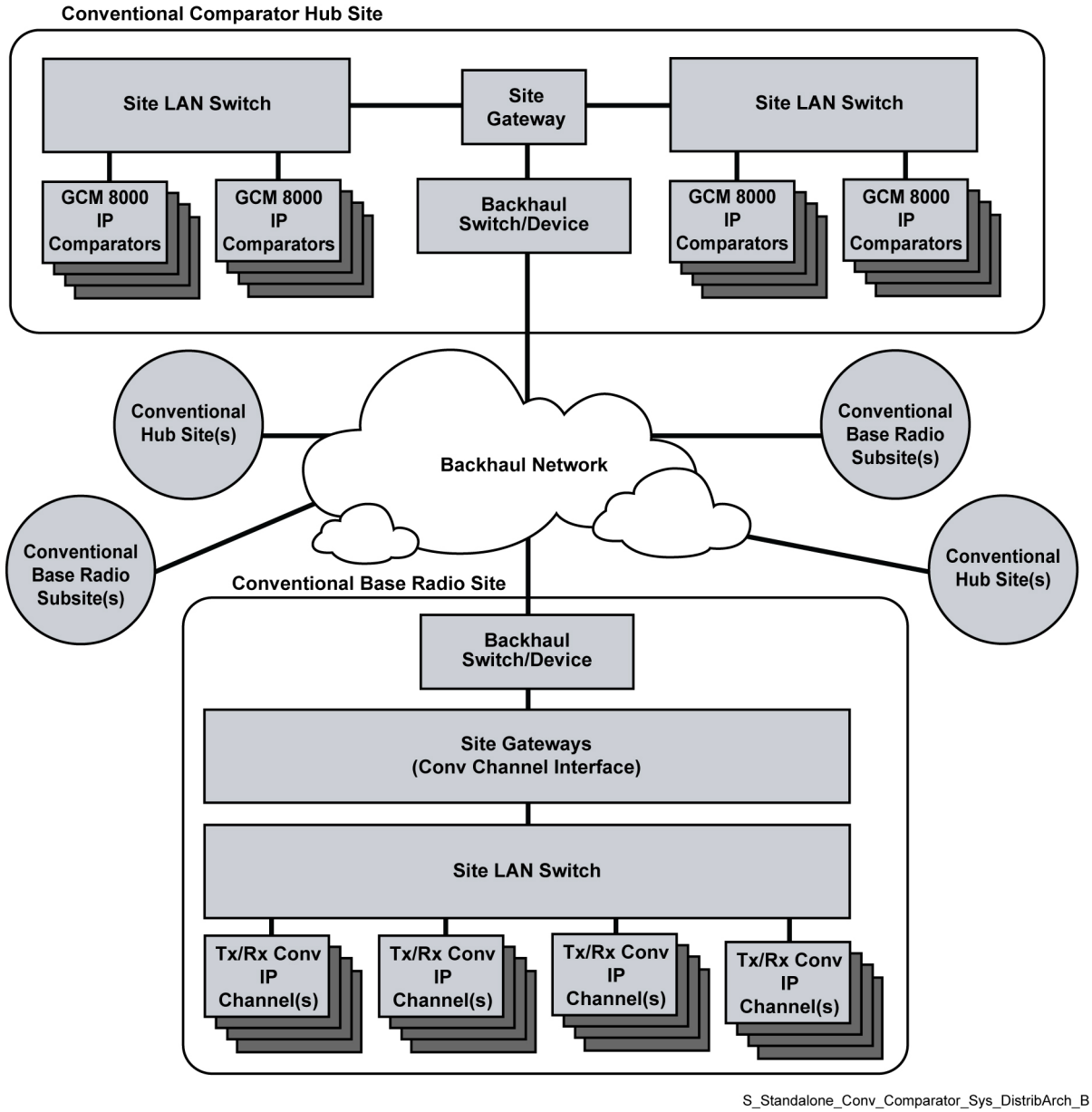
Standalone Conventional Comparator System

The Standalone Comparator-based topology is a standalone conventional voting system, which supports wide area conventional channel operation without an interface to core equipment (core or zone core). Therefore, it does not employ services from network management server applications nor dispatch consoles.

The figure shows IP-based comparators, IP conventional channels, and multiple subsites, although an architecture with a single subsite is also possible. A standalone system can also support analog, MDC 1200, digital, and mixed mode channel operation and link types can range from the analog 4-Wire to Ethernet depending on the capability of the base radio and comparator equipment.

Figure 15: Standalone Conventional Comparator System – Distributed Conventional Architecture

This figure shows a standalone conventional comparator-based system as part of a distributed conventional architecture.



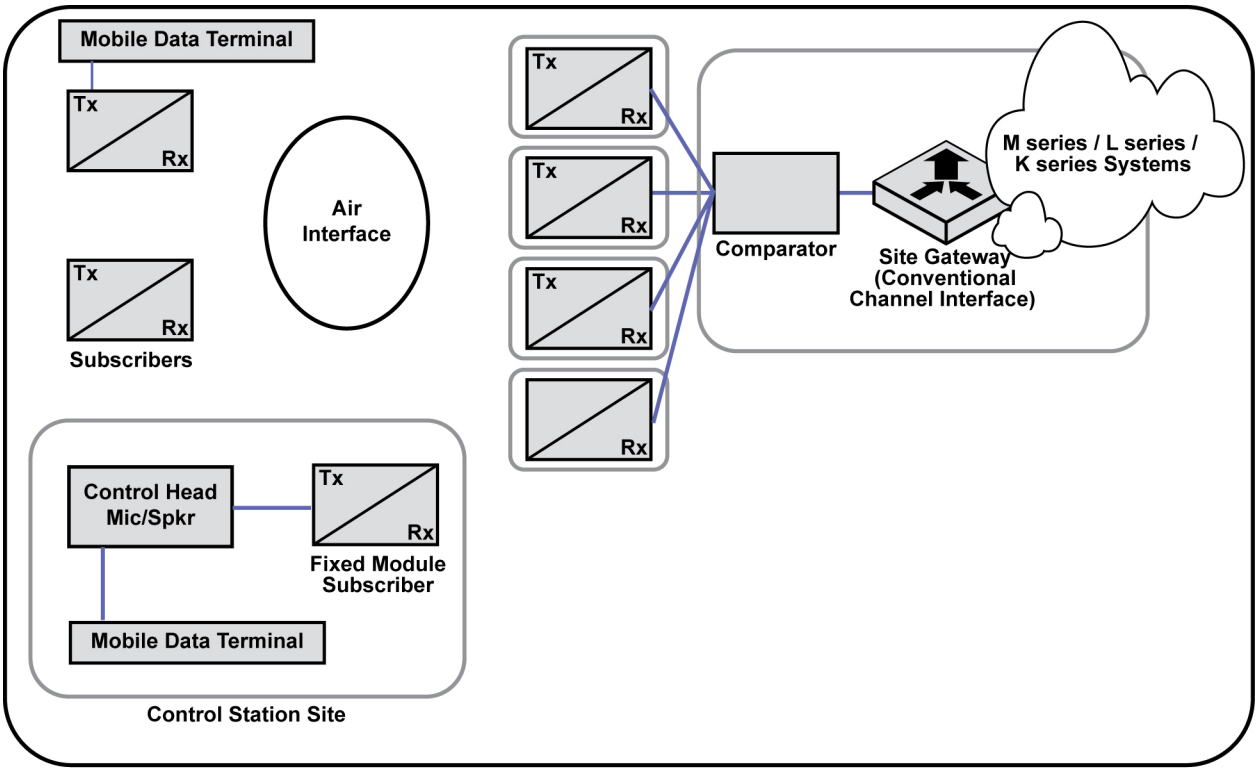
S_Standalone_Conv_Comparator_Sys_DistribArch_B

4.4
Wireline Comparator

The Wireline Comparator conventional topology is like the Standalone Comparator-based conventional topology which consists of a conventional comparator site and conventional base radio subsites. However, this topology includes comparator site transport components (GGM Site Gateway and/or Ethernet Backhaul Switch) to interface it to the dispatch console in system with M, L, or K cores. This topology is supported with QUANTAR® and GTR 8000 Base Radio stations.

See the *MLC 8000 Setup Guide* for details.

Figure 16: Wireline Comparator (Conventional Comparator Subsystem)



Wireline_Comparator_Subsystem

4.5
Circuit-Based Conventional Topologies with Channel Banks

This section provides an overview on adding new equipment to prior releases sites without changing the circuit-based site links. See IP-Based Conventional Topologies with MLC 8000s on page 169 for an overview on replacing circuit-based site links with IP-based site links.

In a circuit-based system, various options for replacing prior releases equipment are available. A conventional analog or mixed mode GTR 8000 Base Radio can replace a QUANTAR® in a conventional analog-only voting/simulcast subsystem as shown in the three configurations in Conventional Analog-Only Simulcast Configurations on page 164.

Analog simulcast reverse burst field specifies whether reverse burst is generated internally by the base radio or by an external device. Options include:

- The GTR 8000 Base Radio generates the internal reverse burst.
- The external reverse burst is the default, and generated by an external device.

For a reverse burst to be generated with the correct phase shift, Tx Private Line/Digital Private Line (PL/DPL) must be programmed in the Multi-PL/DPL Table. The station only uses the Tx PL/DPL

information to generate the reverse burst phase shift for the PL signal generated by the external device, typically, the Conventional Simulcast Control Interface (CSCI).

For information on the CSCI and DIGITAC, see the *CSCI* (6806908P48) manual and the *DIGITAC* (68P06908B19) manual.

The following are three possible ways to connect external signals to the GTR 8000 Base Radio for analog simulcast:

- Audio signal is input on the Gen Tx input pin and PL signal is input on the PL input pin. In this case, set the Configuration/Service Software (CSS) parameter analog simulcast reverse burst to **Internal** if the GTR 8000 Base Radio must create reverse burst, or set to **External** if the external equipment generates reverse burst. See Figure 19: Conventional Analog-Only Simulcast with Separate Conventional Tx Audio and Private Line on page 165.
- The external device sums audio and PL signals and connects them to the Gen Tx inputs. The external device generates reverse burst. The setting of analog simulcast reverse burst has no impact on system operation. See Figure 20: Conventional Analog-Only Simulcast CSCI with Reverse Burst Generator on page 166.
- The external device sums audio and PL signals and connects them to the PL inputs. Analog simulcast reverse burst must be set to **Internal**. See Figure 21: Conventional Analog-Only Simulcast CSCI without Reverse Burst Generator on page 167.

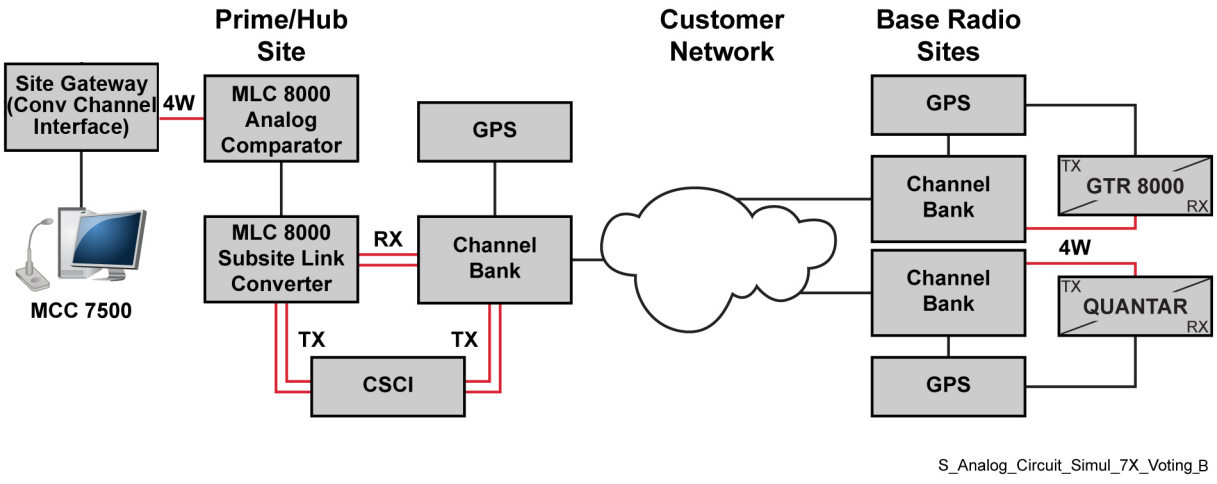
See “System Connector Ports (Conventional)” in the *GTR 8000 Base Radio* manual for relevant pinouts.

All three configurations in Conventional Analog-Only Simulcast Configurations on page 164 show the GTR 8000 Base Radio at the subsite, but the other prior releases equipment remains at the subsite and prime site.

Figure 17: Circuit-Based Analog-Only Simulcast Voting Subsystem with MCC 7500 on page 163 and Figure 18: Circuit-Based Conventional Analog-Only Simulcast Voting Subsystem on page 164 show the following options for replacing additional prior releases equipment in a system with circuit-based site links:

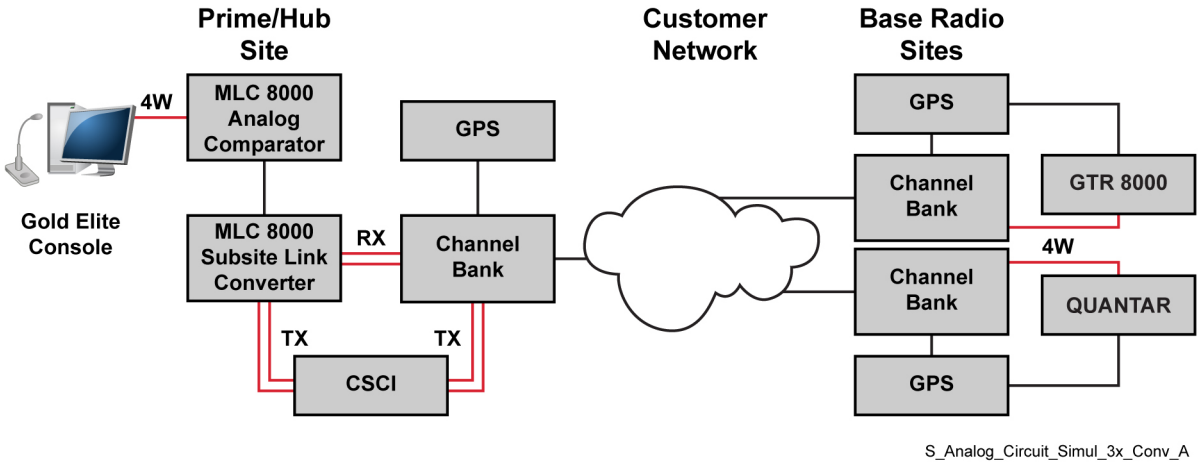
- At the prime site, a prior releases analog comparator (shown as a DIGITAC in Conventional Analog-Only Simulcast Configurations on page 164; other prime sites may have ASTRO-TAC™ 3000 comparators) can be replaced by implementing an MLC 8000 comparator to provide voting and an MLC 8000 link converter to interface the prior releases circuit-based transport equipment with the MLC 8000 comparator.
- If a GGM 8000 Conventional Channel Interface module, also called a Conventional Channel Gateway (CCGW), is added, an analog console can be replaced with an MCC 7500 console.

Figure 17: Circuit-Based Analog-Only Simulcast Voting Subsystem with MCC 7500



NOTICE: The CCGW shown in the diagram is a module added to a GGM 8000 site gateway.

Figure 18: Circuit-Based Conventional Analog-Only Simulcast Voting Subsystem



Although Figure 17: Circuit-Based Analog-Only Simulcast Voting Subsystem with MCC 7500 on page 163 and Figure 18: Circuit-Based Conventional Analog-Only Simulcast Voting Subsystem on page 164 show both, GTR 8000 Base Radios and QUANTAR®s cannot both be present in the same analog simulcast subsystem.

See the *MLC 8000 Setup Guide* for additional information on circuit-based topologies using MLC 8000s for 3.x systems as well as current ASTRO® 25 systems.

4.5.1
Conventional Analog-Only Simulcast Configurations

NOTICE: The following abbreviations are used in these figures in the DSM II Card:

- R – Transmit Ring (Mod in Ring)
- T – Transmit Tip (Mod in Tip)
- R1 – Receive Ring (Demod out Ring)
- T1 – Receive Tip (Demod out Tip)

Figure 19: Conventional Analog-Only Simulcast with Separate Conventional Tx Audio and Private Line

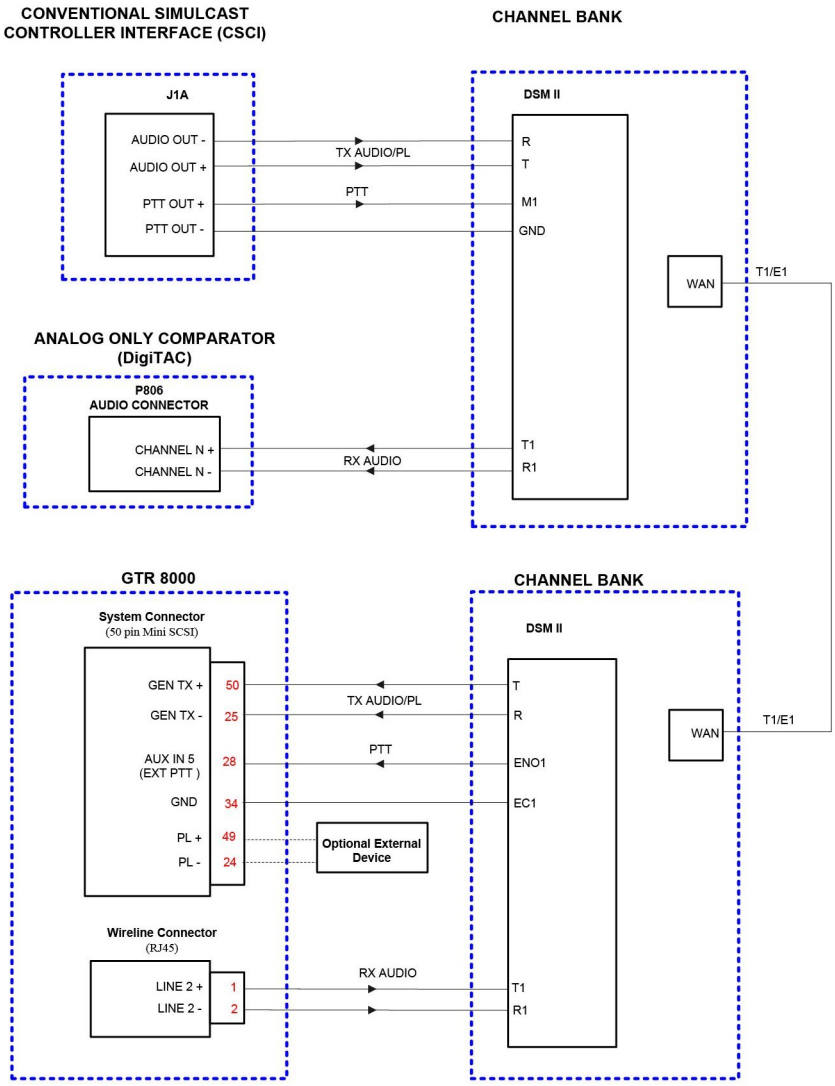


Figure 20: Conventional Analog-Only Simulcast CSCI with Reverse Burst Generator

Always use for Digital Private Line (DPL).

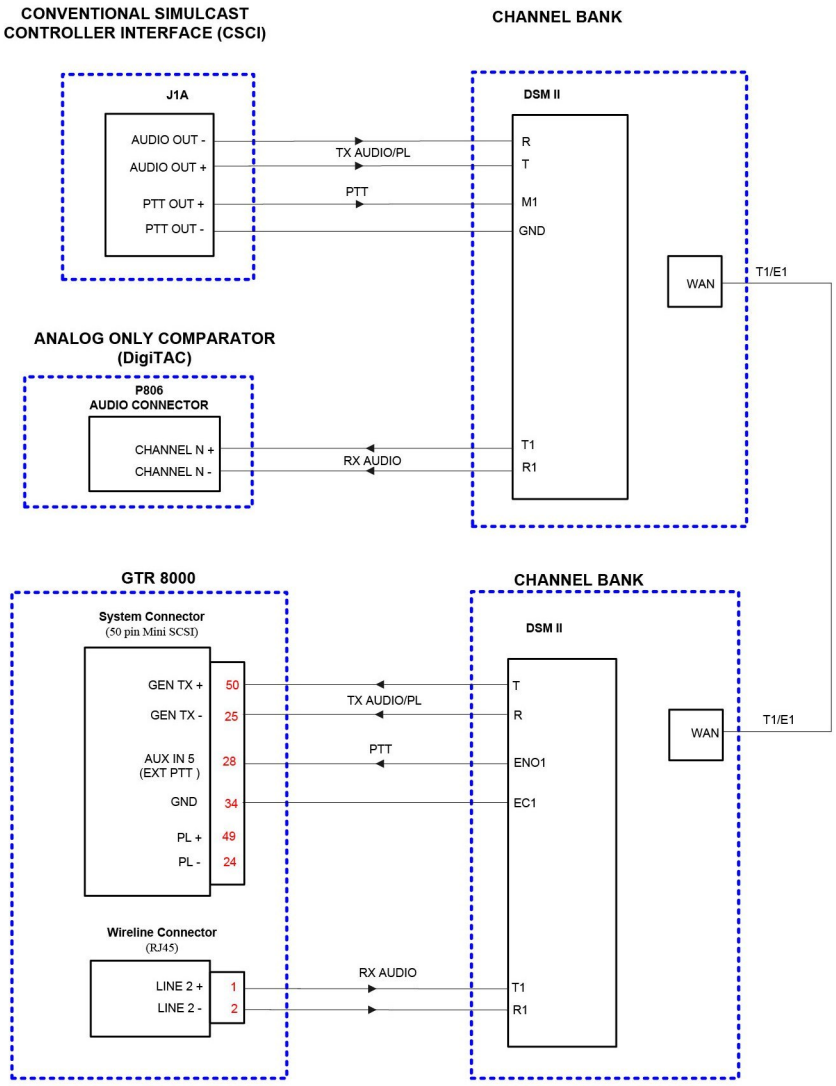
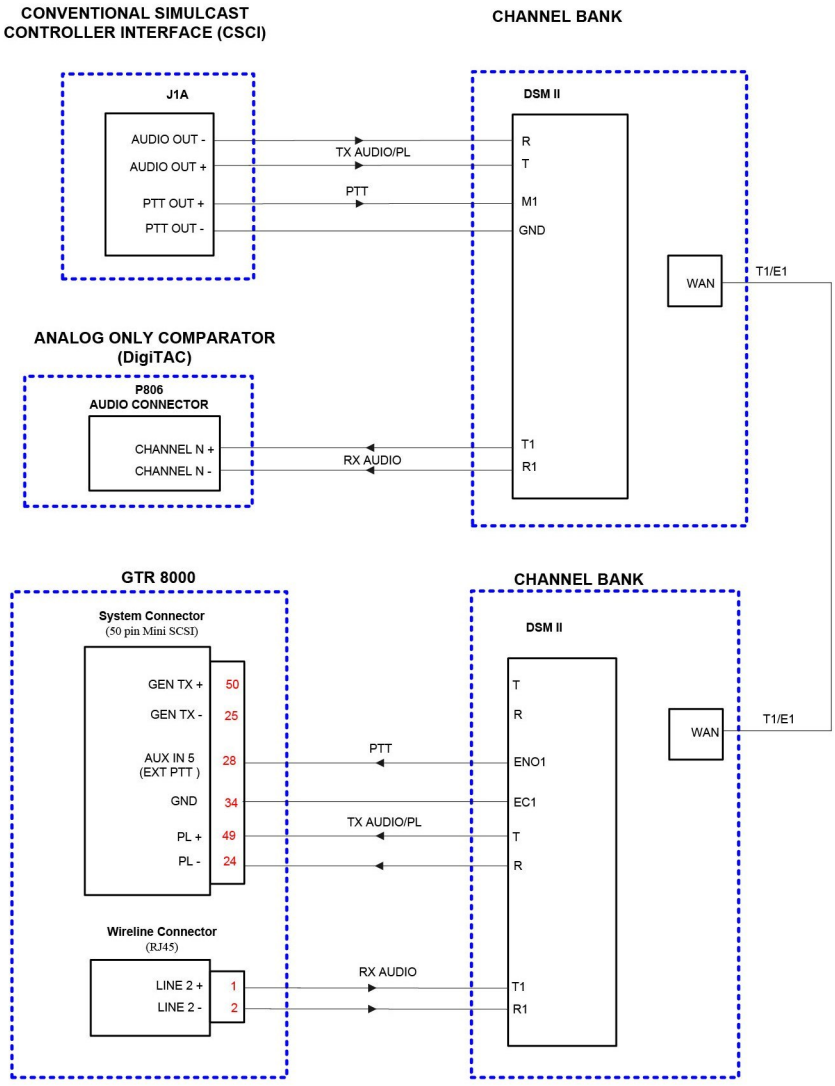


Figure 21: Conventional Analog-Only Simulcast CSCI without Reverse Burst Generator

Configure the GTR 8000 Base Radio to generate Private Line (PL) Reverse Burst.



4.5.1.1

Conventional Configuration Settings for Analog Simulcast

Use the conventional configuration settings in Configuration/Service Software (CSS) provided in the table for analog simulcast.

Table 13: Conventional Configuration Settings in Configuration/Service Software for Analog Simulcast

Window in CSS	Tab	Field	Value
Hardware Configuration	Hardware Configuration	Station Type	Select **Analog Only**.

Table continued…

Window in CSS	Tab	Field	Value
		Frequency Reference	For standalone GTR 8000 Base Radios, select **External 5 MHz Back Panel** or **External 10 MHz Back Panel** (depending on the available frequency reference source) for the conventional standalone GTR 8000 Base Radio used in simulcast. For GTR 8000 Expandable Site Subsystem, select **Integrated Reference A/B**. No other choice is possible. See "Frequency Reference" in the CSS Online Help.
Options	n/a	WildCard	Select **Basic**.
Infrastructure Interface	Common	Comparator Type	Select **DIGITAC or MLC 8000**.
		Fallback In-Cabinet Repeat	The default is **Disabled**.
		Analog Simulcast Reverse Burst	Select **External** for an external source (such as the MLC 8000 Analog Comparator) generating the reverse burst. Select **External** or **Internal** for the CSCI depending on the model of CSCI being used.
		Status Tone	Select **Enabled**. **IMPORTANT:** If Status Tone is not enabled, the DIGITAC fails and the site is not voted, or the MLC 8000 Subsite Link Converter fails to recognize the GTR 8000 Base Radio.
		Tx Notch Filter	Select **Disabled**.
		Rx Notch Filter	Select **Enabled**. Notch Filter must be enabled. If not, voice can cause status tone to be detected. **IMPORTANT:** 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 the GTR 8000 Receiver Activation setting includes **PL/DPL**, ensure that the Private Line/Digital Private Line (PL/DPL) selected in the GTR 8000 Base Radio is the same as the PL selected in the subscriber.
	Timeouts	Repeater Timeout Timer	Select **Disabled**.
	Filters and Alarms	Pre-emphasis	Select **Enabled**.

Table continued…

Window in CSS	Tab	Field	Value
		De-emphasis	Select **Enabled**.
		Commander	Select either **Disabled** or **Enabled**. For proper voice operation, this setting must be coordinated with the subscriber unit setting for the same parameter.
	PL/DPL	Rx Squelch Type	Select **PL** (if needed for your system requirements) to match the setting of **PL** in the **PL/DPL** list of the Modify Device Configuration — IP Simulcast tab of the MLC 8000 Configuration Tool with Analog Display and Control.
Repeater Configuration	n/a	Repeater/ Base Operation	Select **Base**.
WildCard Tables	WildCard Tables	n/a	CSS automatically generates a WildCard table for simulcast using Input 5 as the External PTT input pin and routes the audio from the Gen Tx port to the transmitter..

4.6 IP-Based Conventional Topologies with MLC 8000s

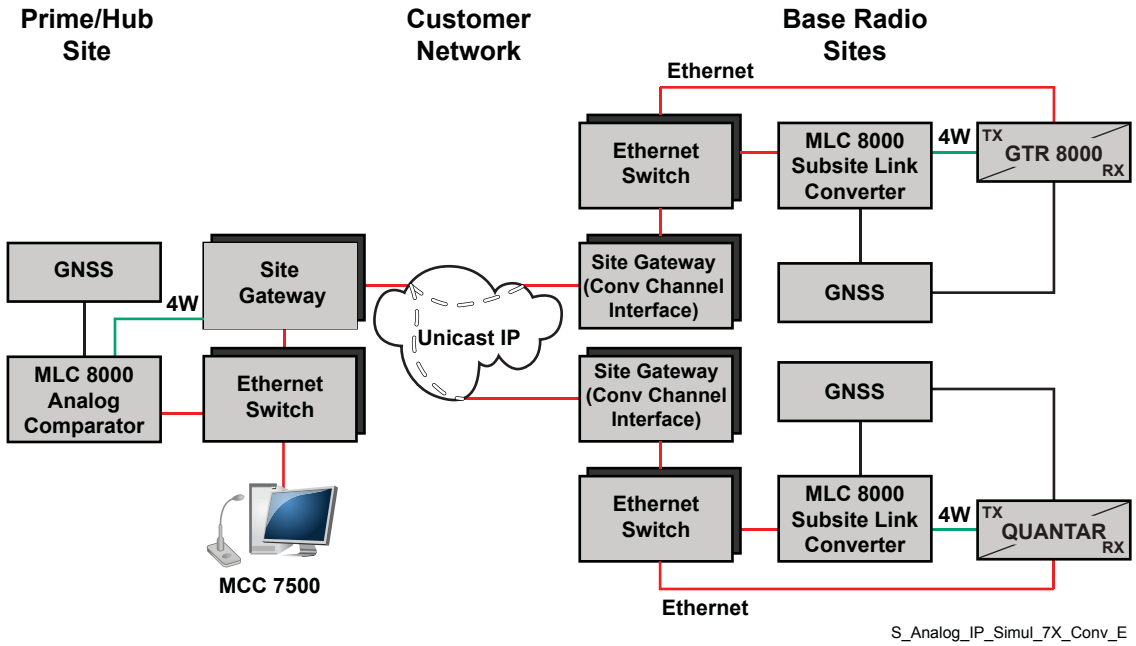
Conventional topologies that include prior releases equipment can add MLC 8000 Link Converters for various purposes:

- MLC 8000 Link Converters can provide IP backhaul to replace circuit-based channel bank links in prior releases systems.
- An analog MLC 8000 Comparator can work with MLC 8000 Link Converters (along with either GTR 8000 Base Radios or QUANTAR®s, to provide voting for conventional analog simulcast and multicast systems.
- An analog MLC 8000 Comparator can be paired with an IP-based GCM 8000 Comparator to provide mixed mode voted configurations. The MLC 8000 handles the voting for the analog audio, and the GCM 8000 Comparator handles the digital audio. The MLC 8000 Link Converter provides the base radio interface for both comparators by providing a hybrid V.24 and 4-Wire link interface.

When the base radio is configured as ASTRO® 25 CAI capable and simulcast operation is set to **Enabled**, the infrastructure link for the base radios, comparators, and conventional channel interface must be V.24 only (not V.24 hybrid).

Features of the GCM 8000 Comparator for trunked systems only (such as local failsoft and redundancy for high availability) are not supported in this conventional configuration.

Figure 22: ASTRO 25 Analog-Only IP-Based Simulcast Subsystem



See the *Quick Guide for Implementing MLC 8000s* for more site-level information on IP-based analog, mixed mode, and digital-only voting configurations for 3.x, as well as current ASTRO® 25 systems.

4.7 Conventional Mixed Mode Simulcast Operation

Conventional Mixed Mode Simulcast operation provides a simulcast infrastructure solution that can support both analog and digital calls.

Only GTR 8000 Gen 2 Base Radios support conventional Mixed Mode Simulcast operation. See the *GTR 8000 Base Radio* manual for instructions on how to recognize whether your GTR 8000 Base Radio is Gen 1 or 2.

This feature enables mixed mode (analog/digital) simulcast operation in an IP conventional simulcast system. It uses a dual comparator solution in which the Prime Site has an MLC 8000 Configuration Tool to handle analog audio processing, and a GCM 8000 Comparator to handle digital audio processing. Within the MLC 8000 Configuration Tool, the MLC 8000 Analog Comparator is referred to as the VGU, and the MLC 8000 Subsite Link Converter is referred to as the AGU.

There are two AGUs which connect to each GTR 8000 Base Radio or GPW 8000 Receiver for a single channel system. One AGU uses 4-W GenTx and Ext PTT for simulcast analog audio processing, and the second AGU uses V.24 for simulcast digital audio processing. This feature supports the standalone GTR 8000 Base Radio and GTR 8000 Expandable Site Subsystem (ESS). The GPW 8000 Receiver is supported for receive-only sites. QUANTAR® base stations are not supported.

Conventional Mixed Mode Simulcast Operation offers the ability for the two comparators, MLC 8000 (VGU) or GCM 8000, to receive their respective type of audio calls while the system is transmitting in the other mode, and to use all previously implemented analog and digital voting operation in the MLC 8000 (VGU) and GCM 8000 Comparator. As a result of this dual mode of operation, console priority can be guaranteed only if a repeater knockdown command is sent before the console call. To establish repeat operation, a console set-up command must be sent at the end of the console call.

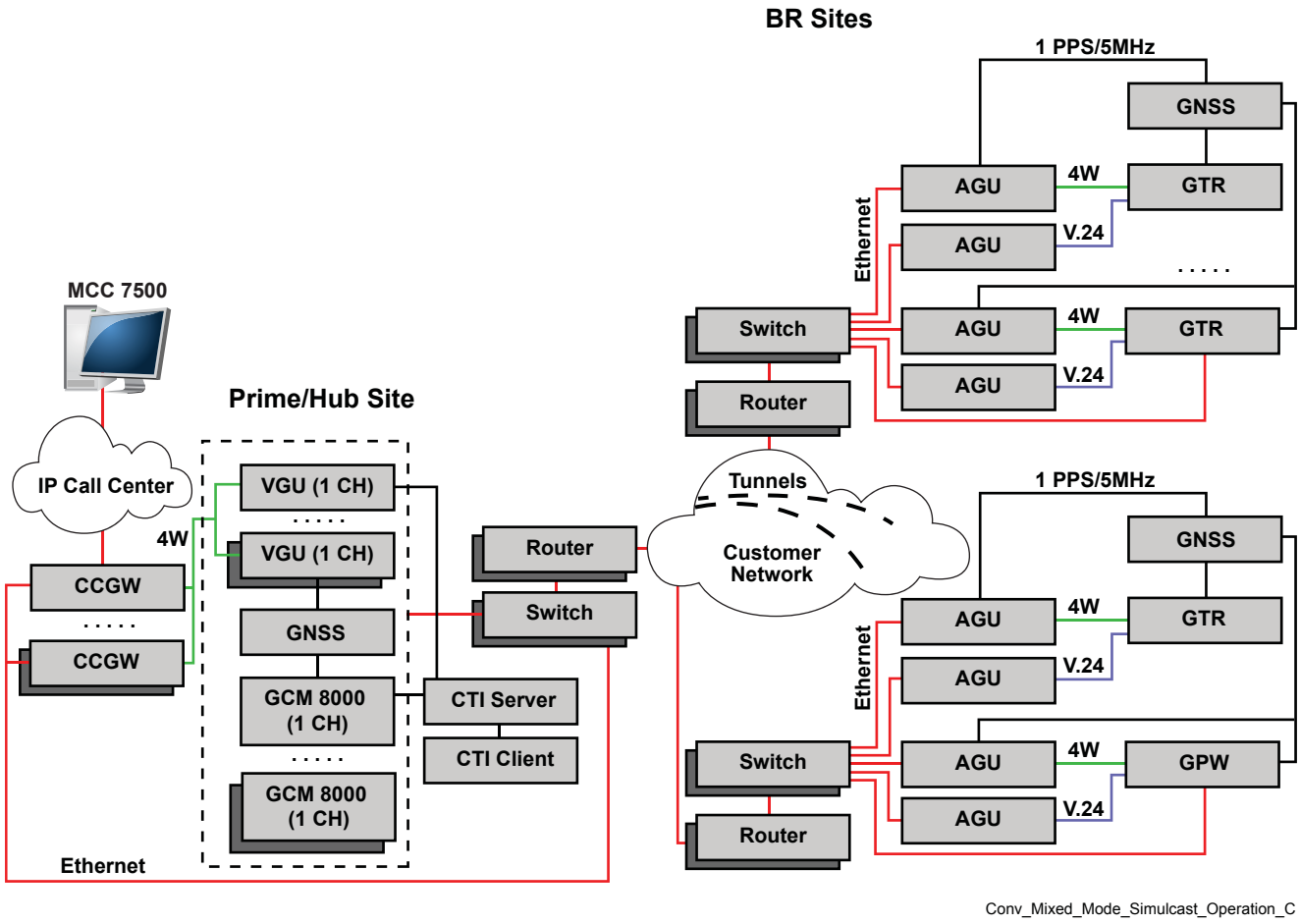
Conventional Mixed Mode Simulcast Operation requires that the console create a mixed mode resource. If the user wishes to use Mobile Data Communications (MDC) signaling on a mixed mode

system, two console channel resources, one MDC resource and one ASTRO® 25 digital resource, must be created for the operator position.

The relationship is 1:1 for AGUs and G.711 channels, and 1:4 for AGUs and V.24 channels. In a four-channel system, the base radio site requires five AGUs, one for each 4-Wire connection and one for all the V.24 connections.

Configuration/Service Software (CSS) allows the user to configure separate simulcast delays for analog and digital simulcast when in mixed mode simulcast. See *CSS Online Help*.

Figure 23: Conventional Mixed Mode Simulcast Operation



Conv_Mixed_Mode_Simulcast_Operation_C

The MLC 8000 Configuration Tool also supports configuration of analog simulcast delay.

A conventional mixed mode simulcast system supports up to 64 subsites.

4.8 Voting Control and Display

Motorola offers three solutions for voting control and display. See the following manuals:

- *MLC 8000 Configuration Tool with Analog Voting Control and Display* (analog MLC 8000 only)
- *MCC 7500/7100 Elite Admin User Guide* and *MCC 7500/7100 Elite Dispatch User Guide* “auxio” sections (up to 15 subsites, IP digital GCM 8000 only)
- *MCN Server 8000 Remote Comparator Display Software for Motorola Solutions IP Comparators* (up to 64 subsites, for IP digital GCM 8000; also supports MLC 8000)

4.8.1

Third-Party Voting Control and Display Application

CTI Products, Incorporated provides an MCN 8000 application that supports Voting Control and Display. The MCN 8000 application supports up to 64 sub-sites using analog and digital comparators. The MCN 8000 application uses a server that interfaces to the comparators to collect the voting information from the sub-sites. This data is processed and distributed to clients in the MCC 7500/7100 Dispatch Console sites and the zone core. The MCN 8000 application provides the ability to view voting data and provide the interface to control voting for a digital GCM 8000 Comparator and analog MLC 8000 Comparator as follows:

- Display of the status of each receiver (No Activity, Receiving, Voted, Vote Disabled, or Failed).
- Control of each receiver (Vote Disabled/Enabled or Forced Voted).
- Vote Disabled to eliminate a sub-site from the pool of sub-sites that are eligible for voting.
- Vote Enabled to return a sub-site to the pool of sub-sites that are eligible for voting.
- Forced Vote to override the comparator voting mechanism and to automatically select a sub-site to be voted.

The dispatch operator can view the voting data for the analog and digital comparators on the same screen to obtain a clear view of the operation of the Mixed Mode voting system.

The MCN 8000 application is installed on its own server, a standard, MSI-supplied computer that can be physically at the MCC 7500/7100 Dispatch Console site, or on a computer running the Network Management Client application. Up to two of these servers can be supported at a single console dispatch site. Load-share voting data for the comparators is supported for the two servers. The servers are not redundant.

The MCN 8000 client application is installed on its own computer, a Network Management client computer, or on an MCC 7500/7100 Dispatch Console in a cohabitate arrangement. Regardless of the platform on which it is installed, the client must be at a site containing MCC 7500/7100 Dispatch Consoles or in the zone core.

The MCN 8000 application supports a separate interface device called the HIB-IP that can be used as a protocol converter for the DigitTAC and Spectra-TAC comparators. The HIB-IP device is installed at the comparator location and converts the general-purpose I/O from the comparator into IP so the voting control and display for these Non-IP devices can be displayed. The following table provides the MCN 8000 application device quantities and the locations in the conventional system at which they can be installed. MCN 8000 application devices can be used in any system configuration supporting conventional services in K, L, and M zone cores.

Table 14: MCN 8000 Conventional System Location

Conventional System Location and Device Quantity				
Device	**Zone Core**	**Conventional Hub Site**	**NM MCC 7500/7100 Dispatch Site**	**IP Simulcast Prime Site**
MCN 8000 Server	2	2	2	0
MCN 8000 Client	2	2	2	0
CTI HIB-IP	0	2	0	2

For voting display and control, the CTI Client/Server can access and receive status from the CTI HIB-IPs at a sub-site to control the sub-site base radios from CTI for:

- Conventional Only Site (single repeater/base station/control station/receiver)
- Voting/Multicast/Simulcast prime site
- Voting/Multicast/Simulcast remote sub-site
- Conventional Hub Site (Defined by the Distributed Conventional Configuration)
- BR Site (Defined by the Distributed Conventional Configuration)
- Conventional Conduit Hub Site (Defined by the Distributed Conventional Configuration)

4.8.2
Interzone Voting Control and Display

MCC 7500/7100 Dispatch Consoles can communicate with conventional comparators through an AUX I/O server located in another zone.

A CTI server resides at a dispatch site and communicates directly with conventional comparators in the same zone or a different zone through a User Datagram Protocol (UDP)/IP protocol.

A console operator in one zone uses the MCC 7500/7100 Dispatch Consoles or CTI client interface to monitor activities for subsites that are supported on IP conventional comparators located in a different home zone. The console operator also uses the MCC 7500/7100 Dispatch Console or CTI client interface to force the IP conventional comparators to vote the audio from only a specific sub-site, and can disable sites from the voting process.

If the interzone link is not operational, a console operator cannot monitor voting and subsite status information from the IP conventional comparators in a different home zone. Additionally, the console operator cannot issue voting commands to the IP conventional comparators.

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Chapter 5

Other Conventional Operations and Topologies

The first section of this chapter provides an overview of topologies which can be connected to an ASTRO® 25 system core, or can exist in a standalone configuration (with no core). The second section of this chapter provides an overview of topologies that can only exist in standalone configuration, with no core.

5.1 Centralized Conventional Functional Topologies

The topologies described in this section show different combinations of devices and different uses of those devices to accomplish various operations for conventional channel resources. The features supported by these topologies are dependent on the types of devices used (such as QUANTAR®, GTR 8000 Base Radios, and others), their functions, and the types of interfaces supported.

Device capabilities determine link types as described in Conventional Devices on page 37.

This section provides an overview of various Centralized Conventional topologies which, in addition to the simulcast/voting topologies in Conventional Simulcast/Voting on page 159, can be connected to an ASTRO® 25 K core, L core, or M core.

To have an MCC 7500/7100 Dispatch Console, you must have an M, L, or K core, depending on your system. Standalone (no core) systems similar to the topology diagrams can be in this section, except instead of the connection to M, L, or K cores, a connection is made to a dispatch console, or other central management site. This situation includes standalone 3.1 systems.

If centralized conventional has no connection to any core, all connections must be made manually.

In topologies that include prior releases equipment, do not assume that the Information Assurance capabilities of that equipment are up to the standards for connecting the site to an ASTRO® 25 release 7.x system.

For standalone topologies, see Standalone Conventional Topologies on page 194.

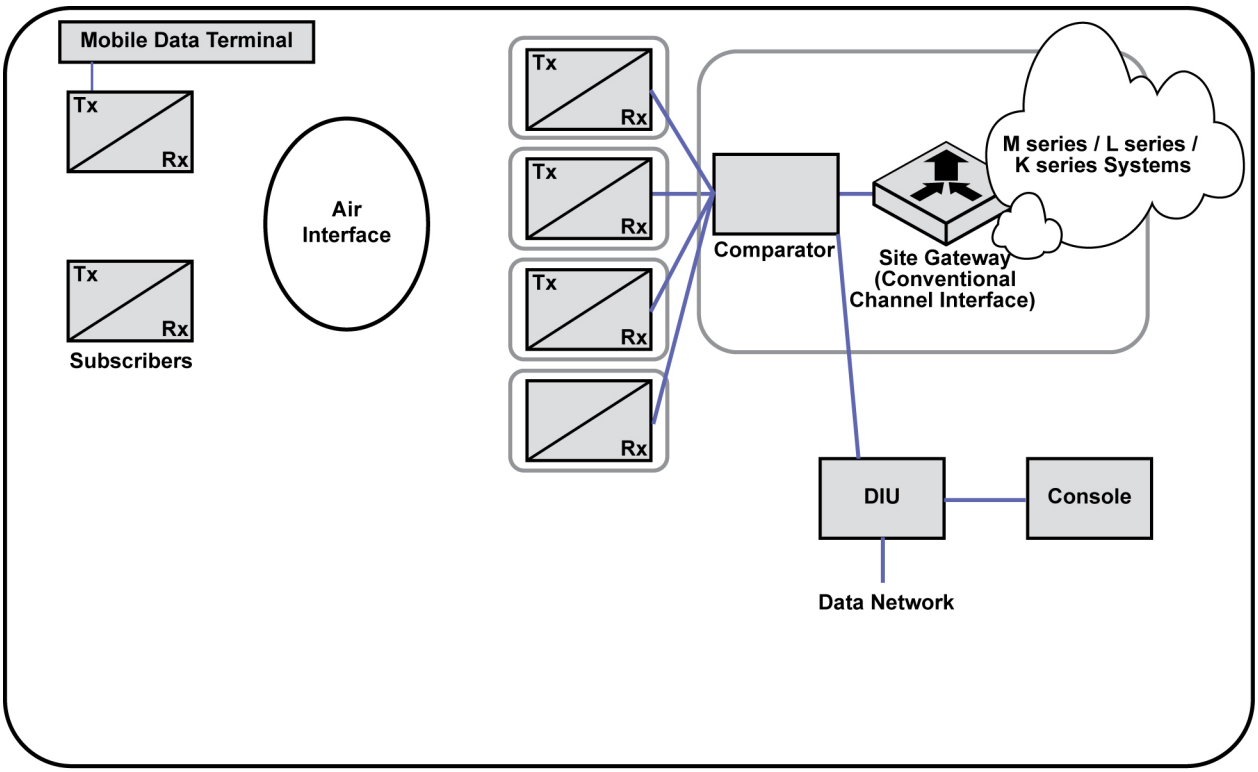
5.1.1 ASTRO 3.1 Coexistence Topology

The A3.1 Coexistence feature provides for the interface of the ASTRO® 3.1 conventional systems to connect to an ASTRO® 25 system. In this topology, the MCC 7500/7100 Dispatch Consoles in the ASTRO® 25 system can use the conventional channels in the ASTRO® 3.1 conventional system. The Coexistence feature enables a gradual expansion from an existing system to a new ASTRO® 25 platform.

NOTICE: The conventional channels supported by A3.1 Coexistence are digital-only channels. Coexistence Topology does not support analog channels.

Figure 24: ASTRO 3.1 Coexistence

This figure shows the architecture for an ASTRO® 3.1 conventional system connected with an ASTRO® 25 system.



ASTRO_3_1_Coexistence

5.1.2
ASTRO 3.x Prior Releases Console Topologies

The IP Link Converter (IPLC) device allows for the use of GTR 8000 Base Radios or QUANTAR® Base Radios with non-IP-based dispatch console/data subsystems found in an ASTRO® 3.x system. The IPLC can be located in the ASTRO® 3.x core or at various base radio sites in the A3.x system to support the use of digital (V.24 or IP) or mixed-mode GTR 8000 or QUANTAR® Base Radios for simulcast, voting, and/or multicast operation where the ASTRO® 3.x system employs either circuit-based channel banks transport or Ethernet-based routers and switches transport devices.

The IPLC is based on the GGM 8000 hardware platform and can be equipped with either a Low Density Enhanced Conventional Gateway module or a High Density Enhanced Conventional Gateway module and running Enterprise OS (EOS) software version 16.6 or higher.

The conventional IPLC must provide:

- Current Conventional Channel Gateway (CCGW) link maintenance functionality, allowing the IPLC to interface with the GTR 8000 and GCM 8000 devices.
- The current Link Management Functional Requirement Specification for the Digital Interface Unit (DIU) to site link.
- Generation of Tone Remote Control (TRC) tones and signaling message for the outbound repeat command to the MLC 8000 and GCM 8000 comparators, respectively.
- Maintaining 9.6 kbps on the V.24 interface to the DIU using either a circuit-based or IP-based backhaul. The conventional IPLC to circuit link converter must account for IP packet jitter, network delay, and lost packets.

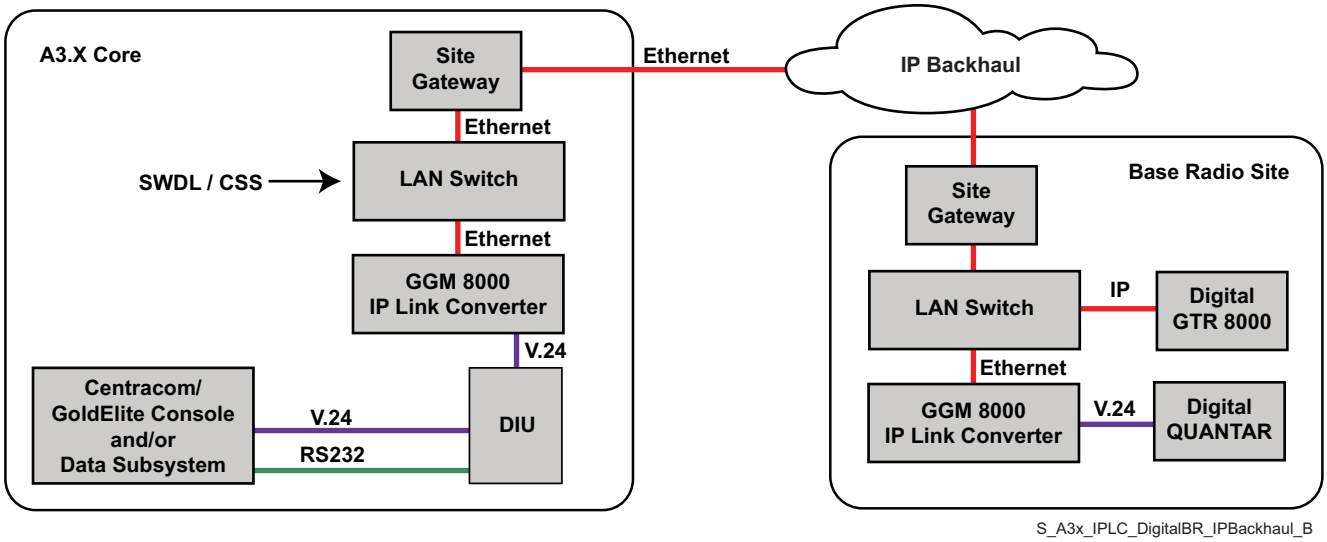
While different IP network configurations are possible with the GGM 8000 Link Converter Gateway solution, implementing a non-certified network solution is the responsibility of the provider to determine specific network requirements to ensure proper performance for the network. Contact your Motorola Solutions field service representative.

The conventional IPLC must support the following interfaces for allowing the following topologies to be deployed:

- 4-wire < > IP
- V.24 < > IP
- 4-wire < > 4-wire

These figures show implementation of the ASTRO® 3.x IPLC in various topologies to support the use of Centracom/Gold Elite non-IP-based consoles with conventional channels at various base radio sites.

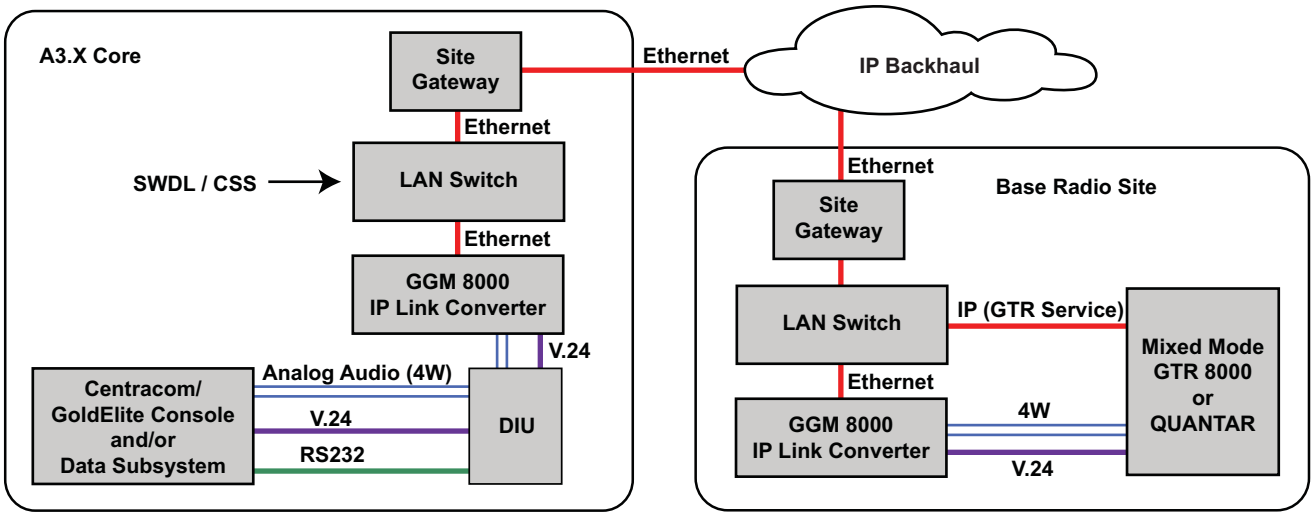
Figure 25: ASTRO 3.x IPLC Conventional Console Site with Digital Standalone RF Subsystem with IP Backhaul Network Topology



ASTRO® 3.x IPLC Conventional Console Site with a Digital Standalone RF Subsystem with IP Backhaul Network includes, but may not be limited to, the following:

- Supports Conventional IPLC devices.
- Allows ASTRO® 25 7.x site devices to interface to a prior releases ASTRO® 3.x console site over an IP backhaul network without the need for circuit base devices.
- A second link converter is required, when a QUANTAR® station is used at the base radio site.
- LAN switches and site gateway devices are pre-configured for the specific equipment and features implemented for your organization.
- IPLC devices are manually configured.
- Remote Configuration/Service Software (CSS) application and Software Download Manager (SWDL) manager are collocated at the 3.x core site and support the G-Series RF devices.
- Supports Ethernet Site Links.
- IPLC devices are at the A3.x core site and interface with a V.24 interface to the Digital Interface Unit (DIU) and an Ethernet/IP connection to the LAN switch.

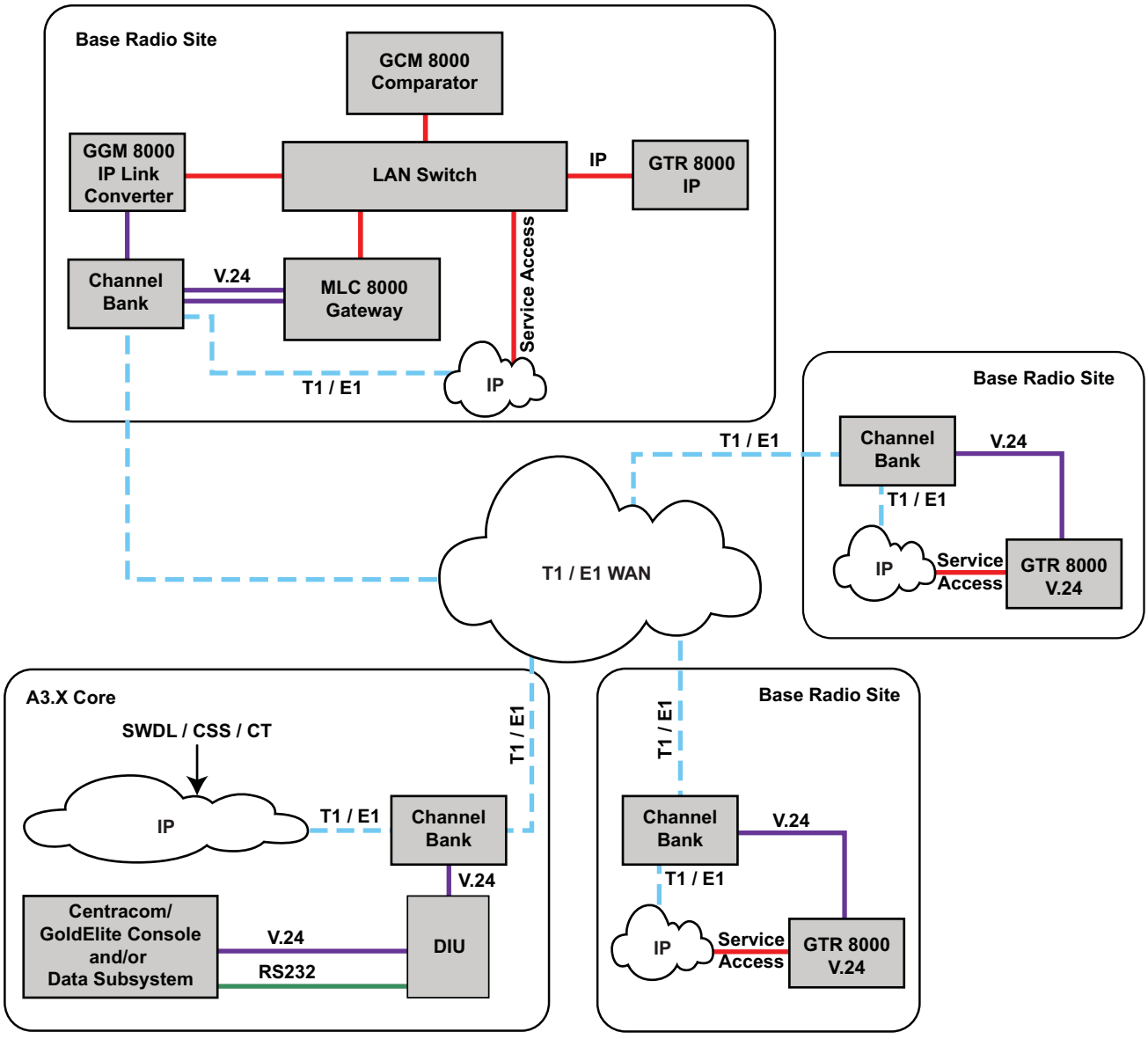
Figure 26: ASTRO 3.x IPLC Conventional Console Site with Mixed-Mode Standalone Digital RF Subsystem with IP Backhaul Network Topology



ASTRO® 3.x IPLC Conventional Console Site with Mixed-Mode Standalone Digital RF Subsystem with IP Backhaul Network includes, but may not be limited to, the following:

- Supports conventional IPLC devices.
- Allows ASTRO® 25 7.x site devices to interface to a prior releases ASTRO® 3.x console site over an IP backhaul network without the need for circuit base devices.
- A second link converter is required, when a Mixed Mode GTR 8000 or QUANTAR® station is used at the base radio site to arbitrate inbound traffic between the GCM 8000 and MLC 8000 Comparators..
- LAN switches and site gateway devices are pre-configured for the specific equipment and features implemented for your organization.
- IPLC devices are manually configured.
- Remote CSS application and SWDL are collocated at the 3.x core site and support the G-Series RF devices.
- Supports Ethernet Site Links.
- V.24 voice traffic is transported over an IP backhaul using IP and 4-wire traffic is transported over backhaul using G.728/IP.
- One IPLC device is at the A3.x core and interfaces with both analog audio/4W and V.24 interface to the digital interface unit (DIU) and an Ethernet/IP/G728 connection to the site gateway.
- The other IPLC device is at the base radio site and interfaces with analog audio (4W) connection to the MLC 8000 Analog Comparator and an ACIM/RS232 connection to the LAN switch.

Figure 27: ASTRO 3.x IPLC Conventional Console Site with Multicast/Voting Subsystem Circuit-Based T1/E1 Backhaul Network Topology



S_A3x_IPLC_Digital_BR_MultiVoting_Circuit_Backhaul_B

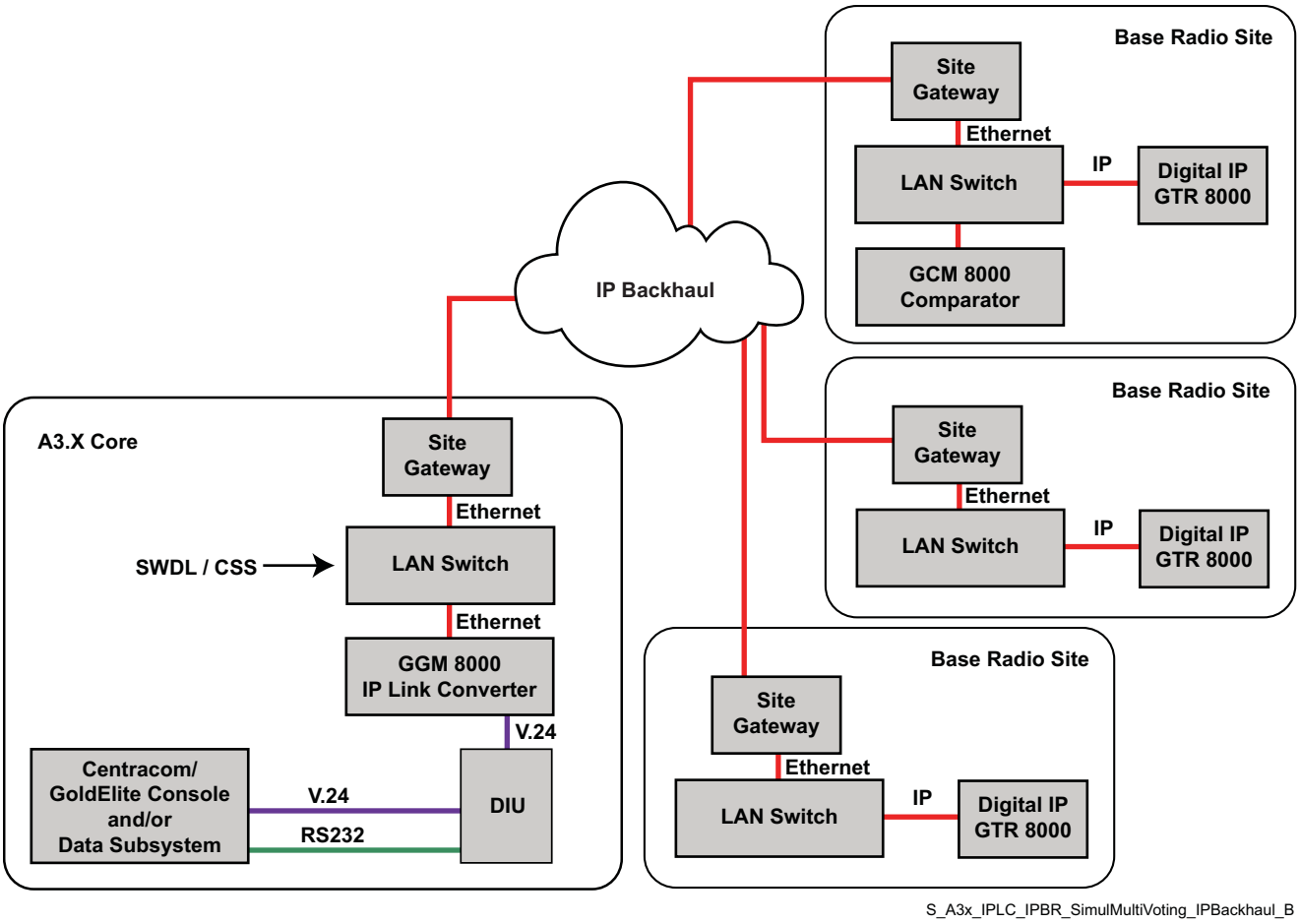
NOTICE: To support simulcast all the base stations, use the same interface (V.24 or IP).

ASTRO® 3.x IPLC Conventional Console Site with Multicast/Voting Subsystem Circuit-Based T1/E1 Backhaul Network, include, but may not be limited to, the following:

- Supports Conventional IP Link Converter.
- Allows ASTRO®25 7.x site devices to interface to a prior releases ASTRO® 3.x console site over an existing ASTRO® circuit-based transport.
- The LAN switch is pre-configured for the specific equipment and features implemented for your organization.
- IPLC devices are manually configured.

- CSS application and SWDLs are collocated at the prior releases console site. The CSS and SWDL remote services support G-Series RF devices. CSS application and SWDL managers are only supported when IP connectivity to the site is available via the T1/E1 WAN links.
- T1/E1 WAN links are used.
- The IPLC device is at the base radio site and interfaces with an V.24 interface to the Channel Bank and an Ethernet/IP connection to the LAN switch.

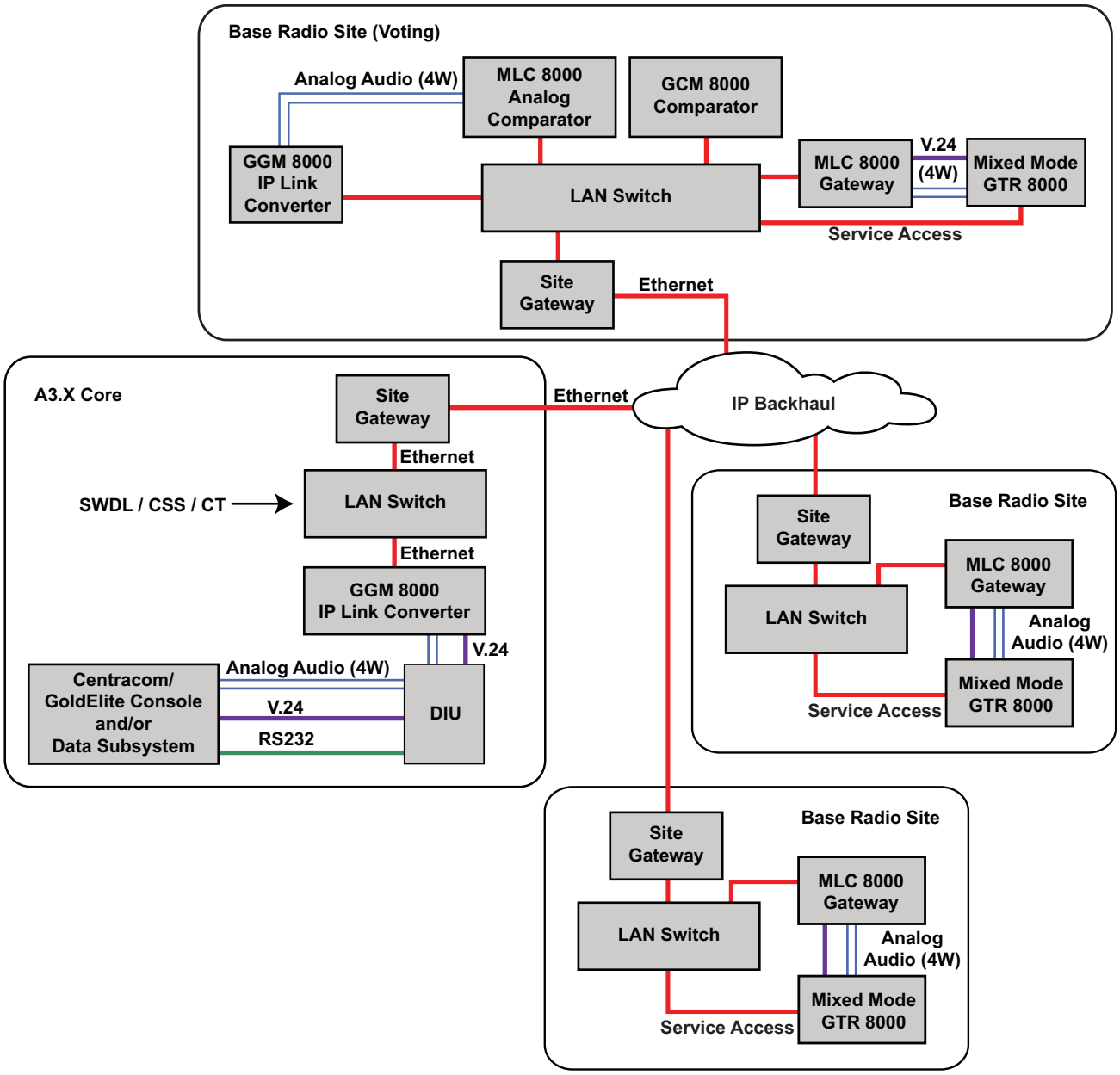
Figure 28: ASTRO 3.x IPLC Console Site with Digital only Simulcast/Multicast/Voting Subsystem with IP Backhaul Network Topology



ASTRO 3.x IPLC Conventional Console Site with Digital only Simulcast/Multicast/Voting Subsystem with IP Backhaul Network includes, but may not be limited to, the following:

- Supports IPLC devices.
- Allows ASTRO® 25 7.x site devices to interface to a prior releases ASTRO® 3.x console site over and IP backhaul without the need for circuit base devices.
- LAN switches and site gateway devices are pre-configured for the specific equipment and features implemented for your organization.
- IPLC devices are manually configured.
- Remote CSS application and SWDLs are collocated at the 3.x core site and support the G-Series RF devices.
- Ethernet Site Links are used.
- The IPLC device is at the base radio site and interfaces with an V.24 interface to the Digital Interface Unit (DIU) and an Ethernet/IP connection to the site gateway.

Figure 29: ASTRO 3.x IPLC Conventional Console Site with Mixed–Mode Multicast/Voting Subsystem with IP Backhaul Network



S_A3x_IPLC_MixModeBR_MultiVoting_IPBackhaul_C

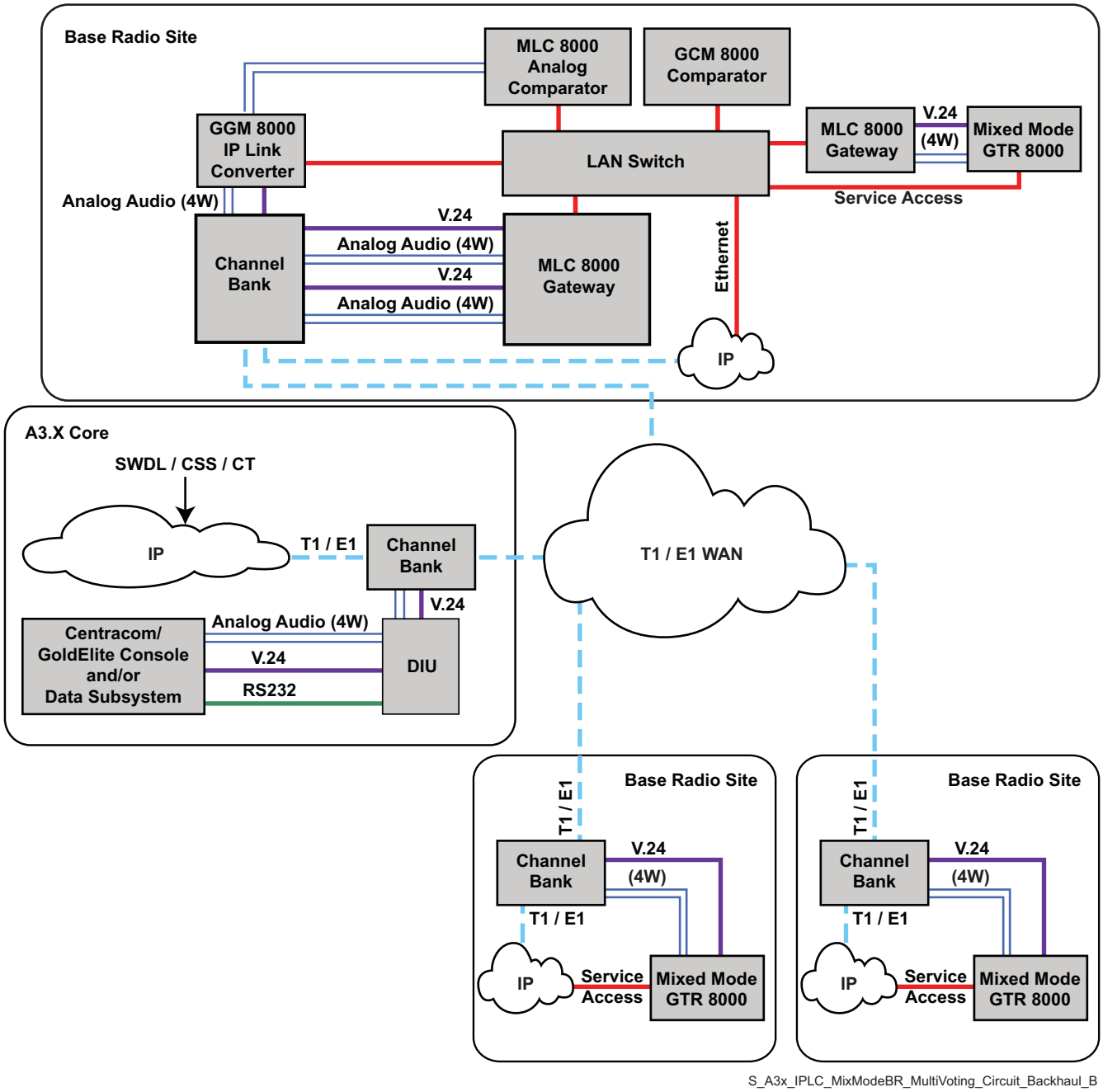
ASTRO 3.x IPLC Conventional Console Site with a Mixed–Mode Multicast/Voting Subsystem with IP Backhaul Network includes, but may not be limited to, the following:

- Supports IPLC devices.
- Allows ASTRO® 25 7.x site devices to interface to a prior releases ASTRO® 3.x console site over and IP backhaul without the need for circuit base devices.
- A second IPLC is required at the base radio site when an MLC 8000 analog comparator is used in a voting subsystem.
- Supports Ethernet site links.
- Remote CT, CSS application, and SWDL are collocated at the ASTRO® 3.x core site. The CSS and SWDL remote services support the G-Series RF devices, while the CT remote service support the

MLC 8000 devices. These remote services are supported only when IP connectivity to the site is available via the WAN links.

- LAN switches and site gateway devices are pre-configured for the specific equipment and features implemented for your organization.
- One IPLC device is at the ASTRO® 3.x core and interfaces with both an Analog Audio/4W and V.24 to the digital interface unit (DIU) and an Ethernet/IP/G728 to the site gateway.
- The other IPLC device is at the base radio site and interfaces with Analog Audio (4W) connection to the MLC 8000 Analog Comparator and an ACIM/RS232 connection to the LAN switch.

Figure 30: ASTRO 3.x IPLC Conventional Console Site with Mixed-Mode Multicast/Voting RF Subsystem with Circuit-based Backhaul Network Topology



S_A3x_IPLC_MixModeBR_MultiVoting_Circuit_Backhaul_B

ASTRO® 3.x IPLC Conventional Console Site with Mixed-Mode Multicast/Voting RF Subsystem with Circuit–based T1/E1 Backhaul Network includes, but may not be limited to, the following:

- Supports Conventional IPLC devices.
- Allows ASTRO® 25 7.x site devices to interface to a prior releases ASTRO® 3.x console site over an existing ASTRO® 25 circuit-based transport.
- LAN switches are pre-configured for the specific equipment and features implemented for your organization.
- IPLC devices are manually configured.
- Remote CT, CSS application, and SWDL are collocated at the prior releases console site. The CSS and SWDL remote services support the G-Series RF devices, while the CT remote service support the MLC 8000 devices. These remote services are supported only when IP connectivity to the site is available through the WAN links.
- The IPLC device is at the base radio site and interfaces with both an Analog Audio (4W) and V.24 interface to the Channel Bank, an Ethernet/IP/G728 connection to the MLC 8000, and an Analog Audio (4W) connection to the MLC 8000 Analog Comparator.

Different IP network configurations are possible with the GGM 8000 Link Converter Gateway solution, implementing a non-certify network solution is the responsibility of the provider to determine specific network requirements to ensure proper performance for the network.

For detailed information regarding manual configuration, operation, maintenance, and troubleshooting for the IPLC, see the *IP to Circuit-based Link Converter User Guide*.

5.1.2.1
ASTRO 3.x and IP Link Converter

While the IP Link Converter (IPLC) supports the use of the MCC 5000 consoles with G-Series MLC 8000 devices, RF equipment and support the ASTRO® 25 Control Interface Module (ACIM) signaling, note the following:

- The IPLC is supported only for use in ASTRO® 3.x systems.
- The IPLC supports the use of Software Download Manager (SWDL), Configuration/Service Software (CSS), and CT tools used from a remote location.
- Fault Monitoring of the IPLC can be done using and optional MOSCAD Network Fault Management (NFM) device.
- Unused auxiliary ports on the IPLC link converter may be used to support more than one MOSCAD I/O indication on a conventional channel.
- The optional CTI solutions are supported.
- The IPLC supports the four conventional channel and eight conventional channel interface card.
- Ethernet based network topologies support the maximum number of channels available the IPLC regardless of whether a channel is mixed-mode or digital. Four or eight conventional channels can be supported on a four-port or eight-port channel IPLC.
- For channels used with circuit-based (channel banks, and other type devices) transport, half the number of channels normally available on an IPLC interface card are available.
- The number of channels available on an IPLC interface card is independent of the channel type (mixed-mode or digital) used for subsequent channels.
- The IPLC supports Tone Remote Control (TRC) tone generation for the outbound repeat message. The IPLC sends TRC tones and the repeat signaling message command to the MLC 8000 and GCM 8000 comparators.

- For network transport provided by Motorola Solutions, IP Sec is employed to support secure payload between sites.
- For network transport not provided by Motorola Solutions, use IP Sec for secure payload between sites.

5.1.2.2
ASTRO 3.x and IP Link Converter Limitations

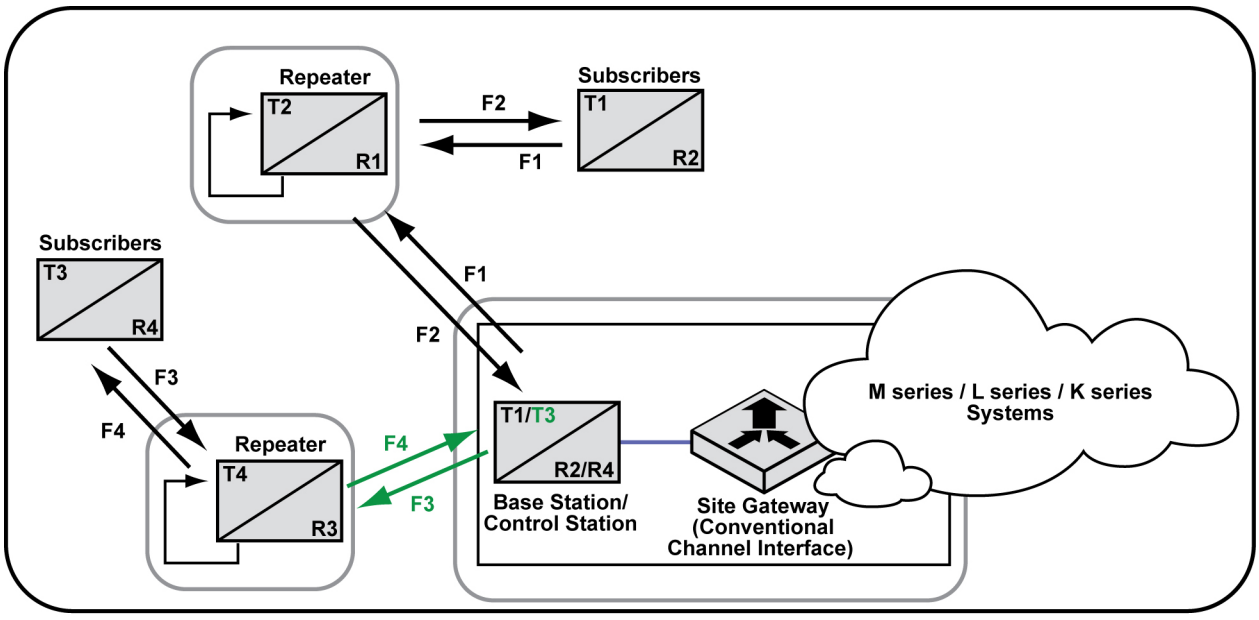
The IP Link Converter (IPLC) does not support the following:

- Archiving Interface Server (AIS) Voice and Channel Event Logging
- Site Conventional Mode
- Over-the-Ethernet-Keying (OTEK)
- Dynamic System Resilience (DSR)
- Interzone Conventional Voice
- Conventional Site Increase
- Affiliation Display
- 7.9 Voting Display
- Dynamic Reports
- Historical Reports
- InfoVista
- Air Traffic Router
- ZoneWatch
- Fault Management – Unified Event Manager (UEM)
- Distributed Conventional
- Time Sensitive Queuing
- High Capacity Queuing
- Dynamic IP Assignment
- Conventional DSR and high availability data

5.1.3
Multiple RF Controlled Repeaters (Voice) Topology

This conventional topology is identical to Single RF Controlled Repeater topology, except that the console operator (and subscriber) can manually select any one of multiple repeaters they choose to access. In the standard topology, this selection is done through mobile/control base station transmit channel mode selection (shown in the figure as F1 or F3, different RF frequencies).

Figure 31: Multiple RF Controlled Repeaters (Voice)



Multiple_RF_Controlled_Repeaters_voice

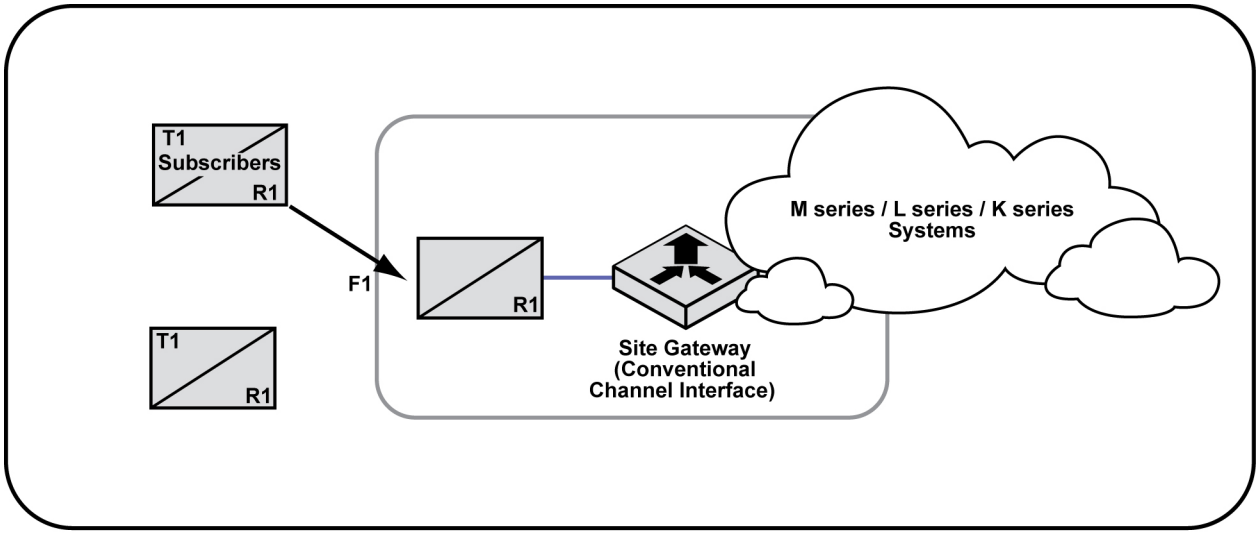
5.1.4

Receive Only Topology

Base radios can be employed as a receiver (receive-only operation). In addition, base radios used as a receiver (only) can be employed as a monitor receiver. This situation is sometimes referred to as a monitor channel because the console operator can monitor the channel, but does not transmit on the channel.

Figure 32: Receive Only Topology

This figure illustrates how base radios support conventional operations.



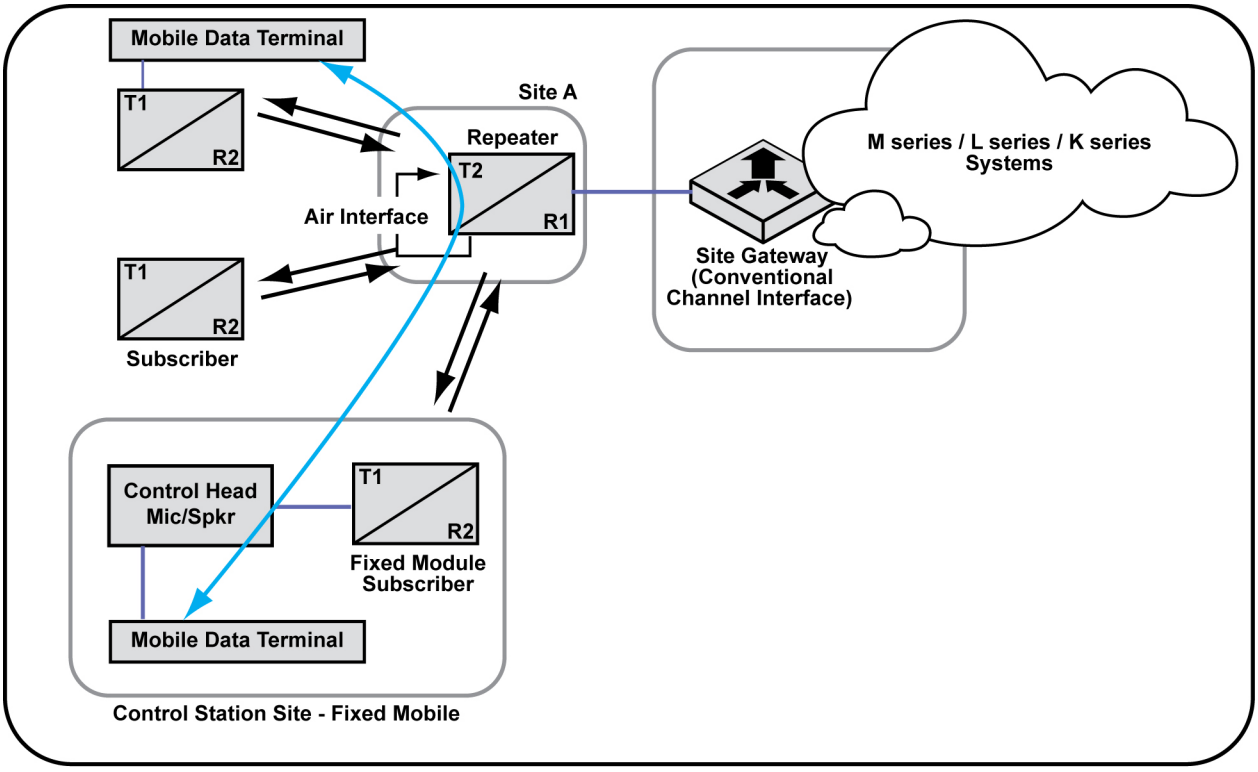
Receive_Only_Topology

5.1.5

Repeated Data not Passed to the Zone Core Topology

When a base radio is configured for repeated data, inbound data is repeated back out to receiving subscribers and up the wireline to the Conventional Channel Gateway (CCGW). In this case, the CCGW is configured to discard data received from the base radio so that it is not passed to the zone core. When the Customer Enterprise Network (CEN) data application is not present, the system is configured so that the zone core does not receive any repeated data.

Figure 33: Repeated Data not Passed to the Zone Core



Repeated_Data_not_Passed_to_Zone Core

5.1.6

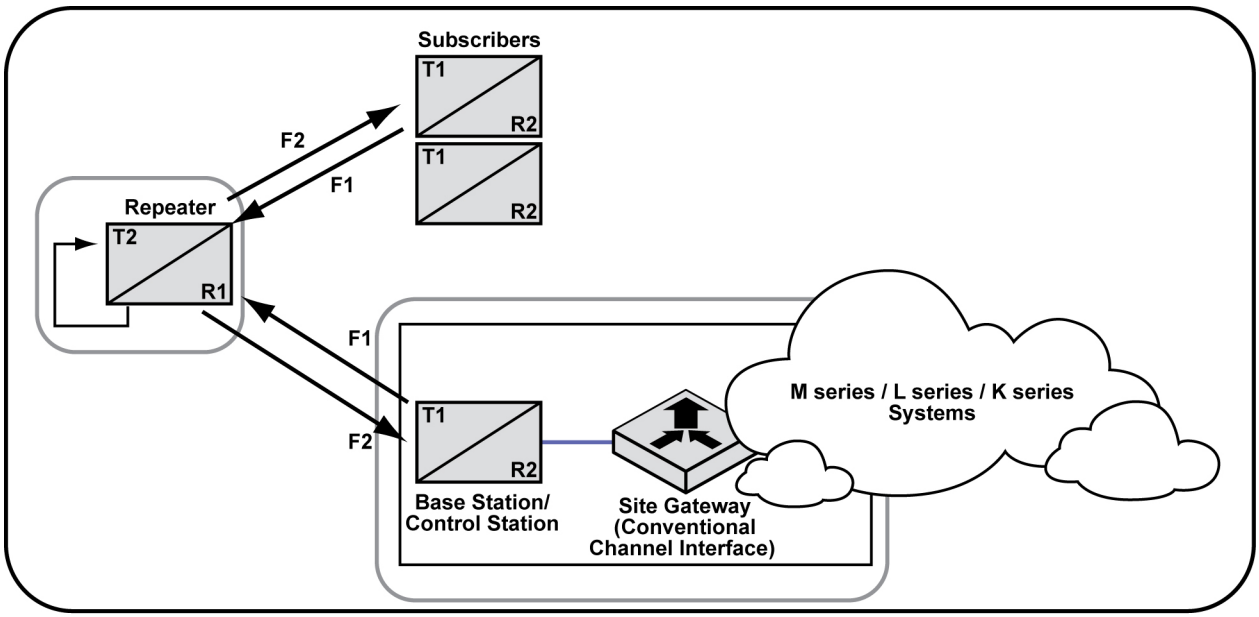
Single RF Controlled Repeater Topology

This conventional topology includes a dispatch console and two base radios. One base radio functions as a fixed repeater used as a transceiver to and from subscriber radios (mobiles and/or portables), and a second base radio used by a dispatch console or subscriber radio as a control station where the control station base radio is connected to the fixed base radio repeater through an RF link.

Every subscriber and the dispatch console transmit on the same frequency (T1) and the repeater receiver is on the same RF frequency as the subscriber transmitters. The repeater retransmits the received information on the repeater transmitter frequency, T2.

The subscriber receivers (and console) are on the same frequency as the repeater transmitter frequency, F2. The control station functionality is the same as the subscriber.

Figure 34: Single RF Controlled Repeater

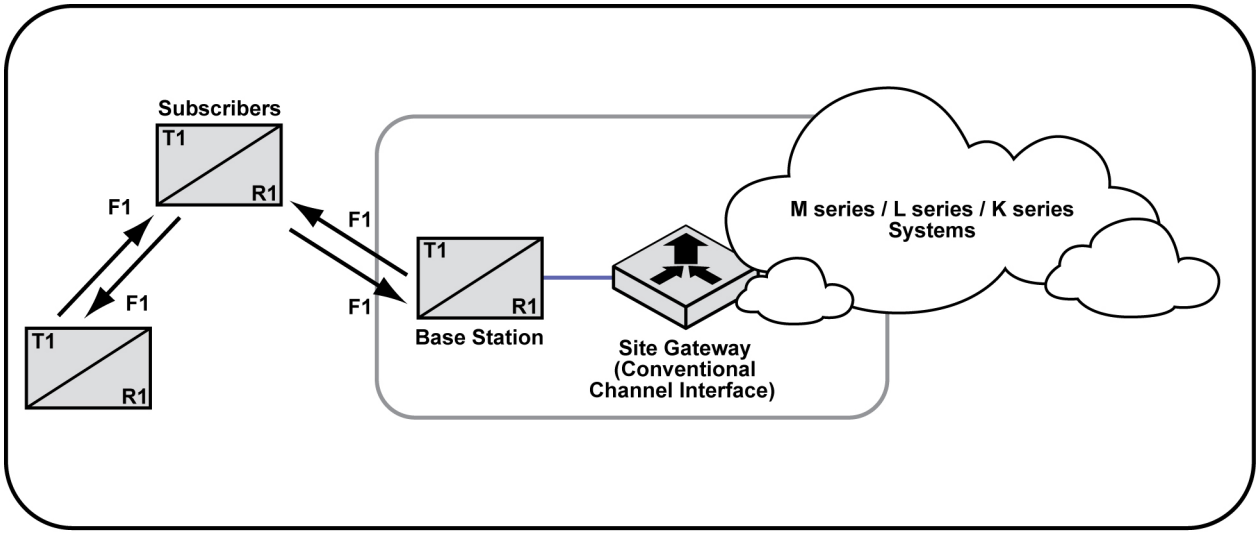


Single_RF_Controlled_Repeater

5.1.7
Subscriber to Base Radio Simplex Topology

A simplex topology uses a single base radio for transmitting and receiving between a subscriber and dispatch console position where the transmit frequency and receive frequency (channel) are the same. The GTR 8000 Base Radio, the QUANTAR®, and other prior releases base radios support simplex operation.

Figure 35: Subscriber to Base Radio Simplex Topology



Subscriber_to_Base-Radio–Simplex_Topology

5.1.8
Wireline Repeater Topology

The Wireline Repeater topology is a conventional data topology, which includes subscribers radios, a fixed base radio repeater, and a "control center" consisting of a "fixed" subscriber radio.

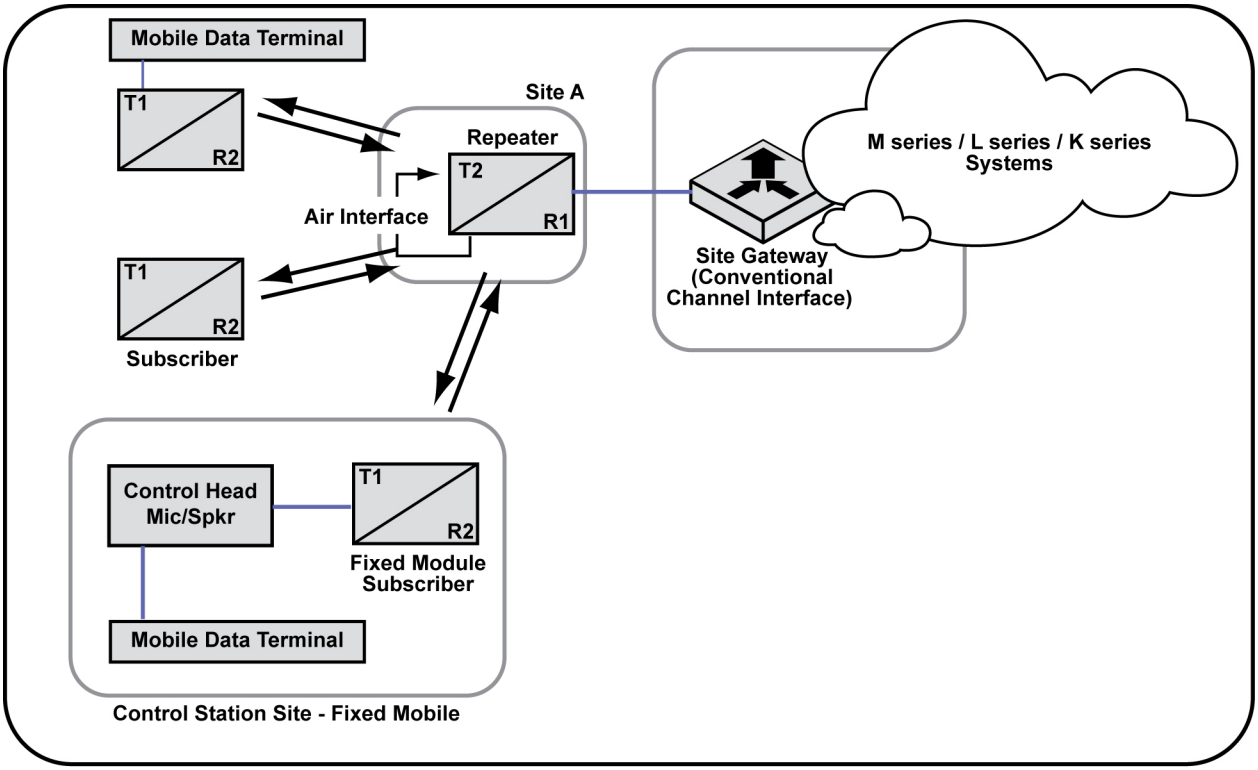
The fixed base radio repeater receive signal is heard at the console and repeated to the mobile subscriber radios. The console transmit audio can take over the repeater transmitter. In this topology, the console operator has direct wireline (physical interface) control of the repeater. This topology is supported with QUANTAR® or GTR 8000 Base Radios.

The data passes from the subscriber to the Customer Enterprise Network (CEN), and from the CEN to the subscriber. For detailed information about conventional data and conventional data call processing, see the *Conventional Data Services* manual.

The following support the Wireline Repeater topology:

- QUANTAR® Base Radios
  - V.24 link
  - Hybrid link
- GTR 8000 Base Radios
  - V.24 link
  - IP link

Figure 36: Wireline Repeater (CEN Data)



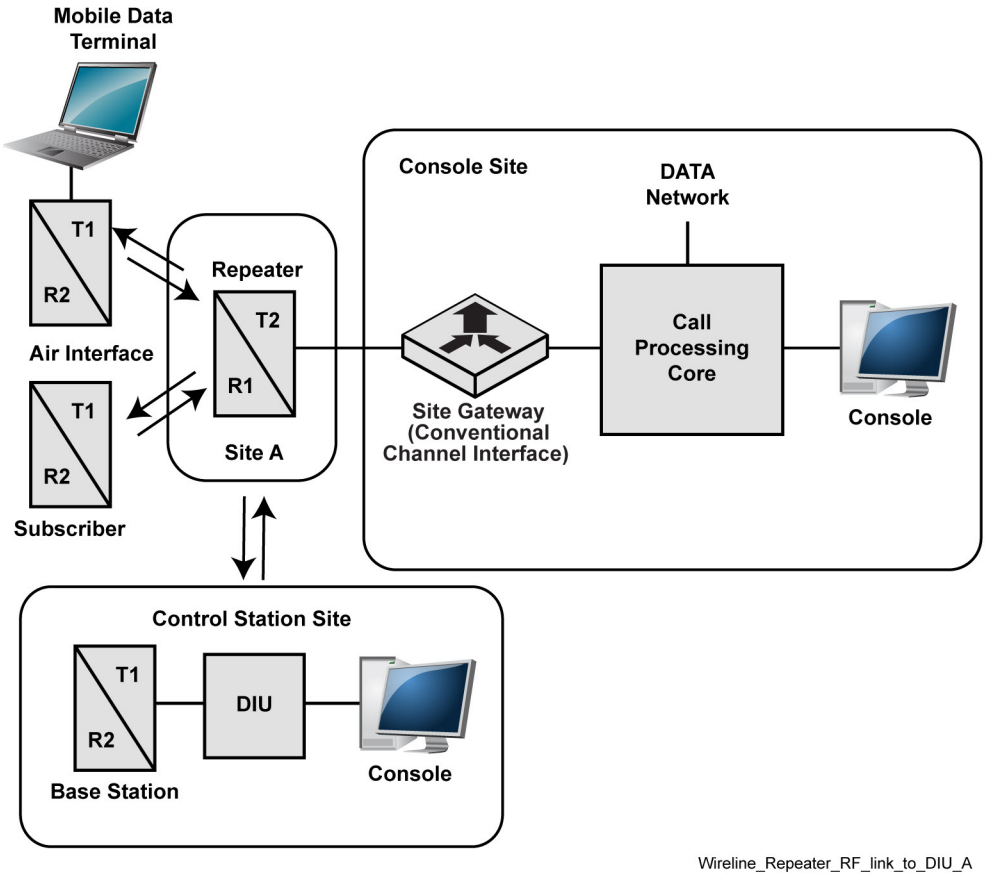
Wireline_Repeater_CEN_Data

5.1.9
Wireline Repeater (RF link to DIU) Topology

The Wireline Repeater – RF Link to Digital Interface Unit (DIU) conventional data topology is a variation of the Wireline Repeater topology. This topology includes subscribers radios, a fixed base radio repeater, and a control center connected to another fixed base radio through a physical link.

This topology is supported with QUANTAR® or GTR 8000 Base Radios to provide remote DIU Over The Air Rekeying (OTAR), and secure voice for remote analog consoles.

Figure 37: Wireline Repeater (RF link to DIU)

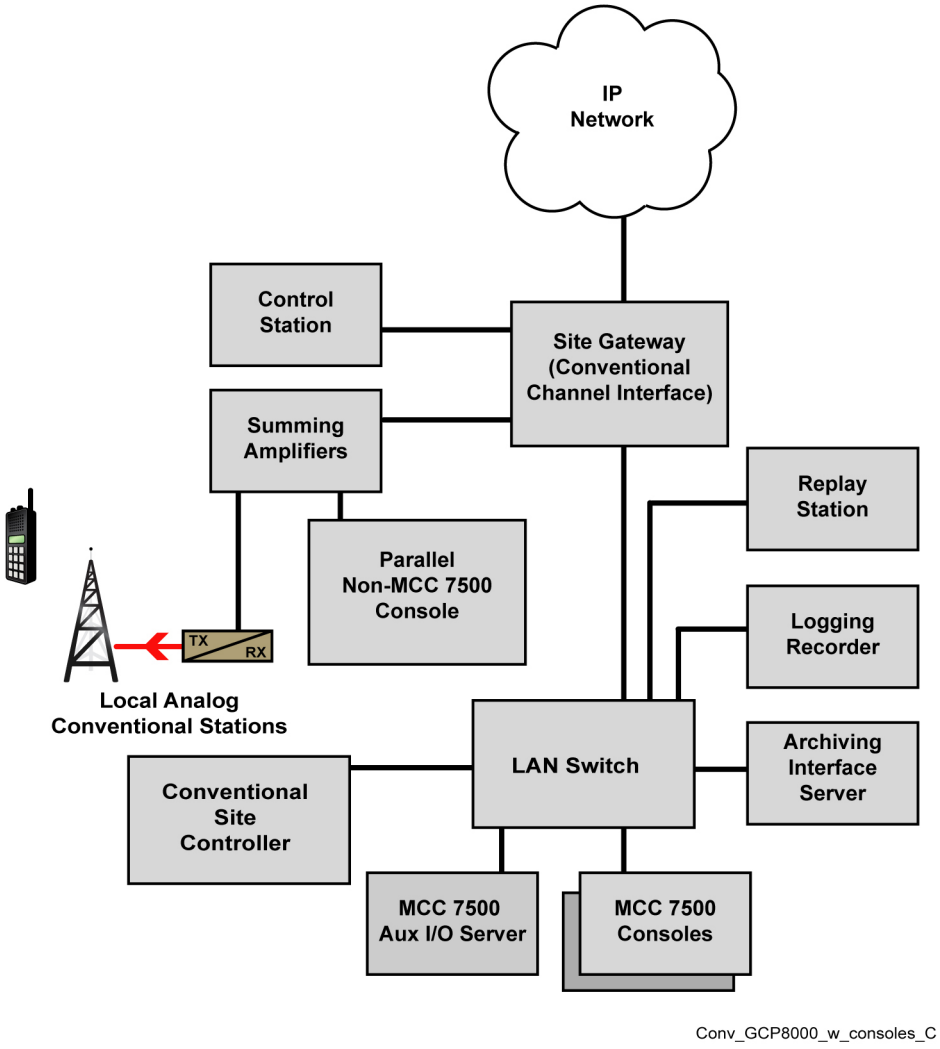


5.1.10

Parallel Analog Console

An MCC 7500 Dispatch Console site can support MCC 7500/7100 Dispatch Consoles in parallel with analog consoles where audio can be provided to both console types in the system as shown in the figure.

Figure 38: Console Site with Analog Conventional Channels



Analog conventional channels use an analog bridge to allow audio to be heard on both types of consoles (parallel audio). The audio bridge is a bi-directional analog (summing) amplifier that allows audio to pass between both types of consoles and the RF base radio equipment. With analog conventional resources (analog-only and MDC 1200, not analog on mixed-mode channels), the interoperability between analog consoles and the MCC 7500/7100 Dispatch Consoles is provided by the audio bridge.

In the preceding diagram analog base radios supported by summing amplifiers (audio bridge for parallel audio) and the conventional channel interface device can include the following:

- Analog QUANTAR®
- Analog ASTRO-TAC Receiver
- Analog MTC 2000/3000 Base Radio
- Other (Spectra-TAC, DIGITAC, and do on)

NOTICE: Parallel analog audio support is limited to the analog equipment supported by the summing amplifiers.

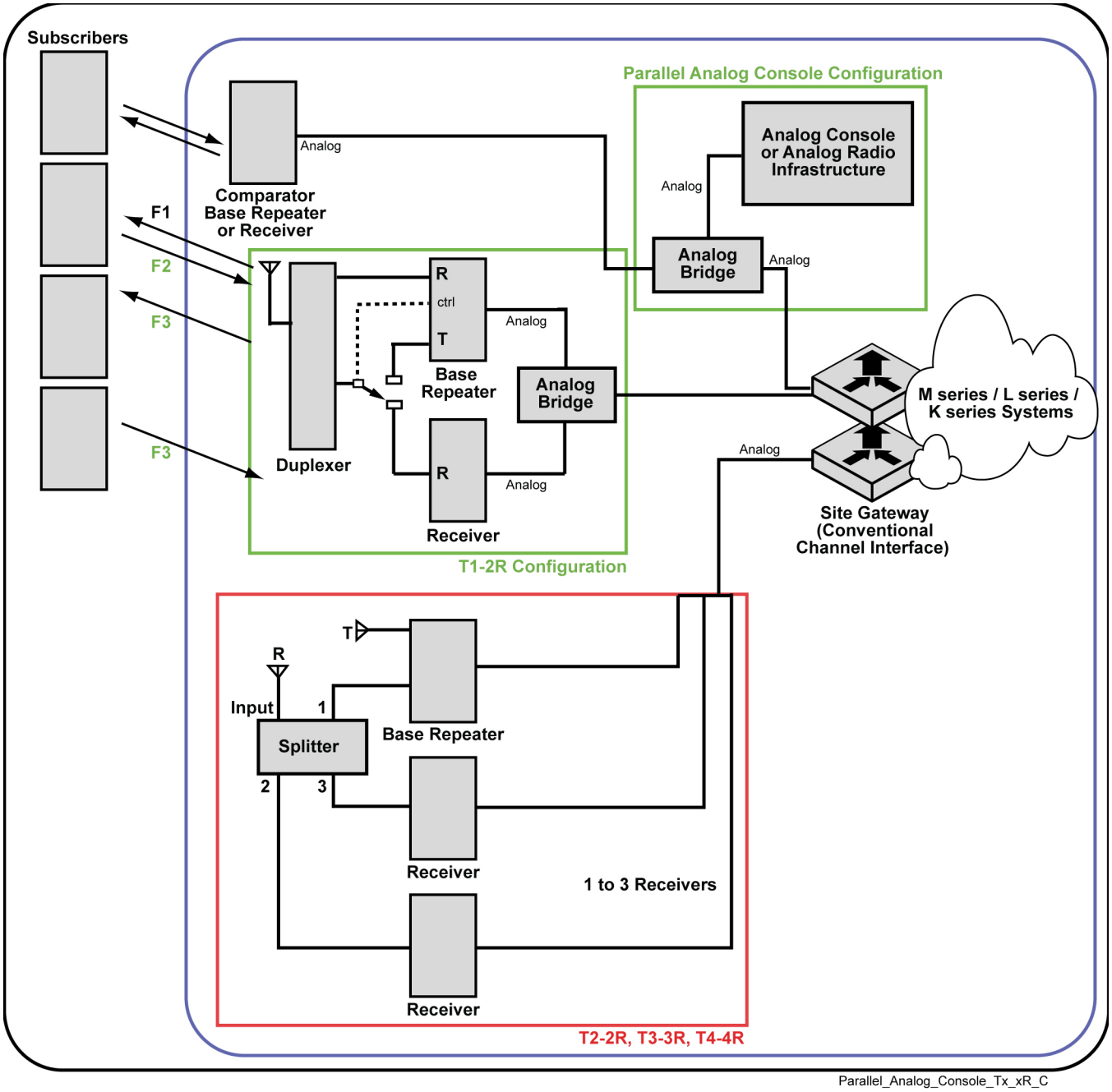
5.1.11

Other Topologies Using the Analog Bridge

The Parallel Analog Console and Tx-xR topology can be used so that console audio can be sent to MCC 7500/7100 Dispatch Consoles. This compatibility is accomplished by using analog bridge equipment between conventional channel analog interfaces and RF equipment as shown in this figure.

For more information about the analog bridge, see Analog LOBL Interoperability on page 84. For duplexer specifications, see the *GTR 8000 Base Radio* manual.

Figure 39: Parallel Analog Console and Tx-xR



The conventional GTR 8000 Base Radio supports the following additional topologies by means of option kits added to a GTR 8000 Base Radio and GPW 8000 Receiver configuration:

- T2-2R, T3-3R, T4-4R, and Tn-nR Receive Mute Option Kits

- T1-2R with talkaround Option Kit
- T2-2R with duplexer and Triple Relay Option kit

See “Appendix A, Conventional GTR 8000 Base Radio Option Kits”, in the *GTR 8000 Base Radio* manual for details.

For implementation of ASTRO® 3.x topologies where non-IP-based console/data subsystems can interface to RF site devices such as G-series, MLC 8000, and/or QUANTAR® devices via the Digital Interface Unit (DIU) to support conventional channels (digital or mixed mode channels) in an ASTRO® 3.x system. See ASTRO 3.1 Coexistence Topology on page 175.

5.1.12
Centralized Conventional-Only Remote Site With No Console

This topology can interface with an L zone core or M zone core to support conventional channel operation. It is not supported in distributed conventional architectures, including systems with K cores.

This topology can include the following equipment only:

- GTR 8000 Base Radios
- Site gateway with a conventional channel interface
- MOSCAD Network Fault Management (NFM) equipment

A similar topology implemented at a core site includes only the conventional channel interface functionality.

This topology cannot include a console, a comparator, or any other equipment not included in the preceding list.

NOTICE: L core does not support T1/E1 links. It supports only Ethernet. T1/E1 links can only be used for M core systems.

Figure 40: Centralized Conventional-Only Remote Site With No Console using T1/E1 Links

An example using T1/E1 site links is shown in this figure.

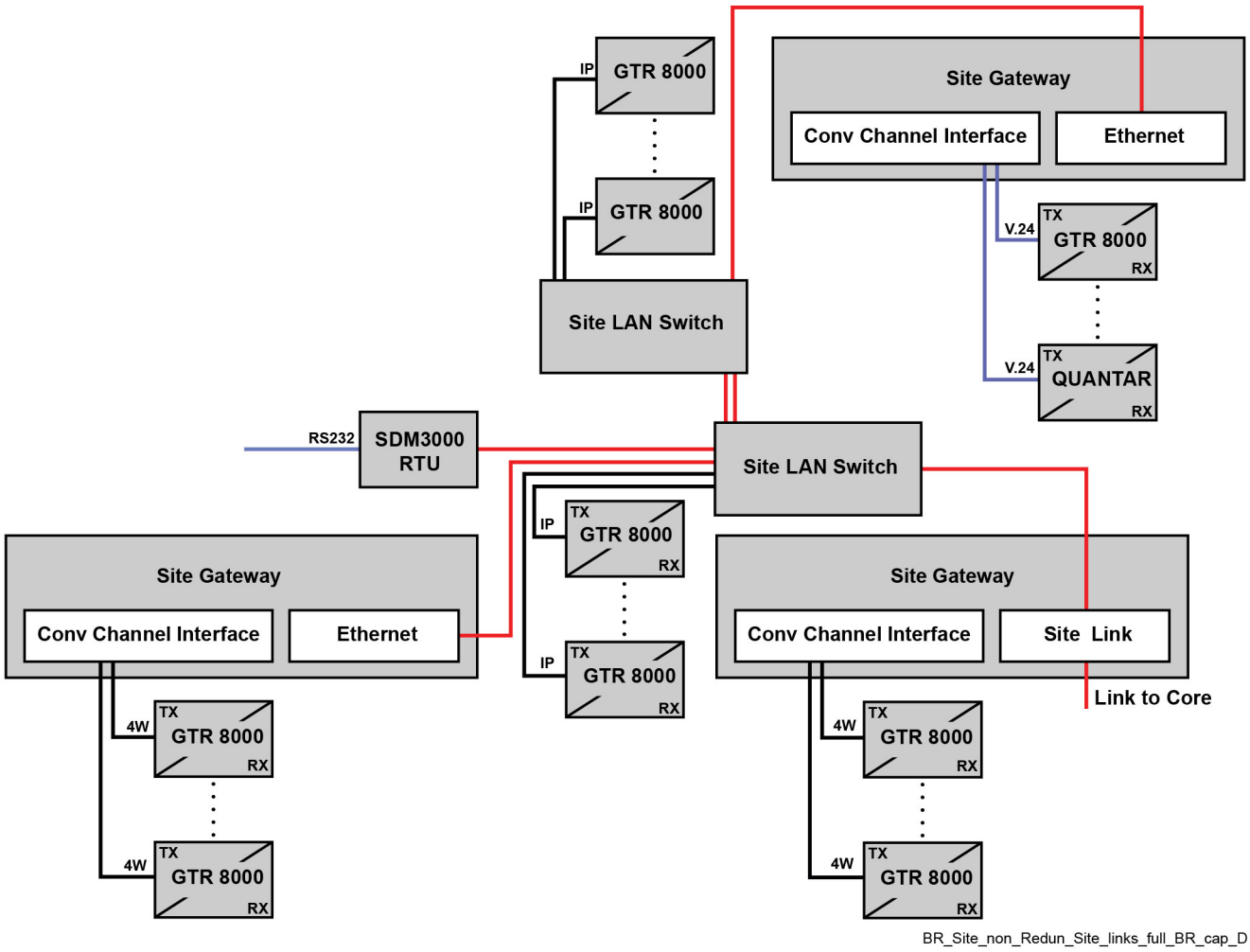
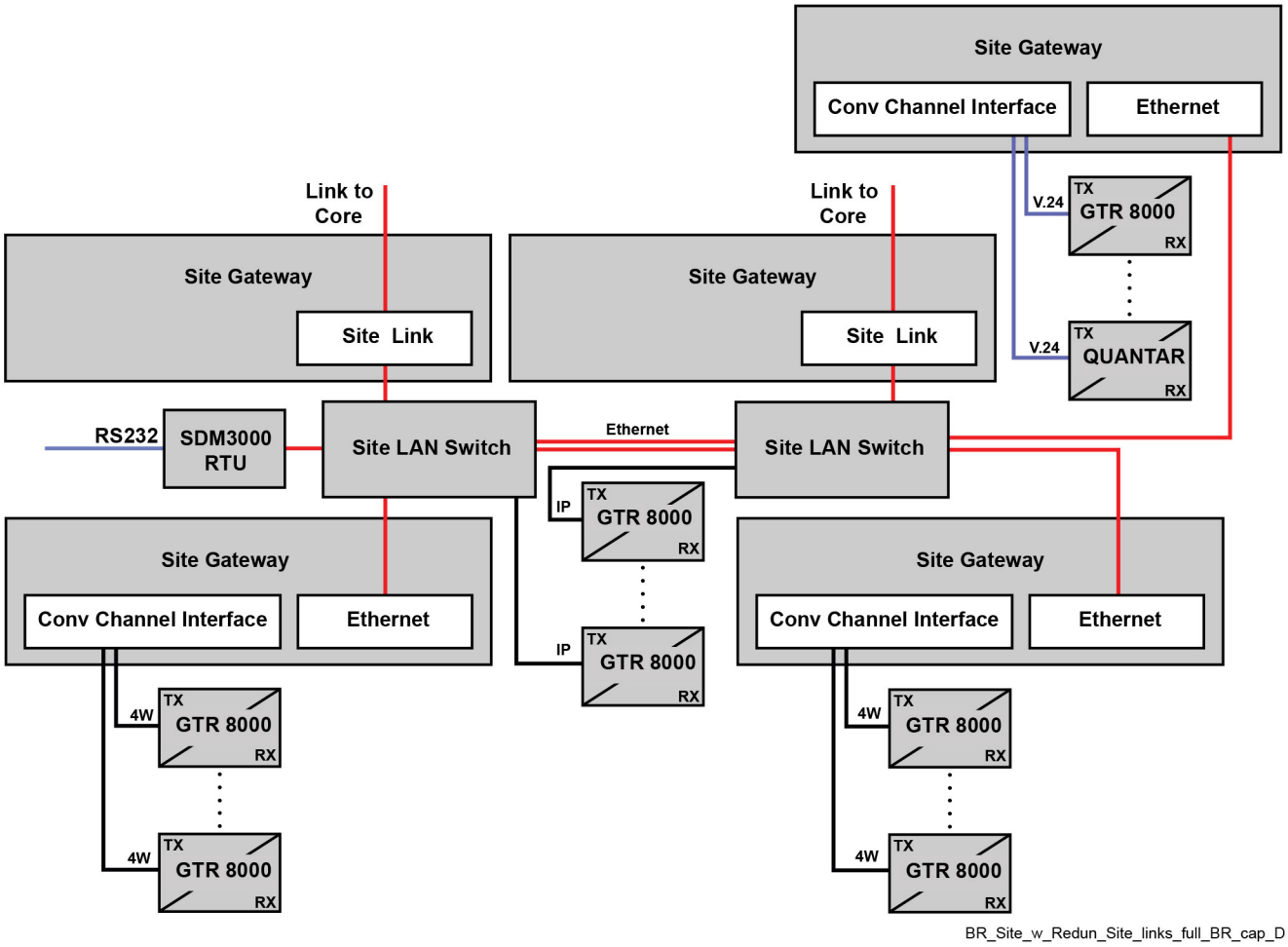


Figure 41: Centralized Conventional-Only Remote Site With No Console using Ethernet Links

An example of this topology using Ethernet site links is shown in this figure.



NOTICE: See the *MOSCAD Network Fault Management Feature Guide* manual for fault management using the SDM Remote Terminal Unit (RTU) and an industry-standard SNMP-compatible fault manager other than the Unified Event Manager (UEM) or MOSCAD Graphical Master Computer (GMC).

5.2 Standalone Conventional Topologies

This section provides examples of standalone conventional topologies that optionally could be added to an ASTRO® 25 system.

NOTICE: Centralized versions of these topologies are also possible.

For implementation of ASTRO®3.x topologies where non-IP-based console/data subsystems can interface to RF site devices such as G-series, MLC 8000, and/or QUANTAR® devices via the Digital Interface Unit (DIU), to support conventional channels (digital or mixed mode channels) in an ASTRO® 3.x system, see ASTRO 3.1 Coexistence Topology on page 175.

5.2.1

RA/RT (E and M Keying) Topology

The Remote Access/Remote Transmit (RA/RT) (Ear and Mouth (E&M) keying) configuration provides a way for controlling the base radio by a remote console using either an RF link or a microwave link. This configuration can be used when the base radio station is located in a relatively inaccessible location (such as a mountain top) where installing phone lines between the console and base radio is impractical.

It is acceptable to have a mixture of GTR 8000 Base Radio equipment and QUANTAR® equipment in the RA/RT configuration.

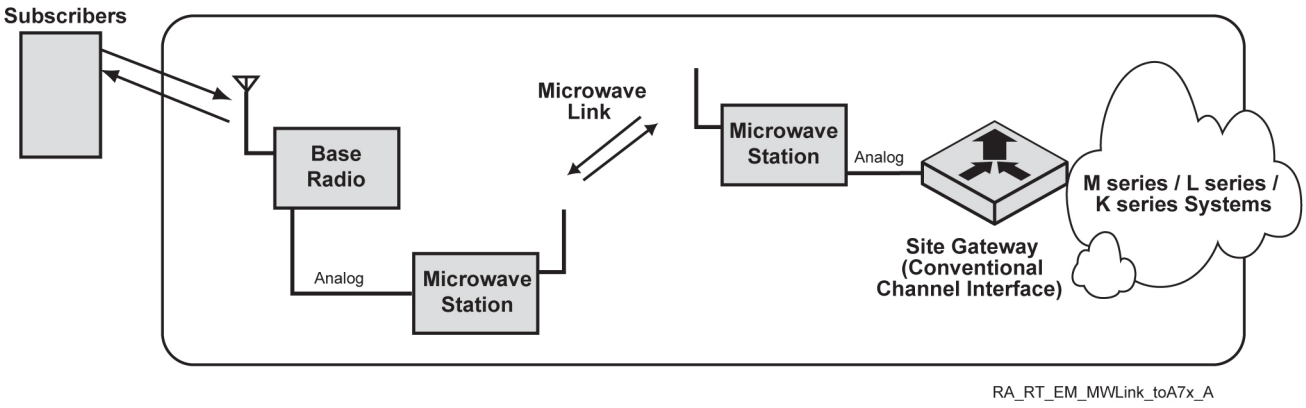
Capability to control the notch filter on an individual station is required to deploy this configuration correctly; otherwise, control signaling is not properly transmitted through the link.

5.2.1.1

RA/RT (E and M Keying) Using Microwave Link

This figure provides a site level view for Remote Access/Remote Transmit (RA/RT) (Ear and Mouth (E&M) keying) using a microwave link.

Figure 42: RA/RT (E&M Keying) Using Microwave Link



The analog connection from the base radio indicates:

- Wireline audio from the base radio Aux Output to the Microwave Station E-lead

  NOTICE: The configurable RX Activation parameter determines how high the signal must be to energize the relay and provide a ground signal to the Microwave Station E-lead.

- Wireline audio from the Microwave Station M-lead to the base radio EXT PTT Aux Input

  NOTICE: M-lead output from the microwave station goes low when transmitting a signal on the wireline to the base radio and causes EXT PTT to activate and key the base radio transmitter.

The analog connection to the site gateway indicates wireline audio between the Site Gateway E-lead (on the E&M interface module) and the Microwave Station E-lead. See the microwave station documentation for details on making wireline connections.

For the GTR 8000 Base Radio, the following configuration is required in Configuration/Service Software (CSS) for RA/RT (E&M Keying) using a microwave link. See *CSS Online Help* to:

- Disable **Tx Notch Filter** on Infrastructure Interface Window (TRC Configuration tab).
- Disable **Pre-Emphasis** and **De-Emphasis** on **Channel Configuration** Window (Filters and Alarm Configuration Tab).

5.2.1.2

RA/RT (E and M Keying) Using RF Link

Figure 43: RA/RT (E&M Keying) Using RF Link

This figure provides a site level view for Remote Access/Remote Transmit (RA/RT) (Ear and Mouth (E&M) Keying) using an RF link.

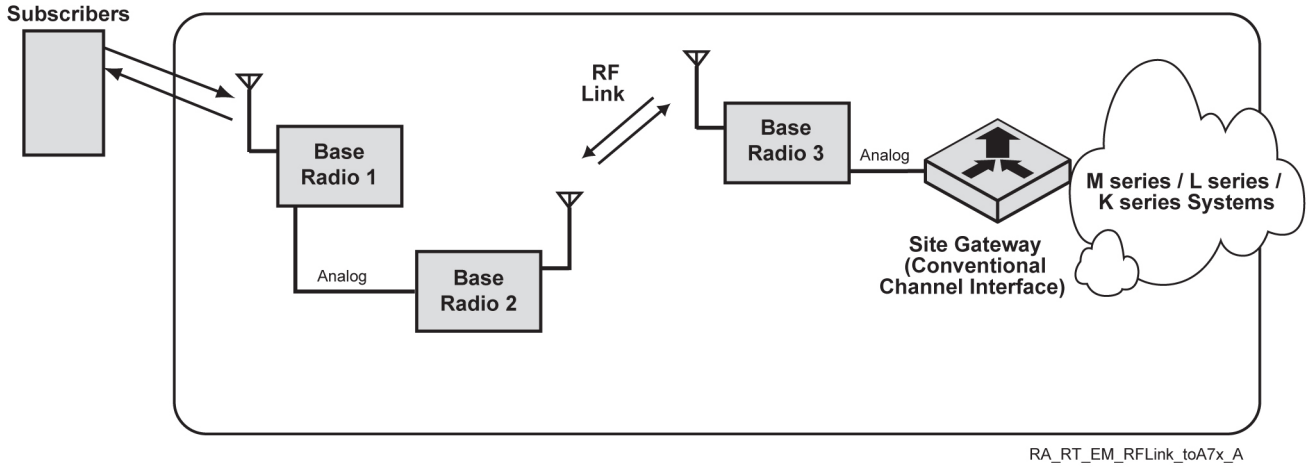
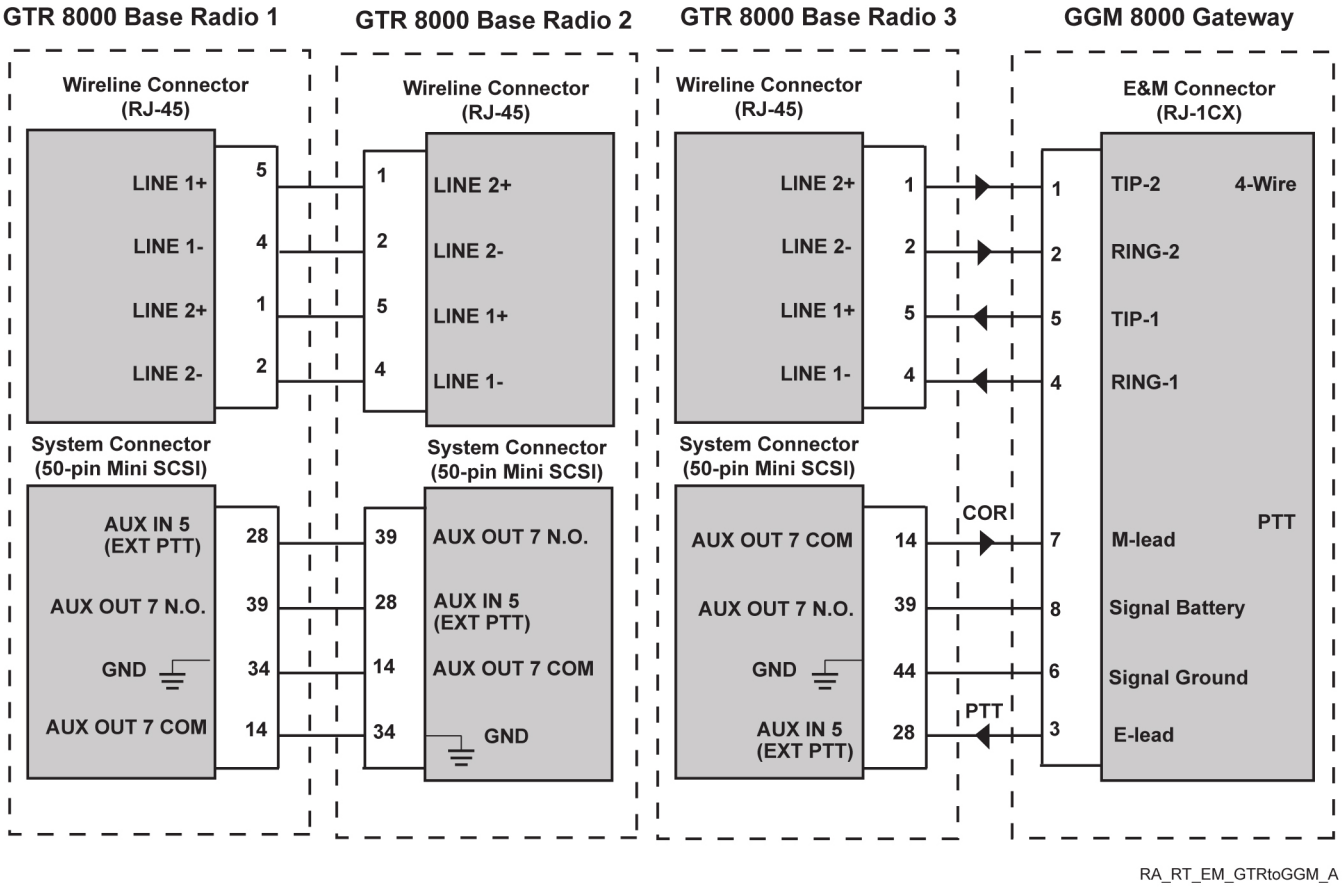


Figure 44: RA/RT (E&M Keying) Using RF Link – Pin Connections

This figure shows the pin connections for RA/RT (E&M Keying) using an RF link.



Routing wireline audio to **Base Radio 2** requires that the relay is energized in Base Radio 1 to key up the transmitter in Base Radio 2.

Routing wireline audio to **Base Radio 1** requires that the relay is energized in Base Radio 2 to key up the transmitter in Base Radio 1.

The **Analog RX Activation** parameter in Configuration/Service Software (CSS) determines the conditions for routing the received audio.

For RA/RT (Tone Remote Control (TRC) using an RF link, the following CSS settings are required:

GTR 8000 Base Radio 1 (the base radio closest to the subscriber):

- Enable **Tx Notch Filter** on the Infrastructure Interface Window (TRC Configuration tab)

`GTR 8000 Base Radio 3` (the base radio connected to the console):

- Use TRC Commands to set **Guard Tone** to **KEY**

  NOTICE: Create a WildCard Table with **HLGT Detect** as **State** and **Key from Wireline** as **Command**.

- Disable **Tx Notch Filter** on the **Infrastructure Interface Window** (**TRC Configuration** tab)

For RA/RT (TRC Control) using an RF link, the following analog console setting is required:

- 240 msec High Level Guard Tone (HLGT)

See RA/RT with RF Link Tx Wireline Alignment on page 200.

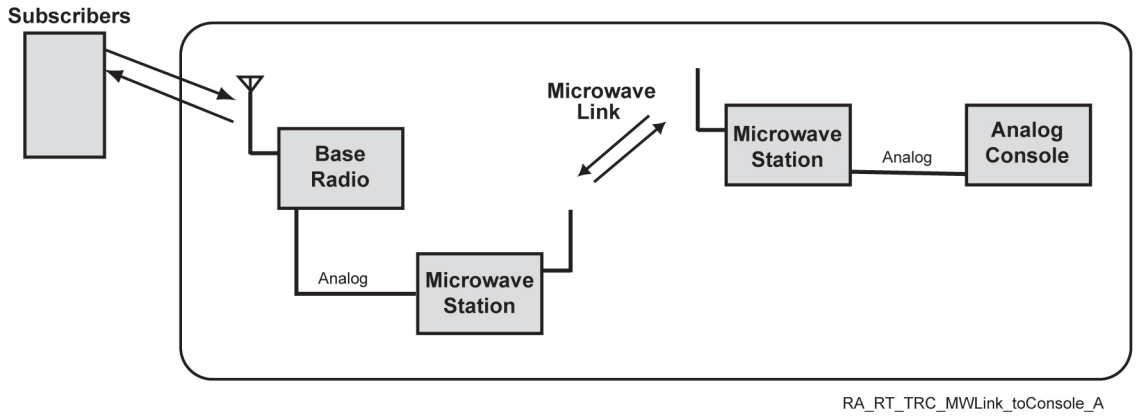
5.2.2
RA/RT (TRC) Topology

The Remote Access/Remote Transmit (RA/RT) Tone Remote Control (TRC) configuration provides control of the base radio by TRC commands from a remote console, over an RF link or a microwave link. This configuration can be used when a base radio station is located in a relatively inaccessible location (such as a mountain top) where installing phone lines between the console and the base radio would be impractical.

5.2.2.1
RA/RT (TRC) Using Microwave Link

This figure provides a site level view for Remote Access/Remote Transmit (RA/RT) Tone Remote Control (TRC) using a microwave link.

Figure 45: RA/RT (TRC Control) Using Microwave Link



The analog connection from the base radio indicates:

- Wireline audio from the base radio Aux Output to the Microwave Station E-lead

NOTICE: The configurable RX activation parameter determines how high the signal must be to energize the relay and provide a ground signal to the Microwave Station E-lead.

- Wireline audio from the Microwave Station M-lead to the base radio EXT PTT Aux Input

NOTICE: M-lead output from the microwave station goes low when transmitting a signal on the wireline to the base radio, causing EXT PTT to activate and key the base radio transmitter.

The analog connection from the console indicates a wireline that connects the microwave station to the landline at the console.

See the microwave station documentation for details on making wireline connections.

For the GTR 8000 Base Radio, the following configuration is required in Configuration/Service Software (CSS) for RA/RT (TRC) using a microwave link:

- Enable **Tx Notch Filter** on **Infrastructure Interface** Window (**TRC Configuration** tab). See *CSS Online Help*.

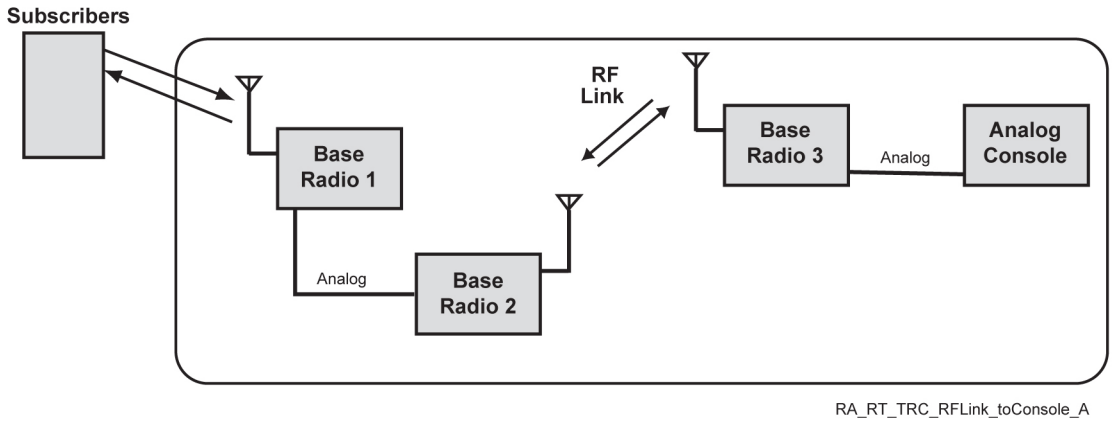
The following analog console setting is also required for RA/RT (TRC) using a microwave link:

- 240 msec HLGT

5.2.2.2 RA/RT (TRC) Using RF Link

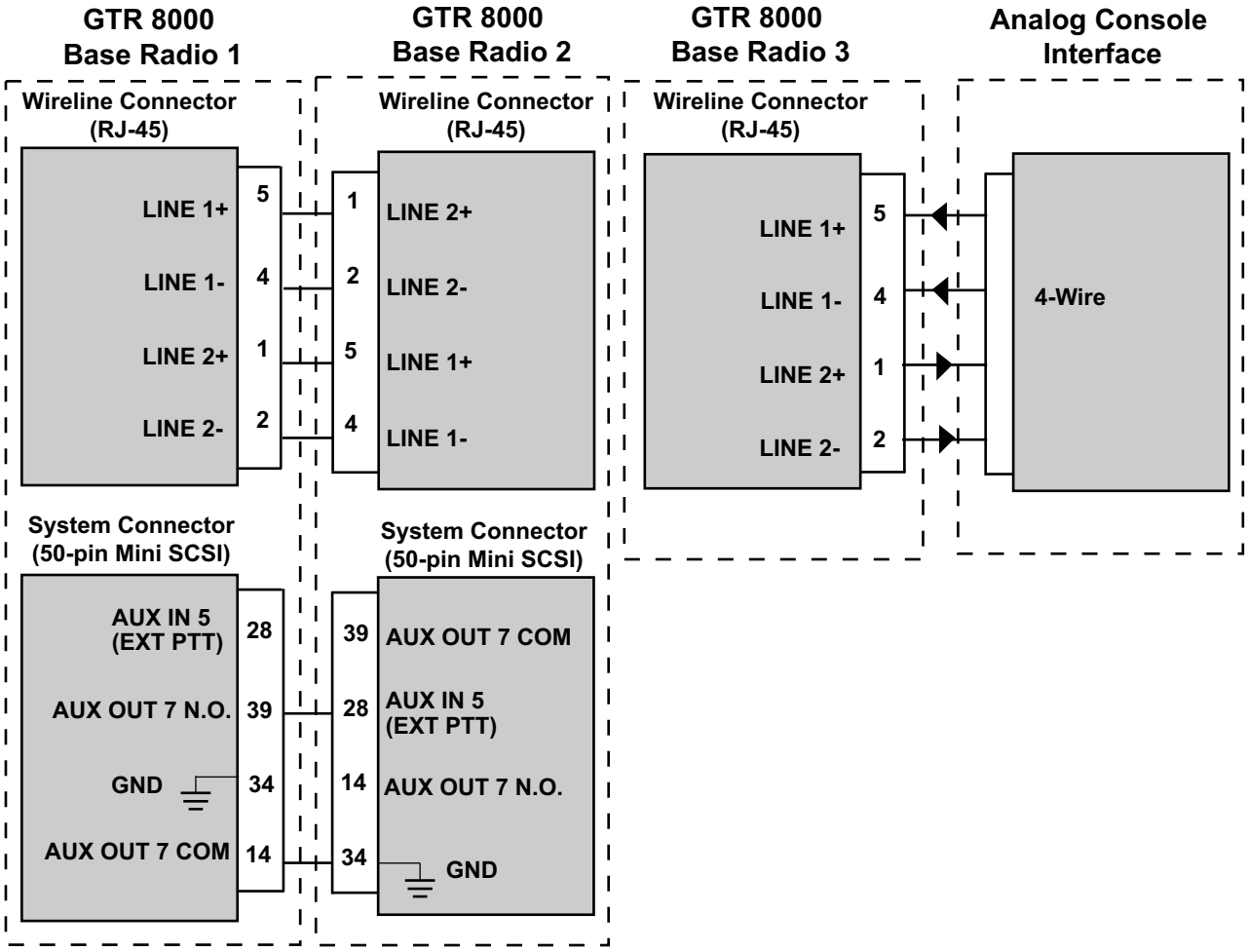
The following figure provides a site level view for RA/RT Tone Remote Control (TRC) using an RF link.

Figure 46: RA/RT (TRC) Using RF Link



The following shows the pin connections for RA/RT (TRC) using an RF link.

Figure 47: RA/RT (TRC) Using RF Link – Pin Connections



Routing wireline audio to **Base Radio 2** requires that the relay is energized in Base Radio 1 to key up the transmitter in Base Radio 2.

The **Analog RX Activation** parameter in Configuration/Service Software (CSS) determines the conditions for routing the received audio.

For RA/RT (TRC) using an RF link, the following CSS settings are required:

GTR 8000 Base Radio 1 (the base radio closest to the subscriber):

- Enable **Tx Notch Filter** on the **Infrastructure Interface** Window (**TRC Configuration** tab)

GTR 8000 Base Radio 3 (the base radio connected to the console):

- Use TRC Commands to set **Guard Tone** to **KEY**

  NOTICE: Delete all other WildCard Table TRC default tables except the one driven by **LLGT Undetect** which contains the command **Dekey from Wireline**.

- Disable **Tx Notch Filter** on the **Infrastructure Interface** Window (**TRC Configuration** tab).
- For GTR 8000 Base Radio 3: Disable **Pre-Emphasis** and GTR 8000 Base Radio 2: Disable **De-Emphasis** filter on **Channel Configuration** Window (**Filters and Alarm Configuration** Tab).

To disable **Tx Notch Filter** and **Pre-Emphasis** and **De-Emphasis** for GTR 8000 Base Radios, see *CSS Online Help*.

For RA/RT (TRC) using an RF link, the following analog console setting is required:

- 240 msec HLGT

Also, see RA/RT with RF Link Tx Wireline Alignment on page 200.

5.2.3
RA/RT with RF Link Tx Wireline Alignment

For Remote Access/Remote Transmit (RA/RT) using an RF link, for either Ear and Mouth (E&M) Keying or Tone Remote Control (TRC), the following Tx wireline alignment is required for the remote base radios (Base Radio 1 and Base Radio 2 in the pin connection diagram).

Before beginning the alignment procedures (Aligning Base Radio 2 Tx Wireline on page 200, Aligning Base Radio 1 Tx Wireline on page 200, and Base Radio 3 Tx Wireline Alignment on page 201), disable the **Automatic Level Control** parameter for all three base radios.

5.2.3.1
Aligning Base Radio 2 Tx Wireline

Perform this procedure to align Base Radio 2 to the Tx wireline.

Prerequisites: Before performing this alignment procedure, disable the **Automatic Level Control** parameter for all three base radios.

Procedure:

1. Connect Base Radio 1 (the base radio closest to the subscriber) to the Configuration/Service Software (CSS) service laptop using an Ethernet connection.
2. Set and save the **Rx Wireline Level** on the **RX Wireline Alignment** tab of the **Alignment** Screen.

   (This screen is accessed from the **Service** menu after reading the configuration from the **Base Radio** and changing to **Service Mode**. See *CSS Online Help*.)

   NOTICE: The wireline level is typically set to -6 dBm (6 dB below the High Level Guard Tone level).
3. Turn on the 1 kHz tone and leave the **RX Wireline Alignment** tab open.
4. Disconnect Base Radio 1 from the CSS service laptop.
5. Connect Base Radio 2 to the CSS service laptop using an Ethernet connection.
6. Click the **Save** button on the **Tx Wireline Alignment** tab of the **Alignment** screen.
7. Close the **Alignment** screen but leave CSS open.
8. Disconnect Base Radio 2 from the CSS service laptop.
9. Connect Base Radio 1 to the CSS service laptop using an Ethernet connection.
10. Turn off the 1 kHz tone on the **Rx Wireline Alignment** tab of the **Alignment** screen (which is accessed from the **Service** menu after reading the configuration from the base radio).

5.2.3.2
Aligning Base Radio 1 Tx Wireline

Perform this procedure to align Base Radio 1 to the Tx wireline.

Prerequisites: Before performing this alignment procedure, disable the **Automatic Level Control** parameter for all three base radios.

Procedure:

1. Connect Base Radio 2 to the Configuration/Service Software (CSS) service laptop using an Ethernet connection.
2. Set and save the **Rx Wireline Level** on the **RX Wireline Alignment** tab of the **Alignment** screen.

   (This selection is accessed from the **Service** menu after reading the configuration from the **Base Radio** and changing to **Service Mode**. See *CSS Online Help*.)
3. Turn on the 1 kHz tone and leave the **RX Wireline Alignment** tab open.
4. Disconnect Base Radio 2 from the CSS service laptop.
5. Connect Base Radio 1 (the base radio closest to the subscriber) to the CSS service laptop using an Ethernet connection.
6. Click **Save** on the **Tx Wireline Alignment** tab of the **Alignment** screen.
7. Close the **Alignment** screen but leave CSS open.
8. Disconnect Base Radio 1 from the CSS service laptop.
9. Connect Base Radio 2 to the CSS service laptop using an Ethernet connection.
10. Turn off the 1 kHz tone on the **Rx Wireline Alignment** tab of the **Alignment** screen (which is accessed from the **Service** menu after reading the configuration from the base radio).

5.2.3.3
Base Radio 3 Tx Wireline Alignment

For Remote Access/Remote Transmit (RA/RT) Tone Remote Control (TRC) using an RF link, follow the instructions in the Tx Wireline Alignment procedure in *CSS Online Help* to align the Tx wireline with the base radio connected to the console (Base Radio 3 in the pin connection diagram).

5.2.4
In-Cabinet Repeat Features for Base Radios

The In-Cabinet Repeat feature and the Fall Back In-Cabinet Repeat (FBICR) feature provide a way for the base radio to continue to receive and transmit when communication with the comparator is lost, for simulcast and non-simulcast voting systems.

Lost communication with the comparator is defined as:

- For digital conventional systems:
  - Protocol Failure
  - V.24 Modem Carrier Detect Loss

    NOTICE:
    For QUANTAR®, in a V.24 Hybrid configuration, the loss of the analog link does not cause the station to enter the FBICR mode. Only the failure of the digital link causes the station to enter the FBICR mode.

    For GTR 8000 Base Radio, in a V.24 Hybrid configuration, the loss of the analog link causes the station to enter the FBICR mode for analog calls only. The failure of the digital link causes the station to enter FBICR mode for both analog and digital calls.
- For analog conventional systems:
  - Loss of external Push-to-Talk (PTT) (simulcast)
  - No Tone Remote Control (TRC) keyup (voting)

When a base radio is operating in In-Cabinet Repeat mode:

- It is independent of other base radios/receivers in the same system.
- In a simulcast system, the simulcast transmission timing is lost for the overlap coverage area between an active simulcast base radio and the base radio operating in In-Cabinet Repeat mode.

  NOTICE: In a simulcast system, it is typical to set up In-Cabinet Repeat on the base radio responsible for the main coverage area. Any adjacent base radios are subsequently disabled.

A base radio can be configured for one of the following In-Cabinet Repeat modes:

- **Fall Back In-Cabinet Repeat (Automatic Mode)**enabled in Configuration/Service Software (CSS)
- **In-Cabinet Repeat (External Mode)**enabled by manually wiring a pin on the base radio system connector, and disabling the FBICR field in CSS.

Automatic or external modes can be configured for the following system types:

- Automatic Mode – typical usage:
  - Conventional analog (non-simulcast voting systems)
  - Conventional ASTRO® 25 (CAI) (non-simulcast voting systems)

  NOTICE: A station operating in the Automatic mode is independent of other stations/ receivers in the particular system. This independence is especially important in a simulcast system, because simulcast transmission timing is lost for the overlap coverage area between an active simulcast station and an FBICR station. In a typical simulcast scenario, the station responsible for the major coverage area is set for FBICR, and any adjacent stations are subsequently disabled.
- External Mode – typical usage:
  - Conventional analog (simulcast voting systems)
  - Conventional ASTRO® 25 (CAI) (simulcast voting systems)

  IMPORTANT: Automatic and External modes are mutually exclusive (a station may not be configured for both modes).

If configured in CSS for the FBICR mode, a GTR 8000 Base Radio connected to a comparator repeats voice and Trunking Signaling Block (TSBK) payload when:

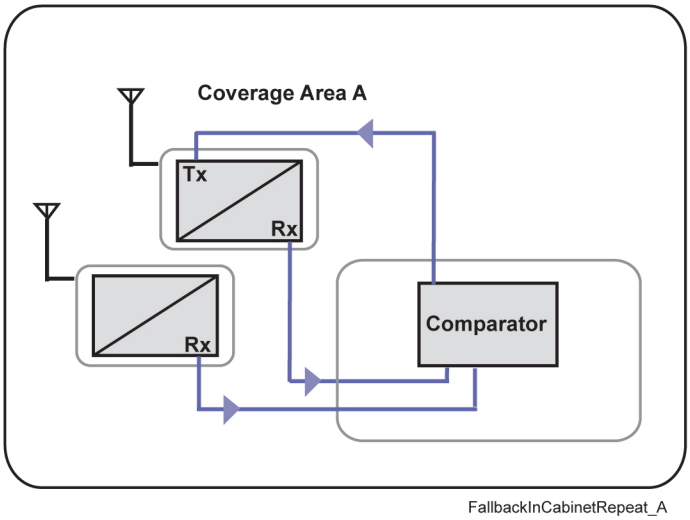
- Link failure to comparator is detected (does not apply to analog links) or GTR 8000 Base Radio sends inbound payload and the comparator fails to respond before the Fallback Determination Time expires.
- FBICR exits when a transmission is received from the comparator.

In mixed mode:

- With ATAC comparator with hybrid link, analog link failure does not cause digital link to go into fallback, but digital link failure does cause analog link to go into fallback.
- With ATAC plus DIGITAC comparators with independent paths for analog compared to digital control as well as analog compared to digital payload, analog FBICR and digital FBICR operate independently in each link.

For In-Cabinet Repeat, the System mini-SCSI port on the conventional base radio connects to a punch block (pin 3 being for GTR 8000 Base Radio and pin 16 for QUANTAR®; pin 34 being Ground pin for GTR 8000 Base Radio and pin 7 Ground pin for QUANTAR®).

Figure 48: Fall Back In-Cabinet Repeat Feature Topology



For CSS instructions, see Configuring FallBack In-Cabinet Repeat (Automatic Mode) on page 203 and Configuring In-Cabinet Repeat (External Mode) on page 203.

5.2.4.1
Configuring FallBack In-Cabinet Repeat (Automatic Mode)

Perform this procedure for conventional analog or conventional ASTRO (CAI) simulcast and non-simulcast voting systems.

Procedure:

1. Make an Ethernet connection from the Configuration/Service Software (CSS) service laptop to the GTR 8000 Base Radio.
2. Read the configuration from the GTR 8000 Base Radio.
3. Click **Infrastructure Interface** in the navigation pane.
4. Set the **Fallback In-Cabinet Repeat** field to **Enabled**.
5. Set the desired delay time in the **Fallback Determination Time (msec)** field.
6. Write the configuration to the GTR 8000 Base Radio.
7. Disconnect the CSS service laptop from the GTR 8000 Base Radio.

Postrequisites: In Automatic mode, if either of the following links fail, the base radio reverts to In-Cabinet Repeat mode:

- Tx from comparator to base radio
- Rx from base radio to comparator

In a V.24 hybrid configuration, the loss of the analog link does not cause the base radio to revert to In-Cabinet Repeat mode. Only the failure of the digital link causes the base radio to revert to In-Cabinet Repeat mode.

For the configuration of In-Cabinet Repeat (External Mode), see the following section.

5.2.4.2
Configuring In-Cabinet Repeat (External Mode)

Perform this procedure for conventional analog or conventional ASTRO (CAI) simulcast and non-simulcast voting systems.

Procedure:

1. Make an Ethernet connection from the Configuration/Service Software (CSS) service laptop to the GTR 8000 Base Radio.
2. Read the configuration from the GTR 8000 Base Radio.
3. Click **Infrastructure Interface** in the navigation pane.
4. Set the **Fallback In-Cabinet Repeat** field to **Disabled**.
5. Write the configuration to the GTR 8000 Base Radio.
6. Disconnect the CSS service laptop from the GTR 8000 Base Radio.
7. Connect a wire to pin 3 of the System Connector.
8. Connect the wire to an external circuit (supplied by your organization) to ground the pin.

5.2.5
Main/Standby Feature for Base Radios

The Main/Standby feature enables two base radios to operate as a redundant pair. If the Main station fails due to a hardware or software malfunction, the Standby station immediately takes over and provides service.

For the Main/Standby feature to be implemented:

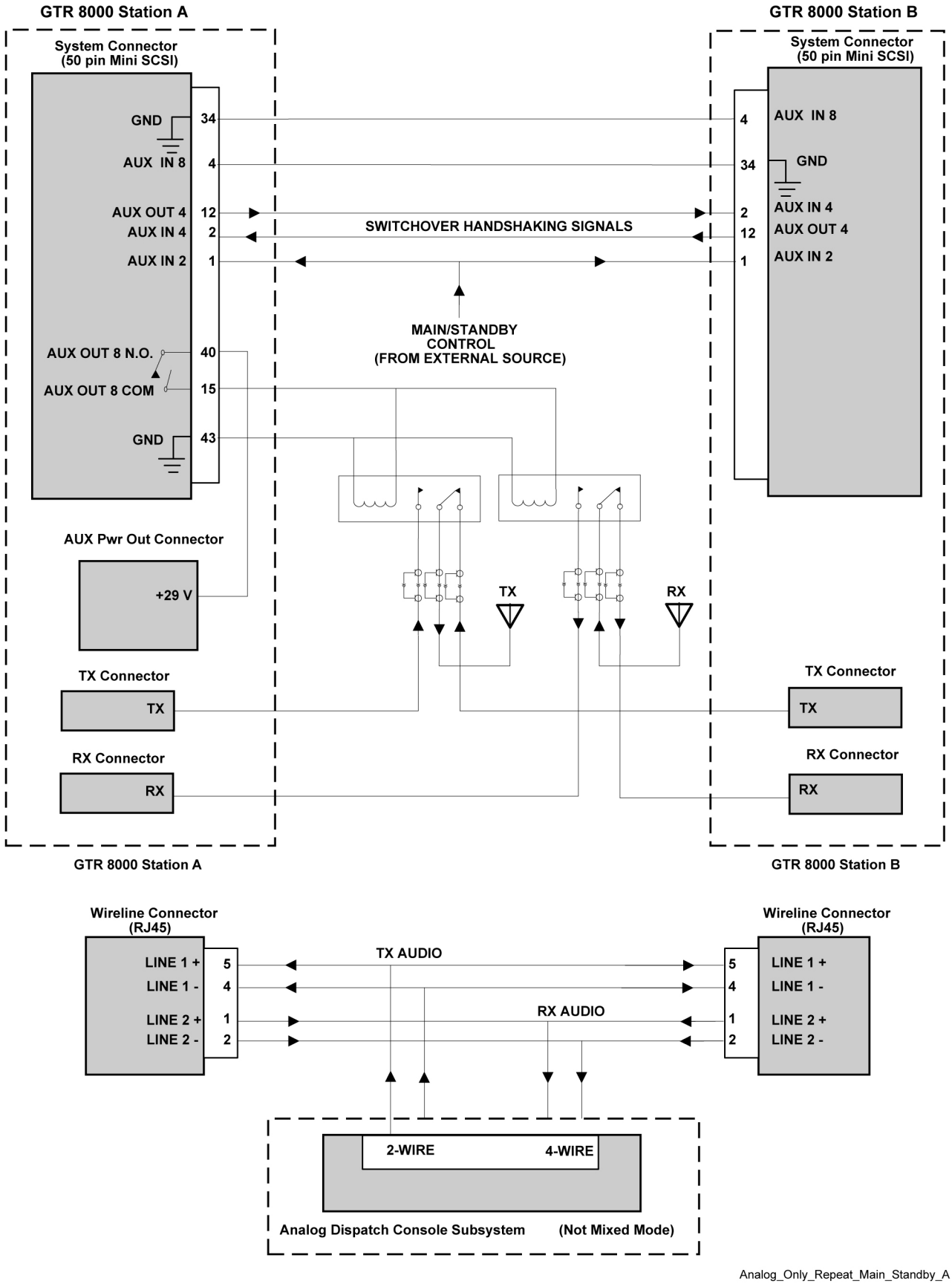
- Two conventional base radios must be used.
- ASTRO® 25 system connection to a console cannot be used.
- The base radio must be equipped with the Enhanced WildCard Option.

The diagram shows the wiring required to implement Main/Standby for two GTR 8000 Base Radios. Consider the following before implementing this wiring:

- Use a standard telephone punch block to facilitate the wiring between the System Connectors on the two base radios.
- Regarding the interface shown between an Analog Dispatch Console Subsystem and the Wireline Connectors on the base radios:
  - Connections shown to the console are for a 4-Wire phone line. If a 2-Wire phone line is used, use only connections to Line 2+ and Line 2-.
  - This interface supports the Main/Standby feature, if the base radios are not configured for **V.24 Hybrid** mixed mode (Station Type = **ASTRO CAI-Capable**).

    NOTICE: For mixed mode base radios connected to an analog dispatch console subsystem, the Main/Alternate channel pairing feature can be used instead of the Main/Standby feature. Main/Alternate channel pairing is configured in the Provisioning Manager for systems with an M core or L core, and in Configuration Manager for systems with a K core.
  - The GTR 8000 Base Radio ports cannot be set to infinite impedance. The ports are always set at 600 Ohms. Therefore, line levels may need to be increased when multiple 600 Ohm loads are connected in parallel.

Figure 49: Analog-Only Repeat Main/Standby



Analog_Only_Repeat_Main_Standby_A

The Main/Standby feature is implemented using WildCard tables pre-configured by Motorola Solutions. These tables contain settings that define the basic operation of the Main/Standby feature. The WildCard tables define Tone Remote Control (TRC) function tones to control the Main and Standby status of two interconnected base radios.

Use Configuration/Service Software (CSS) to designate a base radio as Main or Standby. To enable Main/Standby on interconnected GTR 8000 Base Radios, see Enabling Main/Standby on the Main GTR 8000 Base Radio on page 206 and Enabling Main/Standby on the Standby GTR 8000 Base Radio on page 206.

5.2.5.1

Enabling Main/Standby on the Main GTR 8000 Base Radio

Perform this procedure to enable Main/Standby on a main GTR 8000 Base Radio.

Prerequisites: Before performing this procedure, install the latest version of the Configuration/Service Software (CSS).

Procedure:

1. Make an Ethernet connection from the CSS service laptop to the GTR 8000 Base Radio that you want to be the “Main” base radio.
2. Read the configuration from the GTR 8000 Base Radio.
3. Click **Options** in the navigation pane to access the **Options** window.
4. In the **WildCard** field, select **Expanded**.
5. In the **Main/Standby** field, select **Main**.

   Selecting **Main** deletes any existing STANDBY tables in the WildCard Tables and inserts the default MAIN tables as part of the WildCard tables
6. Write the configuration to the GTR 8000 Base Radio.
7. Disconnect the CSS service laptop from the Main GTR 8000 Base Radio.

5.2.5.2

Enabling Main/Standby on the Standby GTR 8000 Base Radio

Perform this procedure to enable Main/Standby on a standby GTR 8000 Base Radio.

Prerequisites: Before performing this procedure, install the latest version of the Configuration/Service Software (CSS).

Procedure:

1. Make an Ethernet connection from the CSS service laptop to the GTR 8000 Base Radio that you want to be the “Standby” base radio.
2. Read the configuration from the GTR 8000 Base Radio.
3. Click **Options** in the navigation pane to access the **Options** window.
4. In the **WildCard** field, select **Expanded**.
5. In the **Main/Standby** field, select **Standby**.

   Selecting **Standby** deletes any existing MAIN tables in the WildCard Tables and inserts the default STANDBY tables as part of the WildCard tables.
6. Write the configuration to the GTR 8000 Base Radio.

5.2.5.3

Controlling Main/Standby Operation

The three modes of operation for switching from MAIN to STANDBY and from STANDBY to MAIN include:

- Automatic (Hot) Switchover
- Tone Remote Control Switchover
- External Control Switchover

Automatic (Hot) Switchover

In this mode, if one of the modules fails in the MAIN base radio, the MAIN base radio automatically sets itself to STANDBY and signals its peer base radio to set itself to MAIN. The MAIN base radio does not automatically switch to STANDBY unless it is connected to its peer base radio and the peer base radio has not indicated a failure mode. See Disabling Automatic Switchover on page 207.

Tone Remote Control Switchover

In this mode, sending function tone 4 to the base radios forces the MAIN station to STANDBY mode and the STANDBY base radio to MAIN mode.

Sending the function tone 5 to the base radio forces the MAIN base radio back to MAIN mode and the STANDBY base radio back to STANDBY mode.

If either base radio has detected a module failure, no switchover occurs.

The function tones used for these actions can be changed using CSS, as follows:

- To modify the function tone that forces the initial switch from MAIN to STANDBY, modify the TRC TONE entry in WildCard Table 19 in the MAIN station, and in WildCard Table 17 in the STANDBY station.
- To modify the function tone that forces the switch back from STANDBY to MAIN, modify the TRC TONE entry in WildCard Table 18 in the MAIN station, and in WildCard Table 18 in the STANDBY station.

External Control Switchover

In this mode, an external control device may be connected to Input 2 on Connector 3 to initiate a MAIN to STANDBY switchover or a STANDBY to MAIN switchover:

1. Grounding this signal causes the MAIN base radio to go to STANDBY mode and the STANDBY station to go to MAIN mode.
2. Pulling this signal to high (open) causes the STANDBY base radio to go to back to MAIN mode and the MAIN station to go back to STANDBY mode.

5.2.5.3.1

Disabling Automatic Switchover

Perform this procedure to disable automatic switchover using Configuration/Service Software (CSS).

Prerequisites: Before performing this procedure, see Controlling Main/Standby Operation on page 207 and install the latest version of the CSS.

Procedure:

1. Make an Ethernet connection from the CSS service laptop to the GTR 8000 Base Radio.
2. Read the configuration from the GTR 8000 Base Radio.
3. Select **WildCard Tables** in the left navigation pane.
4. Delete WildCard Table 8.
5. Write the configuration to the GTR 8000 Base Radio.

6 Disconnect the CSS laptop from the GTR 8000 Base Radio.

7 Repeat these steps for the peer GTR 8000 Base Radio.

Postrequisites: For all WildCard instructions in Controlling Main/Standby Operation on page 207, the steps above provide an example for accessing and changing WildCard tables for a GTR 8000 Base Radio. See the WildCard topics in *CSS Online Help* for more information.

5.2.5.4
Other Methods of Controlling the Main/Standby Feature

Other methods of controlling the Main/Standby feature include:

Antenna Relay Control

When a station is operating in MAIN mode, the relay driven output 8 (AUX OUT 8) is energized (closed), and is open when the other base radio is in MAIN mode. The use of this closure is left up to the user. Typically a user uses this closure to drive an external relay which connects the antenna to whichever station is operating in MAIN mode.

Status Request

Using Tone Remote Control (TRC) function tone 14, the console operator can determine which base radio is operating in MAIN mode.

One beep is returned if the MAIN station is in MAIN mode, and two beeps are returned if the STANDBY station is in MAIN mode.

To modify the Status Request function tone, modify the TRC TONE entry in WildCard Table 12 in the MAIN station, and in WildCard Table 11 in the STANDBY station.

Reset

Using TRC function 15, the console operator can force both stations to reset to their MAIN/STANDBY operating mode, as designated in CSS.

To modify the Reset function tone, modify the TRC TONE entry in WildCard Table 21 in the MAIN station, and in WildCard Table 20 in the STANDBY station.

5.2.6
MDC 1200 and Singletone Repeater Access

This section describes Repeater Access control mechanisms, Preamble Signaling, and triggering Repeater Access using Dual-Tone Multi-Frequency (DTMF) and MDC 1200.

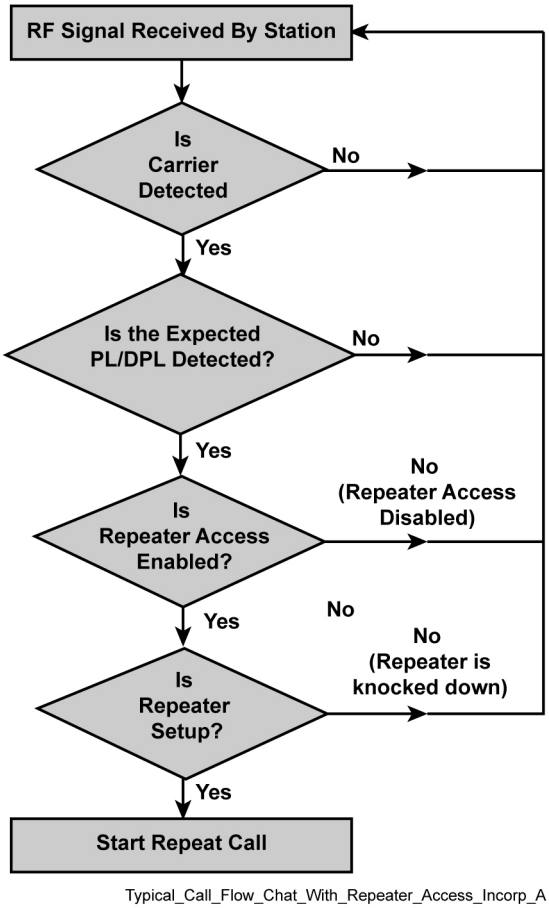
5.2.6.1
Overview of Repeater Control Mechanisms

Conventional base radios have a number of ways to assert repeater control:

- The most basic form is by using control commands which come from the console. These commands are sent through Tone Remote Control (TRC) in an analog only configuration or via the digital link Inbound Control Words (ICWs) in a mixed mode configuration. These commands change the Repeater Control state between Repeater Set Up and Repeater Knockdown. The typical station configuration has the station starting out as Repeater Set Up out of reset and then the console can change the state at will.
- Repeat Qualifiers implement a second repeater control method. For analog, various combinations of Carrier Squelch Detect and received private line or digital private line are used. For digital, the Receive Network Access Code (NAC) is used.
- A third method, called Repeater Access, allows repeater control commands to be sent over the air in the form of two analog signaling formats, MDC 1200 and Singletone. The digital ASTRO® 25 system does not have an equivalent control mechanism. Repeater Access can be enabled/disabled as a separate parameter.

Figure 50: Repeater Control Mechanism Flow Chart

This figure shows the flow control for this three-level mechanism.



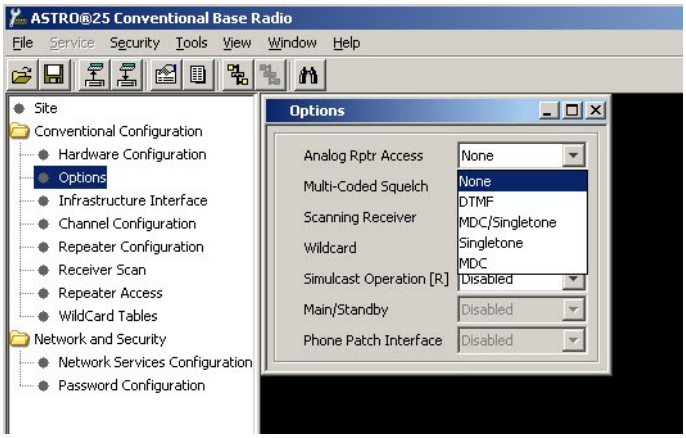
As with the QUANTAR®, GTR 8000 Base Radios support two methods of Repeater Access:

- One method uses preamble signaling in front of every subscriber transmission. MDC 1200 and Singletone are used, Dual-Tone Multi-Frequency (DTMF) is not used.
- The other method uses MDC 1200 and DTMF to trigger WildCard commands, in a way similar to TRC, to change the station repeat control between **Repeater Set Up** and **Knockdown**.

5.2.6.2 Repeater Control with Preamble Signaling

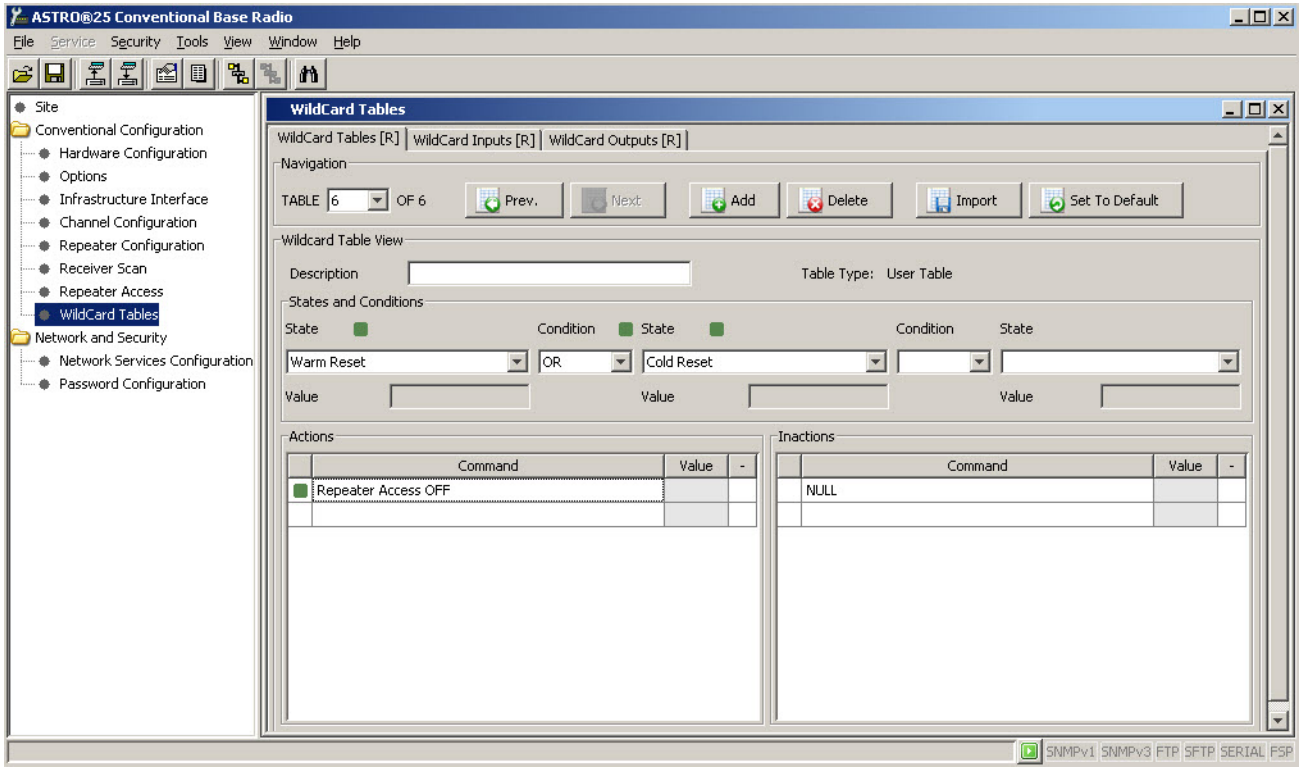
The method for enabling Repeater Control with preamble signaling depends on whether MDC 1200 or Singletone is used. You can select MDC or Singletone, or MDC and Singletone, using the **Analog Rptr Access** parameter on the **Options** window in Configuration/Service Software (CSS).

Figure 51: Analog Repeater Access



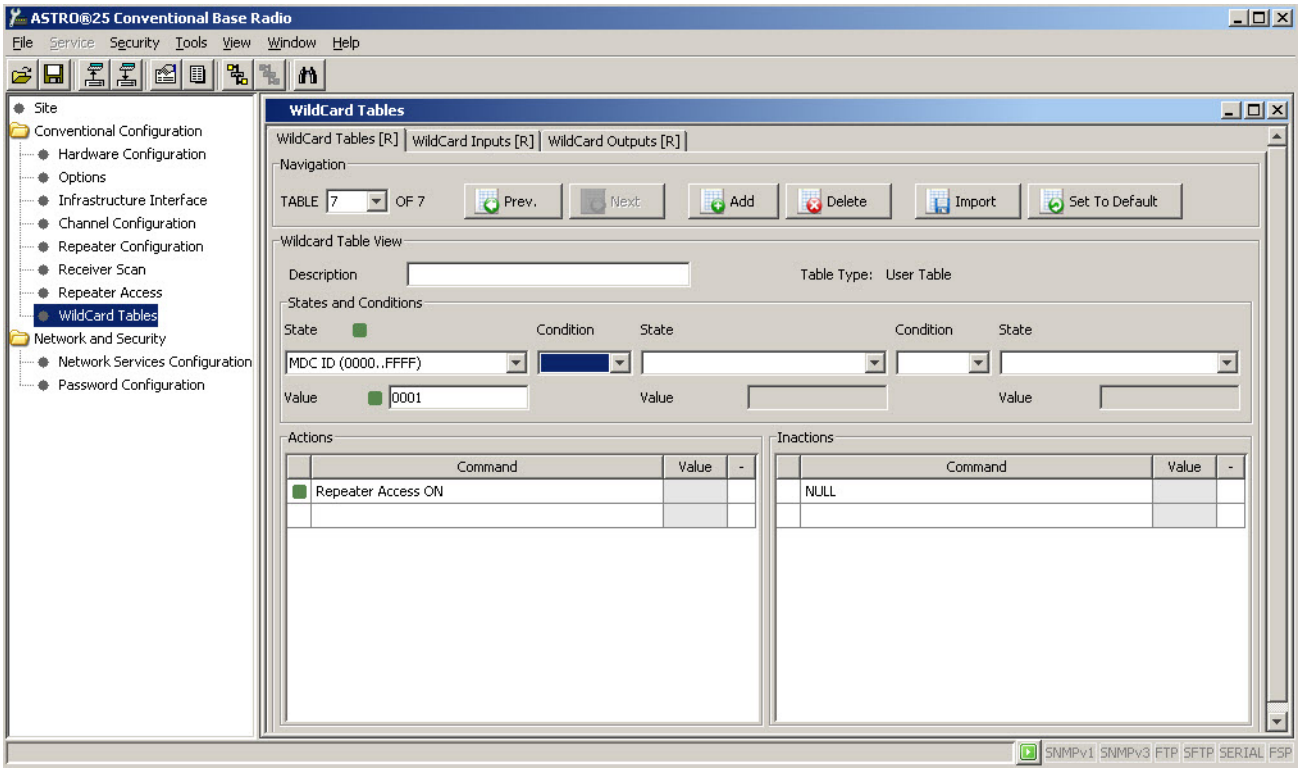
Preamble Repeater Access requires the station be configured with the Repeater Access function to be disabled after reset. This configuration is accomplished by creating the WildCard Table, as shown in this figure.

Figure 52: Preamble Repeater Access Configuration



If MDC 1200 is used, a WildCard Table is created to turn Repeater Access ON when the appropriate MDC 1200 message is received as shown in the following figure:

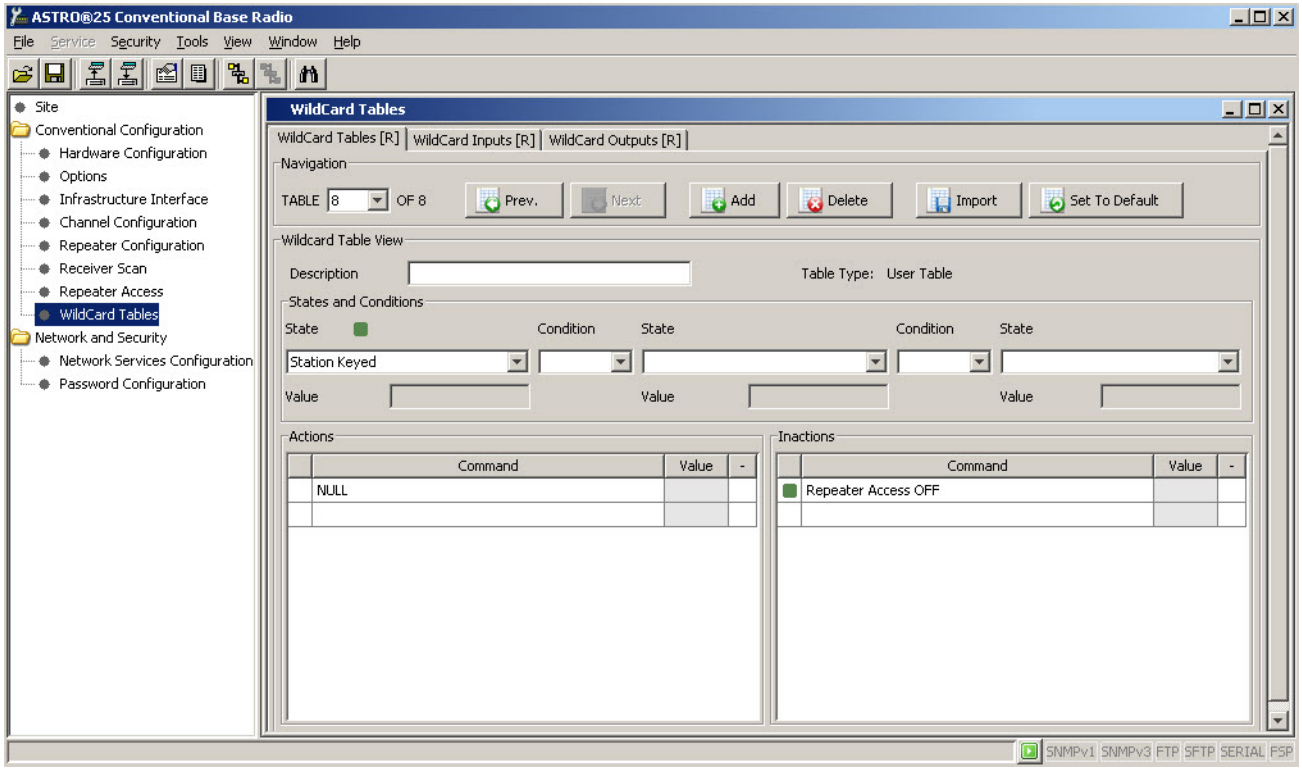
Figure 53: Repeater Access ON



NOTICE: The example shows an MDC ID of 0001. Any number from 0001 to FFFF can be used. This number is programmed in the subscriber Repeater Access configuration.

Figure 54: Repeater Access OFF

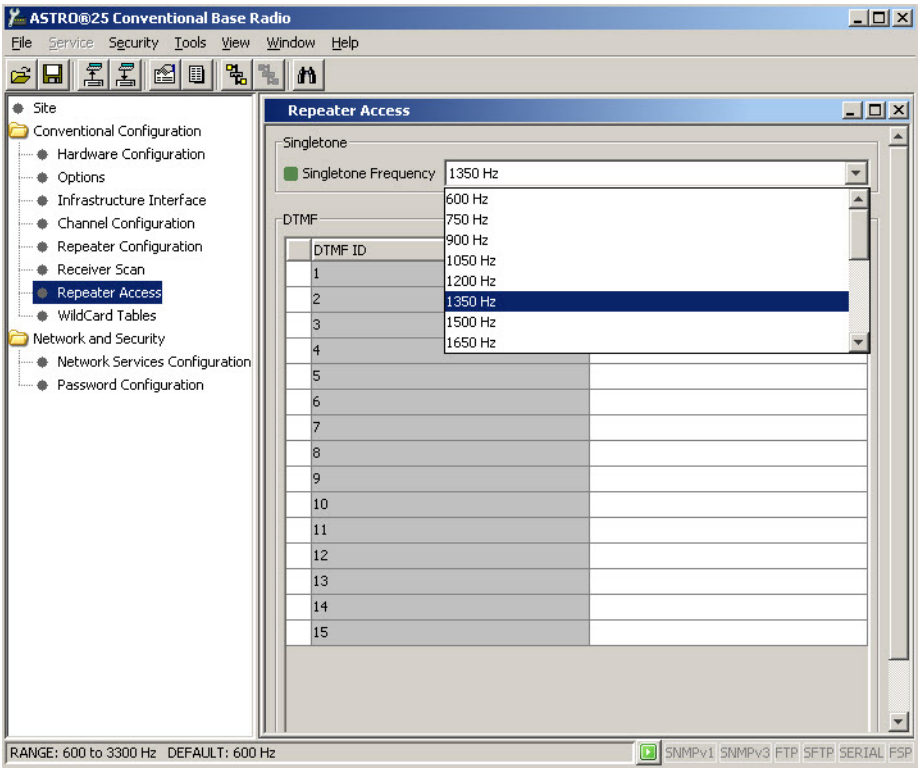
This figure shows what is required to disable repeat at the end of a call.



NOTICE: When the call ends, the station dekeys and Repeat is disabled.

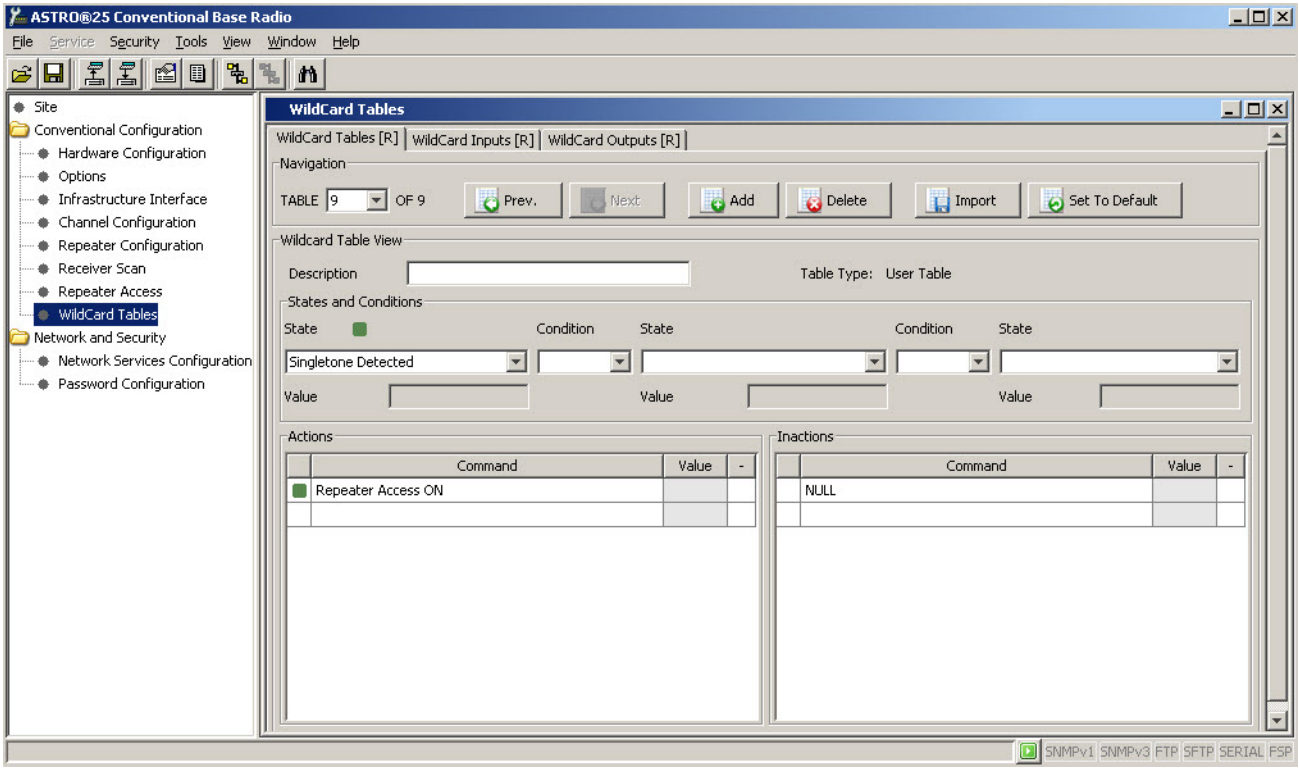
When Singletone is used, select the Singletone frequency from a drop down list in the **Repeater Access** screen.

Figure 55: Singletone Frequency



Instead of the table driven by MDC 1200 ID, use the options shown in this figure to enable Repeater Access.

Figure 56: Enabling Repeater Access



5.2.6.3

Triggering Repeater Access Using DTMF and MDC 1200

Dual-Tone Multi-Frequency (DTMF) or MDC 1200 can be used to trigger any of the available WildCard commands. For example, they can be used to change the state to Repeater Set Up or Repeater Knockdown, or to change the channel. Enable DTMF detection or MDC 1200 detection by making the appropriate selection for the Repeater Access parameter and then drive the WildCard state with either a DTMF string or an MDC ID to perform the desired function, as shown in Figure 56: Enabling Repeater Access on page 213.

5.2.7

Dual Control of Gated Access Using TRC and DTMF or MDC 1200

This section describes how to program the GTR 8000 Base Radio station to allow two functions (repeater setup/knockdown and gated access) to be controlled (toggled on and off) using Tone Remote Control (TRC) and Dual-Tone Multi-Frequency (DTMF).

5.2.7.1

Overview of Dual Control of Gated Access Using TRC and DTMF or MDC 1200

Repeater setup/knockdown and gated access are controlled (toggled on and off) by either of the following methods:

- Console operator using Tone Remote Control (TRC)
- Subscriber unit using Dual-Tone Multi-Frequency (DTMF) or MDC 1200 signaling transmitted over the air

TRC tone detection is provided standard with the GTR 8000 Base Radio station. Detection of DTMF or MDC 1200 subscriber over the air signaling requires the Analog Repeater Access Option and Expanded WildCard. The Gated Access feature requires the Multi-Coded Squelch Option.

An effective talkgroup configuration can be created by controlling the repeater setup/knockdown state and gated access function. In this configuration, subscribers within a specific coverage area (local subscribers) are assigned a primary Private Line (PL) and have their **User Access** field set to **Enabled**. These subscribers repeat as normal (assuming the station repeater setup/knockdown state is set to **repeater setup**).

If emergency conditions require other subscribers outside of the local area to enter the communications area, and these subscribers have been assigned with a secondary PL and have their **User Access** set to **GATED**, they can communicate with each other (as well as local users) through the same local repeater.

Additionally, both a console operator or a subscriber unit may control the repeat mode (setup or knocked down) and gated access mode (enabled or disabled.

NOTICE: Gated user access is disabled upon station reset. Gated Access must be enabled via over the air transmissions using DTMF or MDC 1200, or using TRC tones from the console.

This table shows how the repeater access and gated access functions may be controlled to provide access to local and visiting subscribers. See Repeater Access Call Flow Charts on page 215.

Table 15: Gated Access and Repeater Access Configuration

Gated Access	Repeater Up/Down	Subscriber Operation
Enabled	Up	• Local subscribers (primary PL) repeat

Table continued…

Gated Access	Repeater Up/Down	Subscriber Operation
		• Emergency subscribers (secondary PL and MCS **User Access** set to **GATED**) repeat
Enabled	Down	No subscribers repeat.
Disabled	Up	Only local subscribers (primary PL) repeat.
Disabled	Down	No subscribers repeat.

5.2.7.2

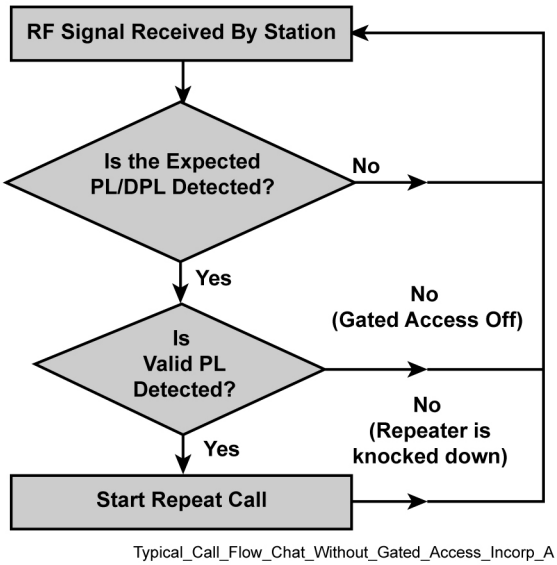
Repeater Access Call Flow Charts

Call Flow without Gated Access prerequisites include:

- User Access is Enabled (but not Gated)
- Analog Repeater Activation Configuration/Service Software (CSS) parameter is set to Carrier and Private Line/Digital Private Line (PL/DPL)
- Local subscribers are using Primary PL

Figure 57: Typical Call Flow Chart Without Gated Access Incorporated

This figure shows a typical repeater access call flow chart before Gated Access is employed.

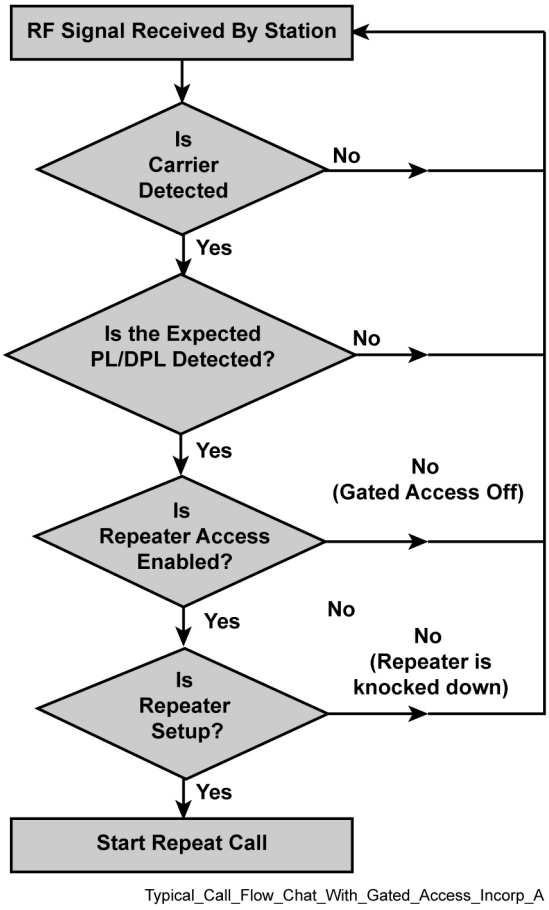


Call Flow with Gated Access prerequisites include:

- **User Access** is set to **Gated**
- **Analog Repeater Activation RSS Parameter** set to **Carrier** and **PL/DPL**
- Local Subscribers are using Primary PL
- Emergency conditions exist, in which non-local subscribers are using Secondary PL

Figure 58: Typical Call Flow Chart With Gated Access Incorporated

This figure shows a repeater access call flow chart after Gated Access is employed.



5.2.7.3 TRC Control From the Console

To control Repeater Set Up and Knockdown from the console, select two Tone Remote Control (TRC) tones, assign one to Repeater Set and the other to Repeater Knock, and then create two WildCard tables as shown below to implement the function. These figures show two TRC function tones as an example; the tones must be programmed in the console.

Figure 59: TRC Table to Enable Repeater Set Up

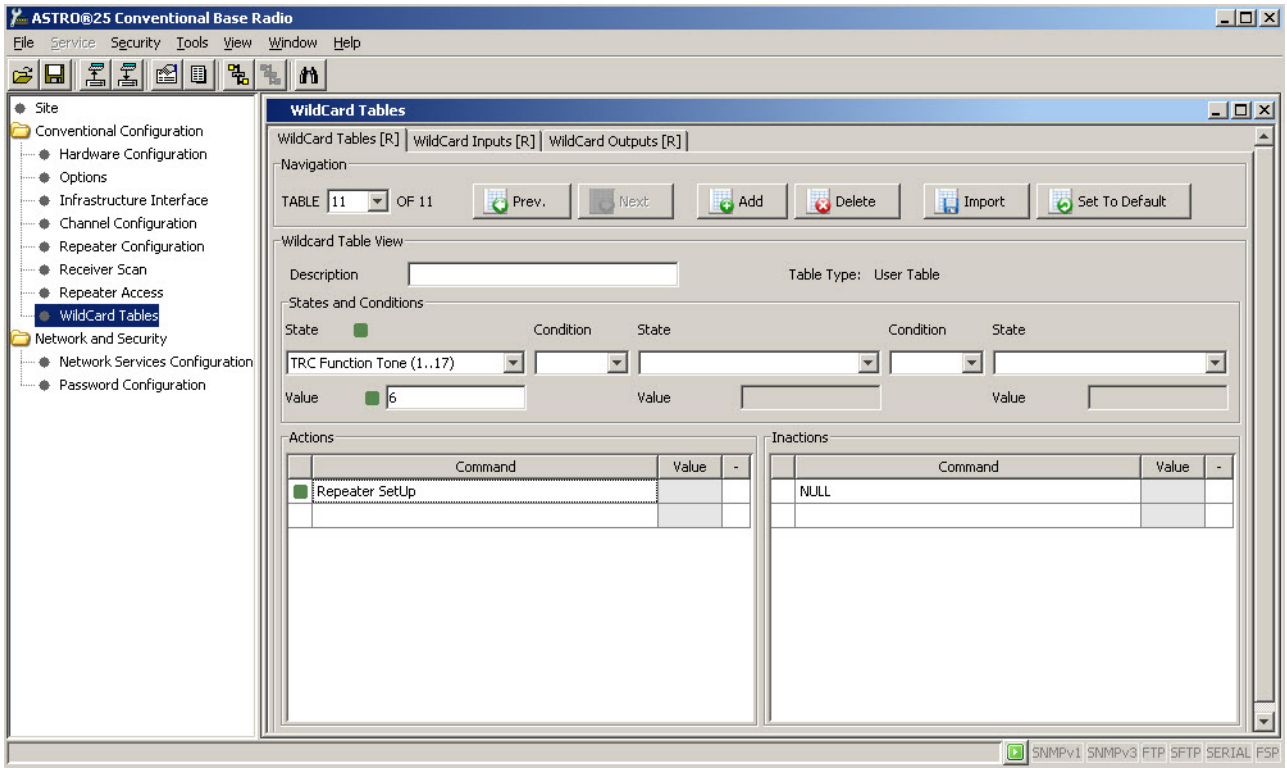
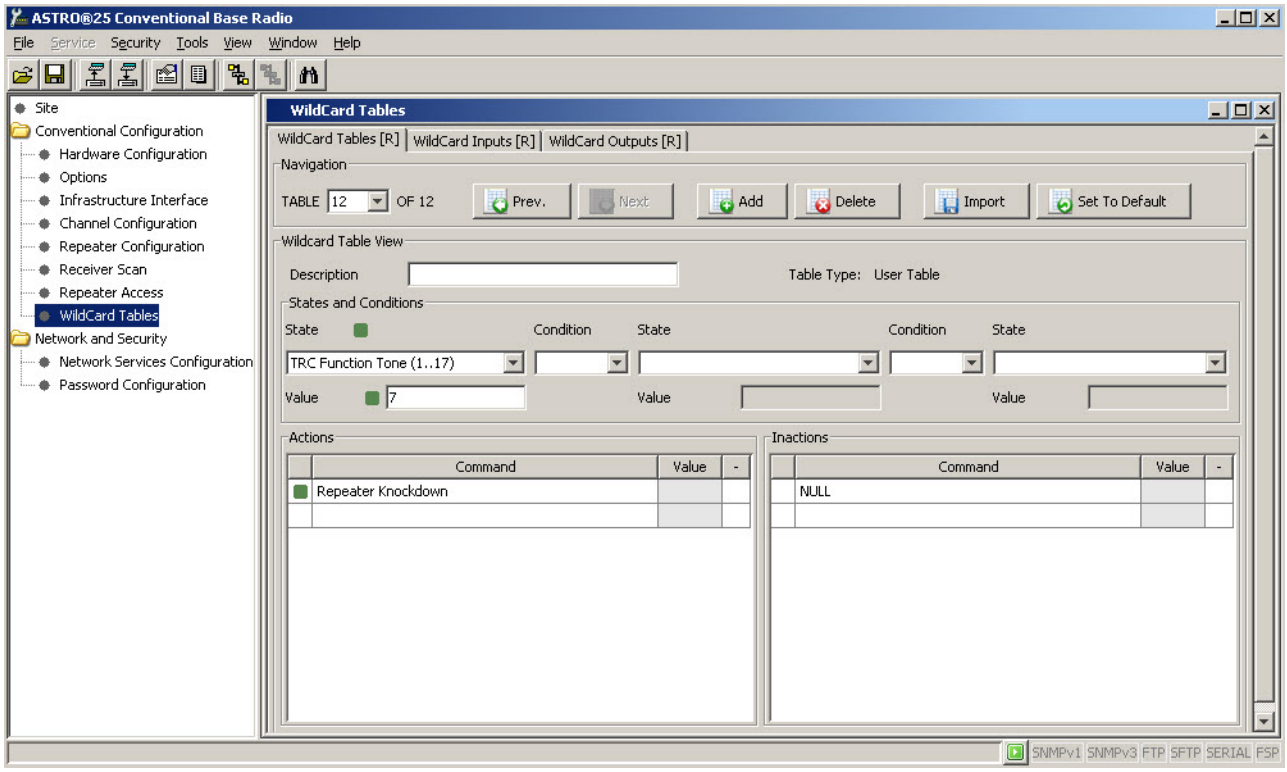


Figure 60: TRC Table to Disable Repeater Set Up



NOTICE: To disable Repeater Set Up means the same as to set Repeater Knockdown.

To Control Gated Access ON/OFF, two other tables are needed.

Figure 61: TRC Table to Enable Gated PL/DPLs to Repeat

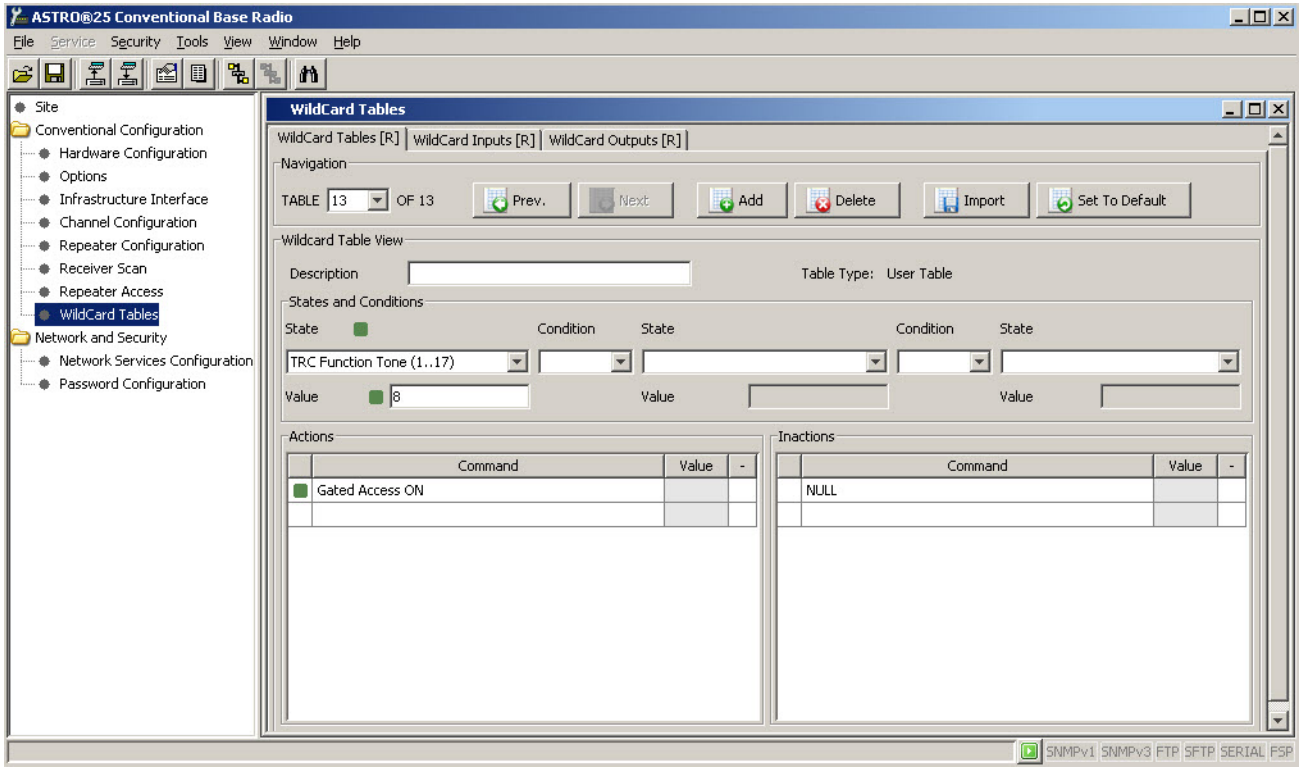
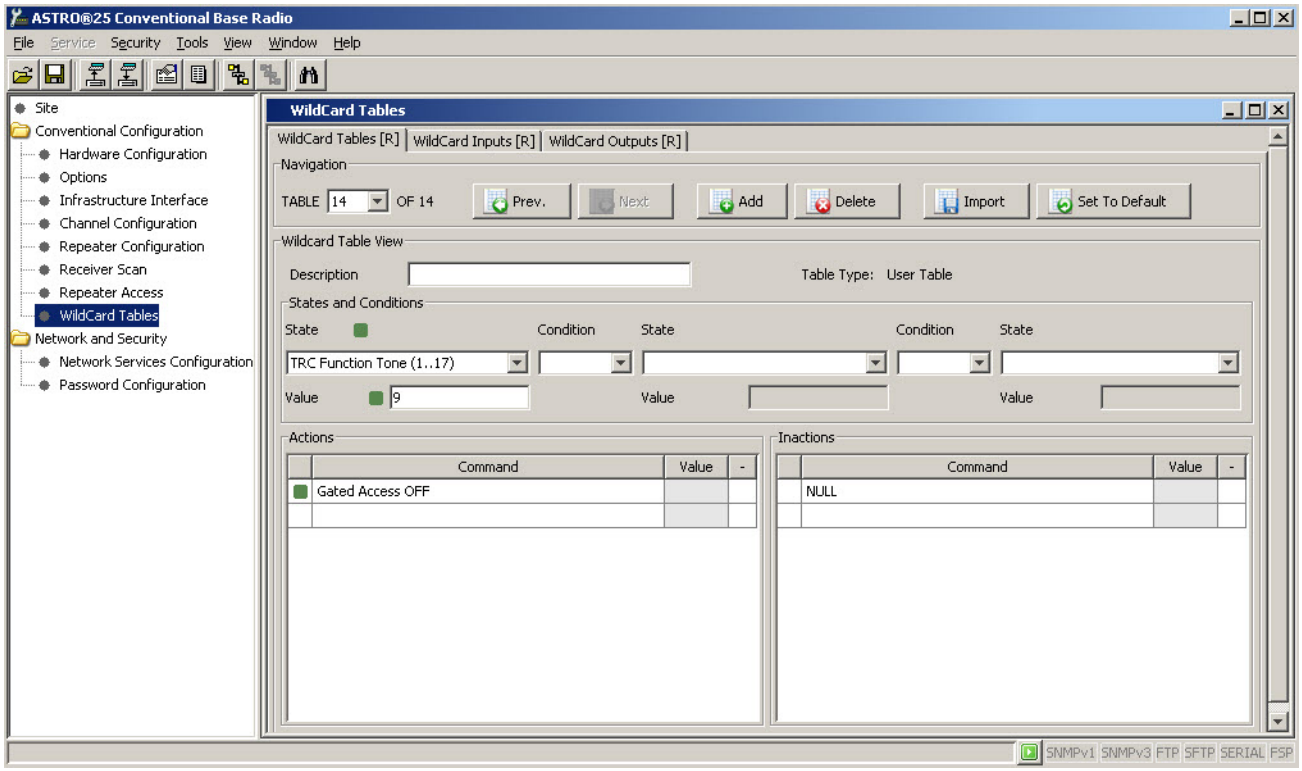
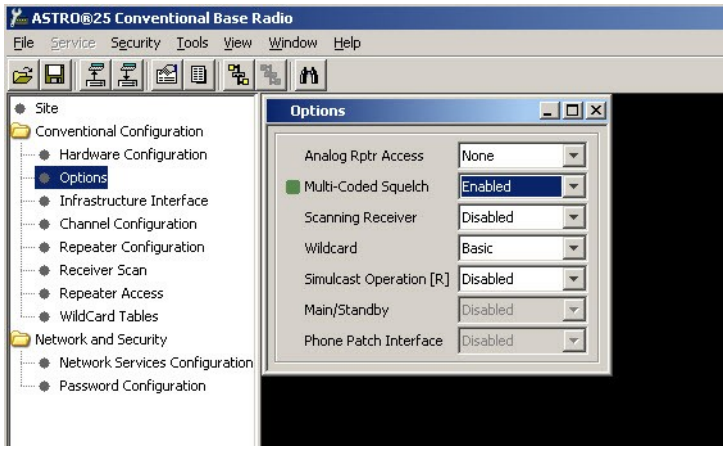


Figure 62: TRC Table to Disable Gated PL/DPLs from Repeating



To enable the Gated Access Feature, the **Multi-Code Squelch** option must be **Enabled** as shown:

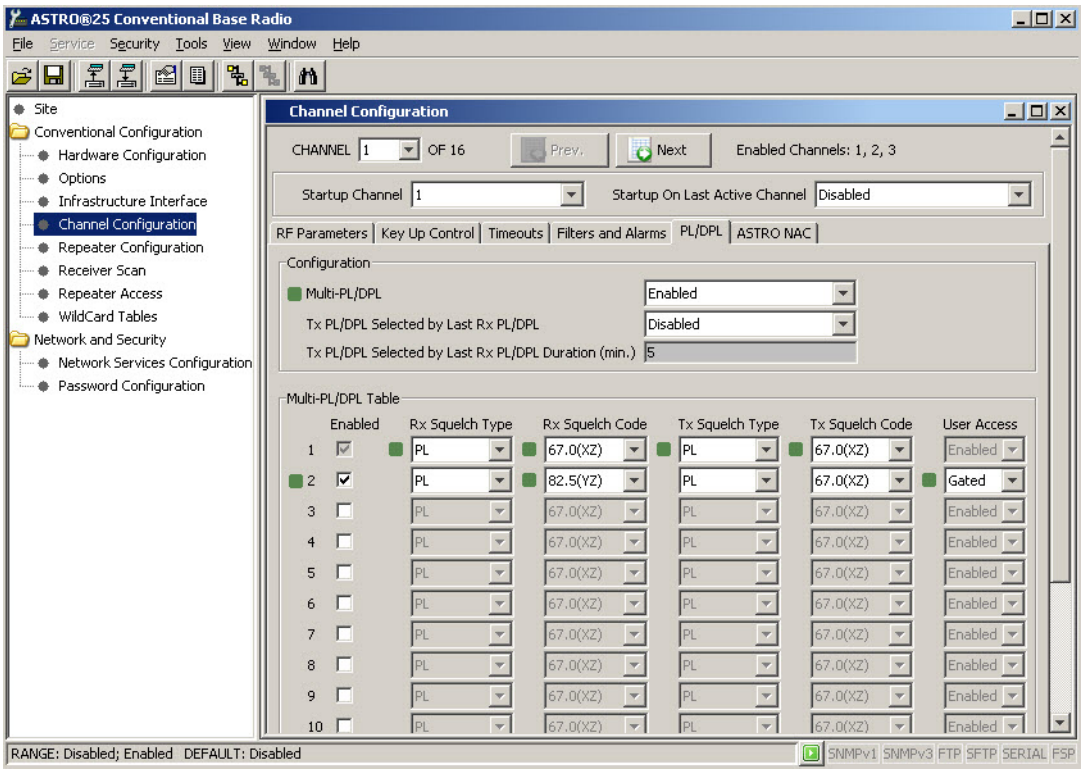
Figure 63: Multi-Coded Squelch Option



Then, the Multi-Private Line/Digital Private Line (PL/DPL) table must be configured for appropriate PL/DPLs as shown below:

NOTICE: Number of enabled channels may vary.

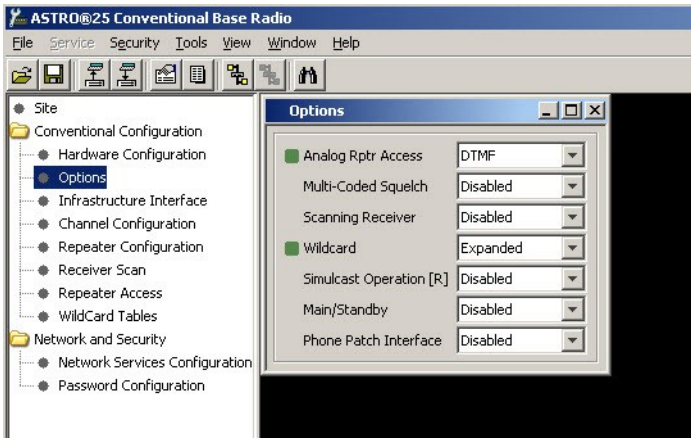
Figure 64: Multi-PL/DPL Table



5.2.7.4
DTMF and MDC 1200 Control from Subscribers and Console

For the GTR 8000 Base Radio to decode subscriber- or console-originated Dual-Tone Multi-Frequency (DTMF) or MDC 1200 signaling, set the **Analog Rptr Access** option to either **DTMF** or **MDC 1200**, and set the **WildCard** option to **Expanded** as shown in the figure.

Figure 65: Analog Repeater Access Option



You can set the **Analog Rptr Access** option to either decode **DTMF** or **MDC 1200** but not both at the same time.

.

When the **Analog Rptr Access** option is set to **DTMF**, the user must define the DTMF strings that trigger the desired functions. Based on the Tone Remote Control (TRC) examples above, at least four DTMF strings must be defined to control Repeater SetUp/Knockdown and Gated Access ON/OFF.

Figure 66: Analog Repeater Access Option – DTMF Sequence

The DTMF strings are defined in the Configuration/Service Software (CSS) table with four examples. Up to 15 strings can be defined for other uses.

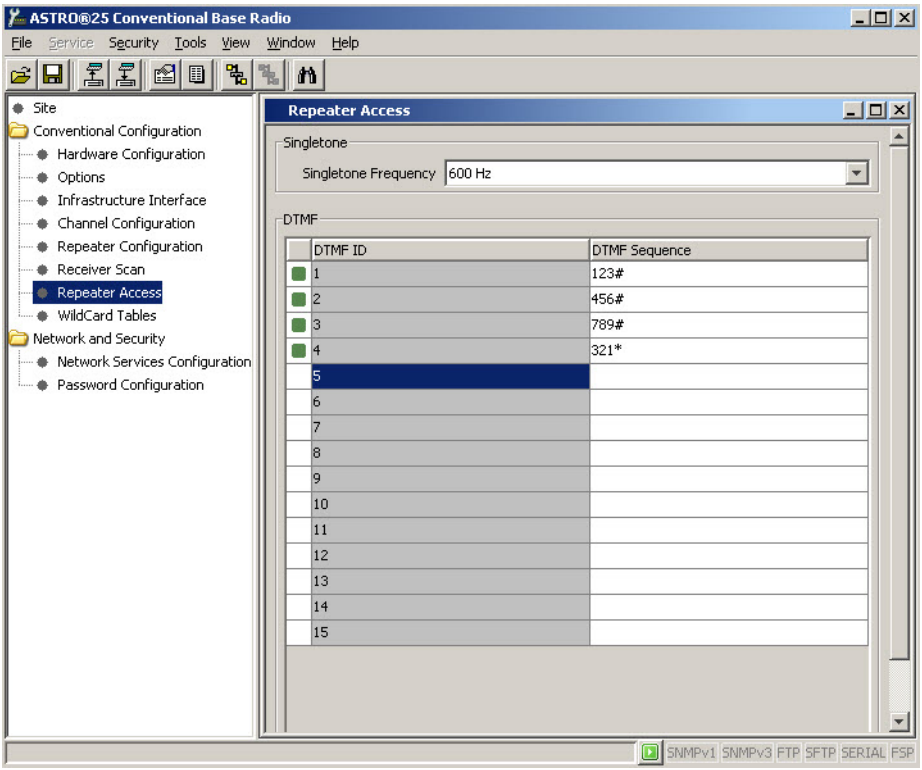
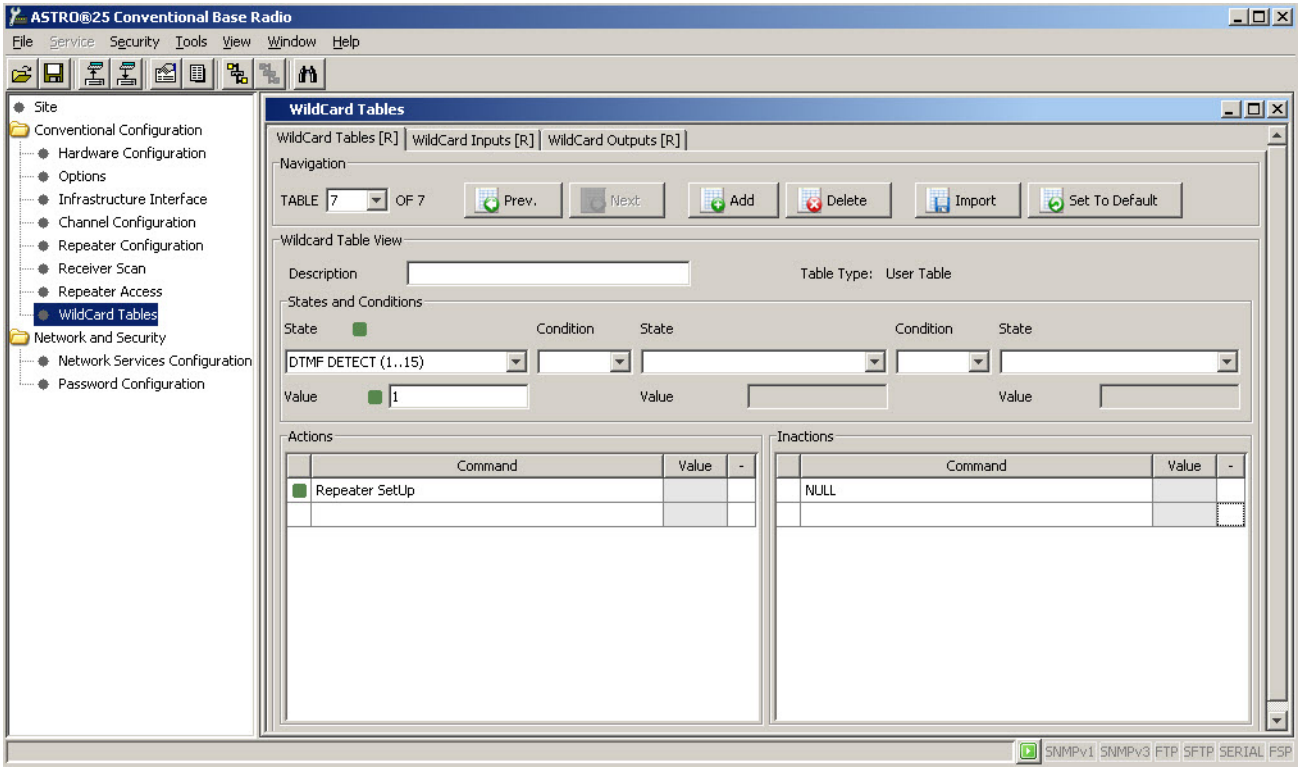


Figure 67: WildCard Table 7

The following four WildCard Tables (numbered 7 – 10) must be defined to handle the required control.



NOTICE: The value 1 represents the DTMF string defined in line 1, DTMF ID 1, of the DTMF table.

Figure 68: WildCard Table 8

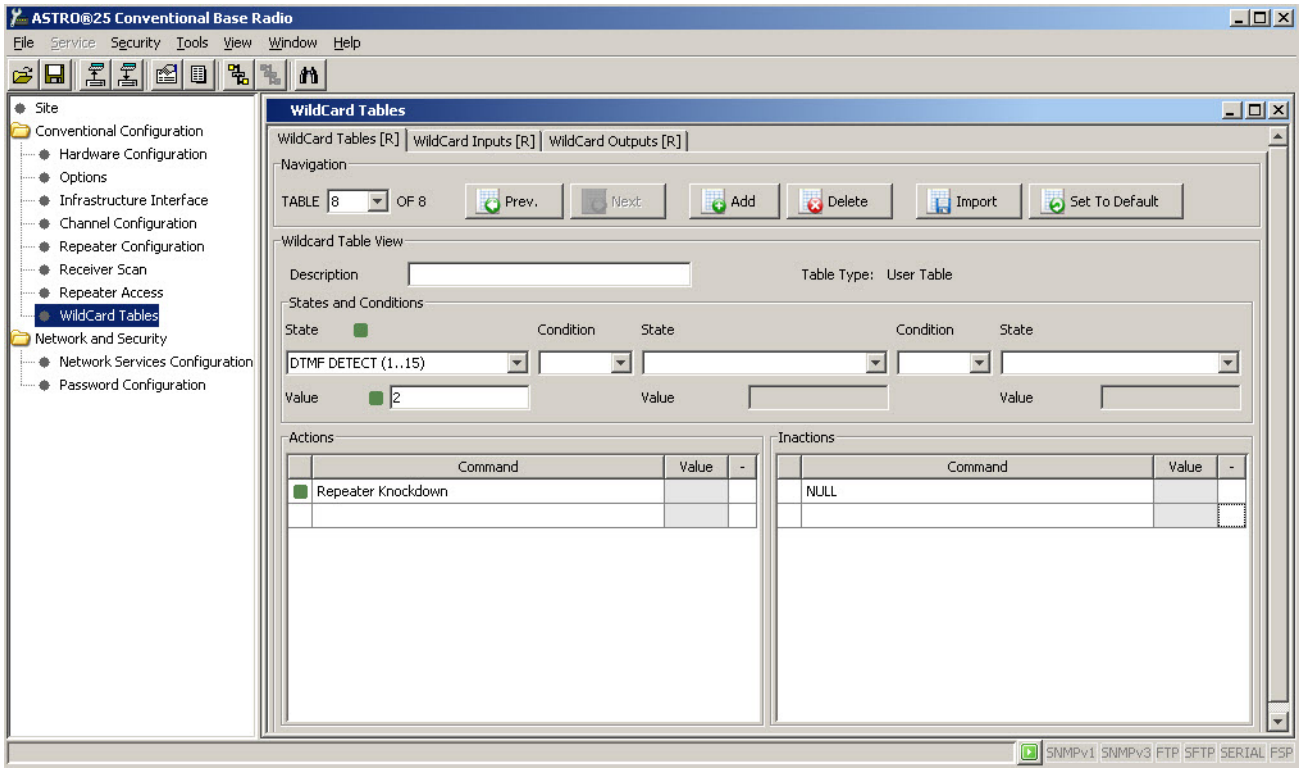


Figure 69: WildCard Table 9

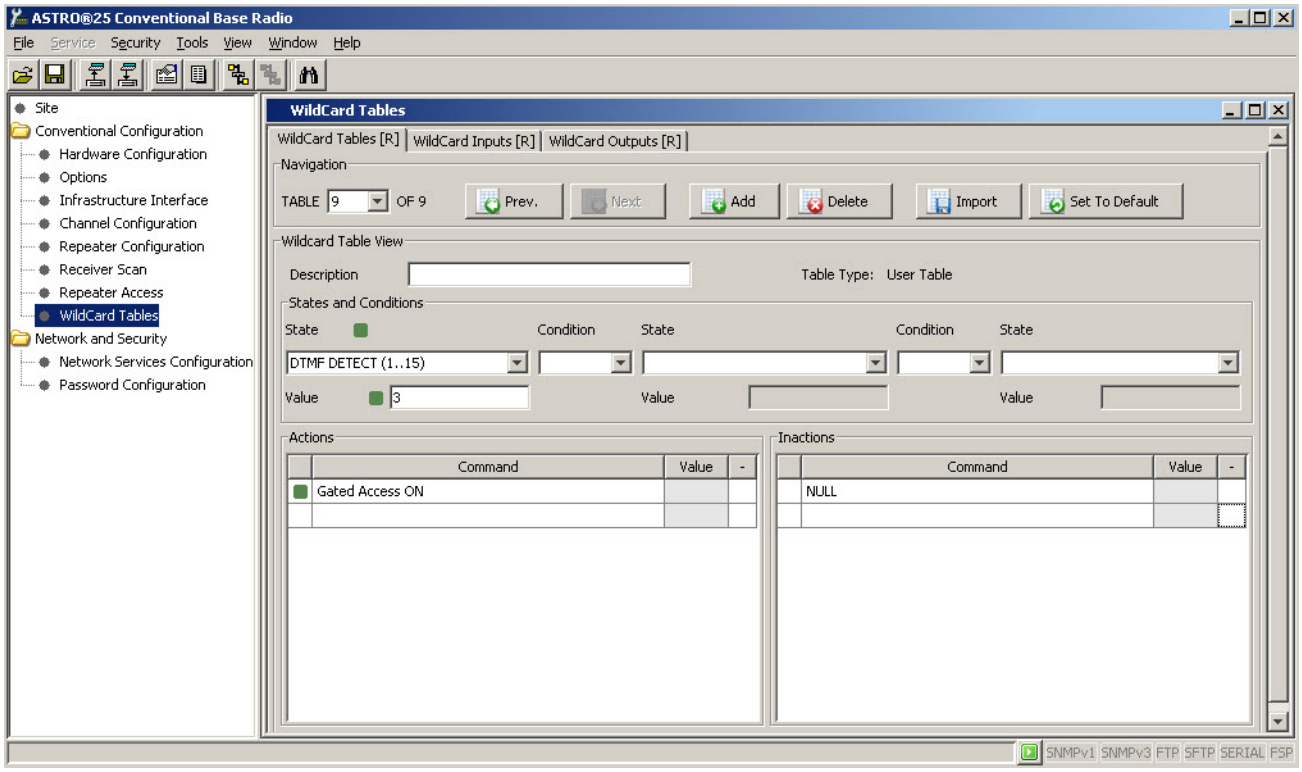
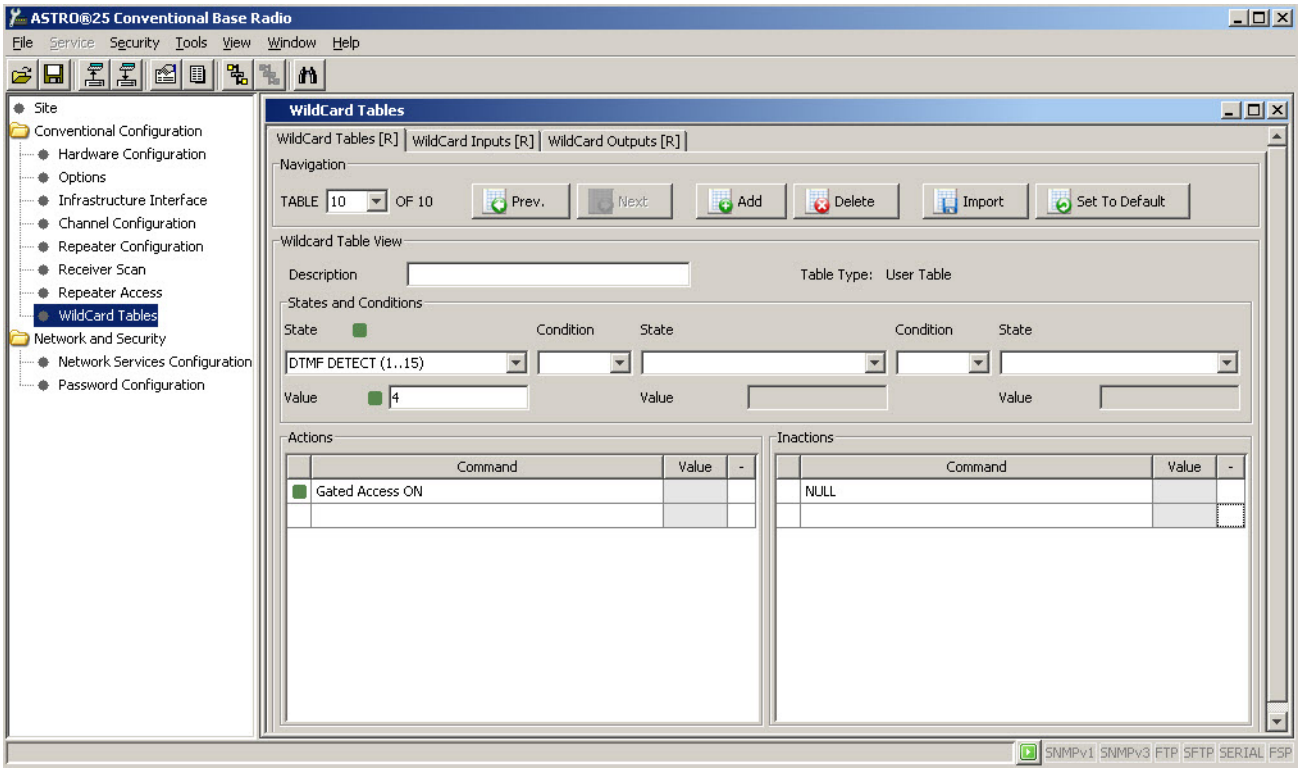


Figure 70: WildCard Table 10

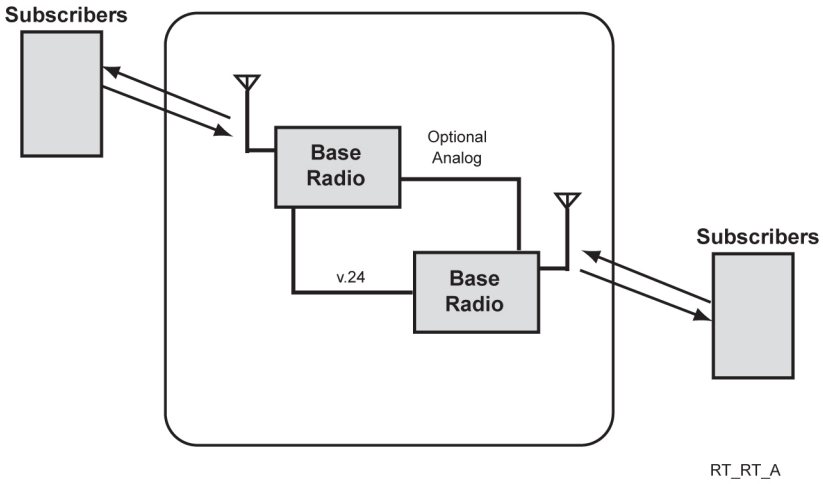


5.2.8 RT/RT Topology

The Remote Repeater/Remote Repeater (RT/RT) configuration is a method to relay signals from one base radio to the next. One typical application for this configuration is a conversion between frequency bands. It is acceptable to have a mixture of GTR 8000 Base Radio equipment and QUANTAR® equipment in the RT/RT configuration.

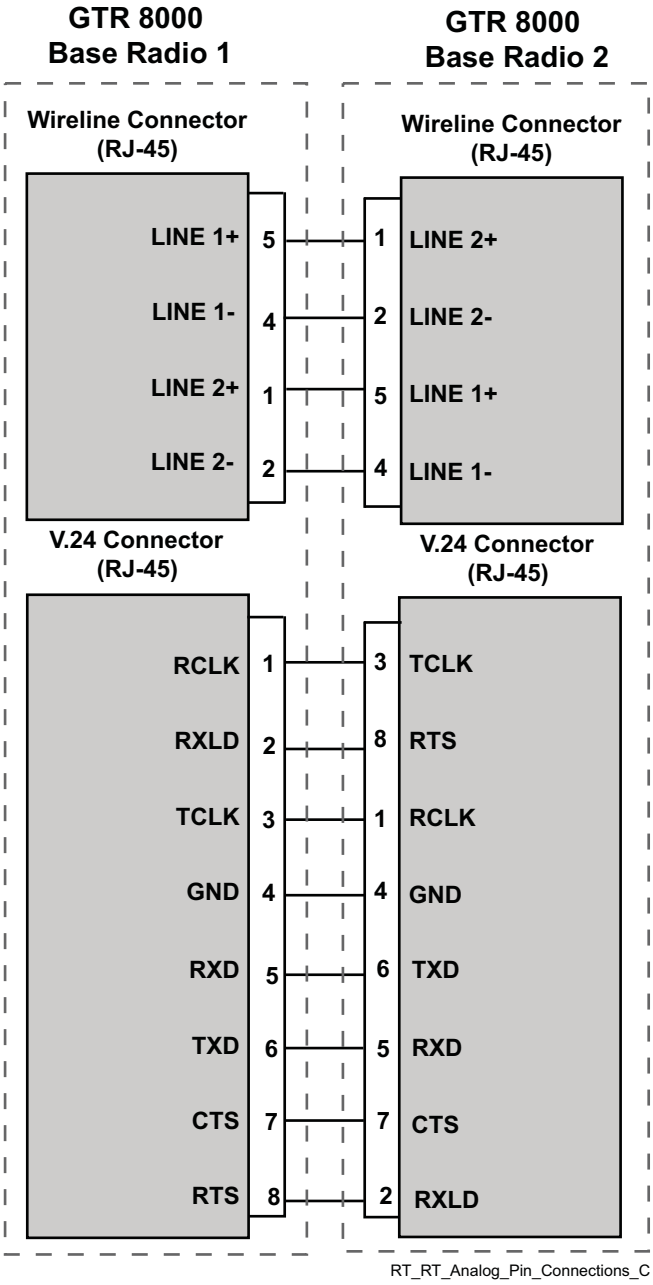
The RT/RT configuration can be used either with V.24 or V.24 hybrid link.

Figure 71: RT/RT



The RT/RT configuration is enabled in Configuration/Service Software (CSS) in the **Infrastructure Interface** window, on the **ASTRO Configuration** tab.

Figure 72: RT/RT – Analog Pin Connections



5.2.9

Phone Patching Topology

Phone Patch (analog only) connects between portables and landline, with the following conditions:

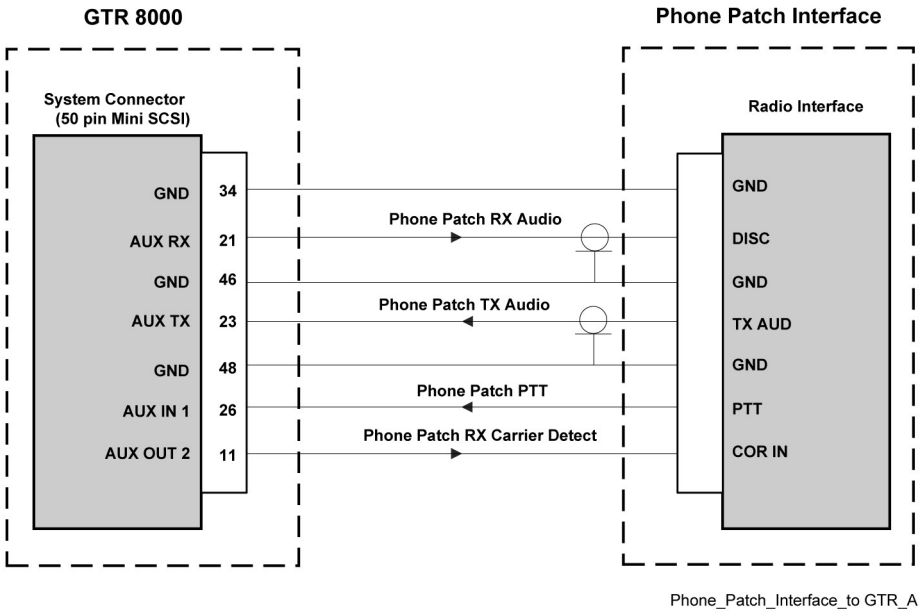
- Subscriber or land line initiates calls.
- Console participates in the phone call.
- Audio received from RF is routed to the Phone Patch.
- Phone Patch sourced audio is transmitted over the air and routed to the infrastructure.
- Infrastructure sourced audio is transmitted over the air and routed to the Phone Patch.

- Phone Patch uses the System connector on the GTR 8000 Base Radio.
- Mixed mode GTR 8000 Base Radio is required.
- Configuration/Service Software (CSS) provides WildCard default Phone Patch tables:
  - Configuration of the Phone Patch on a station basis
  - Configuration on a channel basis
  - Processing of Phone Patch functions using WildCard tables
  - Limiting transmission using the timer

5.2.9.1
Phone Patch Interface

The Phone Patch Interface is an option which bridges the base radio with conventional telephone equipment to allow subscribers to place telephone calls. When Phone Patch Interface is enabled on the base radio, the console can participate in the phone calls but the console cannot originate a phone call.

Figure 73: Phone Patch Interface



5.2.9.1.1
Configuring a GTR 8000 Base Radio to be Phone Patch Capable

Perform this procedure to configure a GTR 8000 Base Radio to be phone patch capable using Configuration/Service Software (CSS).

Prerequisites: Before performing this procedure, install the latest version of CSS.

Procedure:

1. Make an Ethernet connection from the CSS service laptop to the GTR 8000 Base Radio.
2. Read the configuration from the GTR 8000 Base Radio.
3. Click **Options** in the navigation pane to access the **Options** window.
4. In the **WildCard** field, select **Expanded**.

5 In the **Phone Patch** field, select **Enabled**.

The base radio is configured to be phone patch capable for all enabled channels under the **Channel Configuration** window. After **Enabled** is selected on the **Options** window, phone patch can be enabled or disabled on a per channel basis from the **Key Up Control** tab of the **Channel Configuration** window.

6 Write the configuration to the GTR 8000 Base Radio.

Postrequisites: Other CSS configuration considerations include:

- When Infrastructure Interface is configured for **2 Wire** (Station Type = **Analog Only**), the landline listener does not hear console audio.
- When the base radio is configured for **V.24 Hybrid** mixed mode (Station Type = **ASTRO CAICapable**):
  - The phone patch operates in analog only mode and the channel on which it is enabled must be configured for analog capability for the phone patch to work.
  - The console cannot hear the landline talker unless a subscriber is transmitting (landline audio is mixed with Rx audio and forwarded to the console).

5.2.10
Scanning Receiver Topology

The Scanning Receiver includes the following:

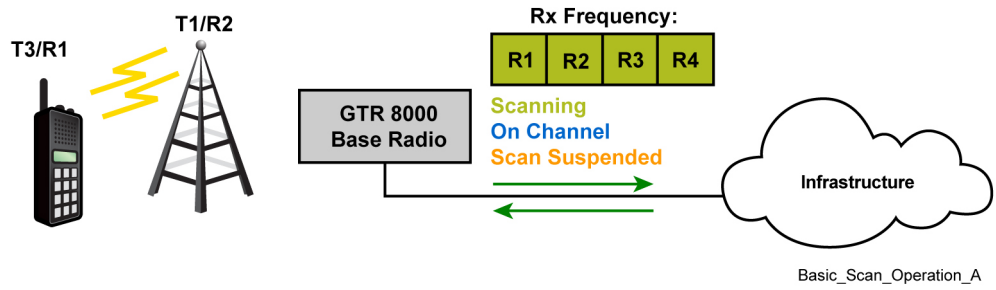
- Basic scan operation
- Priority channel option
- Channel marking option
- Tx slave option
- Scanning Receiver – configuration options

5.2.10.1
Basic Scan Operation

The Basic Scan Operation features include:

- Rx frequencies are in a round-robin way for a Voice/Data/TBSK activity
- As long as Rx activity is present, GTR 8000 Base Radio stays tuned on active Rx channel
- Scanning is suspended and Rx frequency is restored to original when GTR 8000 Base Radio transmits (station resumes scanning starting with last scanned channel when transmission ends)
- Is configurable through Configuration/Service Software (CSS)

Figure 74: Basic Scan Operation



5.2.10.2

Priority Channel Option

The Priority Channel Option features include:

- Allows the receiver to scan one of the frequencies more often (scan alternates between scan list sequence and priority channel)
- Sets the Priority channel to a fixed channel number or can float according to last activity: Rx, Tx, or either with one of the following:
  - With Rx floating priority enabled, the priority channel is the one on which last Rx activity occurred
  - With Tx floating priority enabled, the priority channel is the one on which last Tx activity occurred
  - With Rx+Tx floating priority enabled, the priority channel is the one on which last Tx or Rx activity occurred

5.2.10.3

Channel Marking Option

The Channel Marking Option includes the following features:

- Allows the scan to bypass checking channels where an unprogrammed qualifier, Rx Network Access Code (NAC), or Private Line/Digital Private Line (PL/DPL) was detected
- Enables the Channel Marking option for only priority, only non-priority, or for all channels
- Sets the channel to unmarked when one of the following occurs:
  - The carrier is no longer detected on the channel
  - Qualified Rx activity is detected on other scan channel
  - Scanning is stopped or suspended

5.2.10.4

Tx Slave Option

The Tx Slave Option includes the following features:

- When Rx activity is detected on a scanned channel, that channel becomes the new current channel (current channel parameters determine station behavior including transmitter settings).
- Its common use case is when repeat is enabled for the Tx slave-enabled scanned channel, so that the GTR 8000 Base Radio repeats on the transmit frequency for that channel.
- This option can be enabled for each scan channel separately.

5.2.10.5

Scanning Receiver Configuration Options

In Configuration/Service Software (CSS), when **Scanning Receiver** in the **Option** menu is enabled, the **Receiver Scan** screen is accessible in the CSS navigation pane for the conventional GTR 8000 Base Radio.

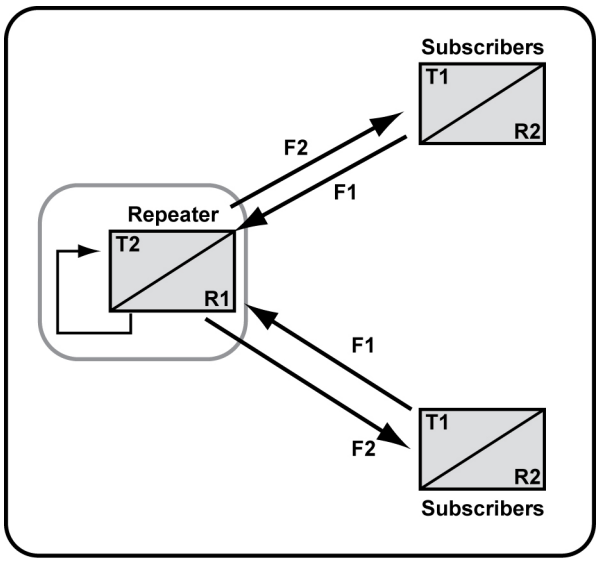
5.2.11

Single Site Repeater Topology

This figure shows the basic Single Site Repeater topology. For this topology, the single repeater functions as a fixed repeater and it is used as a transceiver to and from subscriber radios (mobile and/or portables). The subscribers transmit on the same frequency (F1) and the repeater receiver is on the same RF frequency as the subscriber transmitters. The repeater retransmits the received

information on the repeater transmitter frequency, and the subscriber radios use that as the receive frequency.

Figure 75: Single Site Repeater Topology



Single_Site_Repeater

Chapter 6

Conventional Channels at Trunked Sites

This chapter provides a description of conventional channels at trunked sites.

6.1 Conventional Channels at Trunked IP Simulcast Sites

Conventional comparators that are co-located and share a network with a trunked IP simulcast subsystem are limited to topologies of up to 16 subsite capacity for analog mode and 32 subsite capacity for digital mode.The MLC 8000 in a conventional mixed mode simulcast system can support up to 64 subsites. Conventional comparators within an all conventional IP simulcast subsystem can have topologies of up to 64 subsites. See the *GCM 8000 Comparator* manual or *CSS Online Help* for information about configuring GCM 8000 Comparators for 64 subsites. For information about configuring MLC 8000 Comparators, see the *MLC 8000 Configuration Tool with Analog Display and Control* manual.

An IP simulcast subsite requires a minimum of two channels: one to support control information and at least one for voice and data traffic. The remote sites are linked to a prime site in a simulcast subsystem.

An IP simulcast remote site supports the following trunked and conventional channel combinations and subnets:

- A remote site using the GTR 8000 Expandable Site Subsystem in a standard configuration can support a maximum of 4 IP conventional channels integrated into the cabinet/rack and 4 V.24 or 8 analog conventional channels outside the cabinets/racks.
- Up to two Conventional Channel Interfaces with conventional GTR 8000 Base Radios integrated into the GTR 8000 Expandable Site Subsystem cabinets/racks and standalone conventional GTR 8000 Base Radios or GPW 8000 Receivers outside the cabinets/racks.
- Up to 10 IP conventional channels per Conventional Channel Interface and up to 4 V.24 or analog conventional channels per Conventional Channel Interface with a maximum number of channels, in any combination, not exceeding 30 channels per RF subsystem on the same subnet. Because V.24 conventional channels require an IP address (for centralized network management), the total combined number of IP and V.24 channels must not exceed 30.
- Simulcast, multicast, and voting for conventional channels at a remote site in a standard configuration.

If enough room exists, up to four conventional base radios of the same band can be added to a GTR 8000 Expandable Site Subsystem cabinet that includes trunked channels.

6.1.1 Overview of Conventional Channels in IP-Based and Circuit-Based Systems

The IP network in an ASTRO® 25 system can support digital IP, digital V.24, analog 4-wire, and mixed mode 4-wire/V.24 hybrid circuit wireline link interfaces for conventional channels using a site gateway with a Conventional Channel Interface (Conventional Channel Gateway (CCGW) module on a GGM 8000 or S2500) as the interface device to the WAN links.

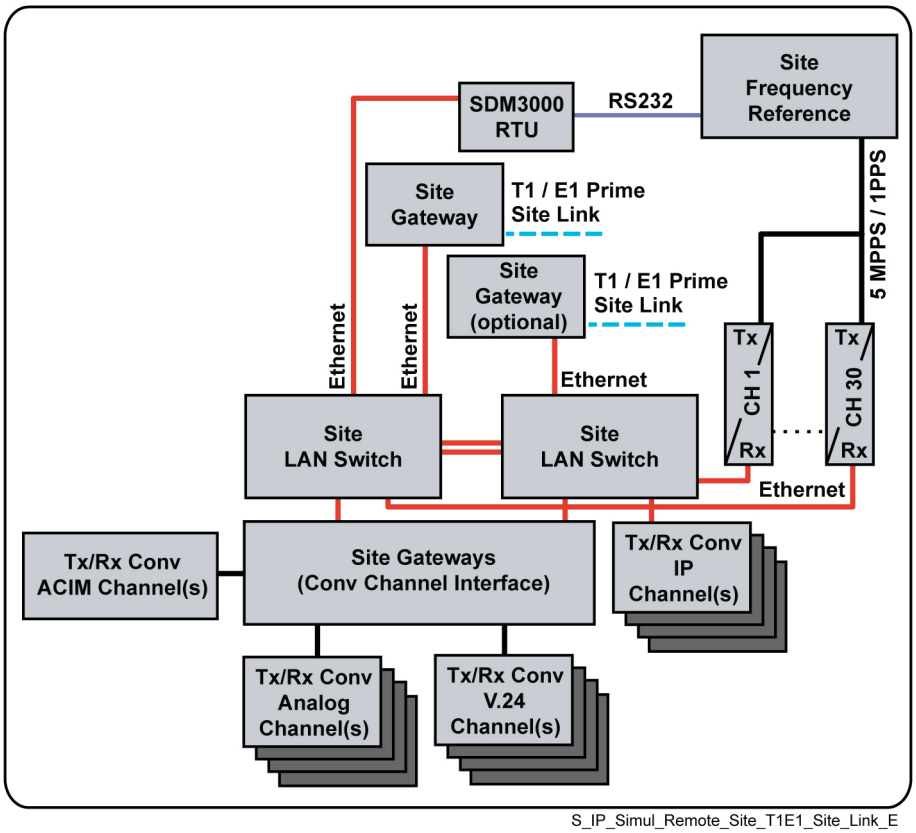
The IP network in an ASTRO® 25 system can also be set up to support circuit-based analog or digital (voted analog or V.24 digital) channels using channel banks. The channel bank is required to multiplex (T1/E1 grooming) the transport circuits and the IP traffic on the WAN links. The remote site can use a site router or site gateway with a serial interface to the High Speed Unit (HSU) in the channel bank.

6.1.2
V.24 and Analog Channel Integration

Standalone conventional V.24 and analog channels can be added to a trunked IP simulcast remote site in any configuration or link type.

This figure shows an example of standalone V.24 and analog channels connecting to a conventional channel interface (Conventional Channel Gateway (CCGW) module on a GGM 8000 or S2500). Conventional IP channels connect directly into the Ethernet LAN switches.

Figure 76: Example of IP Simulcast Remote Site with V.24 and Analog Channels



6.2
Analog IP-Based Conventional Integration at Trunked Site

The Analog IP-based conventional simulcast architecture can be integrated into the LAN at an ASTRO® 25 trunked site. Trunked RF site (repeater or simulcast) cabinet equipment, transport equipment, and timing equipment, can be shared between conventional and trunked channels.

The following scenarios are supported:

- Sharing transport equipment already installed at a trunked subsite by analog conventional channel equipment.
- Sharing transport equipment already installed at a trunked subsite by analog conventional channel equipment, plus sharing of site reference/timing equipment already installed at a trunked subsite.

- Integrating analog conventional channel equipment into a GTR 8000 Expandable Site Subsystem, plus sharing transport and site reference/timing equipment already installed at a trunked subsite.

If an MLC 8000 is included in the conventional channel equipment, it cannot be installed in the GTR 8000 Expandable Site subsystem cabinet. It should be in an adjacent rack. Cabling between the MLC 8000 and the GTR 8000 Expandable Site Subsystem cabinet can use the holes in the Wireline and V.24 subpanel of the GTR 8000 Expandable Site Subsystem junction panel.

The Wireline and V.24 subpanel also provides eight RJ-45 connectors – four V.24 and four analog wireline. In addition to using these connectors for MLC 8000 topologies with GTR 8000 Base Radios, the subpanel connections can be used for topologies with prior releases equipment (see Other Conventional Operations and Topologies on page 175).

If needed, cables can be connected directly from the front transceiver ports of a GTR 8000 Base Radio in the GTR 8000 Expandable Site Subsystem cabinet, to equipment outside the cabinet, instead of using the junction panel. For examples of analog IP-based conventional topologies that can be at trunked sites, see the *MLC 8000 Setup Guide*.

When adding conventional equipment outside the GTR 8000 Expandable Site Subsystem cabinet, if the existing GTR 8000 Expandable Site Subsystem does not have enough Ethernet ports available or does not have an integrated switch, an external HP switch is needed. Conversely, if an external switch is required, at least one open Ethernet port at the GCP 8000 Site Controller or GPB 8000 Reference Distribution Module must be within the GTR 8000 Expandable Site Subsystem where the external switch can be connected.

When implementing conventional channels at a trunked site where the Radio Frequency Distribution System (RFDS) equipment includes a Receive Multicoupler (RMC), select the appropriate RMC option on the **Hardware Configuration** Window in the GTR 8000 Configuration/Service Software (CSS). The four options are:

- GTR 8000 Base Radio Standalone
- GTR 8000 Expandable Site Subsystem
- GTR 8000 BR Emulates Quantar
- GTR 8000 BR Emulates STR 3000

6.3 Conventional Operation in a Trunking Subsystem

The Edge Availability with Wireline Console feature in an ASTRO® 25 radio system provides a Trunking subsystem (Tsub) architecture. For detailed information about Tsub feature, see the *Edge Availability with Wireline Console Feature Guide for Trunking Subsystems* manual.

Trunking Subsystem Overview

The purpose of the Trunking subsystem is to provide dispatch and mobility services within a local area when normal system-wide area communication is not possible. Local area in this case means a group of trunked sites that work together with one or more dispatch sites or centralized conventional sites and resources. Under normal operation, all calls are processed under Zone Controller (ZC) control from the zone core. The remote site devices (Trunking site controllers, consoles, conventional channel gateways) utilize the ZCs in the zone core. When connectivity to the zone core is lost, a fallback ZC located in the Trunking Subsystem (that is, the Tsub ZC) automatically provides the necessary call control for voice services.

Edge Availability with Wireline Console provides failover operation rather than long-term operation in Tsub mode. Motorola Solutions recommends Tsub local area operation of two days or less.

This feature benefits ASTRO® 25 system customers who do not have Dynamic System Resilience (DSR) or who want to minimize their reliance on zone cores managed by other regional entities.

Trunking Subsystem Limitations

During Tsub local area operation, voice services (for example, group call and private call) are supported between radio users and dispatchers that reside within the Tsub. Communication with users external to the Tsub is not possible. In general, radio users and dispatchers have the same capabilities and services that are normally available during system wide area for services that are not dependent on the zone core. Services that require the zone core or access to the Customer Enterprise Network (CEN) through the zone core are lost during Tsub local area operation.

For detailed information about Tsub limitations, see the *Edge Availability with Wireline Console Feature Guide for Trunking Subsystems* manual.

Conventional Site Controller (CSC) is not supported within a Tsub. Local conventional operation is not possible for NM/Dispatch sites that lose transport connectivity with the Tsub prime site, which means that dispatchers are isolated for this failure scenario.

Equip these sites with diverse path redundant site links to minimize the likelihood of this failure scenario occurring.

Chapter 7

Configuration of Conventional Channels

This chapter describes the configuration of conventional channels.

7.1
Configuration Preparation

See Devices and Configuration Tools on page 233. For configuration of other devices, see manuals for those devices (see Hardware Functions and Locations for Conventional Operation on page 37).

Also, see Service Laptop and Software Setup on page 277.

7.1.1
Devices and Configuration Tools

This table shows appropriate component-level manual and configuration software manuals used to establish configuration settings for devices using various software:

Table 16: Devices and Configuration Tools

Devices	Manual	Configured Using
Conventional Site Controllers	*GCP 8000 Site Controller*	Configuration/Service Software (CSS)* Configuration Manager Software
Conventional Base Radios	*GTR 8000 Base Radio*	Configuration/Service Software (CSS)*
	QUANTAR Instruction Manual (6881095E05)	Radio Service Software (RSS)
	For MTR 2000 Base Radio: *Installation and Operation Manual* (6881096E20)	Radio Service Software (RSS)
	MOTOTRBO MTR3000 Base Station/Repeater Installation and User Manual (68007024098)	Customer Programming Software (CPS)
Comparators	*GCM 8000 Comparator*	Configuration/Service Software (CSS)*
	ASTRO-TAC 3000 Comparator Radio Service Software (RSS) User's Guide (6881098E15)	Radio Service Software (RSS)

Table continued…

Devices	Manual	Configured Using
	MLC 8000 Configuration Tool with Analog Display and Control	MLC 8000 Configuration Tool
Voice Processor Module (VPM)	*MCC 7500 Dispatch Console with Voice Processor Module*	Configuration/Service Software (CSS)*
Conventional Packet Data Gateway	*Packet Data Gateways*	Configuration Manager Software & Command Line Interface
Dispatch Console	*MCC 7500 Dispatch Console with Voice Processor Module*	Configuration Manager Software
Site Gateways (Conventional Channel Interface)	*GGM 8000 System Gateway*	Configuration Manager Software
MOSCAD Network Fault Management (NFM), including the following:	*MOSCAD Network Fault Management*	SDM3000 Builder
SDM3000 Network Translator (SNT)	*SDM3000 Builder User Guide*	SDM3000 Builder
SDM3000	*SDM3000 Builder User Guide*	SDM3000 Builder
Graphical Workstation (GWS)	*GMC/GWS for MOSCAD NFM Operator Manual*	SDM3000 Builder
Graphical Master Computer (GMC)	*GMC/GWS for MOSCAD NFM Operator Manual*	SDM3000 Builder

* CSS is installed on the MOSCAD NFM GWS to allow an operator to additionally be able to service/configure supported remote site devices from the same computer (position).

7.2 Conventional Configuration Parameters

This section describes conventional configuration parameters.

7.2.1 Conventional Voice, Supplementary Signaling, and Station Control Operations Configuration

Setting up an ASTRO® 25 radio communication system to support conventional resources in a system that supports trunked and conventional channels involves setting up device-level configuration parameters and system-level configuration parameters.

Various device-level parameters can be established locally or remotely using various configuration tools and methods including the Unified Network Configurator (UNC), Software Download Manager (SWDL), Elite Admin/Elite Dispatch, Configuration/System Software (CSS), and other system software applications. However, the Provisioning Manager application is the foundation for establishing

configuration values for configuration parameters in various software objects to support conventional operations and features employed by conventional resources in a system that supports both trunked and conventional channels.

This section provides an overview of the Provisioning Manager software objects used for setting up configuration parameters associated with conventional resources and conventional features for conventional channel operations in a system that supports both trunked and conventional channel resources.

The following Provisioning Manager software configuration objects are used to establish configuration parameter settings that support conventional operations in an ASTRO® 25 radio communication system:

- Conventional System Object
- Conventional Channel, Conventional Channel Group, and Conventional Unit Object
- Conventional Site Object/Site Gateway Conventional Channel Interface
- Conventional Home Zone Mapping Object
- Conventional Broadcast Data Agency Object
- Zone Object – Conventional Site
- Tone Remote Control Command, Segment, and Sequence Objects
- RF Cross Busy Cross Mute Object
- Console Acoustic Cross Mute Object
- Subscriber Object, Conventional Units
- Console User Capabilities Profile Object
- Console Site Object
- Conventional Site Controller Object
- RF Site Object
- Conventional Talkgroup Channels

NOTICE: For a comprehensive view of all Provisioning Manager software objects that support both trunked and conventional channel operations, including the security group parameter (common to many Provisioning Manager objects to identify the security group alias for various records) and for procedures to create, modify and/or delete Provisioning Manager configuration objects and settings, see the *Provisioning Manager* manual.

7.2.1.1
Conventional Voice, Supplementary Signaling, and Station Control Feature Settings

This section describes the configuration settings to support the conventional features.

7.2.1.1.1
Acknowledgment Delay Timer Considerations

The Acknowledgment Delay Timer is configured for an ASTRO® 25, MDC 1200 and ASTRO® 25 Control Interface Module (ACIM) conventional channel. The Acknowledgement Delay Timer tells the console how long to wait before sending an acknowledgement message. The console must give the subscriber time to prepare to receive the reply. The radio that initiated the emergency alarm uses this delay to prepare for the Acknowledgement. To receive the Acknowledgement, the radio must switch from transmit to receive. To appropriately configure the Acknowledgment Delay Timer, channel link delay time must be considered since the channel link delays may be long enough to make introducing additional delay unnecessary.

The Acknowledgement Delay Timer applies to all inbound signaling messages.

For MDC 1200 channels that also have the Line Operated Busy Light (LOBL) capability enabled or with non-MCC 7500 digital-capable parallel dispatch consoles (for digital and mixed-mode channels), it may be necessary to increase the value of the Acknowledgement Delay Timer to allow the non-MCC 7500 Dispatch Console the ability to acknowledge the emergency alarm coming from a radio.

By extending the Acknowledgment Delay Timer value (Provisioning Manager), the zone controller (or conventional site controller) is delayed long enough to allow the non-MCC 7500 Dispatch Console to send the acknowledgement and prevent collisions either on the 2-wire or 4-wire interface at the LOBL audio bridge (for LOBL configurations) or on the air interface for the digital-capable parallel consoles.

The subscriber radio can also be configured for a silent emergency, where no emergency alarm is sounded.

7.2.1.1.2
Retry Delay Timer Considerations

The Retry Delay Timer is the timer used by the console for sending the retries on the supplementary data messages such as Call Alert and Status Request. For an ASTRO® 25 Control Interface Module (ACIM) channel, the retry timer is calculated differently based on the MDC_Signaling_Capability configuration.

Pre-Time Delay, used on Mobile Data Communications (MDC)-capable channels, is the number of milliseconds that should elapse from the time the resource keys up until the data is transmitted. This time allows for system set-up time and repeater delays. If repeater access is active, pre-time should also include the time it takes a repeater to power up to send a packet.

In case of an MDC signaling capable ACIM channel, the retry timer accounts for the configured values of the pre-time delay parameter. The pre-time is needed for setting up the entire path to the MDC (path to the MDC may have multiple receivers and allows all the receivers to be up and enabled to handle the transmission). Among various channel types supported by the consolette, the MDC channels require the most pre-time.

7.2.1.1.3
Acoustic Cross Mute

Acoustic Cross-Mute prevents acoustic feedback through the select speaker from occurring when dispatch consoles are physically located near each other.

Acoustic Cross Mute is configured using Provisioning Manager (Consoles\Dispatch System\Console Acoustic Cross Mute). It is a capability enacted by the console subsystem when the appropriate resources are keyed up.

To establish Acoustic Cross Mute configuration parameters, see the *Provisioning Manager* manual for detailed parameter descriptions and parameter values.

7.2.1.1.4
Enhanced Alert Tones Configuration

The Elite Dispatch application supports up to 15 Alert Tone buttons, one for each of the 15 default alert tones provided with the MCC 7500/7100 Dispatch Console. Configuration of Enhanced Alert Tones in the Elite Admin application includes configuring the console GUI to use the existing Alert Tone selection mechanism, either the individual Alert Tone buttons or a drop-down menu for the user to choose the configured alert tones. A combination of both buttons can also be used for transmission. For details, see the *MCC 7500/7100Elite Admin User Guide*.

With the Elite Admin application, administrators can configure the console GUI to use the Alert Tone existing selection mechanism, the individual Alert Tone buttons, or a combination of both. The GUI

displays only the Alert Tone selections, which the user has permission to use, based on the privilege level established when the user was configured.

7.2.1.1.5
Channel Marker Configuration

A Channel Marker is a distinct, short-duration audible tone played over subscriber radio and console speakers. Channel Marker provides the ability for dispatch console users to send a periodic, short-duration audible tone (a 700 Hz sine wave) through a conventional channel, Conventional Talkgroup, or trunked channel (talkgroup) resource to subscriber radios.

The primary use of Channel Marker is to inform radio users that the conventional channel, Conventional Talkgroup, or the Trunked Talkgroup is involved in a high priority situation, and radio users should stay off the channel unless they are involved in the high priority situation. The tone also informs users that a console operator is monitoring the talkgroup.

The MCC 7500/7100 Dispatch Console operator has a Channel Marker button on each resource (that is configured with the Channel Marker capability) so that an audible Channel Marker tone can be generated periodically through channel resources (where Channel Marker is enabled) only when no voice activity is on the channel. The console operator is able to activate or deactivate Channel Marker on any resource that has the Channel Marker capability, regardless of the current selected resource on the console.

All MCC 7500/7100 Dispatch Consoles share the status and control of the Channel Marker, so when one dispatcher activates Channel Marker on a resource, all parallel consoles see that the Channel Marker is activated and the parallel operator positions are able to deactivate the Channel Marker.

In the Provisioning Manager, the Console Talkgroup/Multigroup (TG/MG) Capabilities Profile is used to enable/disable the Channel Marker feature for a TG/MG. The Console User Capabilities Profile is used to configure the Channel Marker Repeat Interval (seconds). The Conventional Channel object is used to enable/disable the Channel Marker feature on a conventional channel resource (for Analog, Digital, Mixed, MDC 1200 and ASTRO® 25 Control Interface Module (ACIM) conventional channel types). The Channel Marker tone duration is set at 0.5 seconds. While the Channel Marker tone recurrence rate (Repeat Interval in seconds) is set by default at once every 10 seconds, and is configurable from 5 seconds to 255 seconds, set it no lower than 8 seconds to 10 seconds to avoid an unnecessary increase in communication traffic.

7.2.1.1.6
Conventional Audio and Event Logging Configuration

The Audio and Event Logging feature for conventional operations provides a way to record the console and radio source audio and played it back later. Call information including information regarding the source and mode of the call as well as signaling messages (Call Alert and Emergency Alarm) are also logged.

To facilitate this feature, the Archiving and Interface Server (AIS) affiliates with conventional channels. The calls and signaling messages are forwarded to the AIS where the AIS forwards the audio, call information, and signaling messages to an audio and event logging device. If the AIS is configured to decrypt secure calls, audio is decrypted before being sent to the logging device.

To establish Conventional Audio and Event Logging configuration parameters in the Provisioning Manager, see the *Provisioning Manager* manual for detailed parameter descriptions and parameter values related to the following:

- Local Logging Recorder parameters including Log Select Receive Audio, Log Select Transmit Audio, Log Locally Generated Tones, and others) are found in Provisioning Manager under Dispatch System\MCC 7500/7100 Dispatch Console (VPM-based) parameters.

The audio and event logging feature requires various configuration parameters for the various components supporting the different capabilities of this feature. Also see the ASTRO® 25 System *MCC 7500/7100 Elite Dispatch User Guide*.

7.2.1.1.7
Conventional Call Alert

The Conventional Call Alert feature is configured on the Conventional Channel object in the Provisioning Manager. Dispatch Console and Radio Users can initiate Call Alerts on channels which have been configured with the Call Alert capability.

To establish Conventional Call Alert configuration parameters, see the *Provisioning Manager* manual for detailed parameter descriptions and parameter values related to the following:

- Conventional channel parameters, digital, MDC 1200, mixed mode, and ASTRO® 25 Control Interface Module (ACIM), such as Inbound Call Alert, Outbound Call Alert, Acknowledgement Delay Timer)
- Page parameters (such as page ID, alias)
- Radio user capabilities profile (Call Alert Enabled)
- Radio capabilities profile (Call Alert Enabled)
- Console User Capabilities Profile (Call Alert Receive Enabled, Call Alert Transmit Enabled)

See “Configuring Call Alert” in the *Provisioning Manager* manual.

7.2.1.1.8
Conventional Emergency Call/Alarm

ASTRO® 25 or MDC 1200-capable conventional channels can be configured with the following for emergency calls and alarms:

Inbound Emergency
Ability to receive emergency calls. If this feature is disabled, the emergency call comes across as a normal call.

Emergency Alarm
Ability to receive emergency alarms. If it is disabled, there are no emergency alarm tones or other indications of the alarm.

Emergency Acknowledgment
Ability to acknowledge an emergency. If disabled, this ability is taken away from a console operator. This parameter is an enable/disable parameter that controls whether the console operator can acknowledge an emergency. It does not control whether the emergency acknowledgement is sent to the radio because the infrastructure automatically sends the emergency acknowledgement to a radio.

End Emergency
Ability to knock down an emergency. If it is disabled, this ability is taken away.

7.2.1.1.9
Conventional Emergency Call/Alarm Provisioning Manager

To establish conventional radio ID and radio ID alias configuration parameters, see the *Provisioning Manager* manual for detailed parameter descriptions and parameter values related to the following:

- Conventional Channel Parameters, digital, MDC 1200, mixed mode, and ASTRO® 25 Control Interface Module (ACIM), such as Inbound Emergency, Emergency Recognize, End Emergency, and Emergency Alarm.
- Radio System, System Parameters (Emergency Acknowledged By)

- Radio Traffic Application User Parameters (Receive Unattended EA, Emergency Alarm)
- Console Talkgroup/Multigroup (TG/MG) Capabilities Profile (Emergency Acknowledge, Emergency Alarm, End Emergency, Inbound Call, Inbound Emergency)
- TG/MG Capabilities Profile - (Emergency Enable, Emergency at Not Valid' Sites, Emergency Queue Mode
- Radio Capabilities Profile - (Multigroup Emergency Enabled)
- CAD User - Security Group Access - (Emergency Alarm)

7.2.1.1.10
Conventional Message Update

The Conventional Message Update feature is configured using the Message Update parameter for Conventional Channels, Digital, MDC 1200, Mixed Mode, and ASTRO® 25 Control Interface Module (ACIM), in Provisioning Manager. Dispatchers cannot initiate a Message Update at all as this is a strictly an inbound feature from a subscriber. A subscriber can initiate a Message Update if it has been configured to do so in its programming, regardless of what the system is configured for. If the channel is not configured for Message Update, it is not displayed on the console, yet it does not prevent the subscriber from sending it.

To establish the Message Update configuration parameter for a conventional channel, see Conventional Channel Parameters for Digital, MDC 1200, Mixed Mode, and ACIM Conventional Channels in the *Provisioning Manager* manual.

7.2.1.1.11
Conventional Multi-Select

Conventional Multi-Select enables the dispatch console operator to communicate with multiple talkgroups or conventional channels simultaneously by placing multiple conventional channel resources into one logical group. When the console operator makes a multi-select call, the console initiates a normal conventional call request for each conventional channel for each conventional resource in the multi-select group.

The Conventional Multi-Select feature is configured with the Console User Capabilities Profile object in the Provisioning Manager. A dispatch console user can create multi-select groups and initiate multi-select transmissions at dispatch consoles configured to support multi-select. Each dispatch user can be configured to create up to three multi-select groups.

To establish Conventional Multi-Select configuration parameters, see the *Provisioning Manager* manual for detailed parameter descriptions and parameter values related to Console User Capabilities Profile (Number of Multi-Select Groups Console).

A multi-select group may include clear and secure configured resources. Audio is transmitted in secure or clear mode depending on secure transmit mode of each resource in the multi-select group.

Regrouping is not supported for conventional channels (that is, conventional channels cannot build a super-group).

7.2.1.1.12
Conventional Patch

The Conventional Patch feature allows users of different system resources (Trunked Talkgroup, Conventional Talkgroup, Trunked Private Call, and Analog/ASTRO® 25 / MDC 1200/ASTRO Control Interface Module (ACIM) Conventional Channel) to communicate with each other.

When directed to add a conventional channel to a patchgroup by the dispatch console user, the dispatch console sends a request to patch reserve the channel to the zone controller.

The Conventional Patch feature is configured using the Patch parameter for Conventional Channels (Analog, Digital, MDC 1200, Mixed Mode, ACIM). See the *Provisioning Manager* manual.

7.2.1.1.13
Conventional Radio Check

The Radio Check feature is configured using Provisioning Manager. A dispatch console can only initiate a Radio Check on channels which have been configured with the Radio Check capability.

To establish Radio Check configuration parameters, see the *Provisioning Manager* manual for detailed parameter descriptions and parameter values related to Conventional Channels (Analog, Digital, MDC 1200, Mixed Mode, ASTRO® 25 Control Interface Module (ACIM).

7.2.1.1.14
Conventional Radio Enable/Disable

The Conventional Radio Enable/Disable features (also knows as Radio Inhibit/Uninhibit or Selective Inhibit) are two independent, although related, capabilities configured using the Conventional Channel object in the Provisioning Manager.

You can perform a Radio Disable and a Radio Enable on the channels configured for that operation. Each one should be called out separately. Do not configure the channel for Status Request.

To establish Conventional Radio Enable/Disable configuration parameters, see the *Provisioning Manager* manual for detailed parameter descriptions and parameter values related to Conventional Channel - Conventional Setup (Radio Enable, Radio Disable).

7.2.1.1.15
Conventional Radio ID and Radio ID Alias Display

To establish Conventional Radio ID and Radio ID Alias configuration parameters, see the *Provisioning Manager* manual for detailed parameter descriptions and parameter values related to the following:

- Console Unit ID - Dispatch System/MCC 7500 Dispatch Console (Voice Processor Module (VPM)-based)
- Console User Capabilities profile
- Maps - Home Zone Map
- Conventional Home Zone Map
- Maps - Sub-band Restricted Maps
- Maps - Subscriber Modulation Maps
- Subscriber Objects - Radio Capabilities profile

IMPORTANT: All Radio ID mappings must be set accurately and are critical to system operation. For Conventional Channel Groups configuration when radio IDs are re-used on multiple channels, see the *Unified Event Manager* manual.

7.2.1.1.16
Conventional Remote Monitor Configuration

A dispatch console can only initiate a Remote Monitor on channels which have been configured with the Remote Monitor capability. The Remote Monitor feature is configured using the RF Sites Object \Conventional Menu: Digital Conventional Channel, MDC1200 Conventional Channel, Mixed Mode Conventional Channel, and ASTRO® 25 Control Interface Module (ACIM) Conventional Channel

7.2.1.1.17

Conventional Status Request

The Conventional Status Request feature is a dispatcher capability. A dispatch console can initiate a Conventional Status Request only on channels which have been configured with the Status Request capability.

Conventional Status Request feature is configured using the Provisioning Manager RF Sites Object \Conventional Menu: Digital Conventional Channel, MDC1200 Conventional Channel, Mixed Mode Conventional Channel, and ASTRO® 25 Control Interface Module (ACIM) conventional channel. See the *Provisioning Manager* manual for detailed parameter descriptions and parameter values.

7.2.1.1.18

Conventional Status Update

Only the subscriber can initiate Conventional Status Update. A dispatch console can initiate a Conventional Status Request only on channels which have been configured with the Status Update capability. The Conventional Status Update allows the console to display status messages sent in from the subscribers.

The Conventional Status Update feature is configured using the Provisioning Manager RF Sites Object \Conventional Menu: Digital Conventional Channel, MDC1200 Conventional Channel, Mixed Mode Conventional Channel, ASTRO® 25 Control Interface Module (ACIM) Conventional Channel. See the *Provisioning Manager* manual for detailed parameter descriptions and parameter values.

7.2.1.1.19

Echo Cancellation Configuration

To support Echo Cancellation on the ASTRO-TAC™ 3000 comparator, device-level configuration parameters are established using Radio Service Software (RSS).

The following two parameters are configured on each ASTRO-TAC™ 3000 comparator deployed in a simplex voting channel configuration:

- Console Echo Cancel parameter specifies whether Echo Cancellation is enabled or disabled (it is disabled by default).
- Console Echo Cancel Delay parameter sets the Delay Period, and is applied at the end of the console call; Rx audio is muted for the duration of the console call, plus this additional time.

When configuring Echo Cancellation on the ASTRO-TAC™ 3000 comparator, make the following considerations:

- Enable the Console Echo Cancel parameter only for simplex channels. This scenario is the only one where the console audio echo occurs. However, neither the ASTRO-TAC™ 3000 comparator nor the RSS prevents enabling this parameter in other configurations other than the Echo Cancellation on Dispatch Console feature.
- The Console Echo Cancel parameter is independent of the voice repeat and source-based priority configuration on the ASTRO-TAC™ 3000 comparator. Do not enable repeat and do not set source priority to repeat when Console Echo Cancel is enabled to avoid repeat audio interfering with the subscriber audio. If source priority is set to repeat on a simplex channel, repeat audio take over the console sourced audio. This scenario results in the switching back and forth between the repeat audio and the console audio being sent to the transmitters in a site with a single transmitter and multiple receivers.
- The Console Echo Cancel parameter is independent of the hangtime configuration in the ASTRO-TAC™ 3000 comparator. This independence includes the configuration of the console and repeats hangtime parameters in the ASTRO-TAC™ 3000 comparator. These two parameters determine the time the station stays keyed transmitting short-term Infrastructure Control Words (ICW) after the outbound audio has stopped. The Console Echo Cancel parameter when enabled does not account

for how hangtime is configured. For example, if a console hangtime is set to 1.5 s and the echo delay is set to 1 s, the echo delay ends when the station is still sending out the short-term ICWs. This operation may be acceptable since the short-term ICWs that may be received on the simplex channel are not routed to the Digital Interface Unit (DIU) ports.

NOTICE: The Console Echo Cancel parameter, when enabled, does not account for how hangtime is configured. For example, if console hangtime is set to 1.5 s and the echo delay is set to 1 s, the echo delay ends when the station is still sending out the short-term ICWs. This operation is OK since the short-term ICWs that may be received on the simplex channel are not routed to the Digital Interface Unit (DIU) ports.

- When enabled, the Console Echo Cancel parameter is independent of the Parallel Audio feature.
- When enabled, only by flash capable ASTRO-TAC™ 3000 comparators support the Console Echo Cancel parameter.
- For an Echo Cancellation verification sequence for ASTRO-TAC™ 3000 comparators and consoles, see Verifying Echo Cancellation on page 271.

Setting the Infrastructure Operation parameter for the GTR 8000 Base Radio to half duplex eliminates the need for any echo cancellation configuration on any of the site devices for conventional simplex channels. For information on setting the “Infrastructure Operation” parameter, see the *CSS Online Help*

7.2.1.1.20
Frequency Select Configuration

The Frequency Select console feature allows a dispatch console user to choose a set of transmit/receive frequencies with which to communicate with subscribers. For an ASTRO® 25 conventional console initiated calls, an automatic frequency select is always generated for the currently selected channel before any audio being sent to a base radio so that audio is sent to the currently selected channel, regardless of what channel may have been previously selected.

The Conventional Status Update feature is configured using the Provisioning Manager RF Sites Object \Conventional Menu: Digital Conventional Channel, MDC1200 Conventional Channel, Mixed Mode Conventional Channel, and ASTRO® 25 Control Interface Module (ACIM) Conventional Channel. See the *Provisioning Manager* manual for detailed parameter descriptions and parameter values.

7.2.1.1.21
Key and Keyset Configuration

A parameter in the Elite Dispatch software can be set to enable a console operator to change the Active Keyset. When enabled, a console operator can use the Elite Admin software to change to a different keyset by selecting the desired keyset from a drop-down list box.

7.2.1.1.22
Late Entry

For details on Late Entry, see Late Entry on page 114.

For details on Fast Unmute, see Fast Unmute on page 113.

To establish Late Entry configuration parameters, see the *Provisioning Manager* manual for detailed parameter descriptions and parameter values related to Conventional Channel - Conventional Setup. Fast Unmute/Yes enables the console subsystem to not wait for an Encryption SYNChronization (ESYNC) update before unmuting while Fast Unmute/No disables the console subsystem to not wait for an ESYNC update before unmuting.

Setting Fast Unmute to **Yes** enables the console subsystem to not wait for an ESYNC update before unmuting. Setting Fast Unmute to **No** disables the console subsystem to not wait for an ESYNC update before unmuting. Fast Unmute is configured using the Provisioning Manager RF Sites Object

\Conventional Menu: Digital Conventional Channel and Mixed Mode Conventional Channel. See the *Provisioning Manager* manual for detailed parameter descriptions and parameter values.

7.2.1.1.23
LOBL Conventional Channel Interface and Detect Guard Tones

Local configuration of the Conventional Channel Gateway (CCGW) is necessary to enable Line Operated Busy Light (LOBL). LOBL allows the CCGW to detect guard tones from parallel non-MCC 7500/7100 Dispatch Consoles indicating that a conventional channel is in use by a non-MCC 7500/7100 Dispatch Console keying on a channel.

The following mode must be configured at the CCGW to detect parallel non-MCC 7500/7100 Dispatch Console keying on the channel:

- Tone Remote Control Segment and Sequence Objects (Type of Tone, High, or Low-Level Guard Tone)
- Conventional Site Conventional Channel (LOBL - None, Tone Only, Voltage Only, Contact Closure Only, Tone and Voltage, Tone and Contact Closure)

For detailed parameter descriptions and parameter value, see the *Provisioning Manager* manual. For details on configuring a conventional channel to support interoperation between parallel consoles, see the *Console Systems Interoperability* manual.

7.2.1.1.24
Main/Alternate

A conventional channel role and alternate channel are configured in the Provisioning Manager. The default role is Standalone, and the other options are Main or Alternate.

The channel role may be set to Main only when it is not already an Alternate channel, and when it does not have supervisory takeover capability (in the case of an analog channel).

The channel role is automatically set to Alternate when an alternate channel relationship is configured to it from a Main channel. This setting enables a Main channel to configure another channel as its Alternate, when the other channel:

- Is not already in a Main/Alternate relationship.
- Is in the same zone.
- Has the same node type and security group.
- Does not have supervisory takeover capability, in the case of analog and ASTRO® 25 Control Interface Module (ACIM) channels.
- Is in the same conventional channel group (when both channels are digital and/or mixed-mode or both channels are MDC 1200).
- Has a channel type that can be paired with the main channel:
  - If the main channel type is Analog it can only be paired with an Analog alternate.
  - If the main channel type is Digital it can be paired with an Analog or a Digital alternate, but not an MDC 1200 channel because it is not in the same Channel Group.

    NOTICE: When two digital conventional or mixed-mode channels are configured as a Main/Alternate pair, they must have the same security settings.
  - If the main channel type is ACIM, it can be paired only with another ACIM channel.

If two channels with active calls on them are paired as main/alternate, the call on the newly inactive channel is ended immediately. Call activity in this case implies either inbound or outbound traffic; if the newly active channel is not configured to address the emergency, the console ends radio Tx or console Tx. Emergency conditions on the channel.

7.2.1.1.25

Main/Alternate Channel Type Pairing Configuration

To establish Main/Alternate channel pair configuration parameters, see the *Provisioning Manager* manual for detailed parameter descriptions and parameter values related to the following:

- Conventional Site - RF Sites Object\Conventional Menu: Conventional Site.
- Main/Alternate Channel Configuration - RF Sites Object\Conventional Menu (Channel Role, Main/Alternate Site, and Channel Alias)
- Conventional Channel - Secure Communication Configuration parameters (Secure Key Out, AutoKey, and others). These parameters are configured using the RF Sites Object\Conventional Menu: Digital Conventional Channel, MDC1200 Conventional Channel, Mixed Mode Conventional Channel, and ASTRO Control Interface Module (ACIM) Conventional Channel. See the *Provisioning Manager* manual for detailed parameter descriptions and parameter values.

Table 17: Valid Main/Alternate Channel Type Pairing Configurations

This table shows the valid Main/Alternate channel type pairing configurations.

Main	Alternate				
	Digital	Mixed Mode	MDC	Analog	ACIM
Digital	Supported	Supported	Blocked	Supported	Blocked
Mixed Mode	Supported	Supported	Blocked	Supported	Blocked
MDC	Blocked	Blocked	Supported	Supported	Blocked
Analog	Blocked	Blocked	Blocked	Supported	Blocked
ACIM	Blocked	Blocked	Blocked	Blocked	Supported

7.2.1.1.26

Momentary Override and Auto Key Configuration

A parameter in the Elite Dispatch software can be set to enable a console operator to change the Active Keyset. When enabled, a console operator can use the Elite Admin software to change to a different keyset by selecting the desired keyset from a drop-down list box.

To establish Momentary Override Auto Key and Auto Key configuration parameters, see the *Provisioning Manager* manual for detailed parameter descriptions and parameter values related to the following:

- Console User Capabilities Profile - Momentary Override, Momentary Override Auto Key
- Conventional Channel - Secure Communication Configuration parameters (Auto Key). These parameters are configured using the Provisioning Manager RF Sites Object, Conventional Menu: Digital Conventional Channel, Mixed Mode Conventional Channel

See the *Provisioning Manager* manual for detailed parameter descriptions and parameter values.

7.2.1.1.27

Mute Secondary Receiver Configuration

The Mute Secondary Receiver feature is configured using the Conventional Channel object in the Provisioning Manager. A dispatch console can initiate a Mute Secondary Receiver only on channels which have been configured with the Mute Secondary Receiver capability.

To establish Mute Secondary Receiver configuration parameters, see the *Provisioning Manager* manual for detailed parameter descriptions and parameter values related to Conventional Channel -

Conventional Setup (Mute R2 - **Yes** or **No**, for a hearing talk around audio mixed with a repeat audio, or not).

7.2.1.1.28
Paging Encoder External Paging Configuration

To establish External Paging configuration parameters, see the *Provisioning Manager* manual for detailed parameter descriptions and parameter values related to the following:

- Console User Capabilities Profile (External Paging Capability Enable/Disable)
- MCC 7500 Dispatch Console Parameters - Various External Paging Encoder parameters
- MCC 7500 Dispatch Console (VPM-based) Parameters - Various External Paging Encoder parameters

7.2.1.1.29
Paging Encoder Integrated Paging Configuration

Integrated Paging allows the MCC 7500/7100 Dispatch Console operator to send tone pages to subscriber radios using (conventional or trunked) channel resources. With Integrated Paging, you can create and distribute preconfigured individual pages and group pages (group pages can contain up to 50 individual pages). Custom paging formats can also be created and associated with and used for tone paging. Configuration settings for Integrated Paging are established in the Provisioning Manager application.

Pages are either the tone page type or the system page type. The tones associated with tone pages are sent using the Integrated Paging feature and are generated inside the dispatch console. These tones do not require an external paging encoder device.

Tone pages can be sent using different sets of tone paging data where the tone paging format data describes:

- Mapping of paging digits to analog frequencies
- Various timing parameters to be used by the console when generating sequences of paging tones
- Amplitude of paging tones

To establish Integrated Paging configuration parameters, see the *Provisioning Manager* manual for detailed parameter descriptions and parameter values related to the following:

- Console User Capabilities Profile
- Integrated Paging - Paging Format Consoles Object\Integrated Paging Menu (Paging Tone Group, Paging Format, Page Group, other)
- RF Sites Object\Conventional Menu: Analog Conventional Channel, Digital Conventional Channel, MDC1200 Conventional Channel, Mixed Mode Conventional Channel, ASTRO® 25 Control Interface Module (ACIM) Conventional Channel. See the *Provisioning Manager* manual for detailed parameter descriptions and parameter values.

Configuration settings in for Integrated Paging involve the following:

- Enabling Integrated Paging capability as None, Sequential, or Simultaneous (Console User Capability Profile)
- Modifying the Paging Talk Extend Time per Console User Capability Profile
- Creating Special Product (SP) Paging Tone Group instances
- Creating Special Product (SP) Paging Format instances using SP Paging Tone Group instances
- Creating Page instances pre-configured for the Console on any of a private call, group, conventional channel, or console a selected resource

- Creating Page Group instances pre-configured for the Console that consist of an ordered list of Page instances
- Modifying the instance of Paging Format for each of ten particular paging format types per conventional channel

7.2.1.1.30
Private Line Select Configuration

To establish Private Line Select configuration parameters, see the *Provisioning Manager* manual for detailed parameter descriptions and parameter values related to the following:

- A Dispatch Console can initiate a Private Line Select only on channels which have been configured with the Private Line Select capability. The Private Line Select is configured in Provisioning Manager using the RF Sites Object, Conventional Menu.
- Console User Capabilities Profile - Private Call (various)
- Radio Capabilities Profile (Private Call Enabled Yes, Enabled; No, Disabled)
- RF Sites Object, Conventional Menu, Conventional Site (PL Select)

The Digital channel Network Access Codes (NAC) are not selectable directly by consoles. To select different NAC codes, a console can use the Frequency Select feature to pick a base radio mode defined to use a different NAC code.

7.2.1.1.31
Repeat Control Configuration

The Repeat Control feature (also known as Repeat Mode, Repeat Enable/Disable, or Repeat On/Off) is configured using the Conventional Channel object in the Provisioning Manager. A dispatch console can only initiate a Repeat Control on channels which have been configured with the Repeat Control capability.

The Repeat Control feature for a conventional talkgroup is configured in the Conventional Talkgroup object. The dispatch console can initiate Repeat control only on talkgroups that are configured. Use the Console TG/MG capabilities profile in the Provisioning Manager to configure the Conventional Talkgroup.

To establish Repeat Control configuration parameters, see the *Provisioning Manager* manual for detailed parameter descriptions and parameter values related to the following:

- Conventional Site Conventional Channel - Data Settings Tab (Voice Repeat)

  NOTICE: Voice Repeat is used in conventional IV&D to prevent outbound data from being sent when an inbound voice is on a channel configured with voice repeat enabled. Enable causes repeated audio to suspend outbound data. Disable causes outbound data to be unaffected by repeated audio. If the **Data Capable** parameter is set to **True**, the Data Voice Repeat can be edited.

- Conventional Site Conventional Channel - Configuration Tab (Repeat On/Off - Yes/No specifies user can set an in-cabinet repeat on/off)

7.2.1.1.32
RF Cross Busy/Cross Mute Configuration

The RF Cross Busy Network Management functionality prevents two conventional channels with the same frequency, overlapping their coverage area, from being keyed simultaneously by marking the second conventional channel busy when the other channel configured in an RF cross busy pair is keyed.

The RF Cross Mute feature automatically prevents feedback from occurring, when dispatchers transmit on certain conventional channels. RF Cross Mute can be configured by:

- Muting conventional channels at all other operator positions, or
- Muting conventional channels only at those positions which are acoustically cross-muted with the transmitting dispatch console. If you use this option, the rest of the dispatch consoles continue to receive the audio coming from the receiver.

Configuration of the RF Cross Busy and RF Cross Mute includes setting up source and destination RF Cross Busy and RF Cross Mute frequency pair/pairs and Enabling/Disabling RF Cross Busy and RF Cross Busy for the frequency pair/pairs.

To establish RF Cross Busy / Cross Mute configuration parameters, see the *Provisioning Manager* manual for detailed parameter descriptions and parameter values related to the following:

- RF Cross Busy Cross Mute object - (Destination Zone Alias, Destination Conventional Site Alias, Destination Conventional Channel Alias, Destination Conventional Frequency Alias)
  - Destination Zone Alias - alias of the zone containing the destination conventional channel
  - Destination Conventional Site Alias - alias of the site containing the destination conventional channel in an RF Cross Busy Cross Mute pair
  - Destination Conventional Channel Alias - alias of the destination conventional channel involved in an RF Cross Busy Cross Mute pair
  - Destination Conventional Frequency Alias - alias of the destination conventional channel frequency involved in an RF Cross Busy Cross Mute pair
- RF Cross Busy/Cross Mute object - (Mapping: Source Zone Alias, Source Conventional Site Alias, Source Conventional Channel Alias, Source Conventional Frequency Alias, RF Cross Mute Type, Cross Busy)
  - For a Frequency Alias that refers to the site within the zone where the user has access, select one of the following RF Cross Mute Types: **None**, **RF Cross Mute**, or **Coupled to Acoustical Cross Mute**. For Cross Busy, selecting **On** indicates that the Cross Busy feature is applied to the coupled channels, and selecting **Off** indicates that the Cross Busy feature is disabled.

7.2.1.1.33
Site Conventional Mode Configuration

To establish Site Conventional Mode configuration parameters, see the *Provisioning Manager* manual for detailed parameter descriptions and parameter values related to the following:

- Conventional System object
- Conventional Channel Group object
- Conventional Unit Mapping object
- Conventional Home Zone Mapping object
- Conventional Site Controller object
- Conventional Site object
- Conventional Channel Gateway object
- Conventional Unit

7.2.1.1.34
Supervisory Takeover (with Relay for Analog Conventional through MCC 7500 Aux I/O Server)

This section describes the caveats of a supervisory takeover feature.

7.2.1.1.35

Local Configuration of Supervisory Takeover with Relay for Analog Conventional

This feature enables the dispatch console operator to take over the channel. This feature is set up in the **Configuration** tab of the **Analog Conventional** window in the Provisioning Manager.

If the **Sup Takeover Cap Enabled** field is set to **Yes**, configure an MCC 7500 Aux I/O Server to support the capability or the MCC 7500 Aux I/O Server fields are grayed out and unavailable for configuration. An MCC 7500 Aux I/O Server must have the same security group as the channel. Otherwise, the list of Aux I/Os and servers is empty and an error message appears when you attempt to enter an MCC 7500 Aux I/O Server. Use only latched output Aux I/Os for this function.

For details on this procedure, see the *Console Sites* manual.

7.2.1.1.36

Tone Remote Control Command, Segment, Sequence, and Table Objects Configuration

Tone Remote Control (TRC) is a mechanism by which the Conventional Channel Gateway (CCGW) generates a sequence of tones on the 4 Wire analog interface used to command an entity (such as a base radio) to perform a function (such as turn repeat mode on or off, and others).

NOTICE: While parallel MCC 7500/7100 Dispatch Consoles are supported, parallel console TRC of the ASTRO® 25 Conventional is not supported.

The TRC Table object is used to define tone sequences used for each station control command. The TRC Table maps the station command alias to the tone sequence used by the CCGW to execute that command on a channel.

To establish TRC configuration parameters, see the *Provisioning Manager* manual for detailed parameter descriptions and parameter values related to the following:

- TRC Command object
- TRC Segment object (Tone type, frequency, duration, offset)
- TRC Sequence Object (high-level guard tone, function tone, and low-level guard tone)
- TRC Table object

All portions of the TRC sequence (high-level guard tone, function tone, and low-level guard tone) are modified, but not all aspects (frequency, level, and duration) of each portion are user-configurable. Each conventional channel uses its own set of TRC sequences, and these sets are modified independently of each other.

A Tone Sequence that consists of up to four Tone Segments defines a TRC Command object. Each tone segment is characterized by a level (dB), duration (ms/infinite), and frequency (Hz).

7.2.1.1.37

Radio Service Software and TRC Commands

The Radio Service Software (RSS) tool provides a way to configure a base radio for Tone Remote Control (TRC). See the Online Help in the *Radio Service Software* tool for details.

Setting up TRC involves the following: enter the desired command sequence for the station to execute for each Function Tone (FT) listed. Up to eight separate commands may be entered for each FT.

If the High Level Guard Tone (HLGT) is set to within 40 Hz of a TRC Function Tone, that Function Tone is not allowed to have any commands associated with it.

7.2.1.1.38

Sample TRC Commands

The following shows the typical Tone Remote Control (TRC) commands for a station programmed for four-channel operation, and controlled by a four-channel tone remote console:

- `GUARD TONE: MORE 2175 Hz`
- `F TONE 01: MON`
- `F TONE 02: CHN 001 KEY`
- `F TONE 03: CHN 002 KEY`
- `F TONE 04:`
- `F TONE 05:`
- `F TONE 06:`
- `F TONE 07:`
- `F TONE 08: CHN 003 KEY`
- `F TONE 09: CHN 004 KEY`
- `F TONE 10: MORE`
- `F TONE 11: MORE`
- `F TONE 12:`
- `F TONE 13:`
- `F TONE 14:`
- `F TONE 15:`
- `F TONE 16:`
- `F TONE 17:`

Table 18: Tone Remote Control - Command Descriptions (RSS)

This table provides a list of commands that can be used.

Command	Description
ALARM ON	This command enables the alarm beeps to be routed as defined in the codeplug. This command would normally follow an ALARM OFF command.
ALARM OFF	This command disables the alarms from being set to both the RF and the Wireline as selected in the codeplug. Alarm beeps can be turned on again using the ALARM ON command.
CHN XXX	Commands station to tune a transmitter and receiver to the specified channel; channel must exist on the Channel Information table. Example: CHN 002. **CAUTION:** All CHN XXX (channel) commands must reference valid channel numbers. If an undefined channel number is referenced from the TRC table, inconsistent station operation may result.
GATEACC ON	Enable Multi-Coded Squelch GATED Private Lines/Digital Private Lines (PLs/DPLs) to repeat.

Table continued…

Command	Description
GATEACC OFF	Disable Multi-Coded Squelch GATED PLs/DPLs from repeating.
KEY	Commands station to a key transmitter and remain keyed as long as low-level guard tone is received.
KEY ON	Commands station to a key transmitter indefinitely; the KEY OFF command de-keys the transmitter.
KEY OFF	Commands station to de-key a transmitter.
MORE	Commands station to look for next function tone. The MORE Command is not required for the QUANTAR®/QUANTRO® Station to search for the next function. The Station searches automatically. The MORE Command is only provided to allow for complete compatibility with older Stations that did require this command.
MONITOR	Commands station to turn on a receiver-to-wireline audio path; overrides all squelch requirements, if any.
MRTI ON	This command enables Phone Patch operation after an MRTI OFF command disables it.
MRTI OFF	This command disables Phone Patch operation. Phone Patch operation is always enabled at a startup (RESET).
RXPL ON	Commands station to turn on an appropriate receiver squelch (as programmed in a Channel Information table for an affected channel); includes CSQ, PL, and DPL.
RXPL OFF	Commands station to turn off appropriate squelch (as programmed in a Channel Information table for an affected channel); includes CSQ, PL, and DPL.
RPT ON	Enables repeater mode (if repeater capable); station repeats when qualifiers (as programmed in a Rptr Activation field in a Channel Information table) are met.
RPT OFF	Disables repeater mode (if repeater capable); station does not repeat regardless of qualifiers (as programmed in a Rptr Activation field in a Channel Information table).
SCAN ON	If the Scanning Receiver Option has been purchased, the station begins the scanning operation. Scanning continues until it is turned off or suspended. The scan begins on the first channel in the Scan List.
SCAN OFF	Turns scanning off and the stations returns to the CURRENT channel.
SCAN RESUME	If the SCAN SUSPEND command supports the scanning function, and the scanning function is on, the station restarts the scan function on the SCAN channel. SCAN RESUME restarts the scan timers.
SCAN SUSPEND	If the scanning function is on, the station stops scanning and places the station on the CURRENT channel. If the scanning function is off, the station ignores this command.
SELALARM ON	This command negates the effect of the SELALARM OFF command. If an alarm condition exists and the SELALARM OFF command turned off the beeps, this command turns the alarm beeps back on.
SELALARM OFF	This command turns off the alarm beeps to both the RF and wireline. However, if a new alarm condition is established, then those beeps is

Table continued…

Command	Description
	sent to either or both the RF and wireline depending on codeplug configuration.
TXPL ON	Commands station to turn on an appropriate transmitter squelch code (as programmed in a Channel Information table for the affected channel); includes CSQ, PL, and DPL.
TXPL OFF	Commands station to turn off appropriate transmitter squelch code (as programmed in a Channel Information table for the affected channel); includes CSQ, PL, and DPL.
WAIT xxxx	Commands station to wait a certain amount of time before executing the next command. The units of the time for this command are milliseconds (ms) and the value is rounded to the nearest 10 ms. Example: WAIT 1000 (this command tells the station to wait for 1000 ms).

7.2.1.1.39
Voice Selective Call

A Voice Selective Call allows the console or radio user to communicate with a single console or radio unit without having other units on the same channel listening to the conversation. It eliminates the annoyance of users having to listen to non-relevant traffic.

To establish Voice Selective Call configuration parameters, see the *Provisioning Manager* manual for detailed parameter descriptions and parameter values related to the following:

- Console User Capabilities Profile - Configuration Tab
- Conventional Channel - Conventional Setup Tab - Inbound/Outbound Voice Selective Call

7.2.1.1.40
WildCard I, WildCard II Configuration

The WildCard feature enables a console user to control up to two miscellaneous functions (named WildCard I and II) that a conventional base station performs (for example, turning a relay on or off).

The WildCard I, WildCard II feature is configured using the Conventional Channel object in the Provisioning Manager. A dispatch console can initiate a WildCard I, WildCard II only on channels which have been configured with the WildCard I, WildCard II capability.

To establish WildCard I, WildCard II configuration parameters, see the *Provisioning Manager* manual for detailed parameter descriptions and parameter values related to Conventional Site Conventional Channel - Configuration Tab (WildCard I, WildCard II - Yes/No specifies WildCard processing is allowed/not allowed).

7.2.1.2
Configuring Aliases For Conventional Channel Gateways and Conventional Resources

Follow this process to configure the zone-level aliases required for conventional operation.

Prerequisites:
The Provisioning Manager controls the configuration of zone-level aliases and objects used for conventional operation. The following zone-level aliases must be configured to enable the dispatch console to monitor conventional resources and the Conventional Channel Gateways (CCGWs):

- Conventional Site Alias
- Conventional Channel Gateway Alias

- Conventional Channel Alias

NOTICE: Although only one CCGW per conventional site is configured in the Provisioning Manager, the conventional site has up to ten physical CCGW units. The CCGW configured in the Provisioning Manager is a logical entity. It is not equivalent to an individual CCGW.

Process:

1. Create and specify the parameters for the conventional site. See "Adding a Conventional Site Record" in the *Provisioning Manager* manual.
2. Create and specify the parameters for the conventional site CCGW. See "Adding a Conventional Site, Conventional Channel Gateway Record" in the *Provisioning Manager* manual.
3. Create and specify the parameters for the Analog Conventional channel. See "Adding an Analog Conventional Channel Record" in the *Provisioning Manager* manual.
4. Alternatively to step 3, create and specify the parameters for the ASTRO® 25 Conventional channel. See "Adding a Digital Conventional Channel Record" in the *Provisioning Manager* manual.

   For more information on configuring zone-level aliases and components, see the *Provisioning Manager* manual.

Chapter 8

Optimization for Conventional Operations

This chapter provides performance management information to optimize the conventional resources in the ASTRO® 25 radio communication system supporting trunked channel and conventional channel resources.

8.1 Audio Level Settings for Console Sites and Base Radios

Use the audio level settings provided in this section to control the volume level transmitting both inbound and outbound in your subsystem. These settings described do not apply to ASTRO® 25 Conventional (digital conventional from previous releases).

Change only one audio level parameter at a time, and verify that the desired result is achieved before changing any other audio level parameter. If no change is noticed, return the audio level parameter to its original value before moving on to another audio level parameter.

NOTICE: The Site Gateway (Conventional Channel Interface), based on the GGM 8000 platform and the S2500 Motorola Network Router (MNR) platform, provide a Conventional Channel Interface to conventional base radios in the system. This conventional channel interface may be shown in the Provisioning Manager as CCGW or Conventional Channel Gateway.

So that it is possible to set levels differently for each agency within a shared system, audio levels can be configured using Dispatch Application parameters in the Provisioning Manager application for systems with L or M cores, or the Configuration Manager application for systems with K cores.

The console dispatch application object is part of Group Commit. The Group Commit function applies configuration changes to site equipment after configuration changes to console object records have been saved. Changes to the console system audio level parameters do not take effect on the console until Group Commit is performed. This process is different from the CCGW parameters. Changes to these parameters take effect immediately after they are saved.

Table 19: Console Outbound Audio Level Setting

This table lists the console audio level parameters.

Parameter	Value
Outbound Vocoded Audio Level	-26 dBm0 (Default)
AGC Type	DLM

The console Outbound Vocoded Audio Level is configured to any integer value from -26 dBm0 to -20 dBm0. The value shown in the table is the default value, and considers the audio level settings of trunked digital subscribers, other consoles, and analog conventional channels.

CAUTION: The system is designed to work properly with the default level setting, and this setting should not be changed without guidance from Motorola Solutions. Improperly adjusting this parameter could cause unmatched audio levels and degraded audio quality in some scenarios.

The console Automatic Gain Control (AGC) type is configured as either Digital Level Memory (DLM) or Pure AGC. DLM means that the AGC gain adjustment is active only when the AGC detects voice activity. When no voice activity is detected, the AGC freezes its gain. Pure AGC means that even when no voice is detected, the AGC adjusts the gain (which increases the responsiveness of the AGC to low signal levels, but can create the phenomenon of "noise-pumping").

For diagrams illustrating audio level settings, see the following:

- Audio Levels for Analog-Only Base Radios on page 256 for analog channel (with Unity-Gain and Lossy Wireline media).
- Audio Levels for V.24 Base Radios on page 257 for V.24 digital channel (with Unity-Gain and Lossy Wireline media).
- Audio Levels for Mixed Mode Base Radios on page 259 for hybrid channel (with Unity-Gain and Lossy Wireline media).

For diagrams illustrating MLC 8000 audio level settings, see *MLC 8000 Setup Guide*.

8.2 Audio Levels for the Analog Conventional Channel Gateway

Conventional Channel Gateway (CCGW) analog conventional channel audio level parameters are listed in the following table, and illustrated in Figure 77: Audio Level Settings for Analog Channel with Unity-Gain Wireline Media on page 257 and Figure 78: Audio Level Settings for Analog Channel with Lossy Wireline Media on page 257. Audio level parameters must be configured separately for each analog channel in the CCGW. These parameters are configured through Provisioning Manager or, in K core systems, the Configuration Manager.

NOTICE: No CCGW audio level parameters are required for digital channels.

Table 20: CCGW Audio Level Settings for Analog Conventional Channel

Parameter	Value	
	Unity Gain Analog Media	Lossy 4-Wire Analog Media
Outbound Path (from console, to station)		
Outbound Alignment Tone Level	-10 dBm	-5 dBm
Average Outbound G.728* Audio Level	-26 dBm0	-26 dBm0
Inbound Path (from station, to console)		
Average Inbound G.728 Audio Level	-26 dBm0	-26 dBm0
Inbound AGC Knee Setting	-25 dBm	-20 dBm (- line loss in dB**)

* G.728 is an International Telecommunications Union (ITU) standard for coding telephone-bandwidth speech 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.

*** DLM is only available on the GCM 8000 Low Density or High Density Enhanced Conventional Gateway module.

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 CCGW, the "outbound alignment tone level" must be adjusted as shown in the lossy 4-wire media column.

8.2.1
CCGW Outbound Path

The Conventional Channel Gateway (CCGW) supports a command to generate a station alignment tone entered through the command line. The syntax for this command is explained in the *Enterprise OS Software Reference Guide*. This command may be used to provide the signal input for aligning the base station transmitter deviation.

Outbound Alignment Tone Level

This parameter controls the analog output level from the CCGW channel. Set it to the value of the 60% deviation alignment tone used to align the base station transmitter. Reference the setting to the CCGW analog output point, factoring in any wireline loss. The average audio level at the station is targeted to be 4 dB below the 60% deviation alignment tone level.

Average Outbound G.728 Audio Level

This parameter tells the CCGW the average audio level coming from the consoles. The system is designed to operate correctly with this parameter set to its default value. Coordinate this setting with the outbound vocoded audio level settings of any consoles using the channel. Consider the subscriber audio level settings of any digital talkgroups, for example, P25 IMBE talkgroups, which the consoles are monitoring or which may be patched over to the analog channel.

CAUTION: Because of the complex interactions of audio level settings in the system, the CCGW G.728 audio level parameters must be left at their default settings. Do not change this value except under the guidance and direction of a service technician.

After decoding an outbound G.728 audio signal received from a console, the CCGW applies gain which adjusts the signal level according to the difference between the channel outbound alignment tone level setting and the channel average outbound G.728 audio level setting.

As an example, is the channel configured average outbound G.728 audio level is -26 dBm0 and its configured outbound alignment tone level is -10 dBm, the CCGW calculates that the average outbound path analog audio level should be -14 dBm (that is, 4 dB below the alignment tone level). So, the CCGW applies 12 dB of gain to the outbound audio signal after it performs G.728 decoding.

Continuing the example, if the audio signal from the console has an active speech level of -26 dBm0, the analog audio output from the CCGW has an average audio level of -14 dBm. Alternatively, if the audio signal from the console has an active speech level of -30 dBm0, the corresponding analog audio output has an active speech level of -18 dBm.

As the average outbound G.728 audio level setting of the CCGW channel is adjusted, the CCGW channel internal gain/attenuation is also adjusted to maintain the configured audio output level on the analog wireline side. Therefore, increasing the configured nominal G.728 audio level does not increase the level at which analog audio is sent out. Instead, if the nominal G.728 level is increased, the CCGW channel internal gain is decreased accordingly.

8.2.2
CCGW Inbound Path

The following are the Offset values for the Conventional Channel Gateway (CCGW) devices:

- Offset for CCGW: (0–15)
- Offset for CCGW HD: (-25–15)

This adjustment raises the Voice Operated eXchange (VOX) Detect point relative to the Automatic Gain Control (AGC) Knee point. The default Offset value is 0 dB, which places the VOX Detect point at its default level of 15 dB below the AGC Knee point. When the Offset is set to a positive non-zero

value, it brings the VOX Detect closer to the AGC Knee by the amount of the Offset setting. When the Offset is set to its maximum value of 15 dB, it places the VOX Detect point at the same level as the AGC Knee.

Changes to this field can affect the audio level required to detect or undetect VOX. Leave this value at the default unless Motorola Solutions requests a change. This adjustment is best used when excessive noise on a lossy line is causing false VOX detects. This situation would be most likely to arise when the AGC Knee has been lowered to accommodate lossy lines and/or lower-than-nominal audio levels.

The CCGW inbound path has an AGC whose parameters control the operation.

Average Inbound G.728 Audio Level

This parameter tells the CCGW the target audio level going to the consoles. This level is the target output level of the CCGW inbound AGC. This level setting must match the average outbound G.728 audio level or a difference between subscriber audio level and console audio level in the system occurs. Do not change this value except under the guidance and direction of a Motorola Solutions service technician.

Inbound AGC Knee Setting

The knee setting of the CCGW channel inbound AGC controls the channel receive sensitivity. An incoming signal whose level is at or above the knee setting is given an output level equal to the AGC target output level (the Average Inbound G.728 Audio Level setting.) In configurations where increased receive sensitivity is required due to larger-than-usual receive wireline line losses, the Inbound AGC Knee Setting can be lowered. Lowering the setting increases the gain of the AGC to compensate for the line loss.

8.3 Audio Levels for Analog-Only Base Radios

Table 21: Recommended Base Radio Audio Level Settings for Analog-Only Conventional Channels

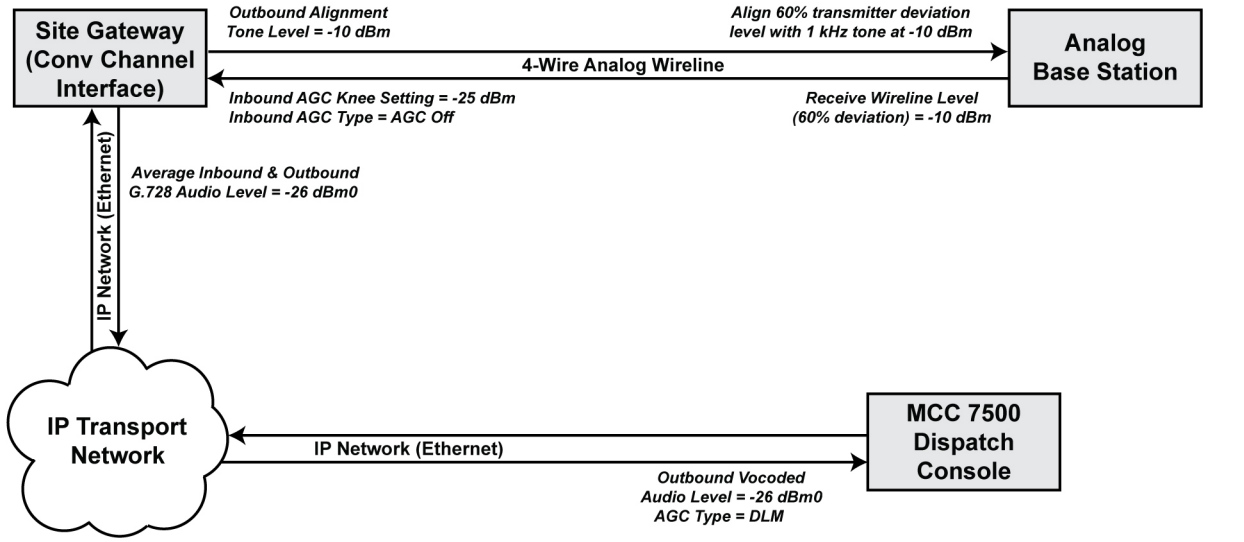
As examples of how to configure analog base radios when they interface to the Conventional Channel Gateway (CCGW), this table provides audio level parameter settings for GTR 8000 Base Radio, QUANTAR®, MTR 3000, and MTR 2000.

CSS Parameter	Value	
	Unity-Gain 4-Wire Analog Media	Lossy 4-Wire Analog Media
Rx Wireline Level – (on RX Wireline Alignment tab of Alignment Screen window)	-10 dBm	-5 dBm
Status Tone – Status Tone (Common tab of Infrastructure Interface window)	Disabled	Disabled
Tx Wireline Level – (on Tx Wireline Alignment tab of Alignment Screen window)	-10 dBm	-21 dBm

The CCGW supports a command-line command to generate a station alignment tone. The syntax for this command is explained in the CCGW product manual. This command may be used to provide the signal input for aligning the base station transmitter deviation.

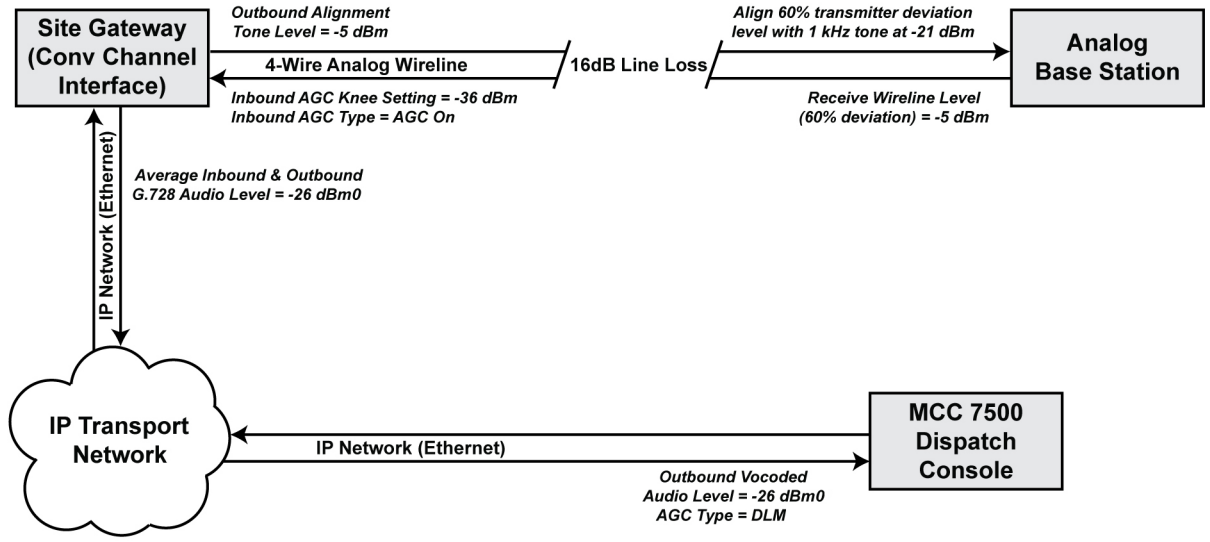
These figures illustrate audio level settings for analog channel with Unity-Gain and Lossy Wireline Media.

Figure 77: Audio Level Settings for Analog Channel with Unity-Gain Wireline Media



MCC7500_Audio_Level_Settings_Analog_Channel_Unity_Gain_Wireline_Media_A

Figure 78: Audio Level Settings for Analog Channel with Lossy Wireline Media



MCC_7500_Audio_Level_Settings_Analog_Channel_Lossy_Wireline_Media_B

8.4 Audio Levels for V.24 Base Radios

Table 22: Recommended Base Radio Audio Level Settings for V.24 Digital Channels

CSS Parameter	Value[2]	
	Unity Gain Media	Lossy Media
Infrastructure Interface (on Common tab of Infrastructure Interface window)	V.24-Only	V.24-Only

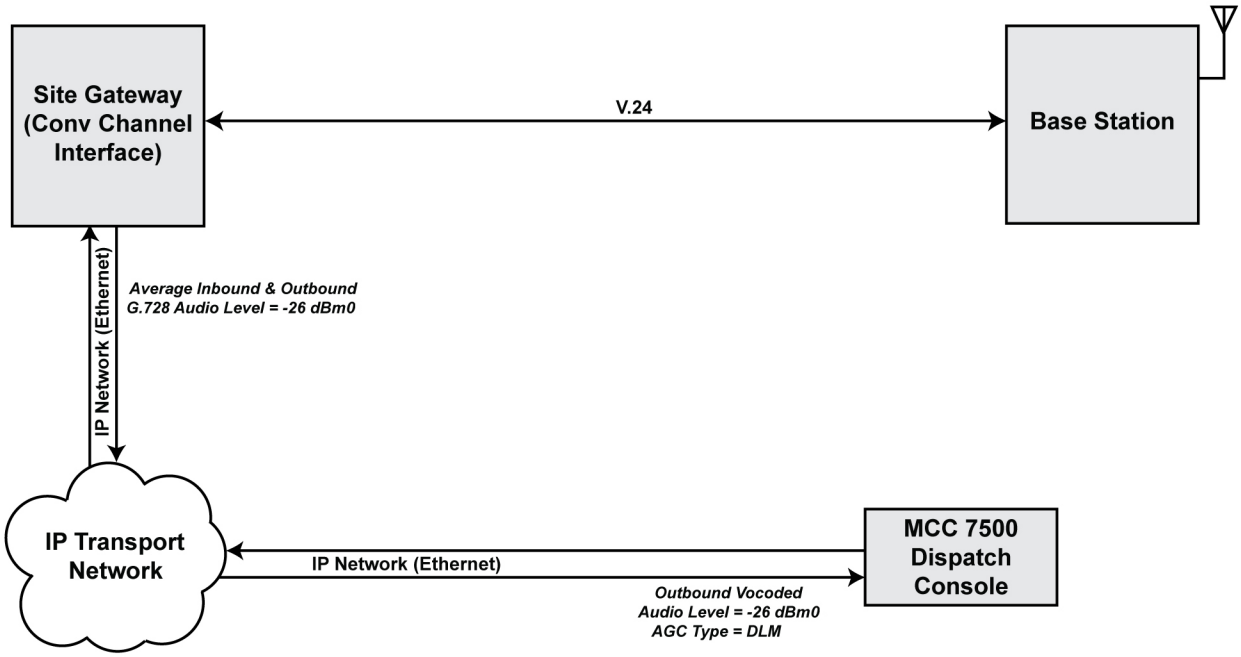
Table continued…

CSS Parameter	Value[2]	
	Unity Gain Media	Lossy Media
Analog Idle Link Check (on ASTRO Configuration tab of Infrastructure Interface window)	DISABLED	DISABLED
Status Tone/ALMT Level Below Peak Audio (on RX Wireline Alignment tab of Alignment Screen window)	N/A	N/A
Rx Wireline Level (on RX Wireline Alignment tab of Alignment Screen window)	N/A	N/A
Tx Wireline Level (on Tx Wireline Alignment tab of Alignment Screen window)	N/A	N/A
Digital Idle Link Check (on ASTRO Configuration tab of Infrastructure Interface window)	ENABLED	ENABLED
V.24 Transmit Clock (on ASTRO Configuration tab of Infrastructure Interface window)	Depends on your system.[1]	Depends on your system.[1]

[1] – For connections which use microwave links, set to **ENABLED** for QUANTAR® and **EXTERNAL** for GTR 8000 Base Radio. Ensure that the external device generates a 9600 Hz clock for the station.

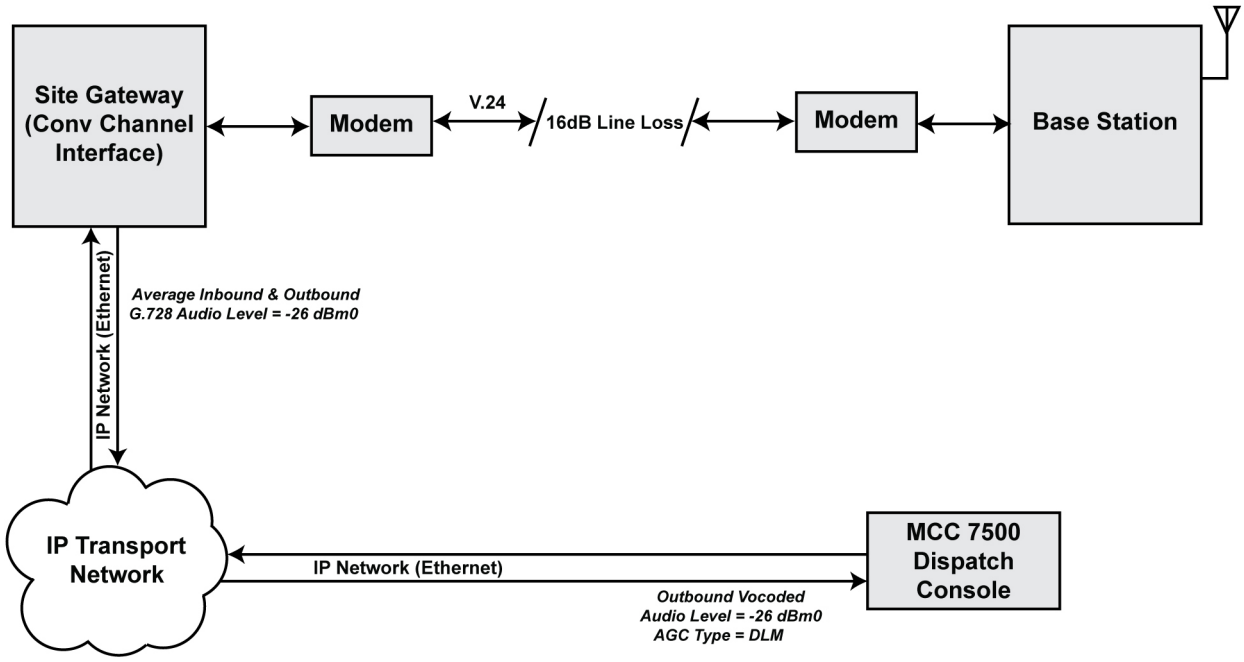
These figures illustrate audio level settings for V.24 with Unity-Gain and Lossy Wireline Media.

Figure 79: Audio Level Settings for V.24 with Unity-Gain Wireline Media



NOTICE: For V.24 only links over lossy media, a difference occurs in Tx Wireline Alignment compared to the lossy media topologies. In that case, the Tx Wireline Alignment value should be -5 dBm. See Audio Levels for the Analog Conventional Channel Gateway on page 254.

Figure 80: Audio Level Settings for V.24 with Lossy Wireline Media



8.5

Audio Levels for Mixed Mode Base Radios

Table 23: Recommended Base Radio Audio Level Settings for Mixed Mode Channels

CSS Parameter	Value[2]	
	Unity Gain Media	Lossy Media
Infrastructure Interface (on Common tab of Infrastructure Interface window)	V.24 HYBRID	V.24 HYBRID
Analog Idle Link Check (on ASTRO Configuration tab of Infrastructure Interface window)	ENABLED	ENABLED
Status Tone/ALMT Level Below Peak Audio (on RX Wireline Alignment tab of Alignment Screen window)	-4.4 dB (-10 dBm)[3]	-4.4 dB (-5 dBm)[3]
Rx Wireline Level (on RX Wireline Alignment tab of Alignment Screen window)	-10 dBm	-5 dBm
Tx Wireline Level (on Tx Wireline Alignment tab of Alignment Screen window)	-10 dBm	***<XX>*** dBm level [4]
Digital Idle Link Check (on ASTRO Configuration tab of Infrastructure Interface window)	ENABLED	ENABLED
V.24 Transmit Clock (on ASTRO Configuration tab of Infrastructure Interface window)	Depends on your system.[1]	Depends on your system.[1]

[1] – For connections which use microwave links, set to **ENABLED** for QUANTAR® and **EXTERNAL** for GTR 8000 Base Radio. Ensure that the external device generates a 9600 Hz clock for the station.

[2] – All Values ± 0.5 dB.

[3] – Entering this value makes Status Tone equal Rx Wireline Level.

[4] – The **<*XX*>** level is determined by generating the 1 kHz tone from the console. measuring the level at the input to the station, and entering that level in the wireline alignment screen

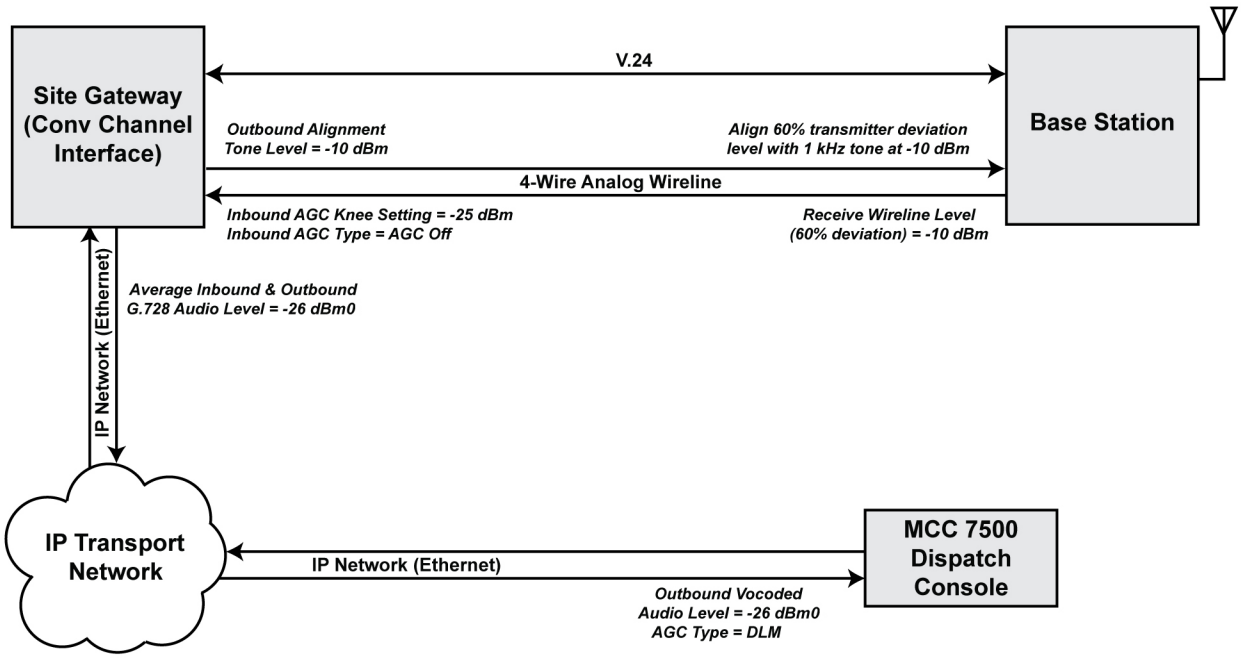
When MLC 8000s are implemented, the Input Level Differential setting on the MLC 8000 must be based on the difference between GTR 8000 Base Radio status tone level, or Analog Link Monitor Tone (ALMT) and peak analog voice input signal level. The difference is 4.4 plus the value in the Status Tone/ALMT Level Below Peak Audio field on the RX Wireline Alignment tab of the Alignment Screen window in Configuration/Service Software (CSS).

Setting the Status Tone differential to -4.4 dB using the CSS makes Status Tone follow the level set for the Rx Wireline level. Status Tone cannot be set directly; the level can only be specified as a differential to Rx Wireline level for maximum deviation received signal. The Rx wireline level is 4.4 dB below the level for maximum deviation received signal level.

For diagrams illustrating MLC 8000 audio level settings, see *MLC 8000 Setup Guide*.

This figure adds a V.24 connection to the topology from Figure 77: Audio Level Settings for Analog Channel with Unity-Gain Wireline Media on page 257, to show the hybrid version of the diagram.

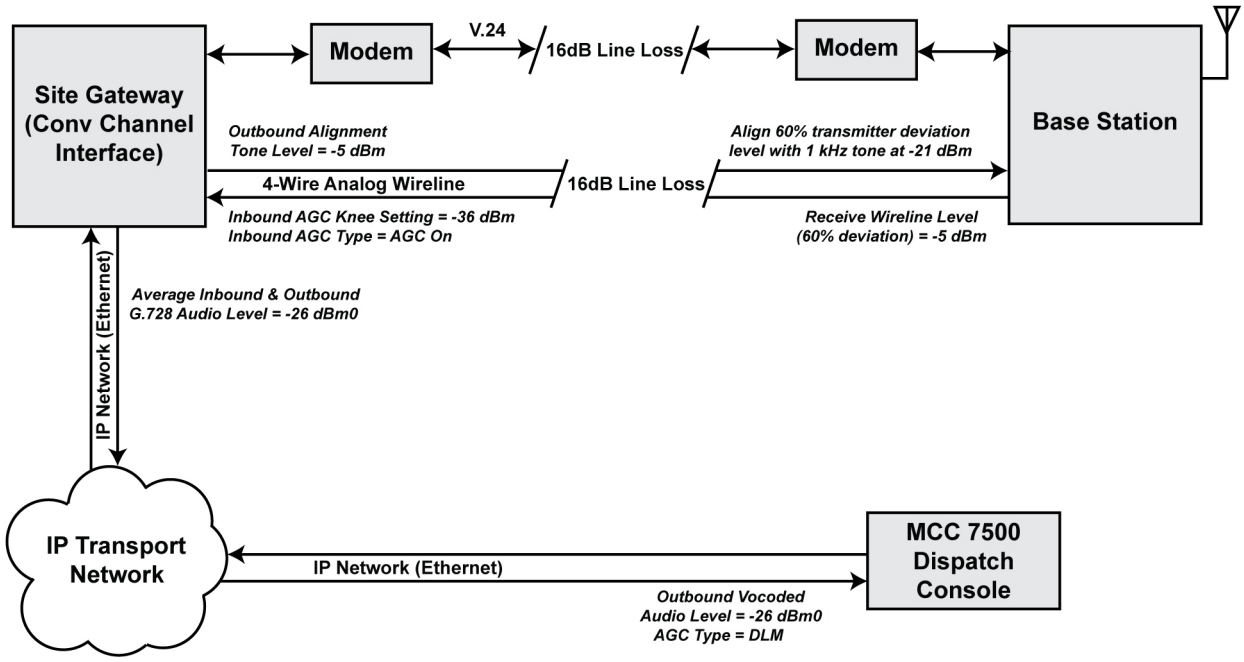
Figure 81: Audio Level Settings for Hybrid Link with Unity-Gain Media



MCC7500_Audio_Level_Settings_Hybrid_Unity_Gain_Wireline_Media_A

This figure adds a V.24 connection to the topology from Figure 78: Audio Level Settings for Analog Channel with Lossy Wireline Media on page 257, to show the hybrid version of the diagram.

Figure 82: Audio Level Settings for Hybrid Link Over Lossy Media



MCC_7500_Audio_Level_Settings_Hybrid_Lossy_Media_A

The analog links in Figure 81: Audio Level Settings for Hybrid Link with Unity-Gain Media on page 260 and Figure 82: Audio Level Settings for Hybrid Link Over Lossy Media on page 261 hybrid topologies require the same types of audio level settings as in the corresponding analog-only topologies.

8.6 IMBE Error Threshold Settings for Conventional Channels

This section describes Improved Multi Band Excitation (IMBE) Error Threshold settings for conventional channels.

8.6.1 Conventional Channel Gateway Inbound Digital Conventional Emergency Call Error Detection Threshold

The Conventional Channel Gateway (CCGW) supports an **IMBEETErr** parameter that sets the threshold value for the Improved Multi Band Excitation (IMBE) error threshold, IMBE ET, error count. IMBE is a vocoder that converts speech into a digital bit stream. The IMBE ET error count is used to determine whether call control information is reliable (based on whether the IMBE audio packets contain more errors than the specified threshold) and to prevent false emergency call indications. If the error rate indicates that the call control information is unreliable, the emergency indication is not passed to the console until the call error rate indicates that the call control information is reliable.

The **IMBEETErr** parameter configures a total IMBE error count threshold for each V.24 digital, IP digital, or mixed mode channel configured on the CCGW (MNR S2500 router or GGM 8000 gateway). This threshold defines the maximum number of IMBE errors that can be present in an inbound Push-to-Talk (PTT) for an emergency state received in that PTT to be considered reliable and the call to be interpreted as an emergency call.

NOTICE: IP conventional and mixed mode channels are supported only on the GGM 8000 gateway. The MNR S2500 router does not support IP conventional or mixed mode channels.

You can set the IMBE error count threshold to any value from 0 (meaning that an inbound PTT received on that channel can be interpreted as an emergency call only if no IMBE errors are present) through 90 (meaning that an inbound PTT received on that channel can be interpreted as an emergency only if 90 or more IMBE errors are present, which disables the threshold from filtering any emergency calls and may result in false emergency calls). Errors are counted across frames IMBE 1 to IMBE 8.

The **IMBEETErr** parameter is configured with a default value of **50**, which should be appropriate for most systems. In general, an inbound PTT with an IMBE error count greater than 50 contains audio that is unintelligible or not decodable. If necessary; however, the **IMBEETErr** value is configurable through the MNR S2500 router or GGM 8000 gateway command-line interface. See Configuring the Conventional Channel Gateway Inbound Emergency Call Detection Threshold on page 262.

NOTICE: This setting does not affect Emergency Signal functionality.

8.6.2
Configuring the Conventional Channel Gateway Inbound Emergency Call Detection Threshold

Perform this procedure to configure the conventional channel gateway inbound emergency call detection threshold on an MNR S2500 router or GGM 8000 gateway.

Prerequisites:

CAUTION: Consult a Motorola Solutions field service engineer before performing the following procedure. The procedure was developed for system fine-tuning and troubleshooting purposes only and cannot be performed as a part of normal system operation.

CAUTION: Adding a command to a device `boot.cfg` file may have unforeseen and undesirable consequences. Consult with a Motorola Solutions field service engineer before issuing the command sequence.

NOTICE: IP conventional and mixed mode channels are supported only on the GGM 8000 gateway. The MNR S2500 router does not support IP conventional or mixed mode channels.

Procedure:

1. Set the Improved Multi Band Excitation (IMBE) error threshold for the desired V.24 digital, IP conventional, or mixed mode channel.
2. From the MNR S2500 or GGM 8000 command-line interface, enter the following command: `SETDefault !c<channel_ID>-CCGW IMBEETErr = <value>`

   NOTICE: Where **<*channel_ID*>** is the channel identifier of the channel for which you want to configure the IMBE error threshold.And where **<*value*>** is the value to which you want to set the threshold (0-90).
3. If you do not know the channel identifier for a channel, issue the `SHow -CCGW ChID` command to display a list of channel identifiers for all conventional channels configured on the device.

   For example, to set the IMBE error threshold on digital conventional channel 2 to a value of 65, enter: `SETDefault !c2 -CCGW IMBEETErr = 65`
4. Enter the following command: `SHow -CCGW IMBEETErr` and verify that the **IMBEETErr** parameter is set to the appropriate value for the channel for which you configured a value in step 1.
5. Issue the following commands to write the IMBEETErr setting to the device `boot.cfg` file and make it persistent:

```
SETDefault -SYS CAPTure = (Enable, BootCfg)SETDefault !c<channel_ID> -
CCGW IMBEETErr = <value>
```

NOTICE: Where ***<channel_ID>*** is the channel identifier of the channel for which you want to configure the IMBE error threshold: And where ***<value>*** is the value to which you want to set the threshold (0-90).

```
SETDefault -SYS CAPTure = (Enable, CaptureCfg)
```

For example:

```
SETDefault -SYS CAPTure = (Enable, BootCfg)SETDefault !c2 -CCGW
IMBEETErr = 65SETDefault -SYS CAPTure = (Enable, CaptureCfg).
```

6 Repeat step 1 through step 5 for other channels as necessary.

7 Pull the configuration file from the MNR S2500 or GGM 8000 into the Unified Network Configurator (UNC) so it is available to be pushed to replacement devices in the future.

a Log in to the VoyenceControl application.

NOTICE: The names EMC Ionix Network Configuration Manager and VoyenceControl are used interchangeably for this product.

b In the navigation pane, expand **Networks, ASTRO 25 Radio Network**.

c Double-click **Devices**.

d Navigate to the device and right-click the view from which you want to pull the configuration.

e Select **Pull** → **Pull Config**.

8.7 Frequency Bandwidth and Modulations Settings

These tables provide the bandwidth and modulation settings to achieve optimal voice and/or data performance between a base radio and a subscriber radio.

Table 24: QUANTAR 25 kHz Channel

Device – Parameter	Option 1	Option 2
QUANTAR® – Receive Channel BW	Wide 25-30	NPSPAC 20
QUANTAR® – ASTRO Tx Filter	Wide Pulse	Wide Pulse
QUANTAR® – Transmit Rated Deviation (for Analog Only)	5.0 kHz	4.0 kHz
SU (Receive) – Digital Modulator Type	Wide	Wide
SU – Transmit Deviation (for Analog Only)	5 kHz	4 kHz
SU – Channel Bandwidth	25 kHz	20 kHz

See *Appendix A* in the *Conventional QUANTAR Replacement Guide* manual for the comparison of Radio Service Software (RSS) and Configuration/Service Software (CSS) parameters.

Table 25: Channel Operation

Device – Parameter	Option 1	Option 2	Option 3	Option 4	Option 5
Base Radio – Receive Channel BW	Wide 25-30	NPSPAC 20	Narrow 12.5-15	Narrow 12.5	Narrow 12.5

Table continued…

Device – Parameter	Option 1	Option 2	Option 3	Option 4	Option 5
QUANTAR® – ASTRO Tx Filter	Narrow Pulse	Narrow Pulse	Narrow Pulse	Narrow Pulse	N/A
GTR 8000 – Tx Modulation Type	C4FM	C4FM	C4FM	C4FM	LSM
Base Radio – Transmit Rated Deviation (for Analog Only)	5.0 kHz	4.0 kHz	2.5 kHz	2.5 kHz	2.5 kHz
SU (Receive) – Digital Modulator Type	C4FM	C4FM	C4FM	C4FM	CQPSK
SU – Transmit Deviation (for Analog Only)	5 kHz	4 kHz	2.5 kHz	2.5 kHz	2.5 kHz
SU – Channel Bandwidth	25 kHz	20 kHz	12.5 kHz	12.5 kHz	12.5 kHz

8.8 Performance Management Applications for L or M Cores

Various applications and methods can be used to view statistics relating to conventional operations. This section describes applications that provide system performance statistics that can be obtained and monitored depending on the performance management application.

For details on these performance management applications, see the *Performance Management* manual and the *Conventional Data Services* manual in the ASTRO® 25 system documentation.

8.8.1 Dynamic Reports

The Dynamic Reports application enables you to determine the same data as Historical Reports, however, Dynamic Reports runs in near-real time whereas the Historical Reports application reports on previous system activity.

NOTICE: Applies to L or M cores only.

8.8.2 Historical Reports

The Historical Reports application provides reports for conventional console calls. This application also enables you to determine conventional bandwidth usage on console site links, call counts, calls denied, and can report on the amount of time a console site was blocked (due to lack of bandwidth) from conventional call participation.

NOTICE: Applies to L or M cores only.

The following is a summarized list of the information available using Historical Reports:

Conventional Call Counts and Durations
Analog and digital non-emergency conventional calls involving a particular console

Conventional BW Utilization
The amount of configured conventional call count used on the console site link (analog and digital conventional calls)

Digital Conventional Call Count
The total number of all (secure and clear) non-emergency digital conventional calls involving a particular console site during the time span of the report

Denied Digital
Identifies a conventional call denied to a console (only) when link bandwidth is exceeded

Digital Conventional Call Duration
The total duration of all non-emergency digital conventional calls involving a particular console site

Digital Conventional Emergency Call Count
The total number of all emergency digital conventional calls involving a particular console site during the time span of the report

Denied Digital Conventional Emergency Call Count
The total number of rejected emergency digital conventional calls involving a particular console site during the time span of this report

Digital Conventional Emergency Call Duration
The total duration of all emergency digital conventional calls involving a particular console site

Secure Digital Conventional Call Count
The total number of all secure digital conventional calls involving a particular console site during the time span of the report

Clear Digital Conventional Call Count
The total number of all clear digital conventional calls involving a particular console site during the time span of the report

For details, see the *Performance Management* and the *Historical Reports* ASTRO® 25 system manuals:

8.8.3 InfoVista

InfoVista is a performance management application that supports gathering and reporting of data statistics, which you can customize according to your needs.

NOTICE: Applies to L or M cores only.

Some of the information available through InfoVista includes:

- Number of Common Air Interface (CAI) Response Messages (ACKs/NACKs/Selective ACKs) received from all Mobile Subscriber Units
- Number of CAI Response Message Timeouts in the Radio Network Gateway (RNG)
- Number of confirmed Protocol Data Units (PDUs) transmitted to all Mobile Subscriber Units
- Number of unconfirmed PDUs sent to all Mobile Subscriber Units
- Number of Broadcast Outbound PDUs forwarded by the RNG to the Conventional Channel Gateway
- Number of CAI PDUs received from all Mobile Subscriber Units
- Number of CAI PDUs retransmitted by all Mobile Subscriber Units
- Number of CAI Response Messages (ACKs/NACKs/Selective ACKs) transmitted to all Mobile Subscriber Units
- Number of confirmed PDUs received from all Mobile Subscriber Units
- Number of unconfirmed PDUs received from all Mobile Subscriber Units
- Number of Registration Requests received (from units and on behalf of units)
- Number of Internet Control Message Protocol (ICMP) messages from subscribers forwarded by the Packet Data Router (PDR)
- Number of ICMP messages forwarded to subscribers by the PDR

- Number of ICMP messages discarded
- Number of ICMP messages generated by the PDR

For details, see the *InfoVista User Guide* manual.

8.8.4
MCC 7500/7100 Dispatch Console and AIS

The Motorola Solutions logging system provides the ability to record audio transmissions and certain radio events which are archived for playback and use by authorized users/administrators. The equipment consists of MCC 7500/7100 Dispatch Console Archiving Interface Server (AIS), MCC 7500/7100 IP Logging Recorder, and a Replay Station. Each recorder can be configured to record up to 256 conventional channels. For the conventional voice calls, the MCC 7500/7100 Dispatch Console and MCC 7500/7100 AIS log Push-to-Talk (PTT) events.

Radio system audio transmissions available for recording and playback in the logging system include Analog Conventional, Digital Conventional, Digital Conventional Mixed Mode, and MDC1200.

NOTICE: Applies to L or M cores only.

For details, see the *Audio Logging* manual.

Chapter 9

Fault Management and Troubleshooting for Conventional Operations

This chapter contains fault management and troubleshooting information for conventional operations including:

- Tools for Fault Management and Troubleshooting for Conventional Channels
- Examples of Fault Management and Troubleshooting for Conventional Channels
- Echo Cancellation Verification
- Fault Management and Troubleshooting (Conventional Channels in L or M cores)

9.1 Tools for Fault Management and Troubleshooting for Conventional Channels

This section includes general information about tools used for fault management and troubleshooting for conventional channels.

9.1.1 Archiving Interface Server

The Motorola Solutions logging system provides the ability to record audio transmissions and specific radio events archived for playback and use by authorized users/administrators. The equipment consists of MCC 7500/7100 Dispatch Console Archiving Interface Server (AIS), MCC 7500/7100 Dispatch Console IP Logging Recorder, and a Replay Station. Use this logging system to fault manage and troubleshoot. For additional details, see the *Audio Logging* manual.

9.1.2 Configuration/Service Software

Configuration/Service Software (CSS) provides remote and local device-level diagnostic information for various components including the Voice Processor Module (VPM), Conventional Site Controller, Conventional Base Radios, and GCM 8000 Comparators.

For example, the **Status Panel** window, **Station Status** tab fields display information related to troubleshooting conventional:

- Rx Private Line/Digital Private Line (PL/DPL)
- Rx Network Access Code (NAC)

Also, this window provides a field to select **Analog Rx Qualifier** (CSQ option, and so on).

The **Status Panel** window, **Decoder Messages** tab fields display information related to troubleshooting conventional:

- Tone Remote Control (TRC) Decodes
- Repeater Access Decodes

- Mobile Data Communications (MDC) ID
- Dual-Tone Multi-Frequency (DTMF)

The **Status Panel** window, **Station Command** tab fields display information related to troubleshooting conventional:

- Station control commands can be turned on and turned off from this window, including:
  - Tx Qualifiers
  - Transmit 3 Test Tones
  - 1 kHz Tone

For details, see *CSS Online Help*.

9.1.3
Dispatch Console

The MCC 7500/7100 Dispatch Console with Voice Processor Module (VPM) is used to monitor and control conventional channel resources in the system and can support fault management and troubleshooting activities to identify and control the status of base radios and comparator equipment. For detailed MCC 7500/7100 Dispatch Console troubleshooting information, see the *MCC 7500 Dispatch Console with Voice Processor Module* manual.

9.1.3.1
MCC 7500/7100 Dispatch Console with Conventional Voting Display

When working properly, the MCC 7500/7100 Dispatch Console with Conventional Voting Display feature allows an MCC 7500/7100 Dispatch Console operator to control the conventional GCM 8000 Comparator subsite voting control functionality, and display voting status updates for conventional GCM 8000 Comparator subsites. This action is performed via Aux I/Os which have been configured on the console interface. If any operational issues occur with the feature, perform the following to diagnose the problem:

- Verify the operational state of links and hardware elements via the fault manager.
- Verify that FSP is working properly on the conventional GCM 8000 Comparator using the local or remote Configuration/Service Software (CSS) application. A user should be able to toggle the voting control functions (vote disabled/enabled and force vote disabled/enabled) for a subsite. Additionally, the user should see subsite display updates and displayed on CSS anytime a voting state change occurs for a subsite.
- Verify the configured Aux I/Os on the MCC 7500/7100 Dispatch Console align with the MCC 7500 Aux I/O Server configuration.
- Verify networking loading and delays are acceptable. If both are high, performance degradation occurs.

9.1.4
Log Files

The Log Files provide various types of diagnostic information for various system components including the Packet Data Gateway (PDG), consoles, IP Link Converter, and other equipment. See the manuals for the above devices for information relating to log files associated with each component.

9.1.5
UEM Network Fault Management

The Unified Event Manager (UEM) is an optional Network Fault Management (NFM) application usable in the L, M, and K core, and standalone conventional configurations. The UEM can be licensed to

support alarms and events associated Supervisory Control And Data Acquisition (SCADA) devices over SNMP protocol.

This application merges fault management functionality of the MOSCAD NFM and UEM resulting in a single NFM application incorporating all fault management information in one client application.

UEM is designed for critical fault management. UEM primary functions are:

- Processing fault notifications
- Detecting and reporting loss of communication with managed devices
- Ensuring that the status reported is up-to-date
- Discovering a device within the system
- Troubleshooting faults
- Sending commands to network elements

UEM presents the faults and, in general, the status of the network elements in the following views:

- Alarms
- Maps
- Network Events
- Network Database

UEM user accounts are managed within the application. You can set up system partitions and assign management responsibility to one or more administrators. UEM also controls critical management operations invoked by operators within the application.

UEM provides the capability to manage devices securely using SNMPv3. UEM can detect and report loss of fault notifications. It can quickly update without constantly polling the devices.

UEM North Bound Interface (NBI) supports notifications in the form of SNMPv3 traps to registered managers and access to management data. The NBI uses SNMPv3 and the User-Based Security Model (USM) to provide a secure communication between UEM and Network Management System (NMS).

See the *Unified Event Manager* manual.

NOTICE: Either UEM or MOSCAD NFM can be used, but not both.

9.1.6
MOSCAD Network Fault Management

Motorola ®Supervisory Control and Data Acquisition (MOSCAD) Network Fault Management (NFM) is optional for the ASTRO® 25 K1, K2, L, and M core configurations. It is an integrated solution that provides the service support personnel with the required tools to monitor and control devices in the ASTRO® 25 K1, K2, L, and M core conventional system. MOSCAD NFM provides a common method for controlling auxiliary system devices and for collecting and forwarding data concerning the state of communication devices such as base stations, channel banks, microwave radios, and time reference. For the conventional system, in addition to base radio, GCM 8000 Comparator, or GCP 8000 status, MOSCAD NFM provides a high-level status for the following devices:

- Core Gateways
- Core Ethernet switches
- Firewall (if data or Motorola Solutions Support Center (SSC) access is purchased)
- Terminal Server (if SSC access is purchased)
- Remote Console Ethernet switches

- Conventional Site Gateway
- Conventional Channel Gateways
- RF Site/comparator Ethernet switches
- Console Operators
- Console Archiving Interface Server (AIS)
- Console Voice Processor Modules (VPMs)
- NICE IP Audio Loggers
- NICE IP Audio Replay Station
- Packet Data Gateway (PDG) Packet Data Router (PDR)
- PDG Radio Network Gateway (RNG)
- Gateway GPRS Support Node (GGSN)
- Network Time Protocol (NTP) time source
- IP Link Converter

Apart from monitoring of Simple Network Management Protocol (SNMP) and IP-based devices, MOSCAD NFM SDM3000 devices allow for device monitoring using Field Service Protocol (FSP), monitoring of supported serial devices, monitoring of supported microware radios, and monitoring of environmental elements using digital input, digital output, and analog input points. Additionally, the MOSCAD NFM Graphical Master Computer (GMC) provides an intuitive and visual display of system level, zone level, site level, and each device with on-screen alarms and controls. In addition to full Alarm Reporting based on Microsoft SQL Server, optional Alarm Paging allows immediate communication of fault conditions in the system to on-call support personnel and managers.

NOTICE: Configuration/Service Software (CSS) is installed on the MOSCAD NFM Graphical Workstation (GWS) to allow an operator to additionally be able to service/configure supported remote site devices from the same computer (position).

NOTICE: The NICE or Verint audio logging solution may be established in your system. See the *MCC 7500 Dispatch Console with Voice Processor Module* manual.

NOTICE: Either UEM or MOSCAD NFM can be used, but not both.

9.1.7
Terminal Server Troubleshooting

A terminal server failure results in loss of out-of-band management capability. While remote and dial-in connectivity to the system becomes unavailable, system functionality is not affected. For more details regarding the terminal server, see the *Terminal Servers LX Series* manual.

Table 26: Terminal Server General Troubleshooting

This table provides general troubleshooting information for the terminal server.

Problem	Corrective Action
General connectivity problems	**1** In the network fault management application, check the condition of the terminal server and all affected devices and links. **2** Verify that all devices are operating and that all links are physically connected and operational.

Table continued...

Problem	Corrective Action
	3 Check for any sharp bends or kinks in cabling. Test any suspected cabling for noise, continuity, attenuation, and crosstalk. **4** If required, press the **Reset** button on the terminal server or cycle power to the terminal server. **5** If the terminal server still has problems, reinstall the terminal server software or replace the terminal server.
Menu and user access problems	**1** Enter the maintenance access environment and check the menu configuration and password definitions for the terminal server. **2** Update the configuration or restore the configuration from a previous backup copy.
Modem access problems	**1** Verify that the remote client is using the correct phone number and modem configuration. **2** Verify that the phone line is in service and operating normally.
Terminal server not starting up or loading	After initialization, the Run LED should flash slowly and the LAN LED should flash as packets are being received from the network. For information on POST error codes, see "POST Test Error Codes".

9.2

Examples of Fault Management and Troubleshooting for Conventional Channels

This section provides examples of fault management and troubleshooting for conventional channels.

Common Misconfiguration of Conventional Unit Missing on Console

A channel cannot affiliate with a console that does not have at least one associated conventional unit. Therefore, the console application used in a conventional system must be associated with at least one conventional unit.

Ethernet Site Link

For information regarding Ethernet Links: characteristics, latency, jitter, packet loss, statistics in Configuration/Service Software (CSS), and so on, see the *Flexible Site and InterZone Links* manual.

9.3

Verifying Echo Cancellation

Perform these steps to verify you can minimize the return echo effect from a console operator perspective (on inbound audio transmission).

When the Echo Cancellation on Dispatch Console feature is working properly, the feature prevents a return echo on a conventional simplex voting channel from being forwarded to a console and thus establishes a clearer communication path. On the other hand, if the return echo on a conventional simplex voting channel is forwarded and a dispatcher hears it, the following steps can be performed. See Echo Cancellation Configuration on page 241 for specific guidance on configuring Echo Cancellation on ASTRO-TAC™ 3000 comparators and consoles.

NOTICE: This procedure can be performed on the ASTRO-TAC™ 3000 comparator only, and only for simplex voting channels. GTR 8000 Base Radio provides echo cancellation without performing this procedure (see Echo Cancellation Configuration on page 241).

Prerequisites: Before performing this procedure, see Echo Cancellation on page 113 and Echo Cancellation Configuration on page 241.

Procedure:

1. Verify that the Echo Cancellation on Dispatch Console parameter is **Enabled** for the selected conventional simplex voting channel.
2. In Provisioning Manager or Configuration Manager, verify that the **Console Echo Cancel Delay** parameter is set to the expected return echo delay for the selected conventional simplex voting channel.
3. Verify existing ASTRO-TAC 3000™ parameters are configured correctly when the **Console Echo Cancel** parameter is **Enabled**.
4. Adjust the **Console Echo Cancel Delay** parameter value accordingly by transmitting an outbound audio message from the dispatch console.
5. Verify that no transmitted audio coming back is heard on the dispatcher headset or speaker.
6. If a return audio is heard on a dispatcher headset or speaker, increment the **Console Echo Cancel Delay** parameter by the smallest time increment and repeat steps 4 and 5 until no audio is heard. When no return audio is heard, the delay setting in effect at the time is the value to be used for the conventional simplex voting channel.
7. If no return audio is heard on a dispatcher headset or speaker, decrement the **Echo Cancel Delay** parameter by the smallest time decrement and repeat steps 4 and 5 until a return audio is heard on the dispatcher headset or speaker. After this point is reached, increment the **Console Echo Cancel Delay** parameter by the smallest time increment. Use this delay setting for the conventional simplex voting channel.
8. Verify that inbound audio can be heard after the dispatcher dekeys and the **Echo Cancel Delay** period has ended for the conventional simplex voting channel.

9.4 Fault Management and Troubleshooting (Conventional Channels in L or M cores)

This section provides fault management and troubleshooting information for conventional channels in L or M cores.

9.4.1 Fault Management Using Unified Event Manager

Alarms and traps generated by various components in the system are sent to the Unified Event Manager (UEM) server application on a system-level server supporting each site in the system.

Devices at the sites must be discovered in the UEM application using subnet discovery before traps are visible in UEM. For additional information on subnet discovery as well as a list of alarms and traps and their definitions, see the *UEM Online Help*. For more information about the UEM application, see the *Unified Event Manager* manual.

9.4.2
Conventional Channel Gateway State Transition Diagnostics

Following are the diagnostic commands that can be sent from the Provisioning Manager or Configuration Manager to control the Conventional Channel Gateway (CCGW):

- Enable the CCGW
- Disable the CCGW
- Enable each channel on the CCGW
- Disable each channel on the CCGW

These diagnostic commands do not apply to a transport device (site gateway or site router) not configured as a CCGW, and the diagnostic commands do not affect the functionality of the transport device when the CCGW coexists on the same device.

Table 27: Conventional Channel Gateway State Transition Events

This table provides a list of the CCGW events that the CCGW reports.

Event	Meaning
ccgwStateChangeTrap	Sent when the CCGW changes states.
ccgwTransientTrap	Sent when a CCGW transient alarm occurs.
ccgwZCCPStateChangeTrap	Sent when a control path between the CCGW and the zone controller changes states.
ccgwZCCPRedStateChangeTrap	Sent when the redundant control path between the CCGW and the zone controller changes states.
ccgwChannelStateChangeTrap	Sent when the channel changes states.

9.4.3
Hybrid Link Partial Availability State

Hybrid links are used for Mixed Mode channels. When in analog mode, Conventional Mixed Mode channels use the analog 4-Wire port on the Conventional Channel Gateway (CCGW) and QUANTAR® for audio transmission, and use the digital V.24 interface for all call control signaling. When in digital transmission mode, the Conventional Mixed Mode channels use the same V.24 resources and signaling as V.24 digital conventional channels.

To support Conventional Mixed Mode channels, a channel state is added to reflect the ability of the channels to support digital transmission while being unable to provide analog. This situation arises when the analog 4-Wire interface is inoperable, and the digital V.24 port is available. This state is called “Partially Available” and is determined through the use of a continuity tone provided by the CCGW and QUANTAR® on the transmit side of the 4-Wire interface. This tone is called the Analog Link Monitor Tone (ALMT). For details, see Analog Link Monitor Tone on page 273.

9.4.3.1
Analog Link Monitor Tone

The Analog Link Monitor Tone (ALMT) is automatically configured on each individual Conventional Mixed Mode channels with the V.24 interface. The ALMT is sent when the transmit side of the 4-wire link is idle. The ALMT is not supported on Conventional Mixed Mode channels with an Ethernet interface.

When the Conventional Channel Gateway (CCGW) detects that no ALMT signal is on the 4-wire interface and that it has not received a “start” signal on the associated V.24 interface it reports that the 4-wire interface is down (for example, “ALMT un-detect”). An alarm is sent to the Unified Event Manager (UEM) for the channel associated with the 4-wire. The status of the Mixed Mode channel associated with that 4-Wire interface is reported as “Partially Available” (assuming that the V.24 interface for that channel remains available). The “Partially Available” status is reported to and displayed at the consoles so that the console operators know when selecting the Conventional Mixed Mode channel that the channel is incapable of transmitting audio in analog mode, but that the channel can function properly in digital mode (that the V.24 is available).

Table 28: Conventional Mixed Mode Channel State

This table gives the channel state for the Conventional Mixed Mode channel when analog and digital failures are detected.

4-Wire Port	V.24 Port	Mixed Mode Channel Status/ Interface
Available	Available	In Service
Unavailable	Unavailable	Out Of Service
Unavailable	Available	Partially Available
Available	Unavailable	Out Of Service

Conventional Mixed Mode channels can also be placed in the “Partially Available” state when the CCGW detects a Digital Signal Processor (DSP) failure. The DSP in the CCGW is critical to the operation of analog operation. A failure of a DSP renders the associated analog channels Out Of Service. However, the digital components of the Conventional Mixed Mode channel may still be available and usable based on the states in the table.

NOTICE: Analog Conventional 4-Wire interfaces alone provide no link failure capability.

9.4.4
Affiliation Display

The Affiliation Display shows a conventional channel viewer which consoles are affiliated to a specific conventional channel, and shows a console site conventional viewer which conventional channels are affiliated to a specific console.

Interzone Affiliation Display allows consoles to affiliate to conventional channels in other zones. For interzone console affiliations to conventional channels in other zones, the console site conventional viewer in the zone where the console is located, displays the conventional channel information for all affiliated channels in other zones, in addition to affiliated channels in its current zone. The conventional channel viewer displays local console affiliations to a specific local channel, as well as local console affiliations to a specific remote channel. Affiliation display also includes the Zone ID information for a conventional channel.

The console site conventional viewer and conventional channel viewer for the home zone of a conventional channel does not display console affiliations from other zones.

The information used to generate the affiliation display is sent from the zone controller to the Air Traffic Router (ATR) in the Zone Controller (ZC)-Radio Application Programming Interface (RAPI) Conventional Mobility Update message.

For information on using Affiliation Display for troubleshooting, see the ASTRO® 25 system *Affiliation Display* manual.

9.4.5
Air Traffic Router

The Air Traffic Router (ATR) converts the conventional call data from the zone controller to Air Traffic Information Access (ATIA) messages and forwards them to Network Management clients such as ZoneWatch and Affiliation Display, and to the Zone Statistics Server (ZSS) for storage. For information on using ATR for troubleshooting, see the ASTRO® 25 system *ATIA Log Viewer* manual.

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Appendix A

Service Laptop and Software Setup

This appendix provides information on the Service Laptop that may be required for system configuration, maintenance, or troubleshooting. In addition, software is described, and its configuration and download are explained.

A.1 Service Laptop Overview

You may require a Service Laptop for system configuration, maintenance, or troubleshooting.

The following software applications must be installed on the service laptop:

- Configuration/Service Software (CSS) – Used to create and back up device configurations and troubleshoot RF site and Voice Processor Module (VPM)-based devices, including GTR 8000 Base Radios, GPW 8000 Receivers, GCM 8000 Comparators, GCP 8000 Site Controllers, GPB 8000 Reference Distribution Modules, SmartX Site Converters, and Telephone Media Gateways. It also supports specific existing devices as indicated in CSS online help.
- Software Download Manager (SWDL) – Used to download firmware to the base radios and site controller.
- Customer Programming Software (CPS) – Used to program subscriber radios.

Laptop hardware and OS requirements depend on the software you intend to use. See requirements for specific software. Depending on your system configuration, install the appropriate software on the Service Laptop. Follow the instructions on the installation DVDs for each software application.

- For systems with MOSCAD network fault management: Local configuration and troubleshooting of SDM3000 Network Translator (SNT) and Devices in the SDM3000 Builder application. See the *MOSCAD Network Fault Management Feature Guide* manual.
- For systems with the Unified Event Manager (UEM) network fault manager: the general functionality of UEM is managed using internal license configuration based on license key entries and embedded licensing management. See the *Unified Event Manager* manual.
- For systems with MLC 8000 hardware, see *MLC 8000 Configuration Tool User Guide* manual and online help.

A.1.1 Service Laptop Requirements for CPS

For Customer Programming Software (CPS) service laptop hardware and OS requirements, see CPS_readme.txt file on the CPS installation DVD or in the program installation directory.

A.1.2 Service Laptop Requirements for RSS and CSS

The Configuration/Service Software (CSS) is used for the GCM 8000 Comparator, GCP 8000 Site Controller, GTR 8000 Base Radio, GPW 8000 Receiver, and GPB 8000 Reference Distribution Module.

The Radio Service Software (RSS) is used for:

- Programming all versions of codeplugs for the QUANTAR® stations and ASTRO-TAC™ Comparators in 3.x and 4.x conventional and trunked systems.
- Software downloading (starting with version R14.00.00 RSS)

Supported operating systems:

- Windows Server 2012 R2 64-bit for RSS (Software Download and CSS is not supported)
- Windows 10 32-bit and 64-bit

Hardware requirements:

- 1 GHz or higher Pentium grade processor
- 1 GB RAM recommended for Windows Server 2012 R2 64-bit
- 1 GB RAM recommended for Windows 10 32-bit
- 2 GB RAM recommended for Windows 10 64-bit
- 300 MB minimum free space for CSS Typical Installation (including Help Text and Software Download Manager) or 100 MB minimum free space for a Compact Installation
- 300 MB minimum free space for RSS Typical Installation (including Help Text and Software Download Manager) or 100 MB minimum free space (for a Compact Installation)

Peripherals:

- Serial port or a USB with a USB-to-serial converter as a connection device (not currently Motorola Solutions-certified)
- Windows-supported mouse or trackball
- Windows-supported 10Base-T Ethernet port for product communication
- Windows-supported printer port for report printing
- DVD for software installation

A.1.3
Service Laptop Requirements for SDM3000 Builder

SDM3000 Builder software is a Windows-based application used to set up and configure the SDM3000 Network Translator and SDM3000 devices. Based on information you enter in the SDM3000 Builder screens, the software calculates inter-site and intra-site dependencies, such as defining the number, order, and connections of the CPU and I/Os in the SDM3000 Network Translator and SDM3000 devices, while considering your equipment and needs.

Supported operating systems:

- Windows Server 2012 R2
- Windows 10 32- and 64-bit

Hardware requirements:

- 512 MB of RAM
- 20 GB of minimum free space

A.1.4
Service Laptop Requirements for Other Software

Load the laptop with the following software:

- Remote Desktop Connection or a similar utility
- PuTTY (for Serial, Secure SHell (SSH) and Telnet connections) or a similar utility

- Microsoft Internet Explorer (latest) or Firefox (latest) for Configuration/Service Software (CSS) software
- VMware vSphere client (if any Virtual Management Servers are included in your system configuration)
- VMware PowerCLI
- .NET Framework 4.5
- Powershell 4.0

A.2 Configuration/Service Software

The Configuration/Service Software (CSS) is a Windows-based application installed on the computer used to perform configuration, status reporting, and servicing tasks for infrastructure devices in the system. The CSS application allows a service technician to:

- Configure operating parameters for Voice Processor Module (VPM)-based devices and RF site devices.
- Retrieve status and operational information from a device.
- Perform alignment procedures for the infrastructure devices that can use the CSS.
- Set the IP address for specified devices, which requires a local serial connection.
- Perform most device configuration and servicing tasks either through a serial connection to the device or over the LAN.

CSS can access each device over the local LAN, or individually through the Ethernet service port. The DB-9 serial port connection is used to set the IP addresses for devices. CSS also can be used to view status information, equalize batteries, and check internal logs of the devices.

Table 29: Installing and Upgrading the Software

Activity	Description	Reference
Install CSS	Install the CSS on the service laptop. CSS installation offers the option of installing the Software Download Manager (SWDL) application included on the same DVD. After installation, two icons appear on the desktop:  Launches the CSS application  Launches the SWDL application	*CSS Getting Started Guide*

A.2.1
Accessing Configuration/Service Software Online Help

To access the Configuration/Service Software (CSS) online help, select **CSS Help** from the **Help** menu in the menu bar. Before performing any procedure or process established in the online help, review the following CSS online help topics so you are familiar with and have access to the appropriate topics:

CSS Main Window
To become familiar with the CSS elements and navigation components.

Overview of CSS
To become familiar with using CSS locally or through the network management subsystem.

CSS Help Links
For specific online help supporting Comparator Configuration and Site Controller Configuration.

A.2.1.1
Reading/Writing Configuration Files From/To a Device

When and where to use: When Configuration/Service Software (CSS) is installed, the online help feature provides information and instructional procedures to read/write a configuration file from/to a device. For information and instructions on how to read/write a configuration file from/to a device in the CSS, follow this procedure.

Procedure:

1. Access the online help. From the menu, select **Help** → **CSS Help**.
2. From the tree view of the **CSS Online Help** topics, expand **CSS Procedures** (list of procedures).
3. Select the appropriate help topic. From the CSS procedure list, select one of the following options:
   - Connecting to a Device Through an Ethernet Connection
   - Connecting to a Device Through a Serial Connection
   - Reading the Configuration File from a Device
   - Writing the Configuration File to a Device
4. Follow the instructions provided to perform the task selected from the online help.

A.3
SDM3000 Builder

For details concerning SDM3000 Builder, see the *MOSCAD Network Fault Management* manual and *SDM3000 Builder User Guide*.

A.4
Software Download Manager

Software Download Manager (SWDL) transfers and installs new firmware in site components including base radios, site controllers, comparators, and Reference Distribution Modules (RDMs).

NOTICE: For detailed information on uploading firmware to the devices, see the *Software Download Manager* manual.

SWDL allows you to perform the following actions:

- Download software to site devices.

- Download software to one device (such as one base radio) that has been disconnected from the radio network.
- Update the software on newly added channels or subsites.
- Determine software and hardware versions on target devices.
- Purge (delete) a software version from selected target devices.
- Obtain device IP information.
- Query the site controller for the number of channels and/or subsites in the system.
- Audit a session using historical information recorded by SWDL.

To download software to an ASTRO® 25 system, perform one of the following actions:

- Software download to the entire site (centralized software download).
- Software download to one device that has been disconnected from the radio network (single device software download).

NOTICE: Conventional devices are supported only in the single device mode.

For more information see *Software Download Manager* manual.

A.5 Customer Programming Software

Subscriber radios are configured through Customer Programming Software (CPS). A computer running CPS is directly connected to the universal connection port on the subscriber radio and the codeplug is loaded. The configuration settings in CPS are categorized into different types, such as **Radio-Wide** settings, **Controls**, **Display and Menu** settings, and **Secure** settings. Parameters must be set according to the services the radio uses. CPS is used to configure each radio with a system ID, a unique individual ID for the radio, and as many talkgroup IDs as needed.

For subscriber radio programming details, see your subscriber radio user guide and *Customer Programming Software* online help.

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Appendix B

Conventional System K1 to K2 Expansion

This appendix contains information supporting expanding your existing K core system from K1 (non-redundant) to K2 (redundant).

B.1
Expanding K1 Core to K2 Core

Expanding a K1 non-redundant core to a K2 redundant core involves various procedures to ensure that all equipment is set up and operational. Follow this process to implement K1 to K2 expansion.

Process:

1. Perform K1 to K2 Expansion – Site Preparation on page 283.
2. Perform K1 to K2 Expansion – Installations and Configurations Required for K2 on page 283.
3. Perform K1 to K2 Expansion – Master Site Equipment Setup on page 284.
4. Perform K1 to K2 Expansion – Transport 1 with CSC2 and PDG on page 285.
5. Perform K1 to K2 Expansion – K Core to Remote Site Links on page 284.
6. Perform K1 to K2 Expansion – Transport 2 with CSC1 and PDG on page 284.
7. Perform K1 to K2 Expansion – Transport 2 with CSC2 on page 285.
8. Perform K1 to K2 Expansion – Transport 1 with CSC2 and PDG on page 285.

B.1.1
K1 to K2 Expansion – Site Preparation

The site preparation tasks include the following:

- Determining layout of equipment in the new redundant configuration, and configuring the existing and new network transport equipment
- Performing software upgrades for each network element as needed
- Performing pre-configuration of transport equipment

See the Motorola Solutions R56 *Standards and Guidelines for Communication Sites* manual. This manual may be purchased on CD 9880384V83, by calling the North America Parts Organization at 800-422-4210 (or the international number: 302-444-9842).

B.1.2
K1 to K2 Expansion – Installations and Configurations Required for K2

The installations and configurations tasks required for K2 include the following:

- Setting up a service computer/laptop
- Installing and verifying the new site gateway configuration files for each base radio and hub site (not the K1 or K2 core master site)

- Updating the Host Name file for each console operator and restarting
- Performing MOSCAD Network Fault Management (NFM) configuration for the new equipment. See the *MOSCAD Network Fault Management* manual, the “MOSCAD NFM in K Core Systems” section.
- Installing the new master site transport equipment
- Installing the new configuration file for the existing master site LAN switches

B.1.3
K1 to K2 Expansion – Master Site Equipment Setup

The Master Site equipment setup tasks include the following:

- Connecting all equipment to Master Site LAN Switch 2 it was configured for
- Ensuring that Master Site LAN Switch 2 is powered on and Master Site Gateway 2 is powered off
- Restarting Master Site LAN Switch 1
- Installing and configuring CSC 2 via Configuration/Service Software (CSS), and verifying that all the equipment moved to the Master Site LAN Switch 2 and voice and data calls are operational after 5 minutes
- Performing a full download configuration to the CSC 2 via the Configuration Manager
- Installing the new configuration files for Master Site Gateway 1 and Backhaul Switch 1
- Loading the encryption keys into Master Site Gateway 2 if it has router encryption

B.1.4
K1 to K2 Expansion – K2 Transport 1 Verification, CSC1, and Packet Data Gateway

The tasks include the following:

- Turning off power to the Master Site Gateway 2 and cycling power to Master Site Backhaul Switch 1 and Master Site Gateway 1
- Waiting 5 minutes and then verifying that voice and data calls are operational

B.1.5
K1 to K2 Expansion – K Core to Remote Site Links

The tasks include the following:

- Configuring and setting up the backhaul network for redundancy if redundant remote site links are used, connecting one remote site link to each backhaul switch for each remote site
- Otherwise, balancing the remote site links between the two backhaul switches by connecting odd-numbered console sites to Backhaul Switch 1 and connecting even-numbered console sites to Backhaul Switch 2. Then connecting odd-numbered Base Radio/comparator sites to Backhaul Switch 1 and connecting even-numbered Base Radio/comparator sites to Backhaul Switch 2
- Waiting 5 minutes, and then verifying that voice and data calls are operational

B.1.6
K1 to K2 Expansion – Transport 2 with CSC1 and PDG

The Transport 2 with CSC1 and Packet Data Gateway (PDG) tasks include the following:

- Turning on the power to Master Site Gateway 2.
- Waiting 5 minutes then turning the power off to Master Site Gateway 1

- Waiting 5 minutes, and then verifying that voice and data calls are operational

B.1.7
K1 to K2 Expansion – Transport 2 with CSC2

The Transport 2 with CSC2 tasks include the following:

- Turning on the power to the Master Site Gateway 2 and wait 5 minutes, then turning the power off to CSC 1
- Waiting 5 minutes, and then verifying that voice and data calls are operational

B.1.8
K1 to K2 Expansion – Transport 1 with CSC2 and PDG

The Transport 1 with CSC2 and Packet Data Gateway (PDG) tasks include the following:

- Turning off the power to the CSC 1 and Master Site Gateway 2
- Turning on power to Master Site Gateway 1
- Waiting 5 minutes, and then verifying that voice calls are operational

When all verification steps pass, turning the power on to all equipment ends K1 to K2 expansion.

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Appendix C

Advanced SECURENET

This appendix provides details on Advanced SECURENET® in the context of Conventional Operation.

Advanced SECURENET® implementation on digital conventional channels (see Advanced SECURENET on Digital-Capable Channel Types on page 287) differs from the implementation on analog conventional channels (see Advanced SECURENET Conventional Operation – Analog Channel Types on page 288).

C.1 ASTRO Advanced SECURENET

Secure communication using Advanced SECURENET® encryption is supported on digital conventional channels using MCC 7500 dispatch consoles in K, L, or M core ASTRO® 25 systems.

Advanced SECURENET® conventional operation allows for secure communication on analog (both with and without MDC 1200) channels with Voice Processor Module-based MCC 7500 Dispatch Consoles in an M3 core ASTRO® 25 system.

C.1.1 Advanced SECURENET on Digital-Capable Channel Types

ASTRO® 25 systems use IC-based digital encryption algorithms. These algorithms are linear functions that operate bit-by-bit; selection of an encryption key variable governs them. ASTRO ® 25 digital technology enhancements to encrypted voice radio systems include:

- No range degradation is in the encrypted mode, regardless of the algorithm employed
- No voice truncation is at the beginning of the voice message
- Provides multiple algorithm capability
- ASTRO® 25 key management facilities support Over-the-Air-Rekeying (OTAR) functions

The following describes a type of encryption called Advanced SECURENET® supported by ASTRO® 25 systems:

Advanced SECURENET® provides Physical Identifier (PID) key management. PID key management identifies a physical memory slot where a key variable is stored in a unit. All products that support PID key management access the same encryption keys dependent on the physical storage capability of the product.

Advanced SECURENET® security is supported on the following digital-capable channels:

- Digital conventional
- IP Conventional
- ASTRO® 25 Control Interface Module (ACIM)
- Mixed Mode conventional (only when operating in Digital Transmit mode)

On these channels, encryption can be performed through Advanced SECURENET® using the following:

- ACIM Consolettes
- Digital Interface Unit (DIU) implementation
- Key Variable Loader (KVL)

The following parameters apply to Advanced SECURENET® digital capabilities. For more information about these parameters, see the manuals and online help for Provisioning Manager and Configuration Manager – Conventional.

Secure Communication Mode
Indicates the security mode capability enabled for the channel (may be **Clear**, **Secure**, or **Both**).

Secure Communication Mode Default
Indicates which security mode is in effect when the channel comes up when **Secure Communication Mode** is set to **Both**.

Common Key Reference Alias List
Lists default Common Key Reference (CKR) assigned to a digital conventional channel configured for secure communication.

Advanced Securenet
Determines if the channel has advanced secure options.

Secure Key In
Enables the console to display the alias of the CKR for the received call

Secure Key Out
Determines if the console user can select from a list of CKRs for use in sending encrypted audio, if Advanced SECURENET® is enabled.

Default CKR
If the console subsystem user does not select the CKR, the default CKR for a given channel is used.

Auto Key
If Secure Key Out is enabled, the Auto Key parameter determines whether the console uses the last received key for the next console transmission. When Auto Key is enabled, the console overwrites the value of the last CKR in the CKR list with the auto key.

Common Key Reference Index List
Selects number of keys to configure for a channel.

In the case of Digital/ACIM/Mixed Mode channels, unlike the Key Numbers for Analog/Mobile Data Communications, CKRs are logical keys shared across the system to which PID-based keys used by Advanced SECURENET® products can be mapped (see “Common Key Reference” in the *Provisioning Manager* manual).

C.1.2
Advanced SECURENET Conventional Operation – Analog Channel Types

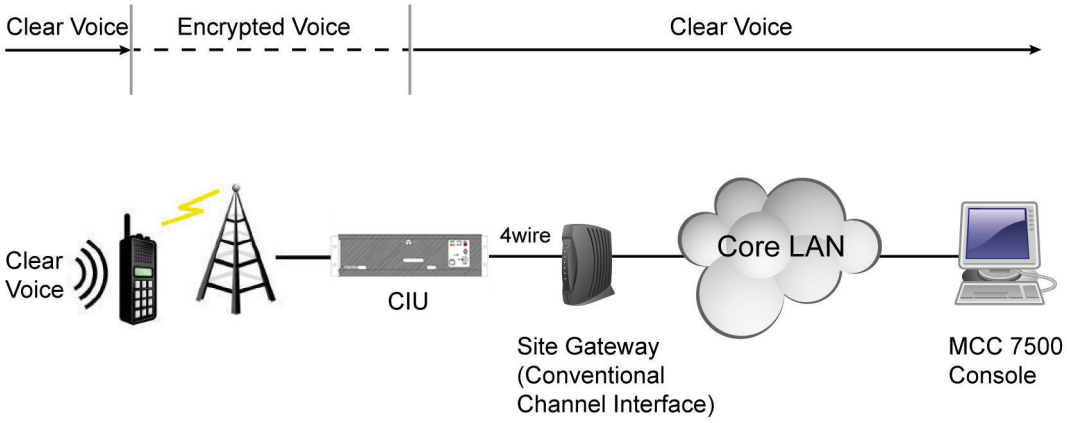
Advanced SECURENET® Conventional Operation on Analog Channel Types requires an existing Advanced SECURENET® Console Interface Unit (CIU) connected to an existing secure-capable base radio to be connected to a GGM 8000 Conventional Channel Interface, to be used by Voice Processor Module (VPM)-based MCC 7500 Dispatch Consoles.

NOTICE: The GGM 8000 Conventional Channel Interface is also known as a Conventional Channel Gateway (CCGW).

The Advanced SECURENET® CIU acts as the station interface to CCGW providing secure decryption for 12 kbit encoded signals. The CIU interface to the CCGW must comply with the same interface specifications as required for a QUANTAR®. For the base station interface specification, see the “Analog Base Stations to Site Gateways (Conventional Channel Interface)” section in the *GGM 8000 Hardware User Guide* manual. For details regarding the CCGW support of the Advanced SECURENET® feature, see *Motorola GGM 8000 Hardware User Guide*.

Regardless of the secure mode (coded or clear) of a call, all audio from the Advanced SECURENET® CIU into the core to the consoles is “clear” audio, assuming the Advanced SECURENET® CIU is able to decrypt a coded call successfully (if not, scrambled digital noise is heard, or is muted by Proper Code detection functions in the CIU).

Figure 83: Secure Voice Using Advanced SECURENET for Analog and MDC 1200 Channels



Call controllers distribute inbound and outbound channel activity to all affiliated consoles. Advanced SECURENET® conventional channels may have inbound calls sourced by various alert tones originating from the channel equipment (as opposed to originating from the radio user). These alert tones are referred to as “Channel Feedback” tones and may include TX or RX clear alerts, or status/ event alerts from the Advanced SECURENET® CIU or transport modems. The Proper Channel Feedback setting (configurable through Provisioning Manager) allows the system administrator to limit tones being heard at the console to operationally critical, as opposed to hearing them all.

Important limitations include:

- Advanced SECURENET® Conventional Operation on Analog Channel Types only works with a QUANTAR® that is version 10 or earlier
- Advanced SECURENET® Conventional Operation on Analog Channel Types is not supported by GTR 8000 Base Radios
- Advanced SECURENET® connections to MCC 7500 Dispatch Consoles are only supported in ASTRO® 25 systems with an M3 core

The following Analog conventional configurations are allowed:

- MDC 1200 configurations
- Main/alt configurations
- M core system that falls back to C-sub operation, because the Conventional Site Controller (CSC) allows Advanced SECURENET® operation to continue
- Systems may contain MCC 7500 Dispatch Consoles or analog consoles enabled for Advanced SECURENET® conventional operation, and other MCC 7500 Dispatch Consoles or analog consoles not enabled for Advanced SECURENET®.

The following parameters apply to the Advanced SECURENET® Analog and MDC 1200 capabilities:

Secure Communication Mode
Indicates the security mode capability enabled for the channel (may be **Clear**, **Secure**, or **Both**).

Secure Communication Mode Default
Indicates which security mode is in effect when the channel comes up (when **Secure Communication Mode** is set to **Both**)

Advanced Securenet
Determines if the channel has advanced secure options.

Secure Key Out
Determines if the console user can select from a list of PID-based keys per channel for use in sending encrypted audio, if Advanced SECURENET® is enabled.

Number of Keys
Selects number of keys to configure for a channel.

Proper Channel Feedback
The CCGW reports the presence of detected channel feedback audio in a bit and only passes feedback tones from the channel to the console.

NOTICE: For information about defining a list of Keys when Secure Key Out is enabled, see "Common Key Reference" in the *Provisioning Manager* manual or online help.
For information about setting up Momentary Override CKRs to override default keys for Advanced SECURENET® channels, see "Momentary Override CKR" in the *Provisioning Manager* manual.

Additionally, see *MCC 7500/7100 Elite Dispatch User Guide* for the following:

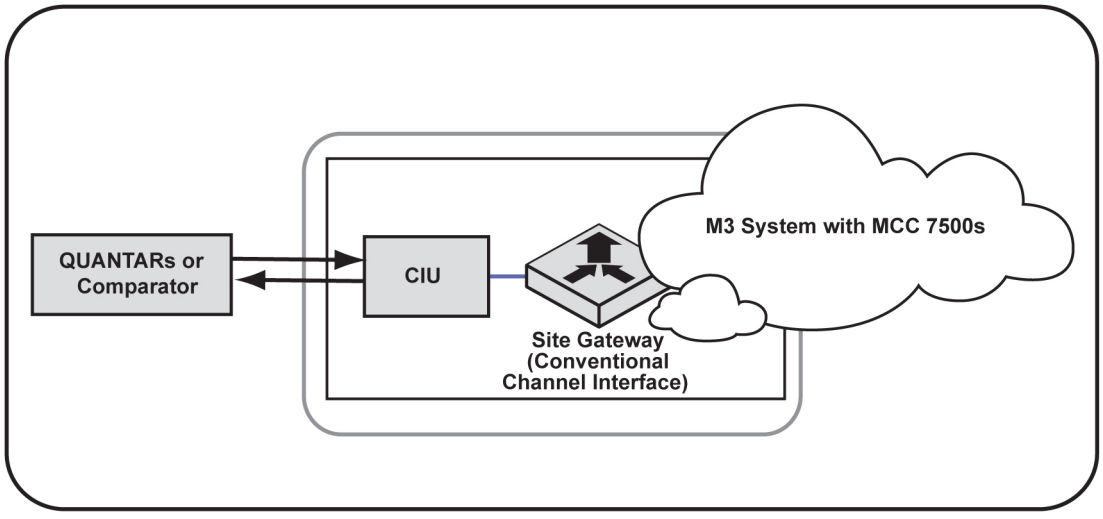
- Instructions on using the dispatch console functions that support Advanced SECURENET® (see the sections about Transmit Mode Select, Outbound Secure Key, and Momentary Override).
- Instructions on changing the way these functions are presented on the dispatch console (see the sections about editing the order of drop-down items and editing the stack).

NOTICE: If a site using the Key Management Controller (KMC) for Advanced SECURENET® is added to a system with the current ASTRO® 25 system Key Management Facility (KMF), the KMC can still be used at its site, but map the relationship between keys in the KMC and keys in the KMF to avoid confusion.

C.2 Advanced SECURENET Functional Topologies

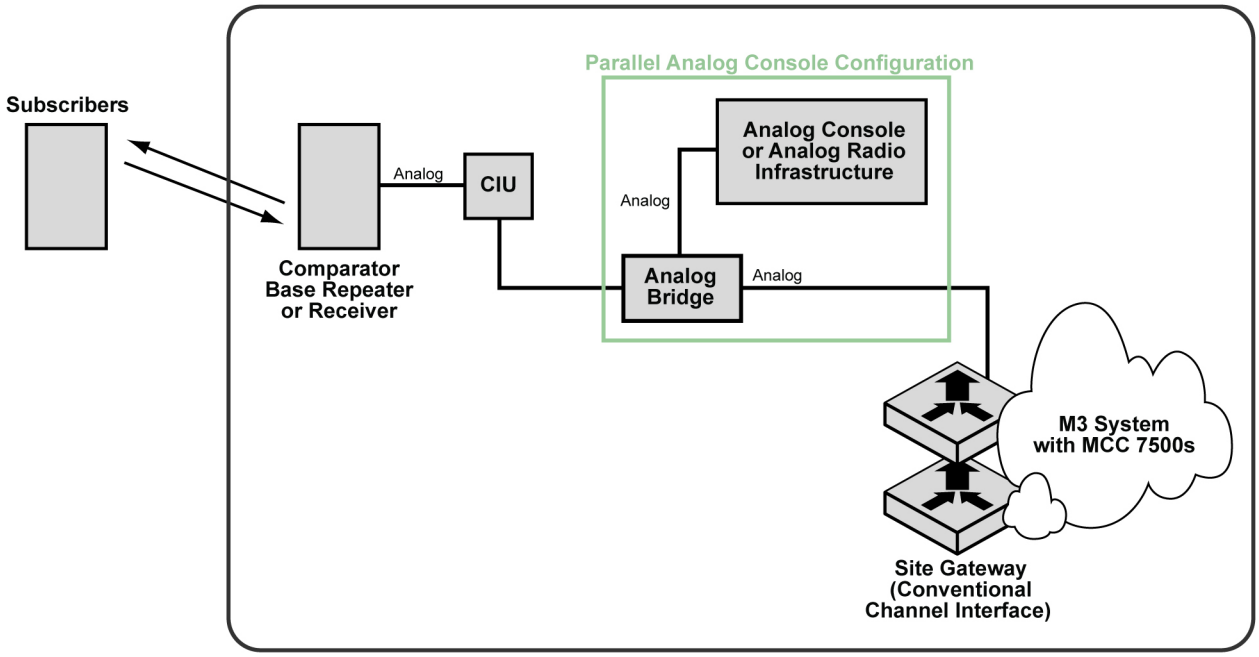
This figure provides a generic view of the equipment required when Advanced SECURENET® channels connect to MCC 7500s in an M3 core.

Figure 84: Advanced SECURENET Connection to MCC 7500s in an M3 core



This figure shows the equipment required when Advanced SECURENET® channels connect to MCC 7500s in an M3 core.

Figure 85: Advanced SECURENET Connection to MCC 7500s in an M3 core – Parallel Analog Console



The Console Interface Units (CIUs) should be in the same room with, or otherwise near to, the GGM 8000, indicated by “Conventional Channel Interface” in the diagram. The Conventional Channel Interface module is also known as the Conventional Channel Gateway (CCGW). The CIU and Conventional Channel Interface are connected by a 4-Wire interface and all audio between them is clear. The consoles can be located anywhere in the radio network infrastructure.

NOTICE: Digital Voice Modems (DVMs) are used with standard Telco lines as transport between remote stations and the CIUs.

C.3 Implementing Advanced SECURENET for Conventional Operation

Perform the following procedure to implement Advanced SECURENET® for conventional operation.

Prerequisites: Verify that you have the following items:

- Existing base radio configured for Advanced SECURENET® (QUANTAR® only, because GTR 8000 Base Radios do not support Advanced SECURENET®)
- Existing Advanced SECURENET® Conventional Interface Unit (CIU)

  NOTICE: For information on CIU, see the *CIU Instruction Manual* (6881066E95).

- Advanced SECURENET® CIU manuals
- GGM 8000 with Analog/V.24 Interface Kit (GGM 8000 Conventional Channel Interface, also known as Conventional Channel Gateway (CCGW))
- MCC 7500 Dispatch Console with Voice Processor Module (VPM)
- User credentials to log on to Provisioning Manager
- Elite Dispatch manual

- LAN Switch – to deploy a LAN switch, see the *System LAN Switches* manual.

Process:

1. Set up MCC 7500 Dispatch Consoles and CCGWs and connect to site switch. Power up and confirm manager access to these components. For more details, see the *Provisioning Manager* manual.
2. Plan which Advanced SECURENET® channels connect to which CCGW. You can connect up to four CIUs to each CCGW (four E&M analog ports available). Use Provisioning Manager to configure up to four ASN channels on each CCGW. Ports not used for Advanced SECURENET® channels may be used for other analog channel types. See the *Provisioning Manager* manual.
3. Configure MCC 7500 Dispatch Consoles from Provisioning Manager to enable console and station capabilities supported on Advanced SECURENET® channels.
   a. CIU with MDC 1200 signaling (Advanced SECURENET®)
   b. CIU without MDC 1200 signaling (Advanced SECURENET®)

   See the *Provisioning Manager* manual.
4. **(Motorola Solutions personnel only)** First set of four CIUs: power down CIU and make physical config changes to enable coded/clear indication function (make wire connection on Interconnect board backplane, and change position of a user jumper). For the details on jumper settings and a diagram, see the “Cabling the E&M (Analog) Connector(s)” section in the *Motorola GGM 8000 Hardware User Guide*, accessible on Motorola Online.
5. Power up CIUs.

Configured Advanced SECURENET® Channel resources initialize on MCC 7500 Dispatch Consoles.

Postrequisites: Verification.
When calls are active on the channel:

- When the CIU is configured for Tx Clear Alerts and outbound clear calls are made, CIU feedback tones should be heard at console speakers.
- MDC 1200 messages should display in MCC 7500 Dispatch Console GUI, if applicable.
- Cross mode indication should display in dispatch GUI if applicable.
- ZoneWatch scrolling log viewer should show DCP protocol.
- Logging Recorder should show teleservice messages with coded/clear indication. Station Control Commands should show Outbound Key Selected.
- 12 kbit and MDC 1200 messages can be heard from sniffer tool, line analyzer, and RF Comm analyzer as described in the diagram captions.